Le réseau de transport d'électricité

Implementing circular economy approach for a sustainable and resilient grid

24th October 2024

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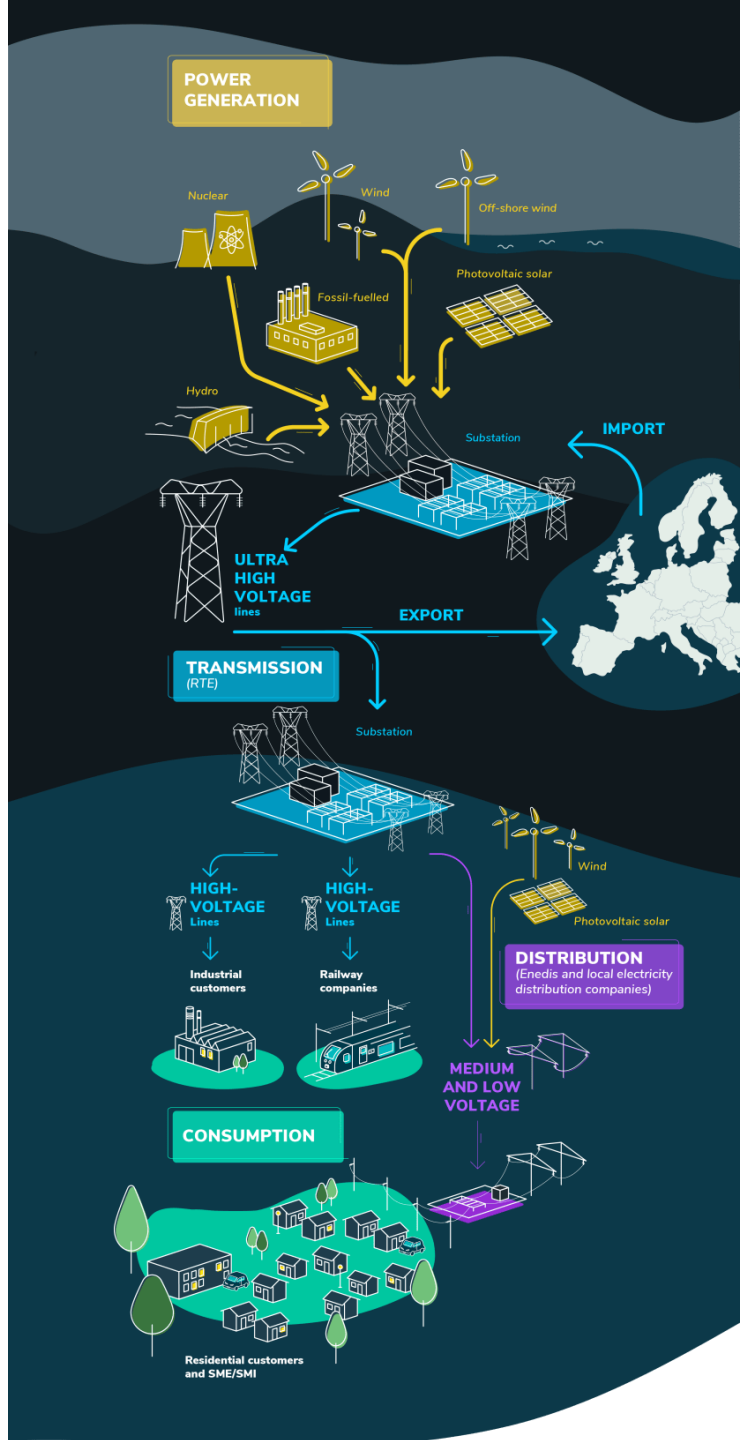
RTE, the transmission system operator in France

Key figures 2023

- 105,817 km of overhead & underground high and very high voltage cables
- 2 828 substations currently in operation
- 25 500 of optical fiber
- 56 cross-border connections
- 10,025 employees, including 507 apprentices
- 6 131M€ revenue
- 1750 M€ invested in the network
- 131 M€ invested in interconnections (France-Spain, France-Ireland, France-Italie)
- 40M€ annually allocated to R&D
- Customers
    - 9 railway companies
    - 327 market players (balance responsible entities, adjustment actors, demand-side response operators, obligated parties or capacity-mechanism certification entity holders, etc.)
    - 424 industrial consumers
    - 274 power producers
    - 136 distribution companies



