



Waste to Energy Kick-start



Benjamin Kind
Business Applications
ESA BASS



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Power for Planet (PFP)



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The Confederation of European
Waste-to-Energy Plants (CEWEP)



Agenda

1. What is ESA, BASS introduction, Kickstart call description & BASS portfolio examples (Ben – 15')
2. Confederation of European Waste to Energy Plants / CEWEP (Fabio – 15')
3. Power for Planet (Dermot – 15')
4. How to apply to the Kick-start call (Ben 5')
5. QA session (10')

We are ESA

EUROPE'S GATEWAY TO SPACE

WHAT

22 Member States, 5000 employees

WHY

Exploration and use of space for exclusively peaceful purposes

WHERE

HQ in Paris, 7 sites across Europe and a spaceport in French Guiana

HOW MUCH

€6.49 billion = €12 per European per year





ESA Business Applications and Space Solutions (BASS)



Zero-equity funding (from €50k to €2M+ per activity)



A personalised ESA consultant



Technical support and commercial guidance



Tailored project management support



Access to our international network of ESA and partners



Access to our network of investors



Credibility of the ESA brand

Invested
€250m

Over
1200 businesses



BASS - Space assets, users & markets

Space Assets...

-  Earth Observation
-  Satellite Navigation
-  Satellite Communication
-  Spaceflight Technologies
-  Space Weather

...potentially coupled with...

- Big Data analytics
- VR/AR
- Artificial Intelligence
- Mega-constellations
- Crowdsourcing
- IoT
- Cybersecurity
- Blockchain
- 5G (<https://artes.esa.int/esa-5g6g-hub>)

...to serve Users & Market

-  Maritime
-  Agriculture
-  Environment
-  Healthcare
-  Financial
-  Transport
-  Education
-  Media
-  Energy
-  Aviation

BASS aims

SOCIO-ECONOMIC

Social value
Green value
Economic sustainability



SPACE USE

Utilisation of space in:
New markets
New user communities



INDUSTRY COMPETITIVENESS

European Industry competitiveness in:
Global space markets
Non-space markets



Waste Management Context - why is ESA interested?



Globally, approximately **2.01 billion tons** of municipal waste generated in **2016**, and **33%** of this was openly dumped. This predicted to reach **3.4 billion tons** by **2050** (Asian Development Bank).

Uncontrolled waste disposal leads to **heavy metal pollution** of soil, the release of **contaminants** into the water cycle, and atmospheric emission of **harmful gases** including **CH₄** which is **20x-80x more potent than CO₂**.

Uncontrolled waste disposal and management is common in developing countries. In rural India, open burning is prevalent, producing **harmful VOCs** and **carcinogens**.

Leveraging Waste to Energy tech to address environmental and health concerns while delivering **affordable, secure energy** and contributing to the **circular economy**.

Waste to Energy

Kick-start Activity



SPACE SOLUTIONS

OBJECTIVE: Investigate if the proposed service / product addresses challenges related to waste to energy by driving the digitization of the waste to energy value chain by coupling downstream technologies with space tech capabilities.

- 6 months duration
- Easy entry to BASS for SMEs / Start-ups
- Up to 80kEur total cost (75% ESA co-funding - 60kEur)

Winners will undertake the following:

1. Engage with **users** and **potential customers** of the proposed service
2. Assess the **technical** feasibility of the Service
3. Develop the **business model** and plan

Open **18 March 2024** until **3 May 2024**



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European Space Agency

Eligible use cases for Waste to Energy KS



SPACE SOLUTIONS

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



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European Space Agency



Example ESA Space Solutions Projects

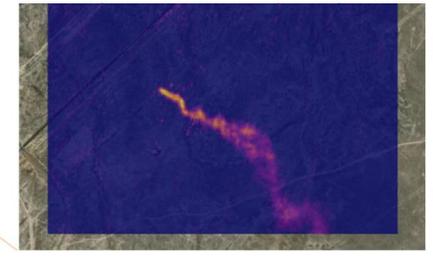


Methane Watch



SPACE SOLUTIONS

Methane Watch is a global monitoring platform that detects methane hotspots, quantifies the emissions flow rate, attributes them to an area and/or asset and provides a series of historical emissions.



- **Targeted Users:** power and gas utilities, investors, governments and public sector entities involved in climate policy
- **Pilot test partners:** . Oil & gas producers and stakeholders (TOTAL, International Energy Agency)

Kayrros will provide data to the International Methane Emissions Observatory (launched 2 days before COP26 with the support of the UN and EU) once operational. Pre-prototype shown at COP26 attracted high attention from the community.



Satellite Earth Observation

Detection of methane hotspots in near real-time

ThermAleego

ThermAleego intends to develop a post-processing software for thermal imagery obtained by drones.

This software will be embedded into a drone mission commissioning platform where entities requiring drone missions (for utility infrastructure inspections, construction activity monitoring, creation of marketing materials, etc...) are able to request missions and be matched with the appropriate drone pilot for their needs.

- **Targeted Users:** Energy Companies, Drone Service Providers...
- **Pilot test partners:** . CEZ (Energy), PGE (Energy), Delair (Drone Services)...

- Improved maintenance of energy infrastructure
- Reduced costs to energy companies
- Reduced energy outages/issues
- Ability to on-board more drone pilots to ALEEGO (due to the camera agnosticism of the software) and thus provide more job opportunities.

