# Space for Energy's sector sustainability challenges

ESA COMMERCIALISATION GATEWAY

SPACE FOR BUSINESS
BUSINESS FOR SPACE

## Business Applications and Space Solutions initiatives in the Energy sector

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# Energy sustainability challenges

1. Increase x3 renewables adoption
2. Drive down energy intensity/accelerate decarbonization
3. Curb methane emissions

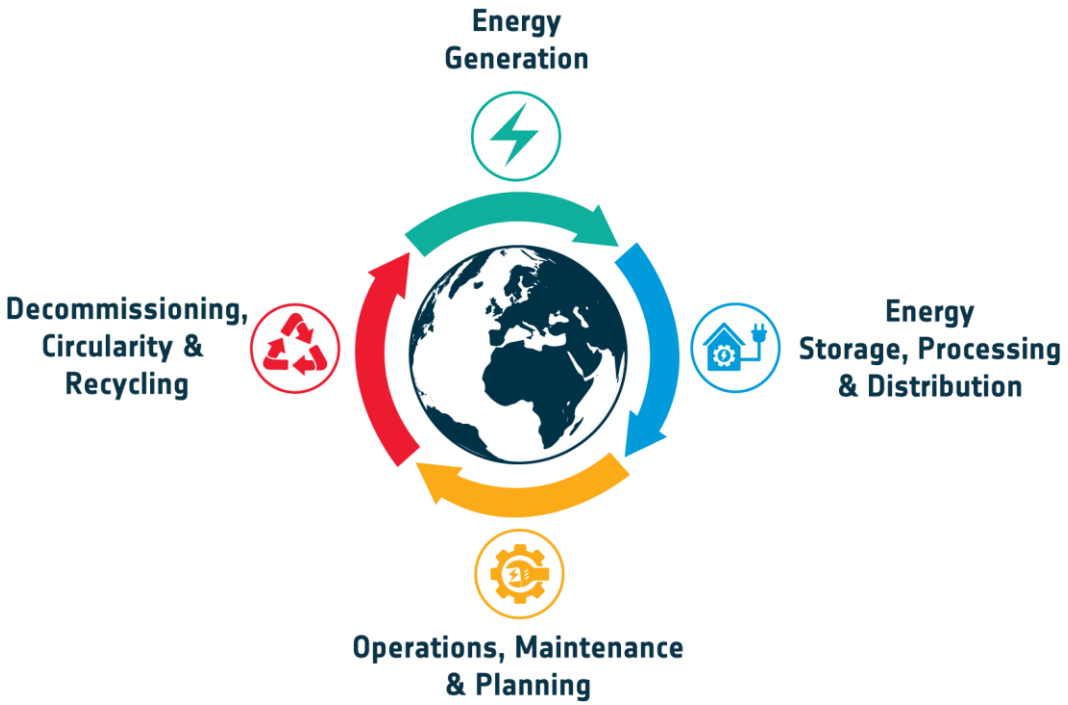
Space applications have a central role to play in developing the energy sector, tackling the challenges it faces and achieving global sustainability targets

# Increase renewables adoption: market opportunity

## Investments into green energy technology are currently at an all-time high of USD 1.3 trillion, with further growth to USD 2 trillion expected by 2030

# Increase renewables adoption: key trends and challenges

1. ENERGY GENERATION:
   - Challenge: With an historical reliance on fossil fuels (80%), the energy sector continues to be the highest contributor to greenhouse gas emissions
   - Opportunity: Use **small-scale renewable sources** as a strategic alternative to the traditional large-scale generation of electrical power by a centralised grid
2. OPERATIONS, MAINTENANCE AND PLANNING
   - Challenge: The supply of certain renewable energy sources such as wind and solar is not fully predictable, leading to unexpected surges or losses of power
   - Opportunity: **electricity grid modernisation and Smart Energy systems** to accommodate a growing share of renewable energy sources and local power generation



# MESPAC

Online platform delivering highly accurate survey data to facilitate the development of offshore wind farm sites without time-consuming, expensive and hazardous offshore operations

MESPAC
Marine Energy Space Control

WAVE FOR ENERGY



Satellite EO data sources are integrated with meteorological stations data and processed with advanced physical models and Artificial Intelligence algorithms to boost the development of new ocean energy applications

# Seed Demonstration Project

## Accurate solar production forecasting through SatEO data analytics with AI

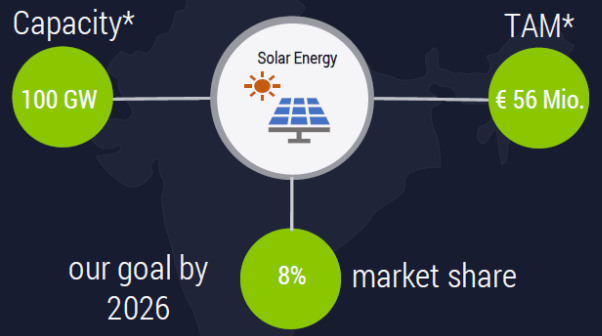
### The Project
**Motivation!**

**Aim.**

Helping **100% Renewable energy transition** through **accurate energy forecasting**.

First focus on **India** & Expansion to **other places**.

