

Advancing life cycle assessment and ecodesign for sustainable space programmes

Lessons learned, industry collaboration and the path forward

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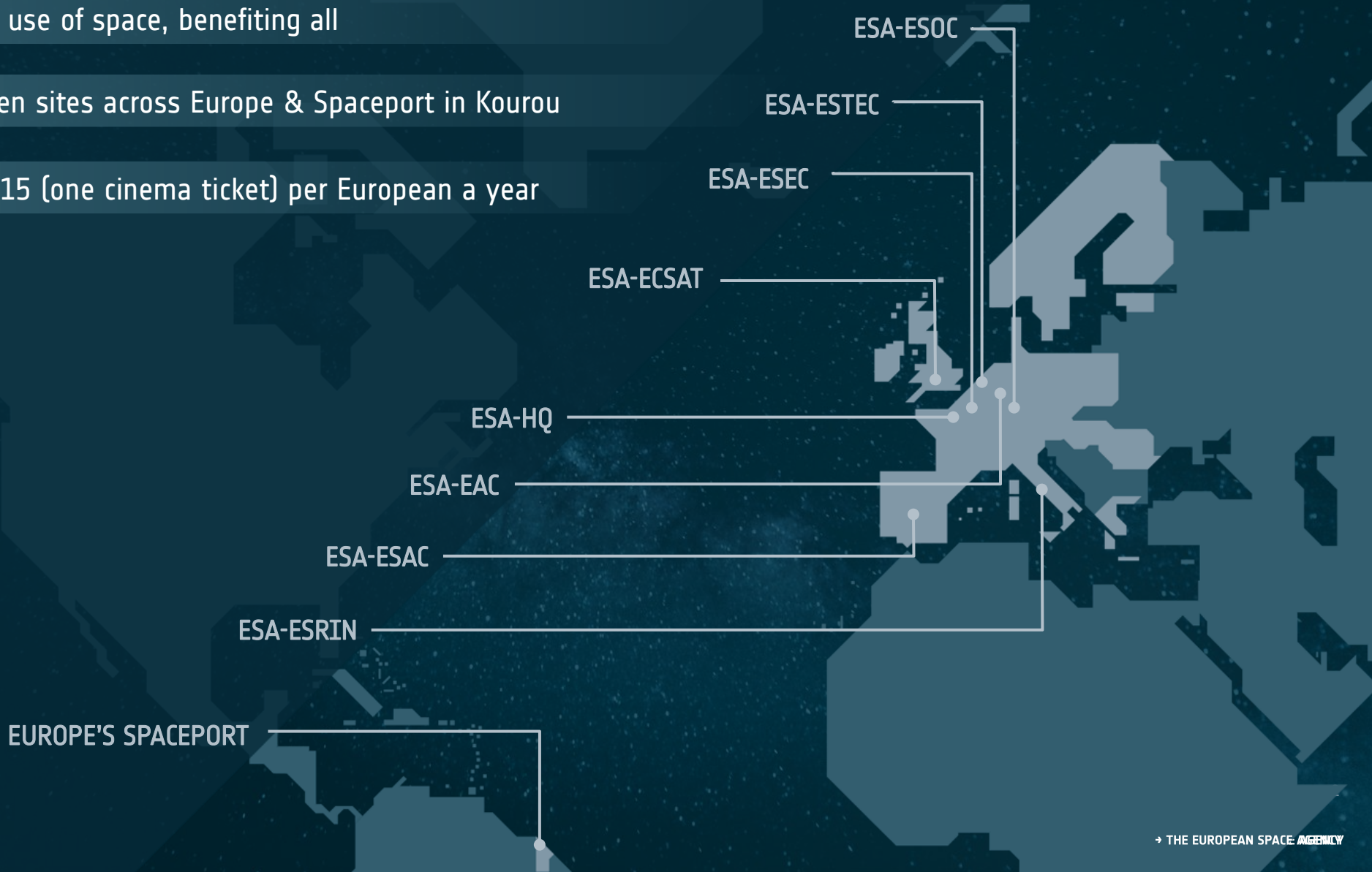
18th November 2025