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Satellite Navigation

Geo-locate and recompose drone images for analysis



Satellite Earth Observation

Mapping layers for visualization of energy infrastructure surroundings

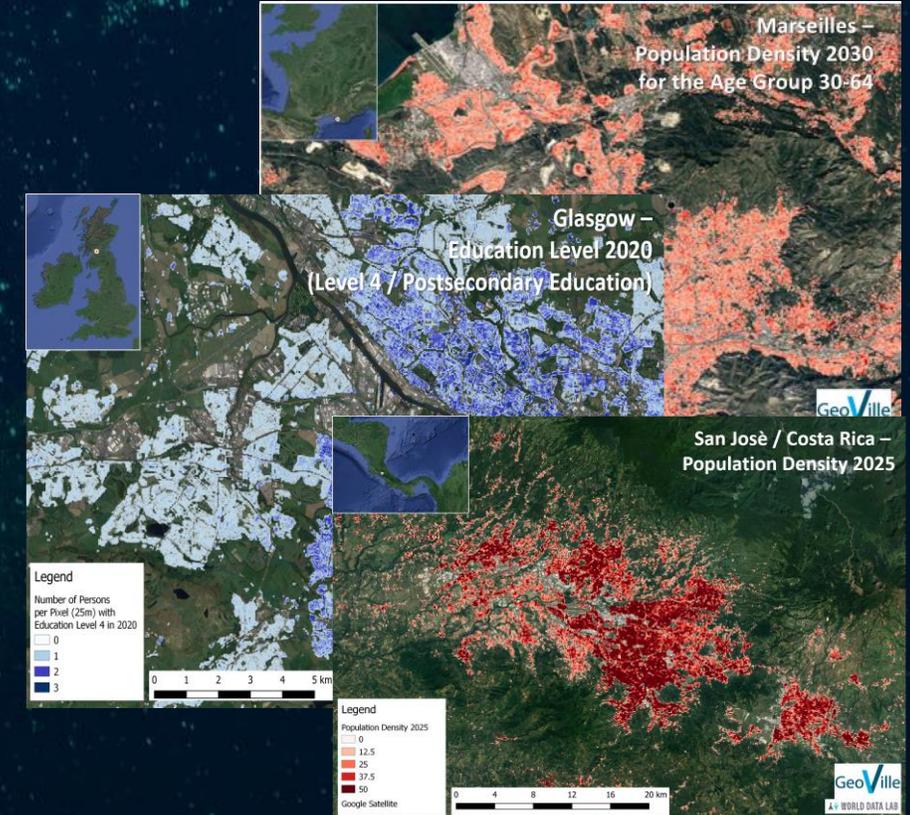


AgeSpot provides information on the current and future distribution of population by age group, including additional socio-economic parameters (education, health).

AgeSpot is a business intelligence solution for companies wanting to know where their customers are now and in the future.

- **Targeted Users:** Telecommunication providers, consulting companies, urban planning, aviation and defence
- **Pilot test partners:** Vodafone, Telefonica, National Institute of Urban Affairs, Deloitte, Airbus, SAP, City of Leipzig

GeoVille joined the World Space Alliance partnership, created by ESA and SAP, which allows easy access, networking and commercial distribution of data and products worldwide.

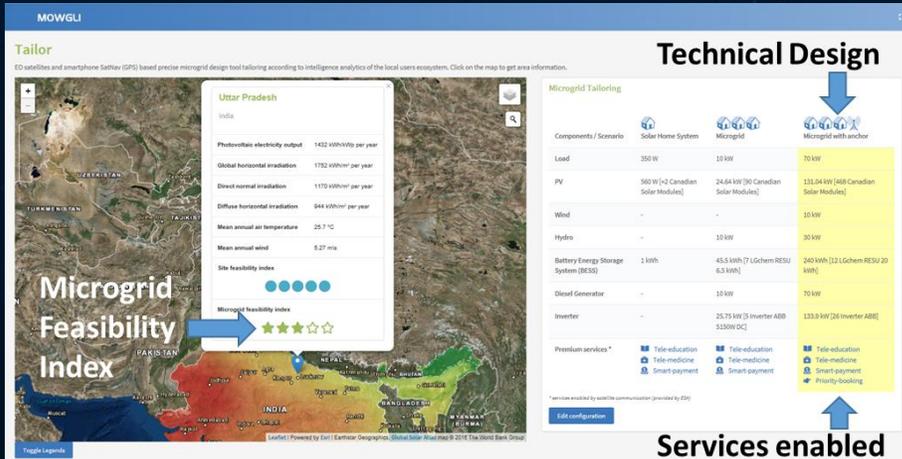


Satellite Earth Observation

Provides land cover and land use information to improve census data on the distribution of the population

MOWGLI

MOWGLI : MOWGLI provides services to address the critical challenges of electrification in developing countries. Service portfolio includes: 1) tailoring and sizing of the micro-grid components based on the electricity demand and availability of renewable energies; 2) provision of monitoring, load balance, disaster recovery and smart services.



- **Targeted Users:** International Financial Institutions (IFI), Electrification Agencies at government level, Microgrid owners/operators and designers/developers.
- **Pilot test partners:** Customized Energy Solutions (CES), STATCON ENERGIAA, JACKSON, RICARDO, VISION Mechatronics, Global Himalayan Expedition (GHE) .

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- i-EM has spun off the solution for commercial markets in US in partnership with ABB
- Company achieved 149.5Keur sales, split in 15% home country (IT), 40% European Countries ; 46% (Other Countries with a strong focus on India
- Customer value proposition substantiated by a 10% CAPEX reduction in microgrid system tailoring; 30% OPEX reduction in microgrid systems operations .



Satellite Communication

Used as complementing solutions where local connectivity is not reliable, or not available at all.



Satellite Navigation

Used to pinpoint the geolocation of local mobile-phone users and /or devices to understand their specific behaviour and needs.



Satellite Earth Observation

Used in all the services as a remote and reliable source of data: energy assessments, real-time for monitoring and forecasting inputs.





Time for our speakers!



Waste-to-Energy is
going to Space 

Launch Kick-start Activity

Fabio Poretti
Technical & Scientific Officer CEWEP

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CEWEP is the umbrella association of the operators of Waste-to-Energy (WtE) Plants across Europe.

