INCITE – The Innovation Centre for Industrial Transformation and Emissions

New Technologies and Sustainability

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EU-BRITE (European Bureau for Research on Industrial Transformation and Emissions)

The ‘Sevilla Process’ – Industrial Emissions Directive

BAT conclusions are implementing decisions adopted by the Commission that are the basis for drafting permit conditions by Member States' permitting authorities.

Developing Environmental Norms for the European Industry for +25 years from Sevilla

BREFs with the Best Available Techniques (BAT)

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INnovation Centre for Industrial Transformation and Emissions

Strategic element of the revised Industrial Emissions Directive (IED) for tackling industrial transformation. It adds to the 'Sevilla Process' a **forward-looking mechanism**: a necessary evolution of the **Best Available Techniques** concept.

Legal status and mandate

Established under the **IED 2.0**

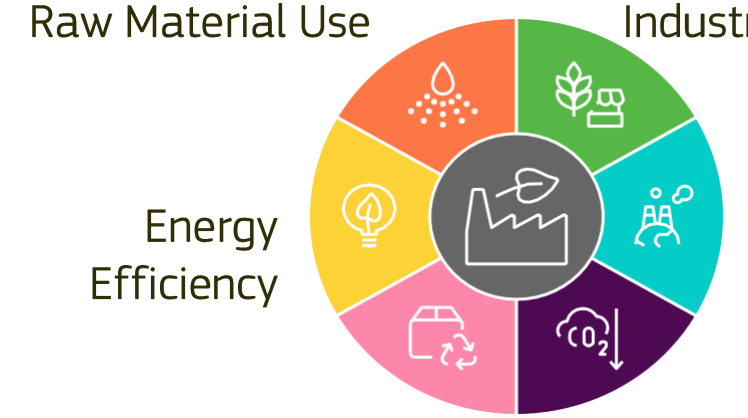
Industry-oriented

Initial focus on **Energy-Intensive** Industries

Readiness

High technology readiness level (TRL > 6)

Integrated approach



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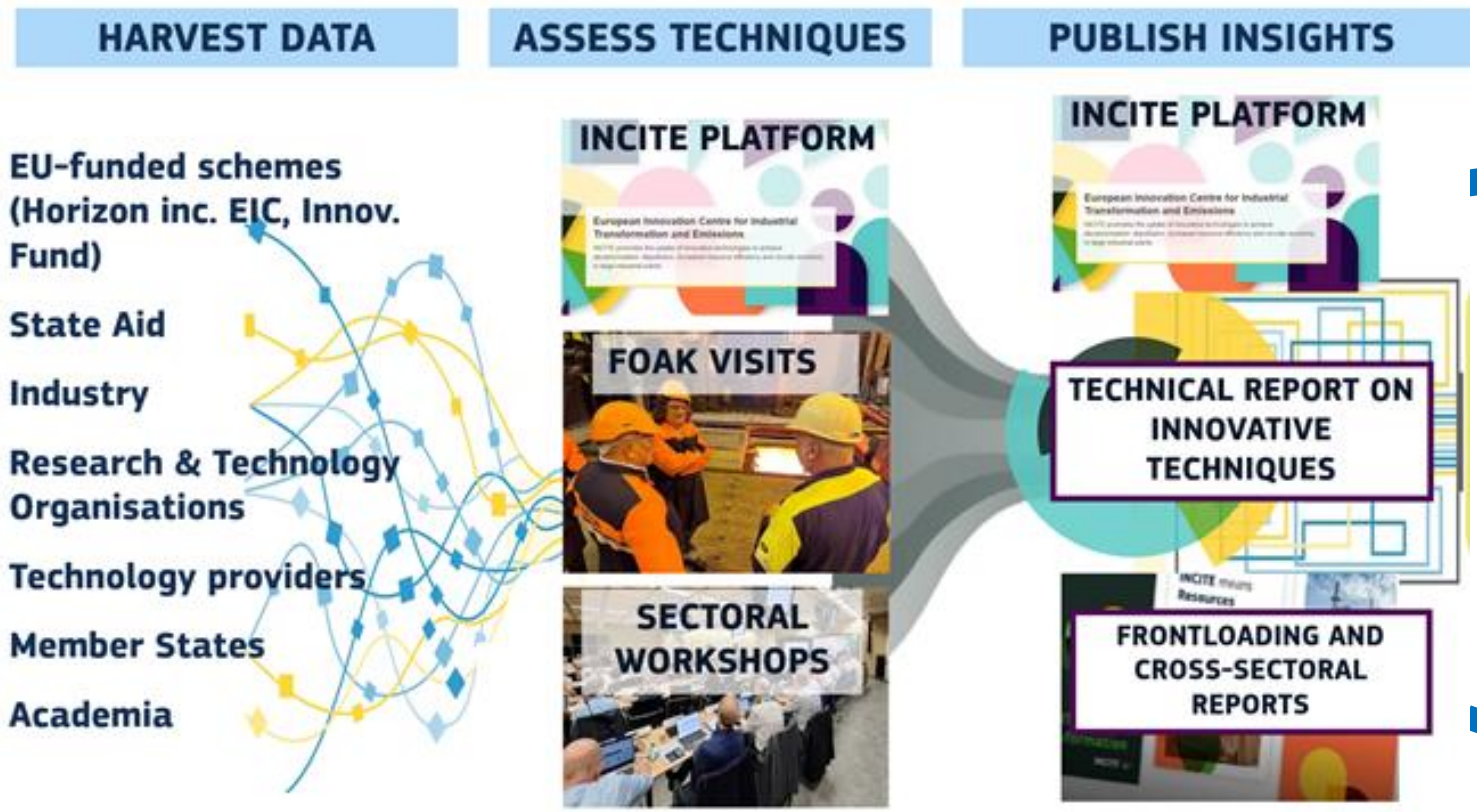
Role and objectives