WHO 23 Member States, 2500+ staff members and total workforce of 6000+

WHY For the peaceful use of space, benefiting all

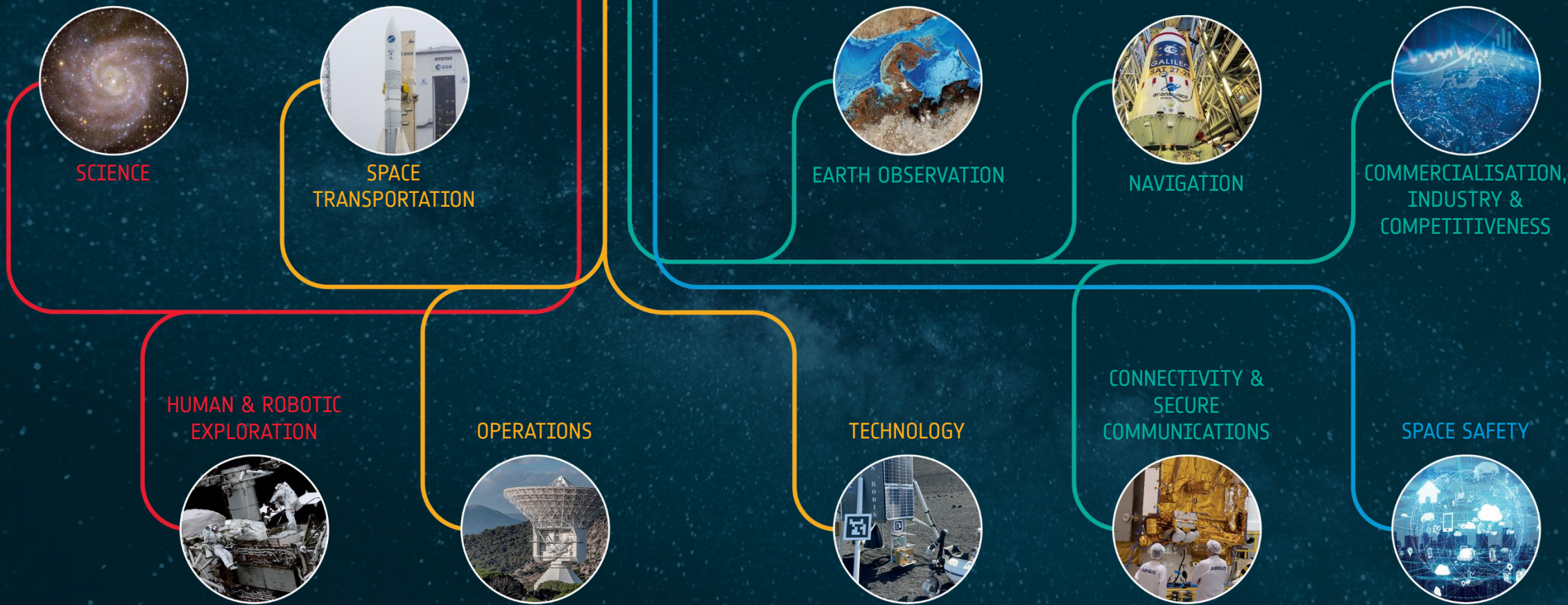
WHERE HQ in Paris, seven sites across Europe & Spaceport in Kourou

BUDGET €7.79 billion = €15 (one cinema ticket) per European a year



INSIDE ESA

Four pillars. One ESA.