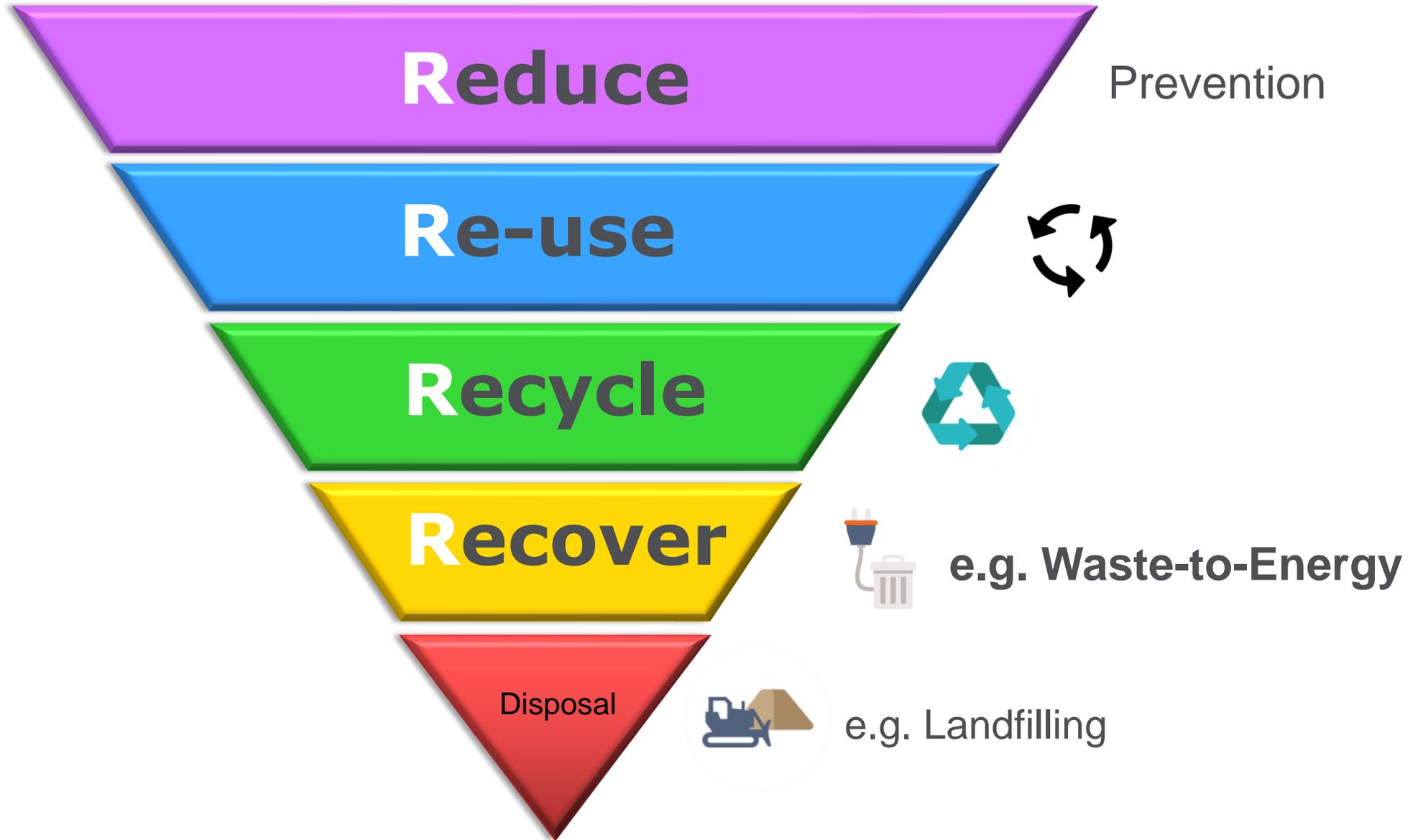


They thermally treat household and similar commercial & industrial waste that remains after waste prevention, reuse and recycling and generate energy out of it.