**Solar Energy Market in India.**




* Estimates in 2021 by geopredict GmbH

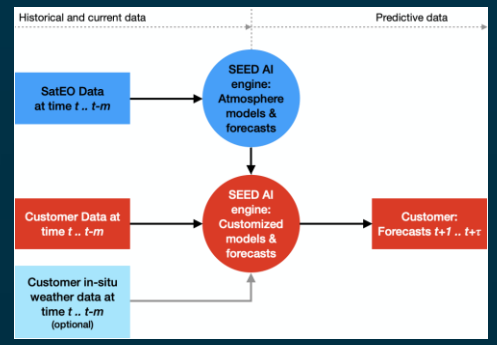
**Challenges.**

Due to low accuracy high penalties are levied under Indian regulations of **Deviation Settlement Mechanism (DSM)**.
An initial estimated loss in revenue for 100 GW capacity only for penalties in India would be **~48.2 M€/year+**

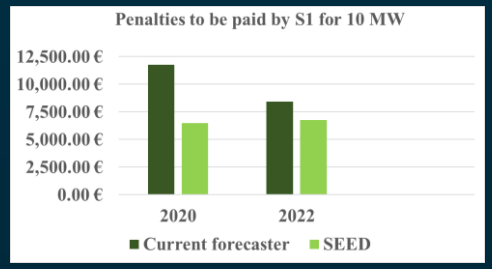
No location specific weather inputs for energy forecasting!

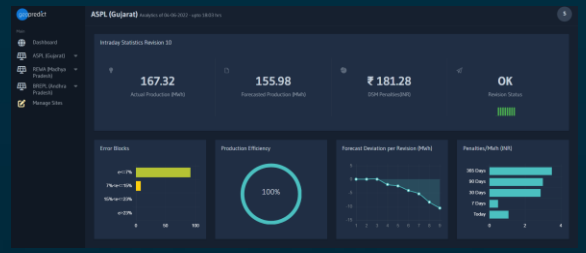
No location specific weather inputs for Operations and Maintenance!

+Calculated using 1 M€/year/2.1 GW estimate from survey by Indian National Solar Energy Federation.









Project involved 4 Solar sites located at different geographical locations in India

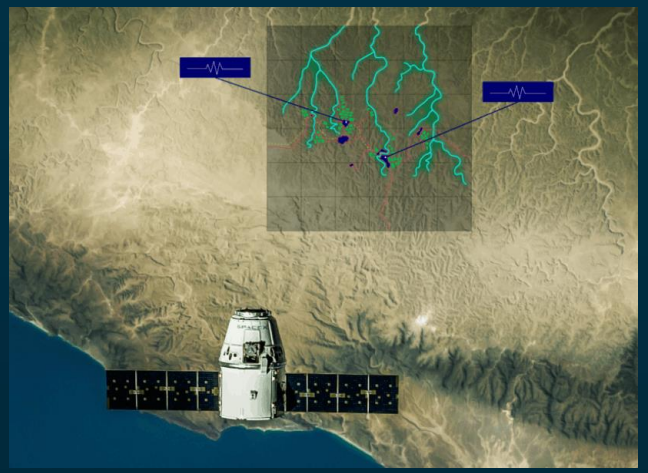
SEED forecasting would save €44/MW/month in 2020 and €14/MW/month in 2022 against current forecasting at S1 solar site.

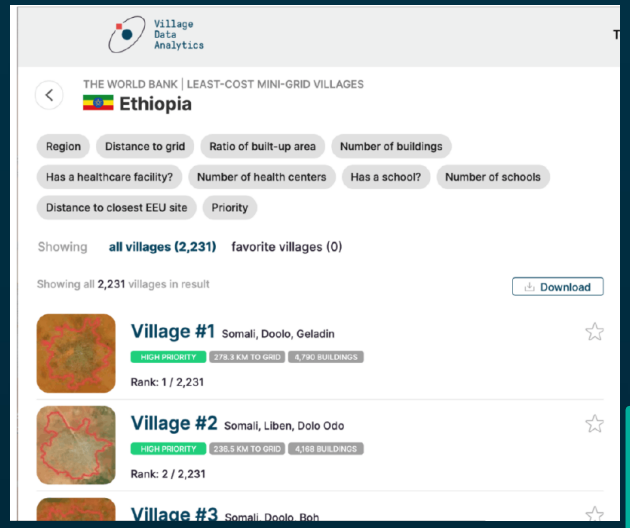
- Successful development of energy forecasting live display to the customer on a dashboard
- All analytics according to regulations are displayed at their scheduled time
- O&M input toolset developed with > 95% accuracy