RTE's purpose and CSR policy

Leveraging its network and dedicated to its public service mission which is essential for the life of our country, RTE works every second to ensure long-term access to decarbonized electricity. The men and women of RTE are conscientiously and passionately committed to achieve the energy transition on a local, national, and European scale by pursuing three ambitions: enlightening, operating, and optimizing

Corporate Social Responsibility policy

Inform public authorities

- Foresight studies for energy policies
- Transparency, dialogue and co-construction with stakeholders

Operate the Energy Transition

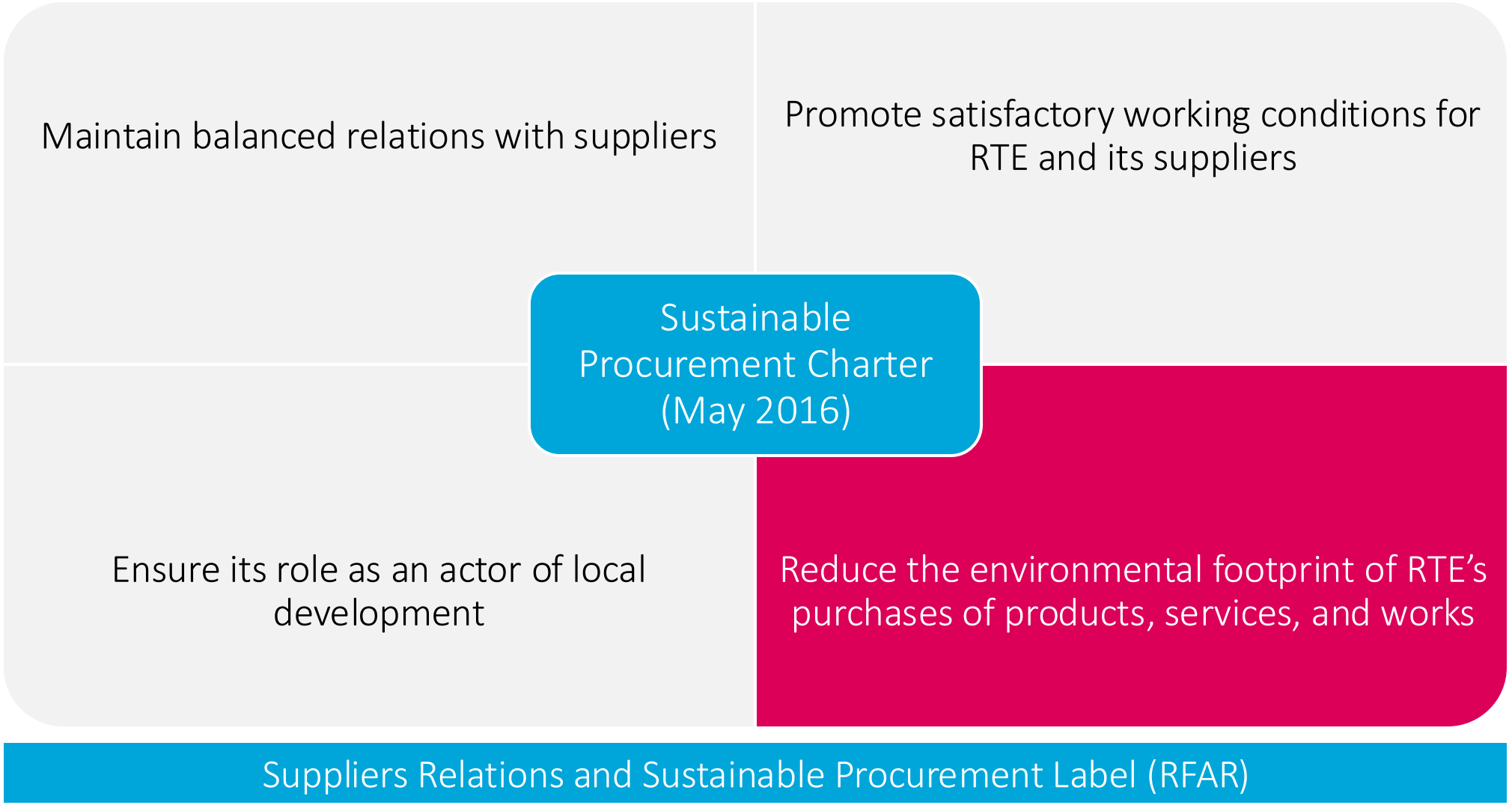
- Network performance, crisis prevention and management
- Development of flexibilities for the electrical system
- Climate change adaptation
- Energy transition support
- Sustainable procurement & territories