Beneficiaries / Outcomes

MS / industry/ Env. NGOs

- Include innovative techniques in BREF / environmental norms
- Support permitting

Policy-makers / analysts

- Identify technology gaps
- Advise on R&I priorities

(e.g. Horizon / RFCS)

Financial institutions / investors

- Steer financial support (public / private)

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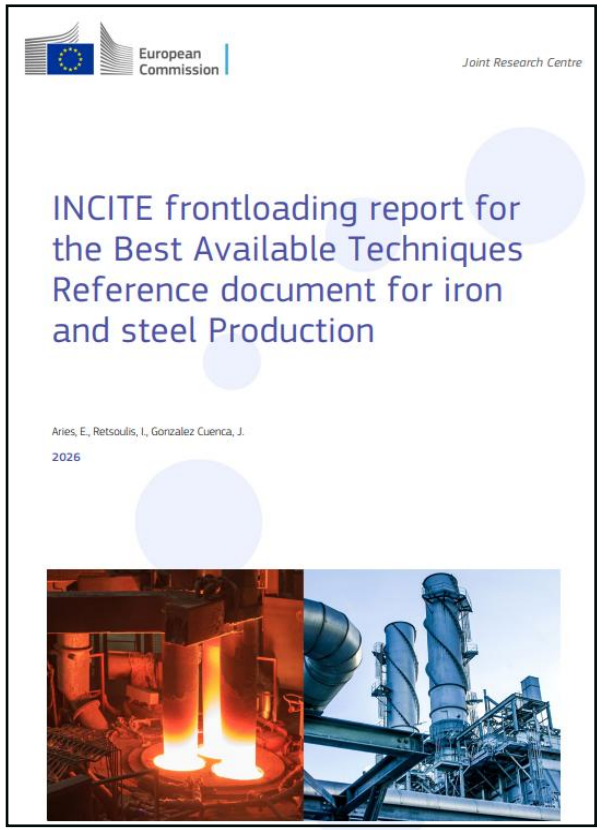
Publications (2026)