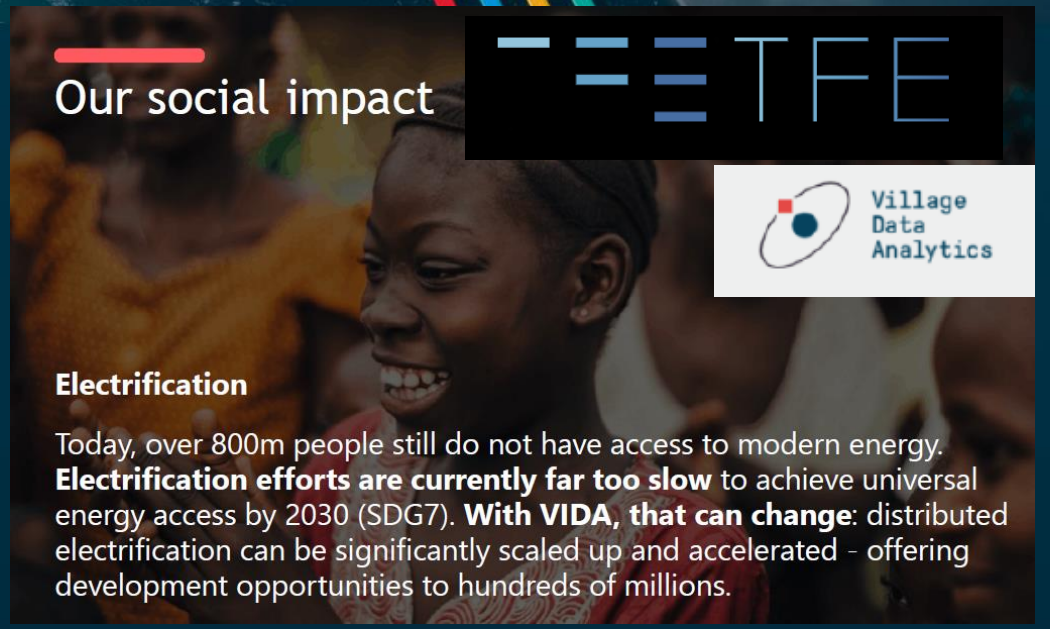
# Space for Microgrids

## Village Data Analytics (VIDA)

AI solution enabling off-grid electrification planning at scale for Governments, International Financial Institutions, Micro-Grid Developers






Satellite EO data, socio-economic statistics, household surveys and electricity consumption data inform Machine Learning (ML) algorithms for microgrids sites characterisation

VIDA is **deployed in 20 sub-Saharan countries**

Norrsken has selected VIDA in the **#impact100 list of the world's most promising impact start-ups**.

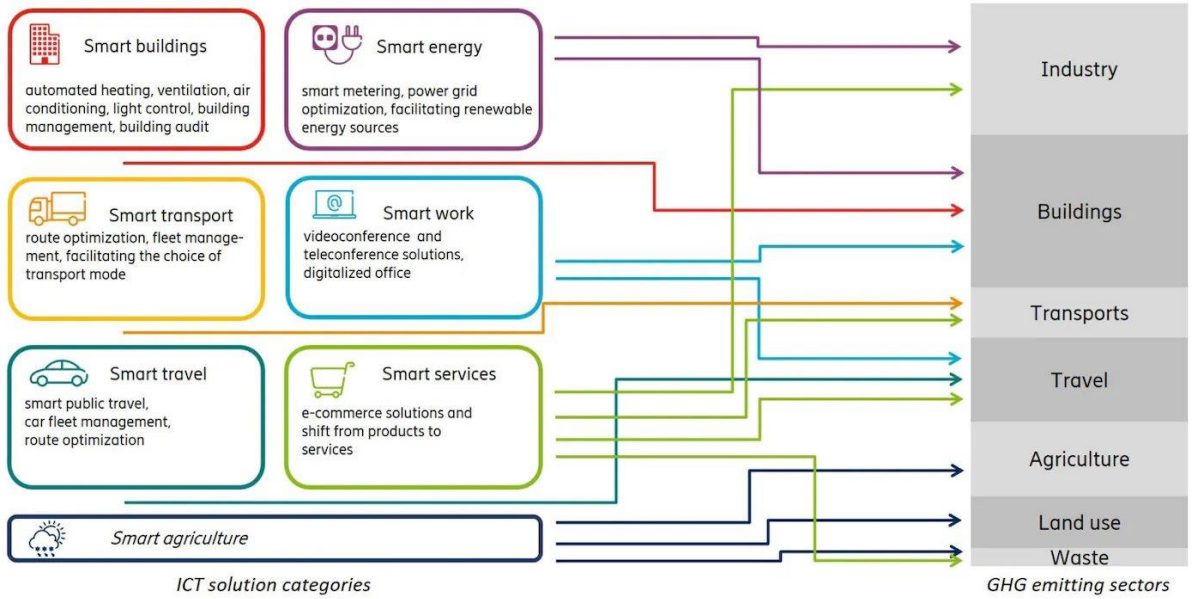
VIDA is now **expanding in the infrastructure development market** (3 Meur Investment from CUSP Capital Investment Fund)

# Decarbonisation: market opportunity

## It is estimated that abandoning the current high-carbon pathway in favour of a low-carbon future will bring $26 trillion in economic benefit

# Decarbonisation: key trends and challenges

1. DECARBONISATION OF GHG-INTENSIVE SECTORS:
   - Challenge: As the world strives to cut greenhouse gas emissions, energy-intensive sectors such as transport and industry, shipping, and aviation present major environmental challenges
   - Opportunity: **smart connected grids** are identified as the largest multiplier among ICT solutions enabling decarbonisation
2. REDUCE POWER SECTOR CARBON INTENSITY
   - Challenge: After transport and industry, the energy supply system is the main emitter of greenhouse gases accounting for approximately 34% of anthropogenic GHG emissions
   - Opportunity: reduce the carbon intensity of the power sector by **introducing innovative solutions** such as**:**
     - **Mapping and monitoring of pollution and heat efficiency**
     - **Low carbon heat production**
     - **Transit to more sustainable, biobased and alternative green energy carriers**



# Transport sector decarbonisation

**34** Activities implemented

**41m** Euros invested
20m from Industry

**11** Member States

## AITO


- Reducing the cost of transport by **up to 90%**
- TeleRetail GmbH secured more than a dozen partnerships for the provision of AITO
- AITO stands to optimise the autonomous vehicles service for roads and exploit this area of the market