Optimize the electrical system

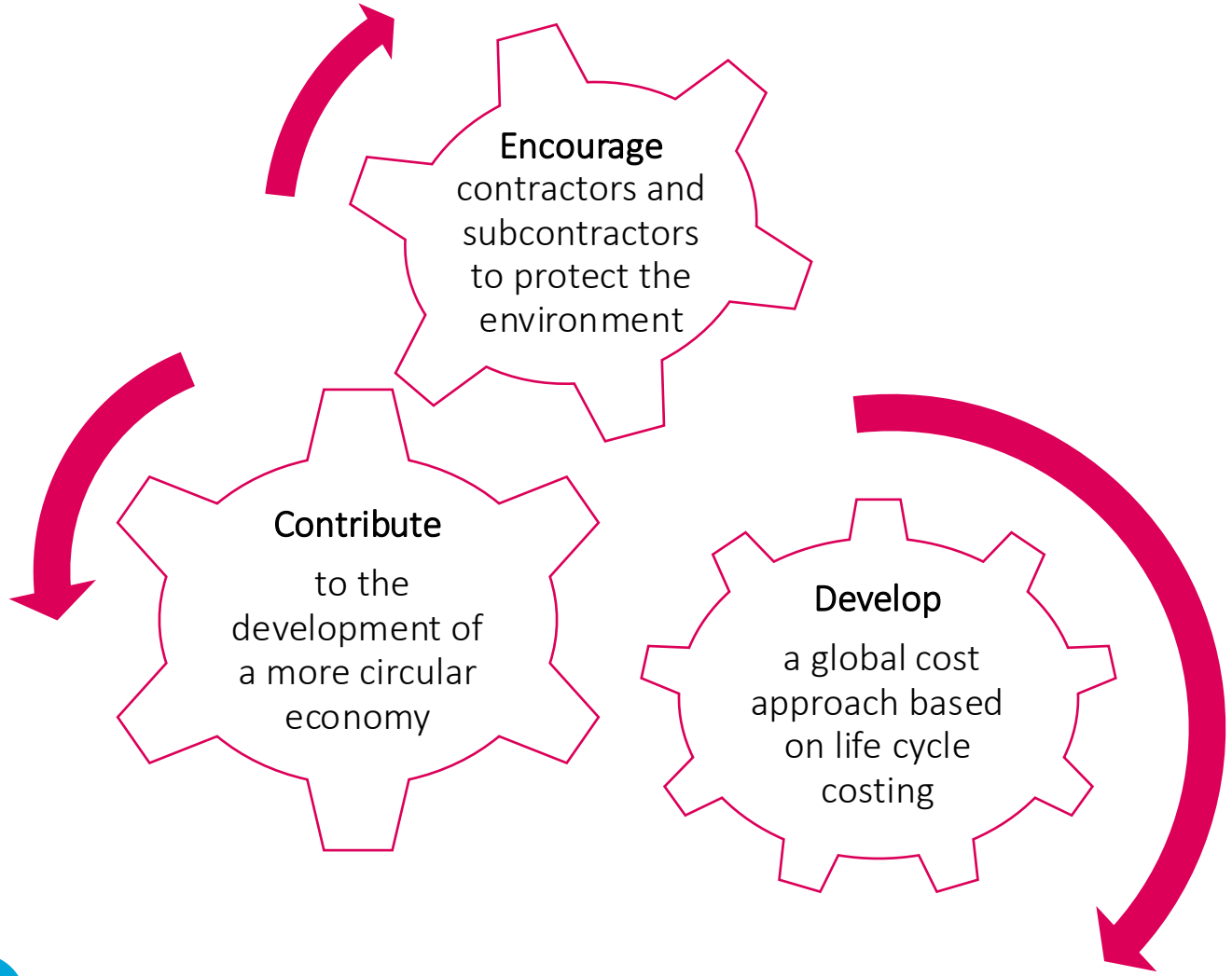
- Address climate change while protecting biodiversity & landscape
- Resource preservation & circular economy

- Governance & business ethics
- Diversity, equal opportunities & inclusion
- Health & safety of internal & external stakeholders
- Skills development & talent management