ESA's holistic approach to space sustainability



THE MOON & DEEP SPACE



EARTH'S ORBIT



EARTH

Maximise benefits to society

(e.g. Climate change mitigation, circular economy, technology transfer from space to Earth)

Minimise negative impacts

Responsible use of resources, prevent contamination, manage waste

Manage and reduce space debris, responsible satellite operations, avoid collisions

Reduce environmental impacts on Earth, including climate change, biodiversity loss, ozone layer depletion



ESA GREEN AGENDA

APPROACH

Systematic implementation of Life Cycle Thinking and Ecodesign in space programs

- **Understanding** key environmental impacts along programmes life cycle
- **Implementing** – early in design – optimised mitigation solutions to reduce space programmes' environmental impacts

LEARNINGS & COMMITMENTS

- **Industrial activities** accounted for **85%** of the ESA GHG assessment in 2019
- ESA has pledged to **reduce it by 28% by 2030**

GOAL

Make the European space sector a role model for ecodesign implementation in space projects

LCA in ESA projects | Implementation per segment



Space transportation segment

Launchers: *Ariane 5-ECA, A64, Themis*
STS Mission: *InSPoC-1*
...



Space segment

SCI Mission: *EnVision, LISA*
CSC Mission: *IRIS2, SAGA, Moonlight*
EOP Mission: *TRUTHS, ROSE-L, CHIME, CIMR, CRISTAL, LSTM, FORUM, CO2M*
HRE Mission: *Argonaut, ExoMars Rosalind Franklin, LEO-Cargo*
S2P Mission: *ClearSpace-1, DOK, RISE, Vigil, Space Weather NanoSats*
...

TRANSVERSE

Ecodesign Technologies & tools development



Ground segment

Grounds stations: *Kiruna, Cebreros*
...

And much more to come...



Implementing long-term reduction through ecodesign

Increase of the **environmental performance** of space systems is based on the simultaneous and **continuous use and improvement** of key items

Providing Technical Guidance

Space Systems LCA Guidelines*

Space LCA Database**



Developing the Ecodesign Technical Roadmap

Key R&D technologies, products and processes targeting environmental hotspots



Implementing the ESA Ecodesign Policy

Early simplified LCA to identify hotspots

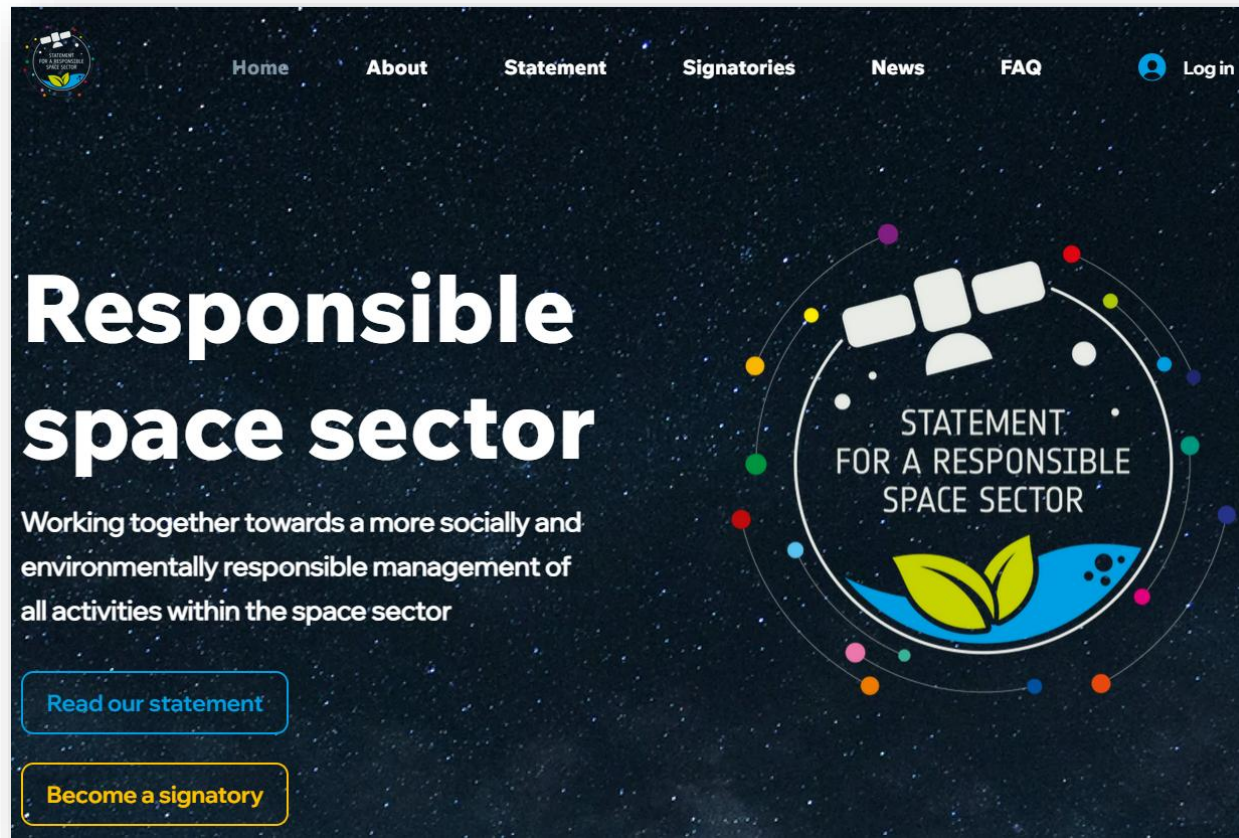
Identification of alternative solutions (ecodesign)