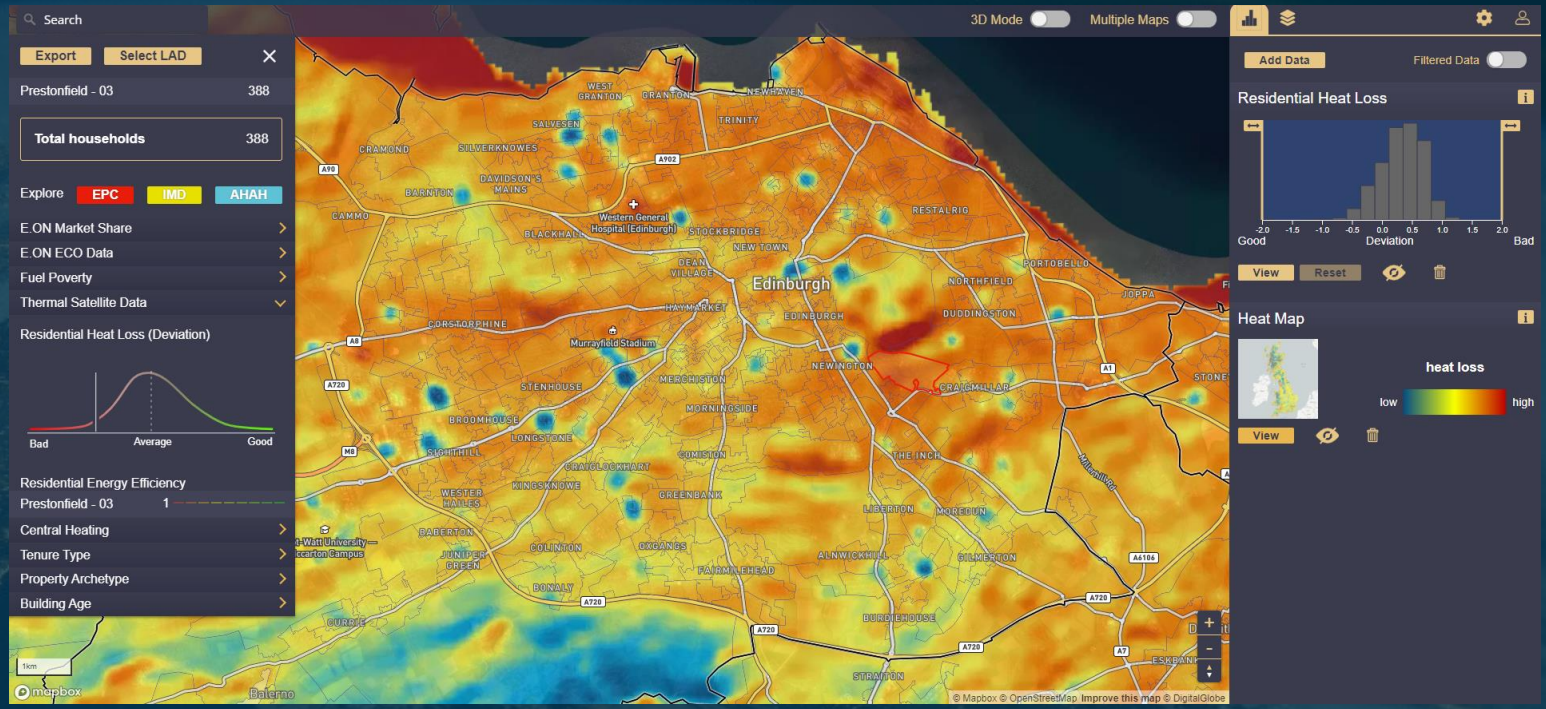
## DPP

- Cloud-based Digital Port Platform (DPP) providing data to achieve **increasing port performance and reducing environmental footprint**
- Predictions of ship arrival time at port, optimal routes of ships, changes in water quality, potential polluting events
- DPP will be piloted in ports in **France** and **Central America**, aiming at a wider deployment in the Northern European market and the Asiatic sector

# ThermCERT

Identify areas across the UK where energy efficiency measures are most needed

ASTROSAT




**Targeted Users:**

e·on

local authorities

Thermal and optical satellite images, government and national census data to derive Residential Heat Loss, Residential Energy Efficiency, Building Age, and Fuel Poverty Prediction

Publicly available geographic information visualised in simple and effective analysis tool.

# Human Switch

Support drivers to SWITCH to electric based on driver's characteristics and provide LIVE asset management for energy market applications V2G

switch

live


Supported on smart phone and through an online portal

- **"Going Electric"** isn't just about buying a new vehicle. There are a number of considerations and opportunities for the owner.
- Live helps customers make and save money by embedding EVs into the energy system.

Uber

Novuna Vehicle Solutions

ALD Automotive

NatWest

NRMA

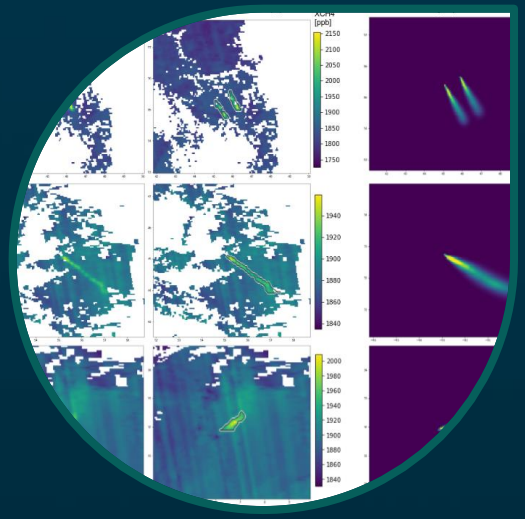
**5000+**
User Downloads

**2.7m**
Miles logged

**£1.60**
Customer Acquisition Cost

# Methane emissions: Methane Watch

- Kayrros has developed and deployed a **Methane Watch platform** capable of identifying and quantifying the sources of methane to support the detection of leaks. This platform is an important aid to support the **decarbonisation of the energy industry**
- Data from Sentinel 5P, Sentinel 2 and Sentinel 1 plus other satellite data sources are combined to detect and monitor methane emissions