RTE’s action in favor of sustainable procurement



Sustainable procurement to reduce environmental footprint



The Greener Choice

The Greener Choice – A Joint Call for Action

Dear suppliers,

In 2020, we as transmission system operators (TSOs) approached you with our letter entitled '*The Greener Choice*'. Since then, global supply chains have been ruptured in the wake of the COVID-19 pandemic and are again being challenged by Russia's invasion of Ukraine. It is clearer than ever that as we are accelerating Europe's transition towards the first climate-neutral continent, we must also build up resilience in our global supply chains and drive decarbonisation well beyond our own activities. Today, we stand together as ten European TSOs and confirm the ambitions we outlined in our first *Greener Choice* letter, in the hope of turning our vision into reality.

We share these ambitions with, and face the same challenges as, many of our suppliers. We must therefore take the next steps together. In practice, this means TSOs and suppliers must both do their part. It is on us to lower entry barriers for innovative technologies and the circular use of raw materials. We will need to revise standards and practices that stand in the way of a smarter way of working and overcome legacy technologies, such as the use of SF_6 as an insulating gas. Naturally, this process will take many years. Along with the signatories of this letter, we have formed a working group which strives to coordinate and consolidate methodologies for rating and quantifying more sustainable manufacturing, service and logistical processes. These metrics will eventually be taken into account in our procurement processes.

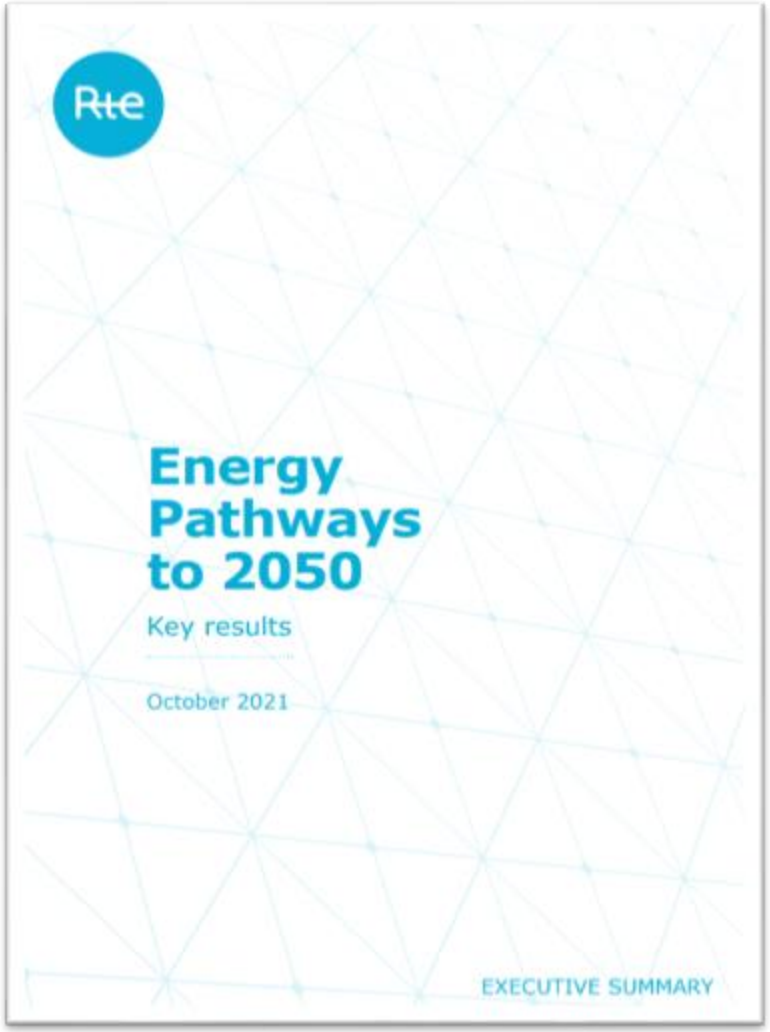
Similarly, we would like to see our suppliers - each to the best of their abilities - also transition towards more sustainable business models. We expect all suppliers to examine their value streams and account for raw materials, their provenance and recycled content, as well as emissions resulting from manufacturing and logistical processes. Where possible, suppliers should undertake standardised life cycle assessments of their products and services and share this data with us via common exchange platforms. This will form the basis for our transition towards carbon neutrality. Moreover, we would like to encourage suppliers of all sizes and from all sectors to invest in seeking out ESG performance ratings. These can help to identify an organisation's strengths and weaknesses and structure its approach to sustainability. At the same time, such ratings allow us as clients to benchmark suppliers' achievements and reward front-runners.