Waste-to-Energy treats residual, non-recyclable waste

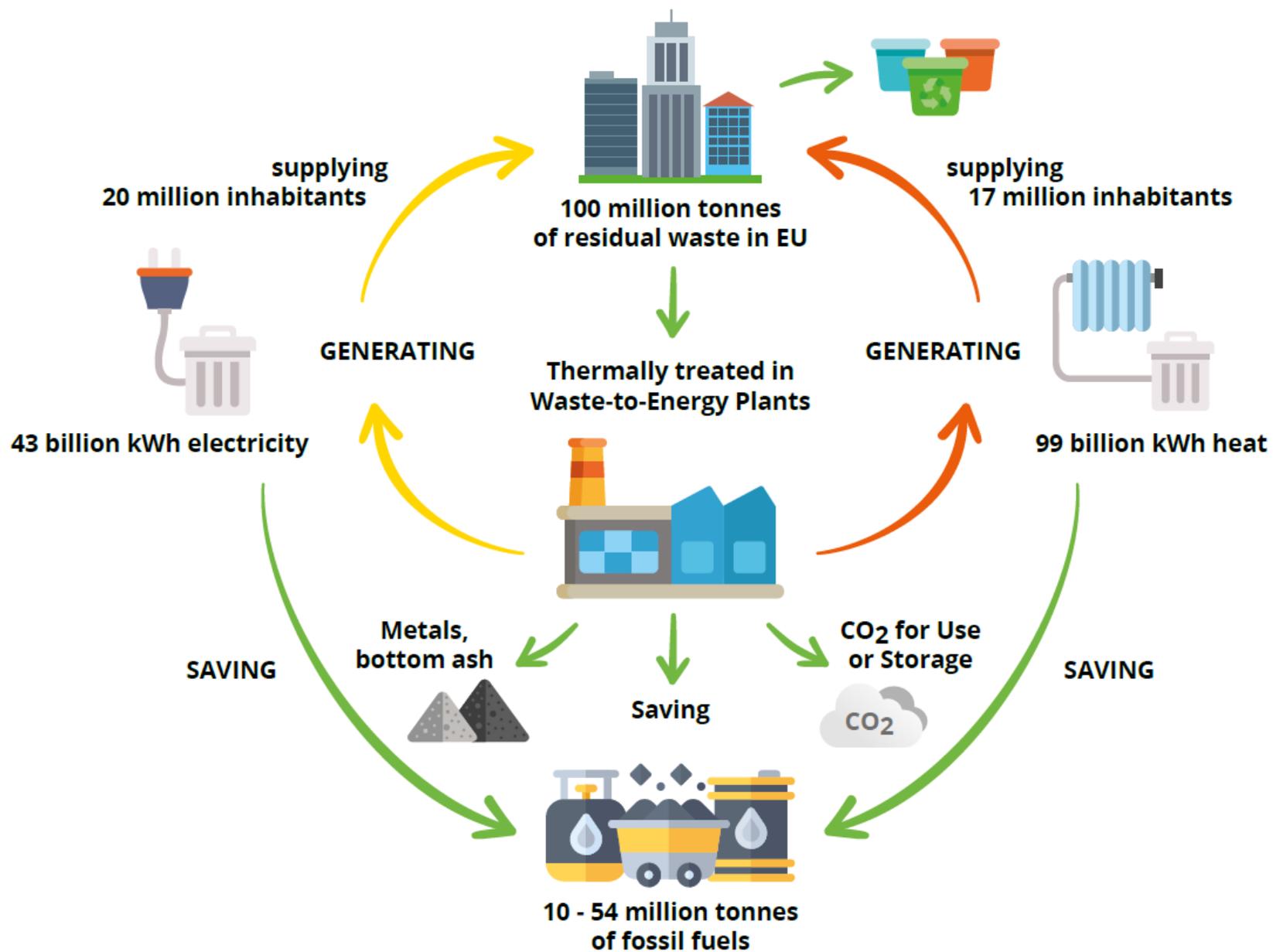


The Waste Hierarchy – The “4R”





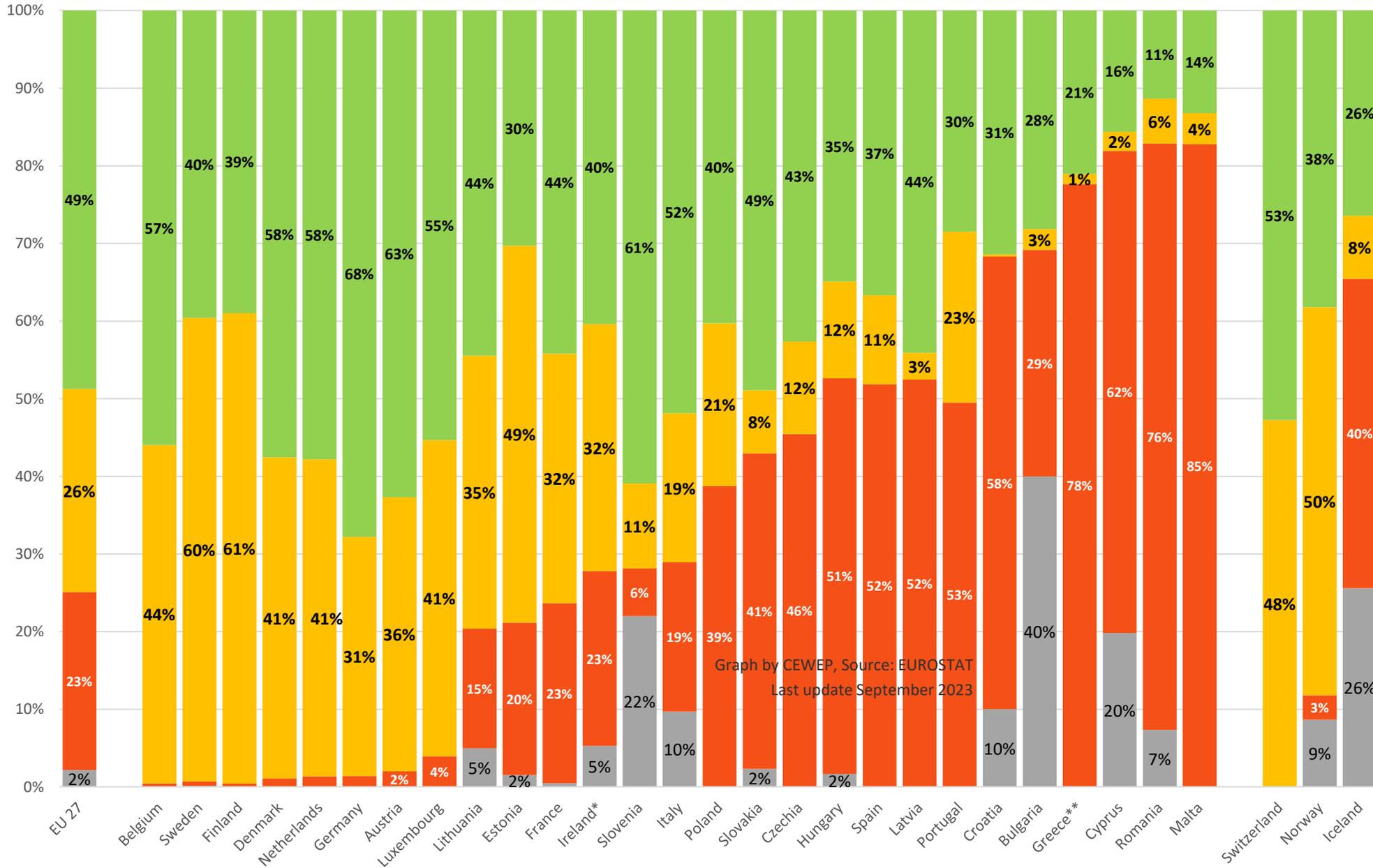
Circular Economy and Climate mitigation go hand in hand with WtE





Municipal waste treatment in 2021

EU 27 + Switzerland and Norway



Percentages are calculated based on the municipal waste reported as generated in the country