*Open to Member states' organizations (to be requested sending an email to cleanspace@esa.int)

** Open to Member states' organizations, need an ecoinvent license

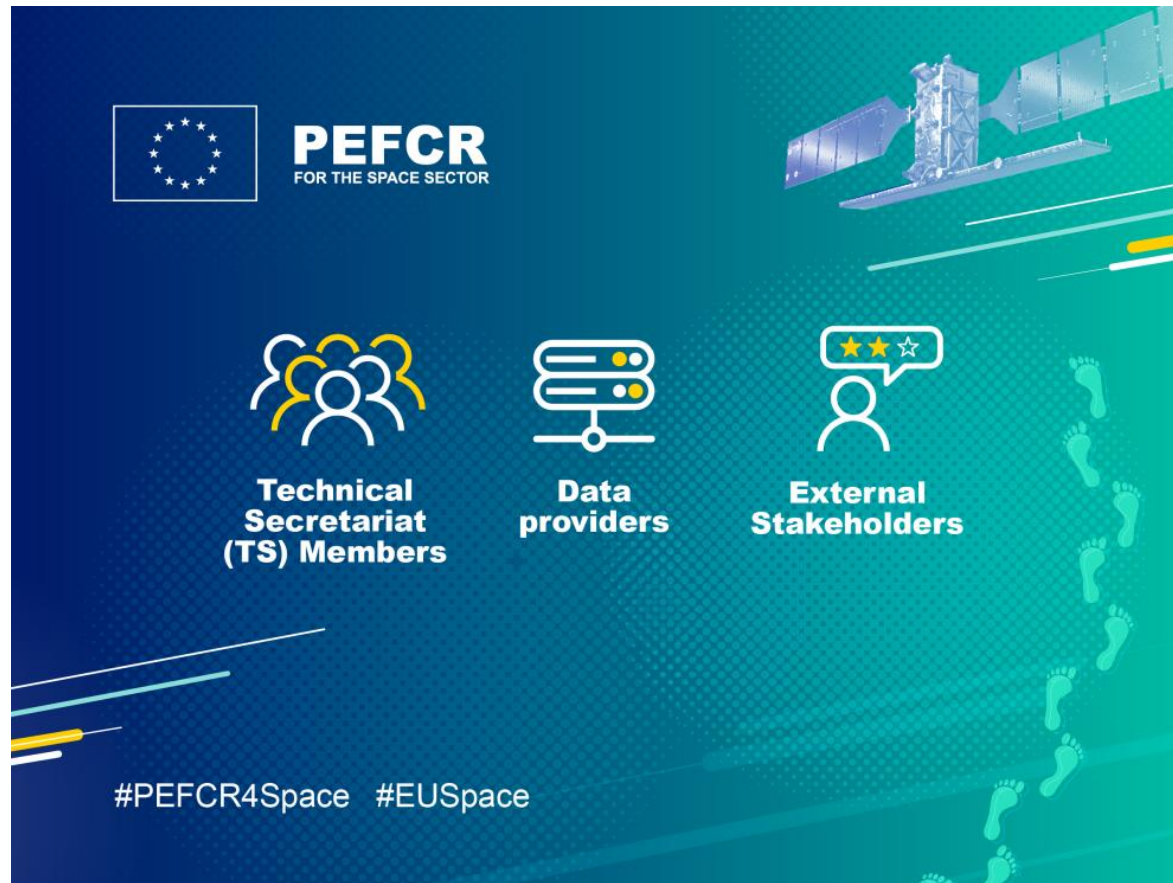
A vision of European cooperation towards socially and environmentally responsible space activities contributing to the development of society