We value the efforts that many of you have already undertaken and encourage you to stay on this path. Your ideas are welcome and we are eager to discuss them with you. If you are unsure about how to tackle these topics, do not hesitate to reach out to us – we look forward to speaking with you.

Let us help each other and work on this challenge together.

Robert Steinemer, Head of Procurement at Amprion
Vivienne Bracken, Chief Procurement Officer at National Grid
Ringeisen Ralf, Head of Procurement and Claim Management at Swissgrid
Domenico Gentile, Head of Procurement & Contract-/Claim management at TransnetBW
Norbert Hiesleitner, Head of Procurement at APG
João Correia Botelho, Director Procurement at REN
Sjouke Bootsma, Director Supply Chain Management at TenneT
Harald van Outryve d'Ydewalle, Head of Elia Group Purchasing
Gilles Etheimer, CPO at RTE
Alessandro Fiocco, Head of Procurement at Terna

Energy Pathways to 2050: Key findings



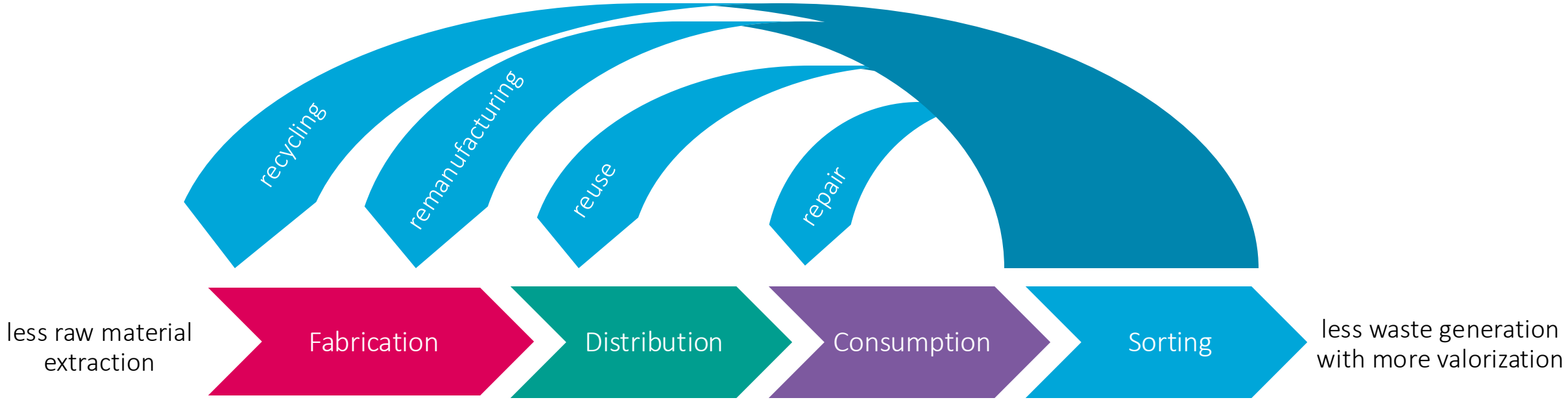
Environmental dimension

Mineral resource supply may face tension in the energy transition, especially for key metals, requiring careful planning

- Transitioning away from fossils fuels increase the need for new mineral resources and supply chains
- Criticality issues for necessary resources vary, including limited reserves, monopolies, conflicts of use and economic importance, substitutability, environmental impacts, etc.
- Copper is especially critical, needing close monitoring in scenarios with a high share of renewables in the mix

RTE's strategic environmental plan 2022

A circular economy approach to reduce environmental impact and increase sustainability include several actions



This approach is essential for tackling resource scarcity, environmental degradation, and reducing carbon emissions

RTE's Circular Economy Action Plan 2023

RTE is now intensifying its efforts and scaling up by developing a circular economy action plan 2023-2030 based on key major actions

- Embedding circular economy principles systemically: integrating circular economy into contracts, accounting, knowledge, metrics, and culture
- Recycling steel & aluminum for pylons & cables
- Recycling copper from underground lines
- Taking action on the lifecycle of key equipment components
- Reusing materials from construction sites & decommissioned assets
- Formalizing the waste management plan in accordance with the green taxonomy