*: last available data 2020
 **: last available data 2021

Graph by CEWEP, Source: EUROSTAT
 Last update September 2023



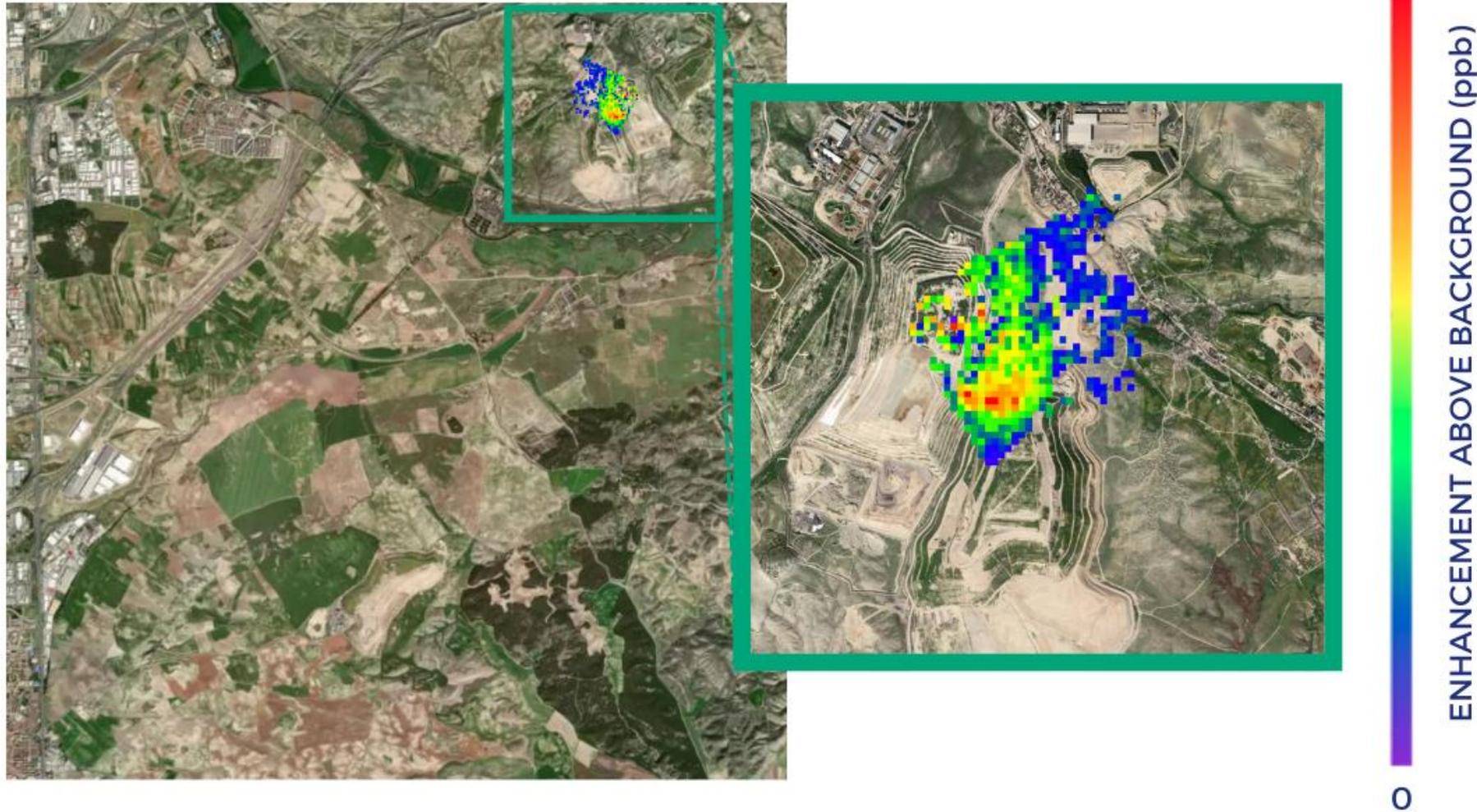
Landfill Diversion

- We need to reduce waste that goes to landfills to:
 - ▶ Protect soil and groundwater from potential contamination
 - ▶ Recover the material and energy content of residual waste
 - ▶ **Avoid Methane Dispersion**



- Methane GWP: **28x (100 years), 86x (20 years)** more potent than CO₂
- Acting on Methane: **Rapid fight to Climate Change** (UN Report 2021)
- **Landfills in Europe: 60 MI tonnes MSW only (2019)**
= ca. **the volume of Wembley Stadium each week**
100 MI tonnes of total non-inert waste per year

High-resolution satellites detected substantial quantities of methane leaking from 2 adjacent landfill sites close to the centre of Madrid, in August 2021