TRIT – June 2026

Download reports from here

Visibility and Transparency on INCITE outcomes



IS BREF frontloading report May 2026

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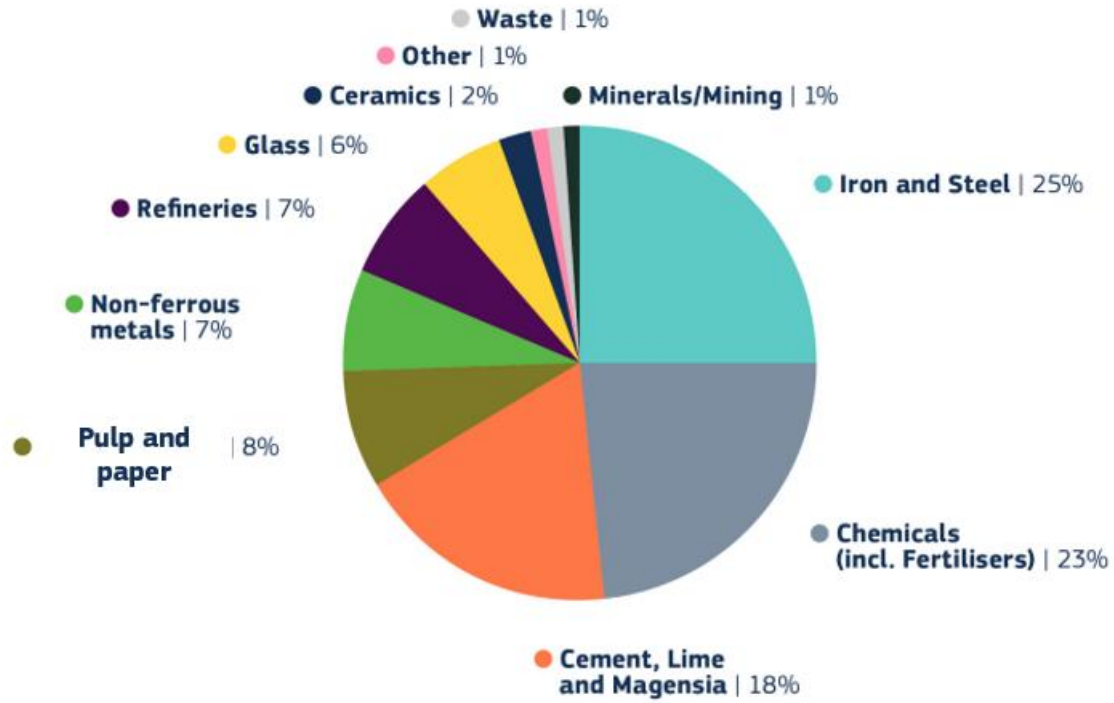
Techniques overview - Mapping

Projects, pilot plants and demonstrators (2020-2025)

563 innovative demonstrators scaling up techniques for decarbonisation, depollution, circularity and resource efficiency across EU´s energy-intensive industries



Sectoral & Geographic Concentration

65% of projects are in three sectors:
Iron & Steel, Chemicals and Cement

Top technology areas:

Circularity & renewable hydrogen lead the pipeline, followed closely by CCS/CCU and energy efficiency

Projects on Plastics Circularity – Preliminary Approach / To be enlarged

* Included in Chemicals Sector / Waste to Feedstock Technology Route
* 22 Demonstrators identified (4% of total Demos)
* 6 Techniques showcased in the TRIT (8% of TRIT)

INCITE – TRIT OUTCOMES

Technique Fiche Example (72 showcased techniques)

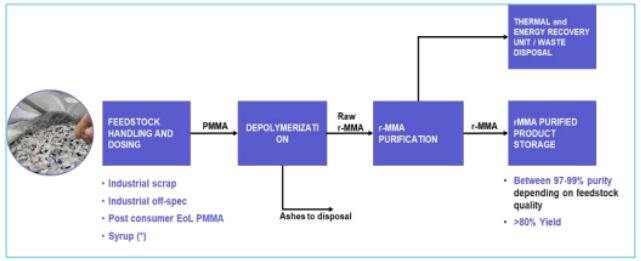
4.6.3.1.5. Chemical recycling of secondary raw materials derived from polymethyl methacrylate (PMMA) scraps

Technical description

The NX ReTM PMMA technology represents an innovative chemical recycling solution designed to address a critical challenge within the plastics value chain. Its strategic importance lies in its ability to convert post-industrial and post-consumer polymethyl methacrylate (PMMA) scraps — which cannot be effectively recycled through traditional mechanical processes and hence are destined to incineration or landfill — into a high-value, virgin-like quality raw material. This process not only diverts waste but also creates a circular pathway for a valuable polymer.