The LCA (Life Cycle Assessment) as the starting point

RTE has being using LCA methodology for several reasons

To **learn about the environmental** impacts of grid technologies throughout its entire life cycle

To **compare** different **technologies** for a specific grid solution and evaluate the opportunity to review its technical policies

To **compare** different **references** for a specific component and evaluate the opportunity for adding new references

To identify **levers** to reduce environmental impacts for a specific project and **integrate new environmental clauses in contracts**

LCA helps to rethink the design of grid technologies in a circular economy context

Standardized LCA methodology to ensure reliability, comparability and transparency regarding product's sustainability

PCR (Product Category Rules) **for life cycle assessment** of Electrical and Electronic Products and Systems (**EEPS**) proposed by IEC, IEC 63366 ED1, provide a uniform approach (**core rules**) to perform LCA

- To ensure a consistent quality of the LCA results
- To enable data aggregation in larger systems
- To serve as basis for product environmental declarations using quantitative environmental impacts

According to the decision of IEC SMB (June 2024), **PCR standard IEC 63366 ED1 is horizontal, and shall be used to define PSR** (Product Specific Rules) for each EEP within this family (product-related, vertical) **to be more specific** than the general PCR

- Power transformers
- Cables
- High-voltage switchgear and controlgear IEC TS 62271-320 ED1

Other challenges

- Product information traceability to improve transparency in the value chain
- The choice of data and database is crucial to reflect the real industrial process in LCA

Having a specific sectorial common database open source, periodically updated will help to ensure robust and consistent quantitative environmental data on electrical and electronic products

Raw Material Passport for driving material reduction and increased used of recycled resources

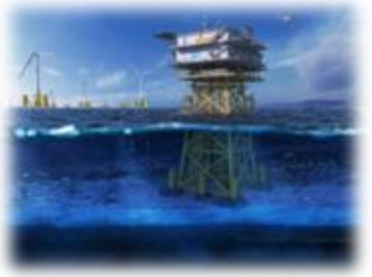
Raw Material Passport

Together, progressing towards a circular economy to promote sustainability

As a key stakeholder in the European energy system, RTE is deeply involved in the societal, environmental and energy transition, placing Ecodesign at the core of each of our solutions, aiming to improve our environmental footprint as strong as possible, including for subcontracted services.
Indeed, the whole value chain must be mobilized to be able to activate the relevant levers to address systemic challenges encountered throughout the life cycle of our activities.
This is the reason why, as part of this collective and essential effort, we are asking you to fill out this Raw Material Passport (RMP) to gather key insights about our assets to steer our circular economy strategy.
Each equipment proposed under RTE contracts should be accompanied by a filled RMP.
This marks the initial step toward better understanding the composition of the sustainable RTE infrastructure in accordance with our Green Procurement strategy, which aims to minimize the use of scarce, critical, or non-reusable materials, promoting materials reuse, and reduce waste in our operations.
Should you require further assistance or clarification, please feel free to reach out your procurement contact at RTE.