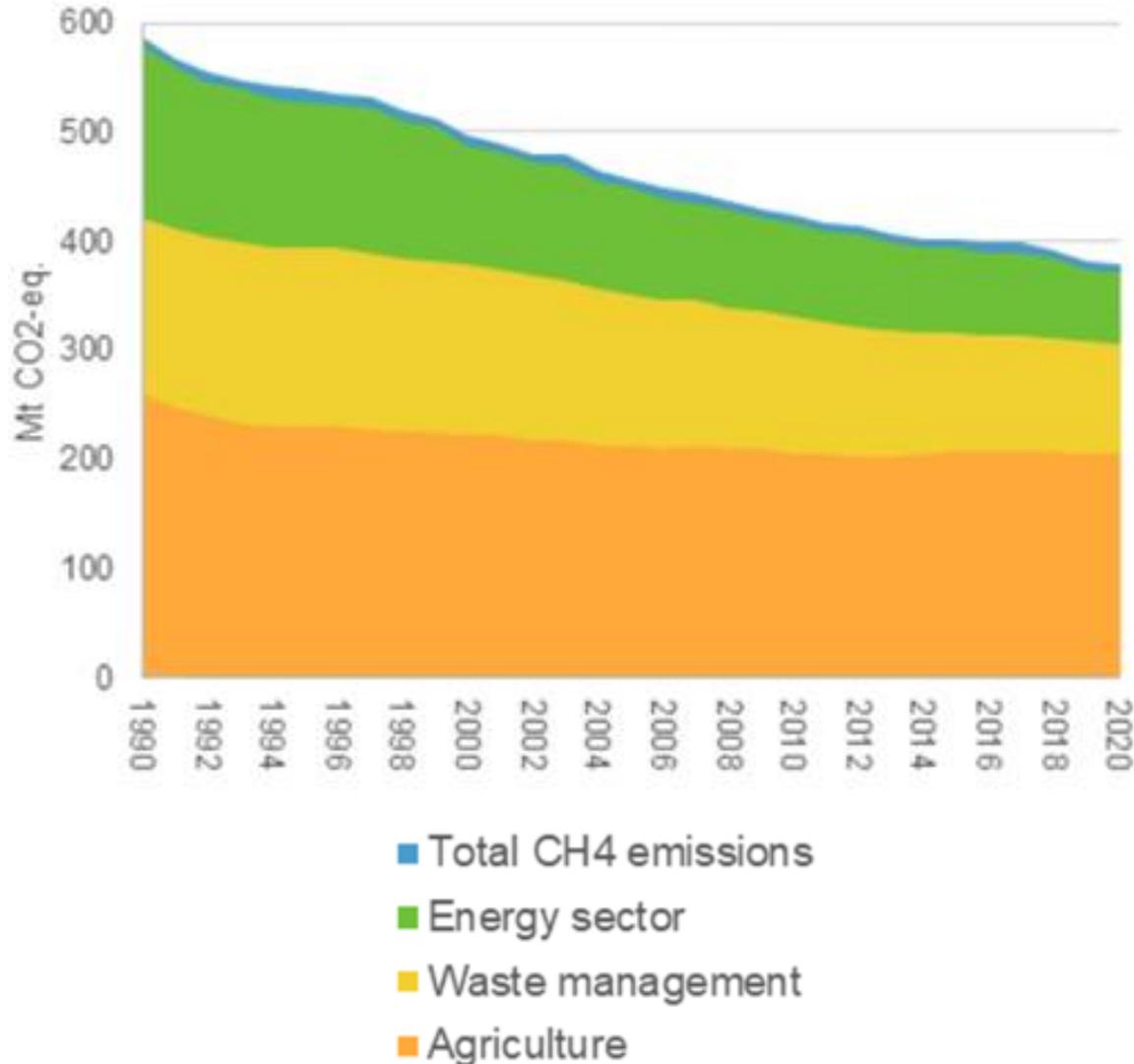
Source: [European Space Agency](#)



Using data from the **Copernicus Sentinel-5P mission**, combined with **GHGSat's** high-resolution commercial imagery, scientists discovered the both Spanish landfill sites combined emitted **8800 kg of methane per hour** – the highest observed in Europe by GHGSat.

EU Methane Strategy (October 2020)

CH₄ emission trends EU27



In the EU the main releases of methane are (2020 data):

- 17% Energy sector (Oil&Gas and Coal Mining, 64 Mt CO₂eq)
- **27% Waste sector**
 - Uncontrolled landfill gas
 - Sewage sludge
 - Leaks in Biogas plants (101 Mt CO₂eq)
- 54% Agriculture (206 Mt CO₂eq)

> What will the EU do about it?

The EU will **lead the way globally to address methane emission reductions** in all relevant sectors and with all partner countries.

MORE ACCURATE MEASUREMENT AND REPORTING



Proposing **EU legislation** on **compulsory measurement, reporting, and verification** for all energy-related methane emissions.



Improved measurement and reporting of methane emissions by companies, including through sector-specific initiatives.



Satellite-based detection of super-emitters through the EU's Copernicus programme.



Support the creation of an **international methane emissions observatory** with the UN, including a methane supply index for international transparency.

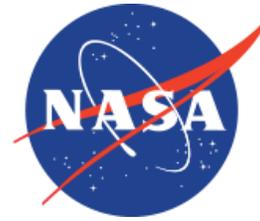
International Cooperation

COP26: The **Global Methane Pledge** was launched by the EU and the USA

COP28: The USA, People's Republic of China, and United Arab Emirates convened a Summit to accelerate actions to cut methane



Article in Nature (2019)