**"The amount of methane is increasing at record rates"**

## Global Methane Pledge by 2030

150 countries have agreed to cut their methane footprint **by at least 30%.** Methane Watch is well placed to accelerate the transition and to attract resources from private and public actors

**2021**

**COP26 (Nov)**

Kayrros Contract signed with the International Methane Observatory (IMEO) of UN Environment Programme

**2023**

**Entered into the portfolio of NewSpace Capital (June)**

The company has recently signed a contract with **Bloomberg** to support journalism investigation on environmental matters

The impact of the work has led to several awards and widespread media coverage

**2030**

**Global Methane Pledge by 2030**

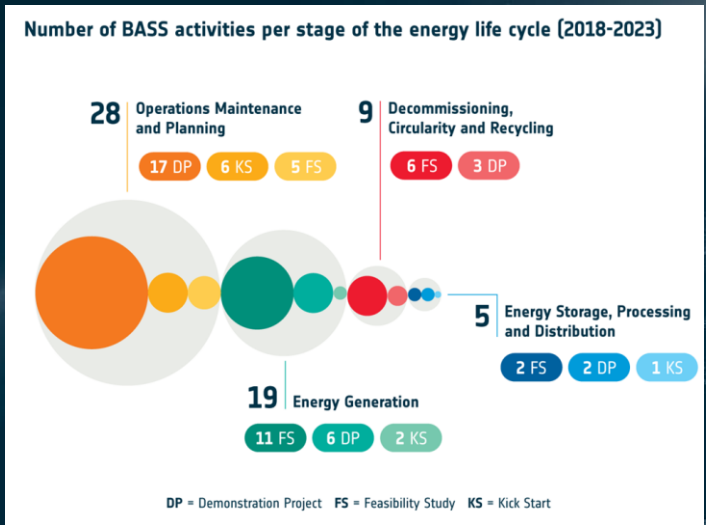
Long-term vision is to deploy a fully-fledged platform on digital monitoring, reporting and verification (MRV)

Bent curve of Methane emission

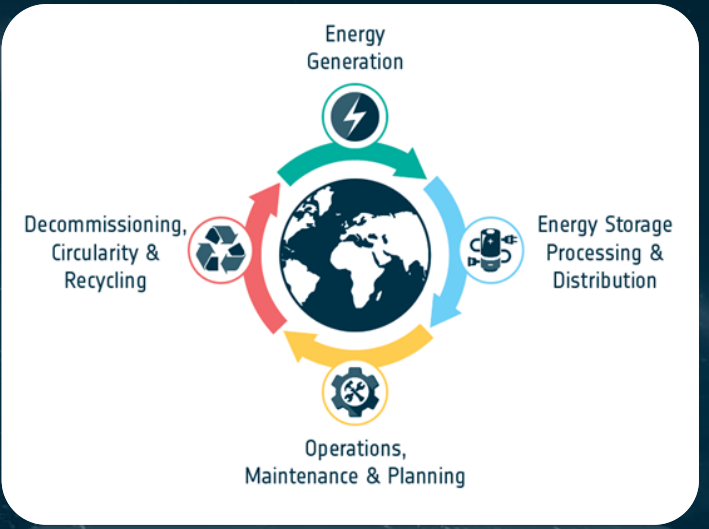
# ESA BASS activities overview per stage of the Energy Life Cycle (2018-2023)

In the period of 2018-2023 a total of almost EUR 30 million of investment has been made by ESA and industry to support a total of 61 energy related activities initiated in the ESA BASS programme, of which EUR 12.30 million has been invested by industry, users and potential customers.

Approximately 65% of energy related activities originated from fixed thematic calls, ITTs and kick-start calls issued by ESA.