- ❖ Signed on 21st November 2022
- ❖ More than 100 signatories
- ❖ Organisation of workshops and working groups led by ESA to generate collaboration within the European space sector
 - ❖ **Ecodesign** WG
 - ❖ **Decarbonization** WG

<https://www.responsiblespacesector.com/>

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The Product Environmental Footprint Category Rules (PEFCR) for the space sector will establish a standardised method for assessing and reducing environmental impacts across the EU space sector.

❖ **ESA active member of the Technical Secretariat**

❖ **Open consultation of 1st draft**
→ until 01/12 ([here](#))



Importance of engaging with industry

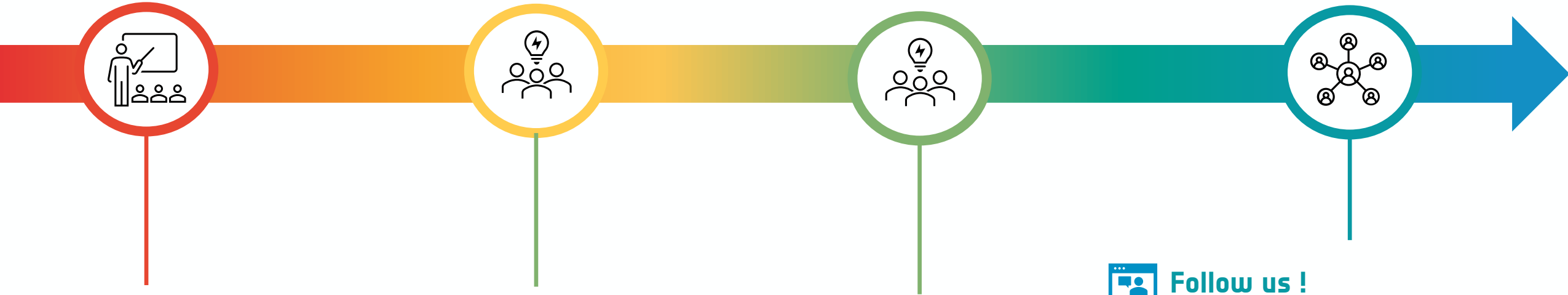
- ✓ **Space specific framework** (Guidelines, database, etc.)
- ✓ **Statement for a Responsible Space Sector**
- ✓ Working groups, conferences, webinar, etc.

Driving innovation and ecodesign trade-offs

- ✓ Adopt **systematic ecodesign approach** from early phases (Ecodesign Policy)
- ✓ Define key **R&D programmes** to support ecodesign (Ecodesign Technical Roadmap)
- ✓ **Lessons learned** and virtuous flow of knowledge

To come

- Release of the update of the **ESA Space Systems LCA Guidelines** (Q4 2025)
- Webinar on **ESA Ecodesign Policy** and approach (Q1 2026)
- Annual **Cleanspace Industry Days** at ESTEC (NDL) with dedicated ecodesign sessions (TBD Q4 2026)



Accessing the ESA LCA Database

To be accessed [here](#)

Ecodesign Days

[ESA Ecodesign Days 2025](#)
[Clean Space Days](#)

Atmospheric impacts of spacecraft launch and re-entry
[2025 Edition](#)

Release of the ESA Space Systems LCA Guidelines (LCA Handbook V2)

Planned Q4 2025
To be requested sending an email to cleanspace@esa.int



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