The core of the NX ReTM PMMA process is an innovative, patented technology that uses a continuous flow of molten metal as a highly efficient thermal vector. This molten metal circulates within a closed-loop system at temperatures up to 500 °C. When prepared PMMA scraps are introduced, close contact with the hot metal facilitates a fast and effective depolymerisation, breaking the polymer down into its constituent monomers. This generates a gas rich in methyl methacrylate (MMA), which is then cooled, condensed and purified to produce recycled methyl methacrylate (r-MMA) suitable for direct substitution of fossil-based virgin MMA. The design's short residence time and high heat transfer rates allow for the construction of compact depolymerisation units and confer high energy efficiency levels.

Figure 80. NX ReTMPMMA block flow diagram



Source: [171]

Key operational steps

- **PMMA preparation and feeding**: Ground and cleaned PMMA scraps are stored in buffer storage and dosed into the depolymerisation section through a valve system that prevents air contamination.
- **Molten metal depolymerisation**: PMMA comes into contact with circulating molten metal at up to 500 °C in a closed-loop reactor system, enabling close contact that depolymerises PMMA into an MMA-rich gas with a short residence time.
- **Gas condensation and raw r-MMA recovery**: Depolymerisation gas is channelled to a heat exchanger where it cools and condenses into liquid raw r-MMA containing high MMA concentration plus by-products and contaminants.
- **Purification**: Raw r-MMA undergoes purification to produce pure r-MMA suitable for virgin MMA substitution, while separating gaseous low boilers (light hydrocarbons) and liquid high boilers (heavy hydrocarbons) as by-product streams.
- **Solid residue extraction**: Solid residues generated during depolymerisation are periodically extracted from the molten metal without requiring process shutdown, enabling true continuous operation throughout the year.

Environmental performance

GHG emissions reduction	Production of r-MMA through NXRe™ PMMA is expected to be 96% less carbon-intensive than fossil-based MMA production, reducing the carbon footprint compared to traditional manufacturing methods and delivering substantial greenhouse gas savings.
Water conservation	NXRe™ PMMA does not have any water requirements and does not produce emissions to water. The technology generates minimal waste water from the purification system (less than 1% by weight of processed PMMA scraps), which is managed as liquid waste and originates from PMMA scrap humidity and depolymerisation by-products.
Chemical substitution	The 650K Plant is expected to avoid consumption of approximately 13 000 tonnes per year of chemical products, including particularly hazardous substances, normally used to manufacture equivalent quantities of fossil-based virgin MMA, requiring only negligible raw materials beyond PMMA scraps.
Circularity and waste diversion	The technology fosters circularity by recovering PMMA scraps currently landfilled or incinerated, increasing recycling rates for a scarcely recycled polymer. Only approximately 1% by weight ashes and some filters require disposal, while other residues including waste water, high boilers and recovered dust undergo recycling or recovery.

MAIN INCITE SCOPE ASPECTS COVERED

Depollution	Circularity	Decarbonisation	Resource Efficiency
	✓	✓	

Cross-media effects

Compared to fossil-based virgin MMA manufacturing technologies, NXRe™ PMMA does not present meaningful cross-media effects. The technology is energy-efficient, requires only negligible raw material quantities except PMMA secondary raw materials, and does not generate more waste, noise or odour than fossil-based alternatives. Not requiring highly hazardous raw materials like HCN, it is possibly less risky.

The only identifiable cross-media effect relates to using metals as the thermal vector for depolymerisation, though metals remain confined within the closed-loop depolymerisation system with no external environmental contact, and the quantity involved is limited.

Degree of maturity

Current technology readiness	Path to commercial maturity	Potential technology extension
NXRe™ PMMA currently stands at TRL 7, having been extensively validated through laboratory-scale (10K Prototype) and pre-industrial scale (200K Prototype) testing with private funding supporting technology development.	Upon completion of the EU-funded BOOST Project, MyRemono will build the 650K Plant, the first commercial-scale facility processing 5 000 tonnes per year of PMMA secondary raw materials, achieving TRL 9 and full industrial maturity for widespread market deployment.	NXRe™ could possibly be applied to other polymers including polyolefins and polystyrene. Initial tests with the 10K Prototype generated interesting results, and a first R&D campaign for polystyrene application has been initiated with a major Italian university.