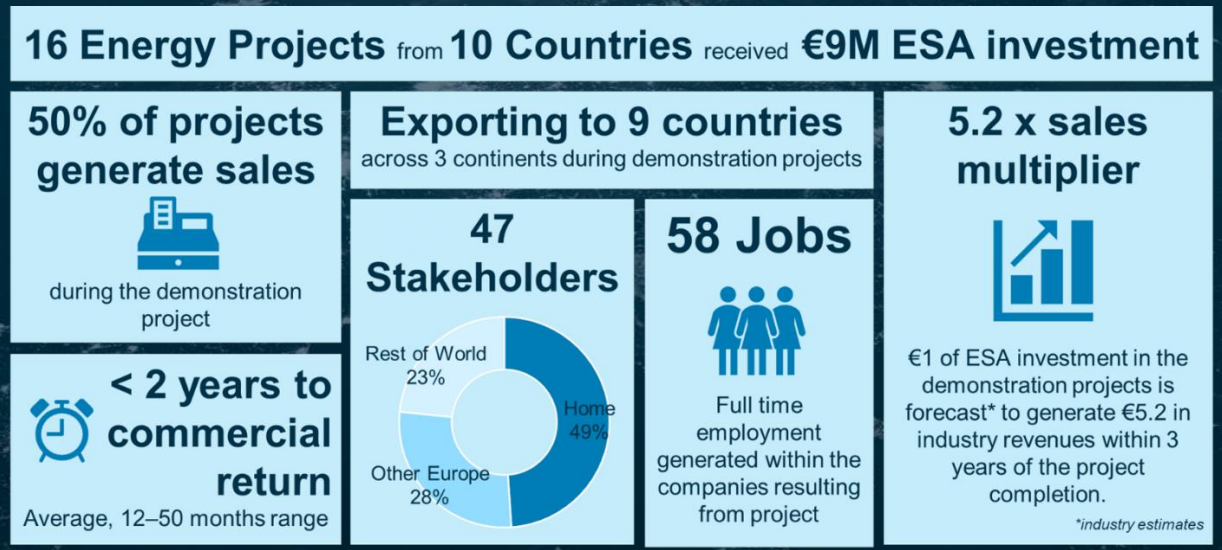

- The analysis of ESA's ARTES BASS portfolio shows that 28 of the activities supported so far have addressed the 'Operations, Maintenance and Planning' stage of the energy life cycle, which is the most represented stage with a total cost 16.09 million EUR
- The Energy Generation stage follows with 19 activities and a total cost 5.65 million EUR
- The Decommissioning, Circularity and Recycling stage of the energy life cycle, had 9 activities with a total cost 6.62 million EUR
- The least number of activities (5) relate to the Energy Storage, Processing, and Distribution stage with a total cost 1.46 million EUR




Stages of the energy life cycle

# Socio-Economic Impact

- Half of the projects generated sales during the demonstration project.
- €3.6M in industry sales reported during the demonstration projects alone
- The sales multiplier of the ESA investment is projected to be 5.2 after 3 years, meaning that €1 of ESA investment in these demonstration projects is forecast (based on industry estimates) to generate €5.2 of industry sales within 3 years of the project completion
- The average estimated time to commercial return for the demonstration projects was less than 2 years
- 47 stakeholder engagements with prospective customers were created, half within the home country, a quarter within Europe, and a quarter in the rest of the world
- 58 jobs (full time employment) were generated within the companies resulting from the projects, all but one in Europe