Jet Propulsion Laboratory
California Institute of Technology

California's methane super-emitters

<https://doi.org/10.1038/s41586-019-1720-3>

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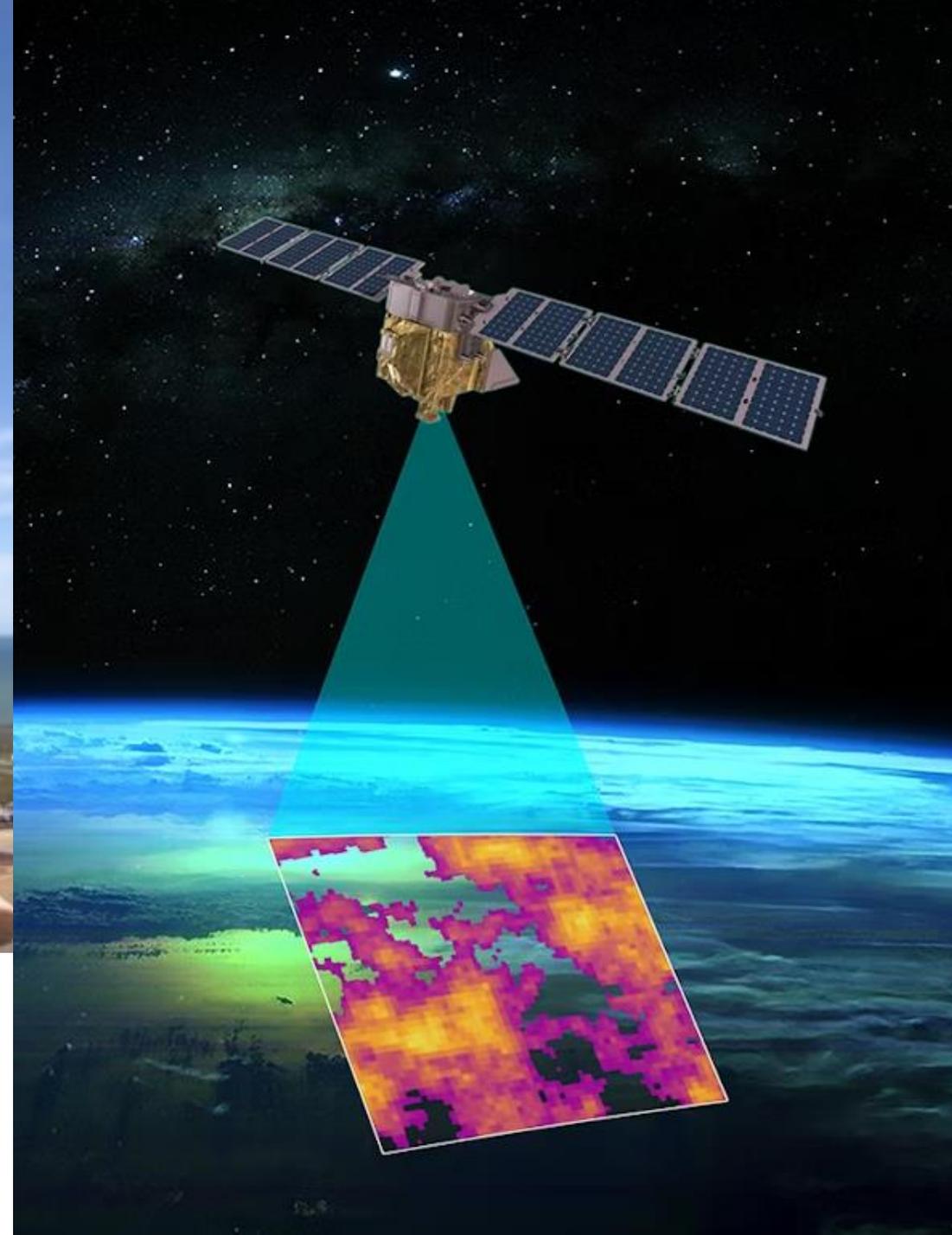
Methane is a powerful greenhouse gas and is targeted for emissions mitigation by the US state of California and other jurisdictions worldwide^{1,2}. Unique opportunities for

*“Methane point-source emissions in California are **dominated by landfills (41%), followed by dairies (26%) and the oil and gas sector (26%).**”*

Follow-up (2022): A nonprofit group, **Carbon Mapper**, will use data from NASA's EMIT mission to survey waste sites for methane emissions.

MethaneSAT

- launched on **4th March 2024** aboard a **SpaceX Falcon 9**
- Space:
The next frontier for climate action and accountability?
- **GOAL:** providing global high resolution data regarding **methane emissions from oil and gas facilities**



Some Take-Aways:

- **Research Needed**: Better understanding and modelling of methane emissions from different landfill types.
- **Policy Making**: ESA projects can have a crucial role to monitor and report methane emissions in Europe from landfills and waste sites.
- **Reality Check**: Landfills are still a big elephant in the room in Europe
- **Long-term vision**: even once closed, landfills can keep emitting methane for decades.
- **Landfill Diversion**: Good for the Climate, Good for the Environment.

Thank you



*Poretti F., Stengler E.,
The Climate Roadmap of the European Waste-
to-Energy Sector | The path to Carbon Negative,
GHGT-16, Oct. 2022*



Fabio Poretti

Technical & Scientific Officer





esa



POWER FOR PLANET



 PFP Core Mission

Facilitating access to existing Waste-to-Energy technologies, to enable on-site, off-grid, green energy projects

 USP

PFP is entirely technology agnostic and has identified 170+ global technology providers in the waste sector



Over **100m** tonnes of waste ends up in landfill or the ocean per annum in the UK

This non-recycled waste is fuel that can be used to create on-site, off-grid **green energy**





The Waste Problem



Power from non-recycled waste is under-utilised by businesses
because of **3 key challenges**



1. Underestimating the value of waste and the potential cost savings



2. Understanding the myriad technologies



3. Using waste to generate energy is not a core function

EXPLORATION STATION

Green power from non-recyclable waste

Power-from-waste technology can convert non-recyclable waste into a myriad of different outputs, including electricity, heating, cooling, and biochar, among others

[Explore the possibilities](#)



How it works



Our technology agnostic approach

Our in-house experts, in conjunction with our innovative global **platform** provide tailored **green power** solutions from non-recycled waste



EXPLORATION STATION

Interact with our exploration station to learn more

Whether you're a business owner, facility manager, community leader or just interested in sustainable energy solutions, our exploration station has something for you

Intuitive click-to-reveal interface

Dynamic data pop-ups providing a rich, visual display of waste stream characteristics



Cow manure

GCV: 17.57 MJ/kg
Energy content: High

- High organic content
- High nutrient content
- High nitrogen content
- Low pH levels

Case study

600 dairy cows or 3500 tonnes of cow manure per year

- Produces 656m³ biogas every day
- Ability to power 187 UK households every day



Most appropriate technology

Anaerobic Digestion

Start your project

Learn more



Immersive geospatial exploration interface with over 50 diverse feedstocks

Advanced power-from-waste technology recommendations

Case Study 1: Biomass Pyrolysis

UK project for a large kitchen supplier:

Using pyrolysis technology located on site to reduce the dependence on the grid for both electricity and heat.