Economics of the technique

Cost competitiveness compared to fossil-based production	Competitive advantages over chemical recycling alternatives
Production costs for NXRe™ PMMA r-MMA, even in small-scale plants, are expected to be 15-25% lower than fossil-based virgin MMA production costs, making the technology economically competitive with established conventional manufacturing processes.	Short residence time, high heat and mass transfer rates, and proprietary continuous solid residue removal provide NXRe™ PMMA with significant economic advantages including compact depolymerisation units, drastically reduced equipment size, and high energy efficiency.

Barriers to implementation

PMMA scrap availability	Emerging r-MMA market	Regulatory classification uncertainty
Of the European PMMA consumption of roughly 330 000 tonne/year, only about 50 000 ton/year of PMMA scraps are collected; these scraps are mainly sent to Asia for chemical recycling, as demand for PMMA scraps in Europe is merely 7 000 ton/year. Increasing the number of possible customers for PMMA scraps and having chemical recycling centres will not only divert to Europe the scraps currently sent to Asia, but willa also support the creation of new PMMA scraps supply chains.	No commodity-like market for r-MMA currently exists, though customer interviews indicate strong appetite for high-quality circular virgin MMA substitutes, with r-MMA potentially priced at equivalent or slight premium levels compared to virgin MMA.	Regulatory uncertainty regarding high boilers classification as by-product versus waste. Commission Implementing Decision (EU) 2021/2326 defines them as "Process fuels from chemical industry," but for example Italian regulation D.Lgs. 152/06 may classify distillation residues from non-oil sources as waste, affecting permitting procedures and technical requirements.

INCITE Why submit innovative techniques to INCITE?

SHORT-TO-MEDIUM TERM BENEFITS

- Contribute to establish a comprehensive **assessment of the innovation** status in a given sector, identify potential **funding gaps** and opportunities, help lift potential **barriers to implementation** (e.g. permitting, legislation, market)

- **Take part in the INCITE journey**! Document / showcase innovative techniques in **INCITE Technical Report** & **information Platform.** Give visibility and document case studies and plants using innovative techniques

MEDIUM-TO-LONG TERM BENEFITS

- **Contribution to BREF Frontloading Reports** - Early identification of innovative techniques for potential inclusion in future BREF / BAT conclusions as candidate (*) for… :

  - **"Emerging Technique"** – Access to special permitting flexibilities for longer testing and commissioning – up to 30 months derogation to meet BAT-AELs.

  - **"Best Available Technique"** – Become sectoral reference and ensure wide implementation in the sector (potential competitive advantages / faster permitting)

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“How” connect with INCITE - Information exchange

1. **Bi-lateral meetings with tech. provider / project coordinator**
2. **Written submissions using the INCITE standardised template**
3. **INCITE data check, refine submissions with data submitter, inclusion in the INCITE technical report**
4. **Upload key data in the online INCITE information platfomr**
5. **Review / consent for publication in the INCITE information platform**

- Safe submission process: Confidentiality of information & High Cybersecurity
- Technical descriptions of Innovative techniques are **co-created**, reviewed and finalised between the INCITE team and experts in charge of a technique, ensuring that the most accurate and up-to-date information is provided
- **INCITE template questionnaire** to be distributed following this presentation to kick-off exchanges!

INCITE – Information gathered via INCITE questionnaires

1

Title & Description

— Short summary
— Industrial sector, developing company, pilot scale, location, linked research project

2

Technical Description

— Technique performance
— Innovative features, BAT comparison (or relevant alternative)
— Potential to achieve decarbonisation, depollution, or circular economy goals

3

Maturity Level

— TRL assessment
— Scalability potential
— Next steps & future developments
— Deployment to other sectors

4

Environmental Benefits

— GHG emissions reduction
— Air & water conventional pollutants
— Chemical substitution
— Resource consumption (energy, water)
— Circularity & industrial symbiosis aspects

5

Cross-Media Effects

Negative environmental effects & trade-offs: increased use of resources, energy or water; higher or new emissions; increased waste generation; use of hazardous substances; noise/odour generation.

6

Economics

CAPEX, OPEX, payback period, cost comparison to alternative solutions.