# SPACE FOR INNOVATION IN ENERGY TASK FORCE

DECOM North Sea

areg Aberdeen Renewable Energy Group

entsoe

Net Zero Technology Centre
Technology Driving Transition

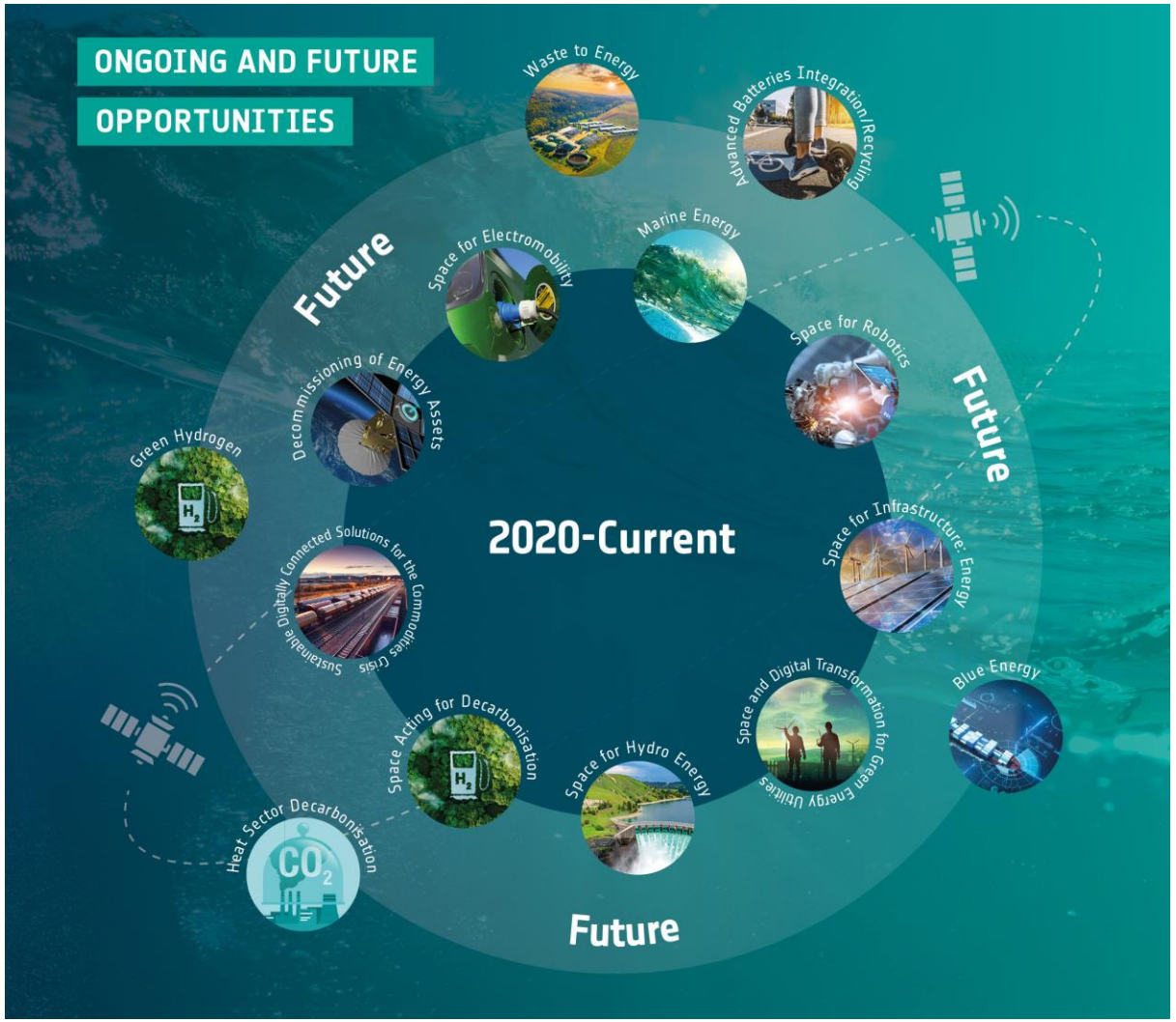
Global Alliance for Sustainable Energy

E.DSO
SHAPING SMARTER GRIDS FOR YOUR FUTURE

EPRI

IESA India Energy Storage Alliance

# Key topics


ONGOING AND FUTURE
OPPORTUNITIES
Waste to Energy
Advanced Batteries Integration/Recycling
Marine Energy
Space for Electromobility
Future
Space for Robotics
Future
Decommissioning of Energy Assets
Green Hydrogen
2020-Current
Space for Infrastructure: Energy
Sustainable Digitally Connected Solutions for the Commodities Crisis
Blue Energy
Space and Digital Transformation for Green Energy Utilities
Space Acting for Decarbonisation
Space for Hydro Energy
Heat Sector Decarbonisation
Future

# Space for Electromobility

1. Countries and cities are introducing rigorous regulations to reduce emissions (In Great Britain, the zero emissions vehicle (ZEV) mandate requires 80% of new cars and 70% of new vans sold to be zero emission by 2030, up to 100% by 2035)

2. The continued acceleration of electrification is putting pressure on charging infrastructure and the electric grid network

3. The ESA BASS ITT Space for Electromobility will support the study and development of space-enabled commercial services aiming to support the electrification of transportation.

4. Topics of relevance: supporting electrification infrastructure roll out in rural and urban areas, supporting grid resilience and flexibility, services to drivers to encourage EV uptake & V2G applications

PLANNED Q3 2024

# Value of Space

## Satellite positioning and timing:

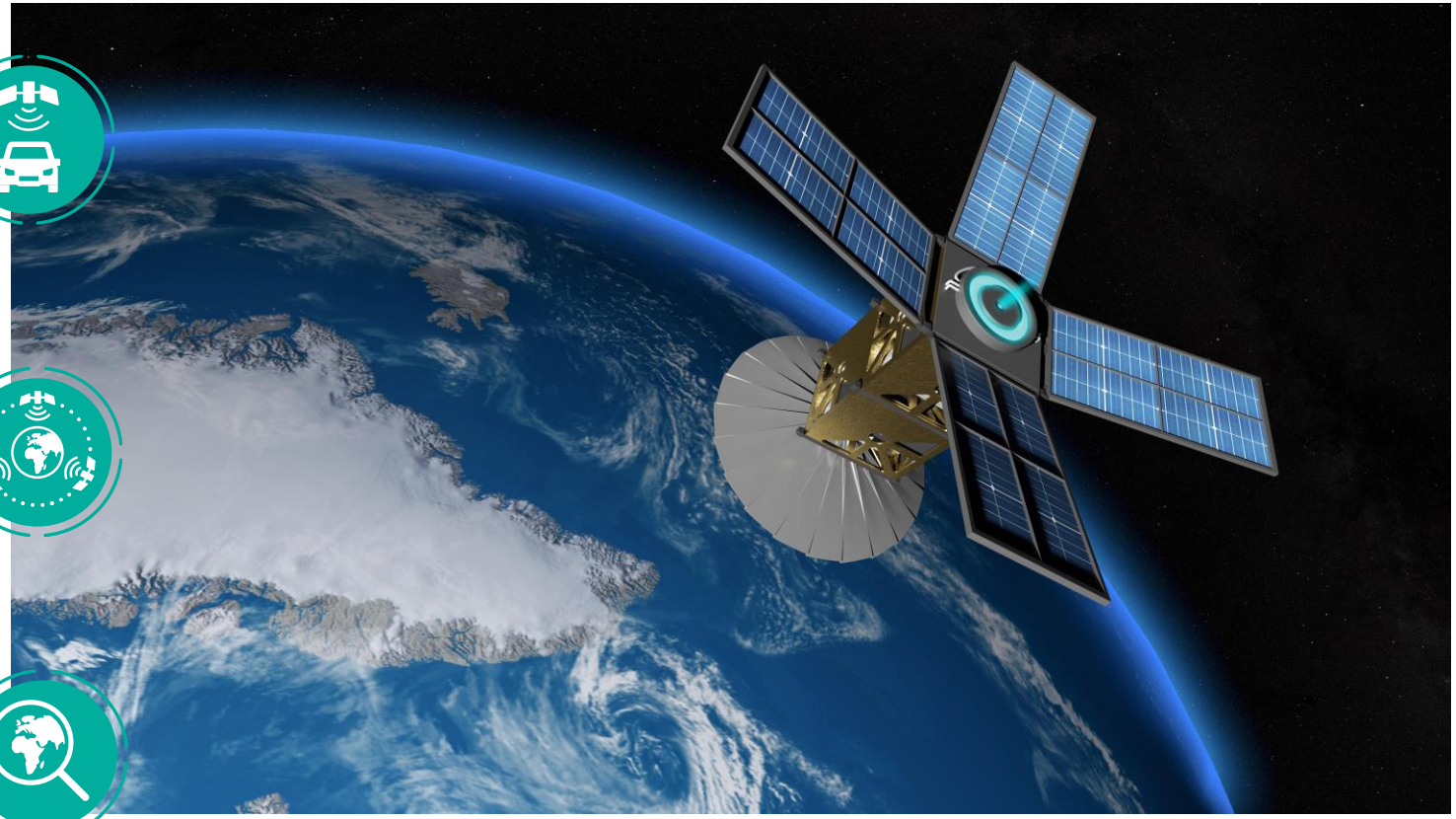
GNSS data can be used to provide innovative services to drivers by providing information on locations of charging points and traffic density, as well as giving insights on driver behaviour and supporting route planning.