Waste Tonnage: 24,000 tonnes per annum

Footprint: 10,000 m²

Electrical savings: £10,100,000 per annum

Heat savings: £760,000 per annum

Gate fee savings: £900,000 per annum

Biochar value: £200,000 per annum

Annual savings + income = **£12 M**

CAPEX: **£17.2 M**

OPEX: **£2 M**

As a result, our solutions provide:



1. Lower waste disposal fees, by reducing waste sent to landfills or incinerators



2. Stabilised and reduced energy costs (a typical project will be operational for c.25 years)



3. Sustainable energy production, improved green credentials and enhanced ESG performance



Space Assets and Waste to Energy: The Connection



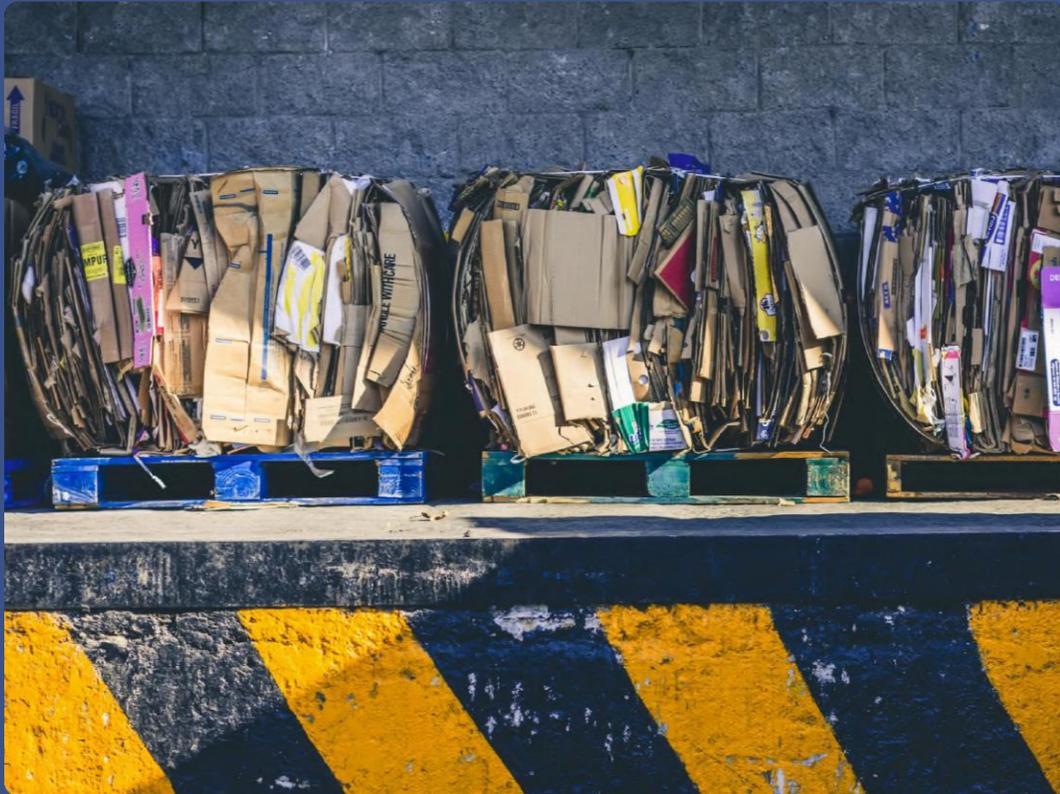
Emissions & EO (Earth Observation)

One of the most pressing environmental challenges in agriculture is the management and reduction of **methane emissions**, a potent greenhouse gas.

EO satellites leverage advanced remote sensing technologies to detect and quantify methane emissions. Integrating EO data with ground based measurements, we can monitor methane emissions in real time, before and after a project.



Space Assets and Waste to Energy: The Connection



Optimising waste transportation routes

By leveraging **Global Navigation Satellite System (GNSS)** data, WtE operations can dynamically calculate and adjust waste collection and transportation routes in real-time.

This optimisation not only aims at reducing operational costs and improving time efficiency but also at **minimising the carbon footprint** associated with the transportation of waste.



Space Assets and Waste to Energy: The Connection



Market Insights and Planning

High-resolution optical imagery, provided by EO satellites, is a crucial asset in identifying waste accumulation areas and assessing the environmental status of potential plant sites.

These images can be processed using advanced algorithms to quantify potential waste volumes, distinguish between different materials and evaluate the suitability of locations.



Opening the floor to questions!



www.powerforplanet.com



alice@powerforplanet.com



How can I apply?



Who can apply?



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To be eligible for funding, your team must be based in one of the following countries: *Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Sweden*, and the *United Kingdom*.

If you are considering applying, you must inform your National Delegation to obtain a letter of authorisation allowing the funding of the proposed activity. Contact details of each National Delegate can be found here →



However, if your team is based in *Germany, Luxembourg* or the *United Kingdom* you do not have to contact your National Delegate. These Delegations have pre-authorized this Kick-start opportunity.

Please note that currently, *Austria, Greece*, and *Switzerland* are not supporting any Kick-start activities. *Spain* and *Slovenia* are not supporting this particular Kick-start initiative.



How can I apply?

1. Register your team on [ESA-STAR Registration](#) today!



2. When the Kick-start opens on **18 March 2024** visit [ESA-STAR Publication](#) and search for this “Waste to Energy” opportunity to download the official competition documents.



3. Use the official documents to prepare your proposal.

4. Reach out to your National Delegate (if applicable) to request a Letter of Authorisation. Contact details of each National Delegate can be found [here](#)



5. Submit your proposal via [ESA-STAR Tendering](#) before the deadline of **3 May 2024**



Proposal template

Your Proposal should include the following information:

- 1. Executive Summary (max 1 page)
- 2. Business potential (max 5 pages)
- 3. Technical Concept (max 5 pages)
- 4. Team and Resources (max 3 pages)
- 5. Management (max 4 pages)
- 6. Financials (max 2 pages)



Kick-start Tasks

Study Kick
Off Month 0

Mid-Term Review
Month 3

Final Review
Month 6

Study Outputs



Kick-start outcomes



Before applying check...

1. Your team is proposing a service that could become operational in the near future (1-4 years)
2. Your idea tackles a challenge relating to residual waste sent to landfills (following the waste hierarchy value chain)
3. Your idea uses satellite data or space technology (e.g. satellite communication, earth observation or navigation)
4. Your team is eligible for funding and has attained a letter of authorisation from the National Delegate (if applicable)
5. There is a market for your service and potential users/customers will be involved in the Kick-Start





QA session!





SPACE SOLUTIONS

Thank you!

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European Space Agency