7

Implementation Barriers

Challenges and techno-social-economic constraints for scaling up and deployment

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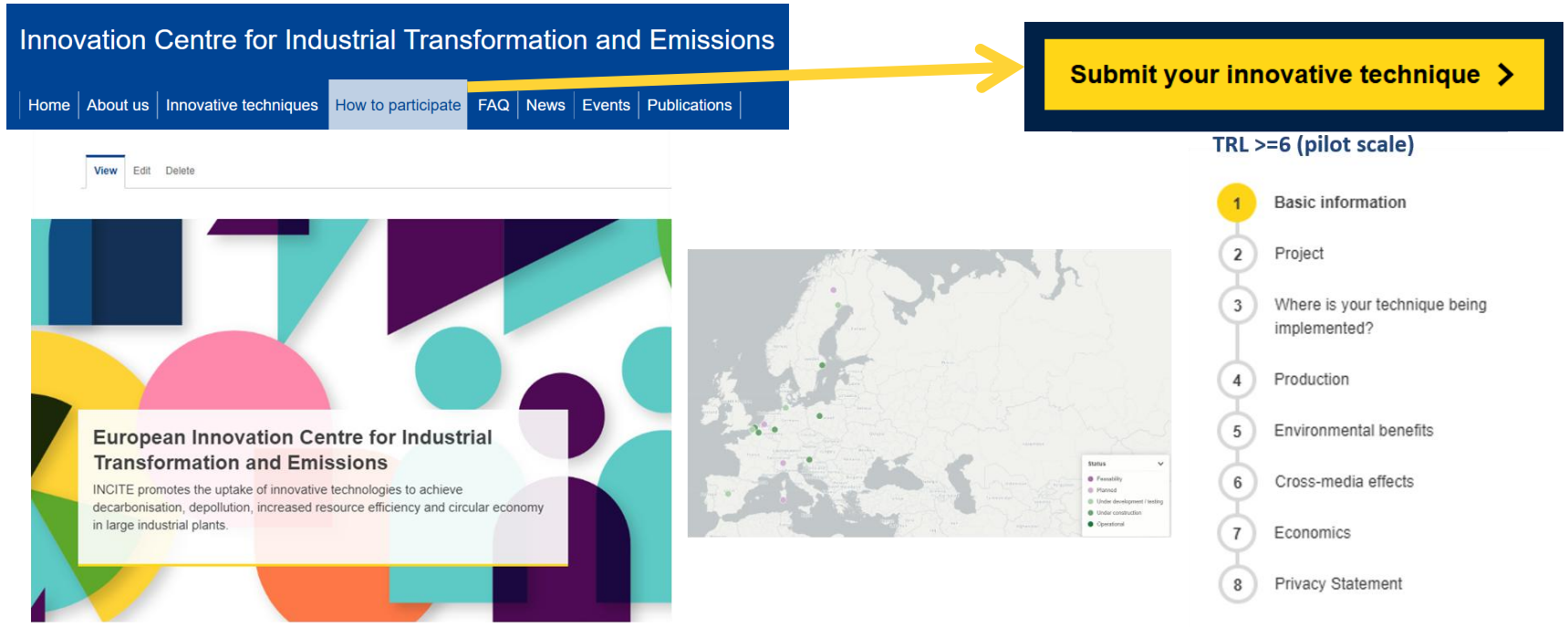
How to collaborate with us - INCITE web platform

- **Contacting INCITE:** JRC-INCITE@ec.europa.eu
- Submitting directly an innovative technology in our website:



- **Confidential Business Information (CBI) is not published** – only viewed by INCITE team
- **High cybersecurity level** (Classified non sensitive data) - data submitted is encrypted

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Final remarks

- **Plastics (Circularity & Sustainability) to become a key activity in INCITE's future work.**

- **INCITE is supporting the early frontloading of the ORG BREF**, with a focus on identifying and assessing innovative techniques / **A dedicated INCITE report to be prepared**, providing technical evidence to support the future review BREF process.

- Importance of connecting with INCITE and sharing information.

  - **Proactive exchange** – collaborative and safe – reports published as reference

  - **Benefits for Industry**

Thank you for your attention

https://innovation-centre-for-industrial-transformation.ec.europa.eu/

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