## Satellite communications:

Satellite communication can provide reliable connectivity in rural and remote areas where terrestrial infrastructure may be limited. This can support innovative services which connect and monitor the status of EV charging infrastructure in rural areas.

## Satellite Earth Observation:

Earth Observation can support with strategic decision-making on infrastructure deployment locations by providing data on topography, land use, weather, accessibility, and environmental risks



# Waste-to-Energy in Europe

## WtE Plants operating in Europe

(not including hazardous waste incineration plants):

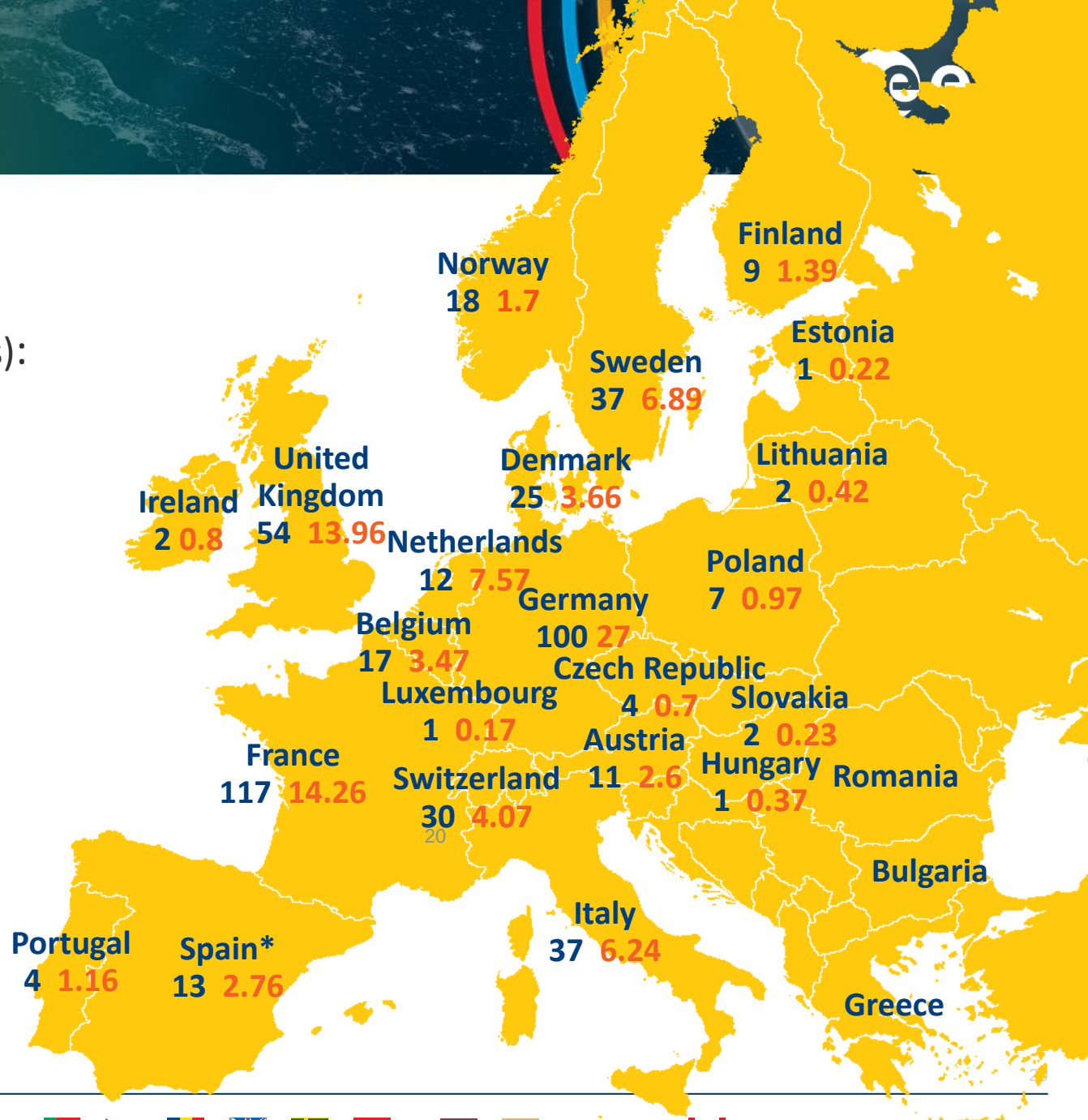
**504**

## Residual waste thermally treated:

**101 Million tonnes**

Data for 2020, supplied by CEWEP members and national sources

***: Includes plant in Andorra and SAICA plant**




CEWEP Confederation of European Waste-to-Energy Plants

# Waste to Energy use cases

SatEO Satcom SatNav

## Market Insights and planning

- Defining waste catchments
- Economic viability planning
- Environmental impact assessments

## Operations and Monitoring

- Efficient routing and waste pickup
- Energy generation monitoring
- Emissions monitoring
- Inventory management

## Clean-up and Landfill Mining

- Detection of methane sources
- Verification of extended producer responsibility (EPR)
- Landfill identification and analysis

OPEN (Closing Date 3 May 2024)

# Thank you for your attention!

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