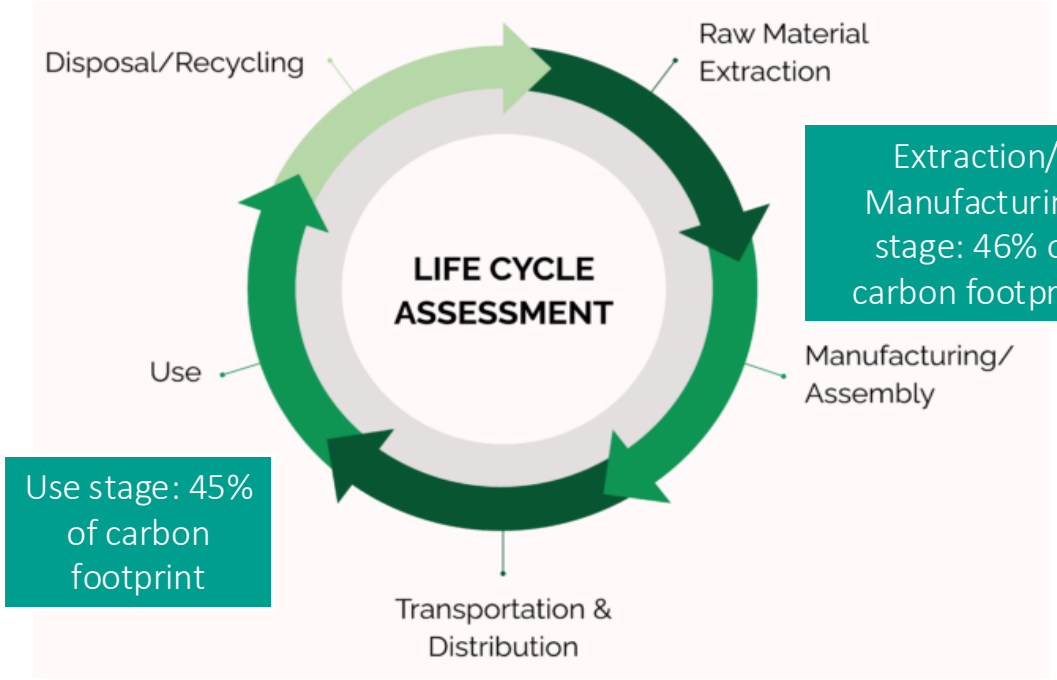
	Weight (kg)	Weight (%)	Recycled content (%)	Recyclable (%) (at the end of life of product)	Critical Material (yes or no)	VIRGIN MATERIAL UPSTREAM			INPUT RECYCLED MATERIAL UPSTREAM		
Type of material - eg. copper/aluminium/steel/etc. Specify on molecul level. *The Contractor shall chose the material in the list. If the material is not included in the existing list, the Contractor shall add the corresponding the material*	*Total weight of that material in the product (kg)*	*Weight of this material divided by total weight of the product.*	*How much (%) of the material has been sourced from recycled sources. Ex: material A recycled (kg)/total weight material A (kg)*	*How much of the material can be recycled after end-of-life? Definition of recycled is when it is not send to incineration or landfill Ex: material A recyclable (kg)/total weight material A.*	*Yes: material is obtained from at least one of the 2023 European commision list of Critical Raw material (Annex 2 of Critical Raw Materials Act CRMA)*	*First tier supplier of material A*	*Country where first tier supplier of material A production plant is located*	*Location of Original raw material of material A extraction (eg. Material that is sourced by mining)*	*First tier supplier of recycled material A*	*Country where second tier supplier of recycled material A production plant is located*	*Give precisions o recycling chain : h step (refinery ...)*

Using LCA results to define sustainability criteria in procurement



HVDC Offshore Substation framework contract

Based on LCA results, RTE focus on Extraction/Manufacturing and Use stages



Extraction/ Manufacturing stage: 46% of carbon footprint

Use stage: 45% of carbon footprint

Impacts are expressed in CO2 equivalents based on LCA. CO2 can be translated into cost using a French accepted externally value (Quinet II value, 250€/CO2 ton 2030)

- About 90% of the Manufacturing carbon footprint is generated by 4 elements: Steel, Aluminum, Copper, and Electronic Components
  - Award criterion on manufacturing carbon footprint with carbon pricing estimation
- About 90% of the Use carbon footprint is generated by electrical losses. RTE considers two aspects:
  - Economic cost of energy losses
  - CO2 cost associated to those energy losses

The evaluation require bidders to commit to the weight and emission factors of these materials. Proposed quantities are binding with penalties for significant discrepancies between the call for tender and the execution phase

Life Cycle Cost helps accounting environmental impacts throughout the entire product's life cycle

A second life for grid monitoring systems

Decommissioning management aims to recover old low voltage equipment (wiring, telecontrol systems, state indicators, perturbographs, etc.) when replacing by digitized electrical substations

Main principles

- Supply spare equipment to the Industrial Systems Automation teams for maintenance
- Provide complete low voltage systems to engineering projects
- Recover still-functional old low voltage installations for reuse

The involvement of a specialized provider was essential

- Our partner is responsible for equipment recovery, storage in dedicated RTE area, performing necessary test

Several tests were carried out in 2022 and 2023 on equipment that has been in operation for over 30 years

- An additional 15 years of aging is projected
- High recycling rate: 98% of waste valorized, excluding non-recyclable plastics

RTE has changed its replacement policy for instrument transformers

50 000 oil-insulated instrument transformers in service

Combine Unit

63kV-90kV

Current Transformer

63kV-400kV

Voltage Transformers

63kV-90kV

Capacitive Voltage Transformers

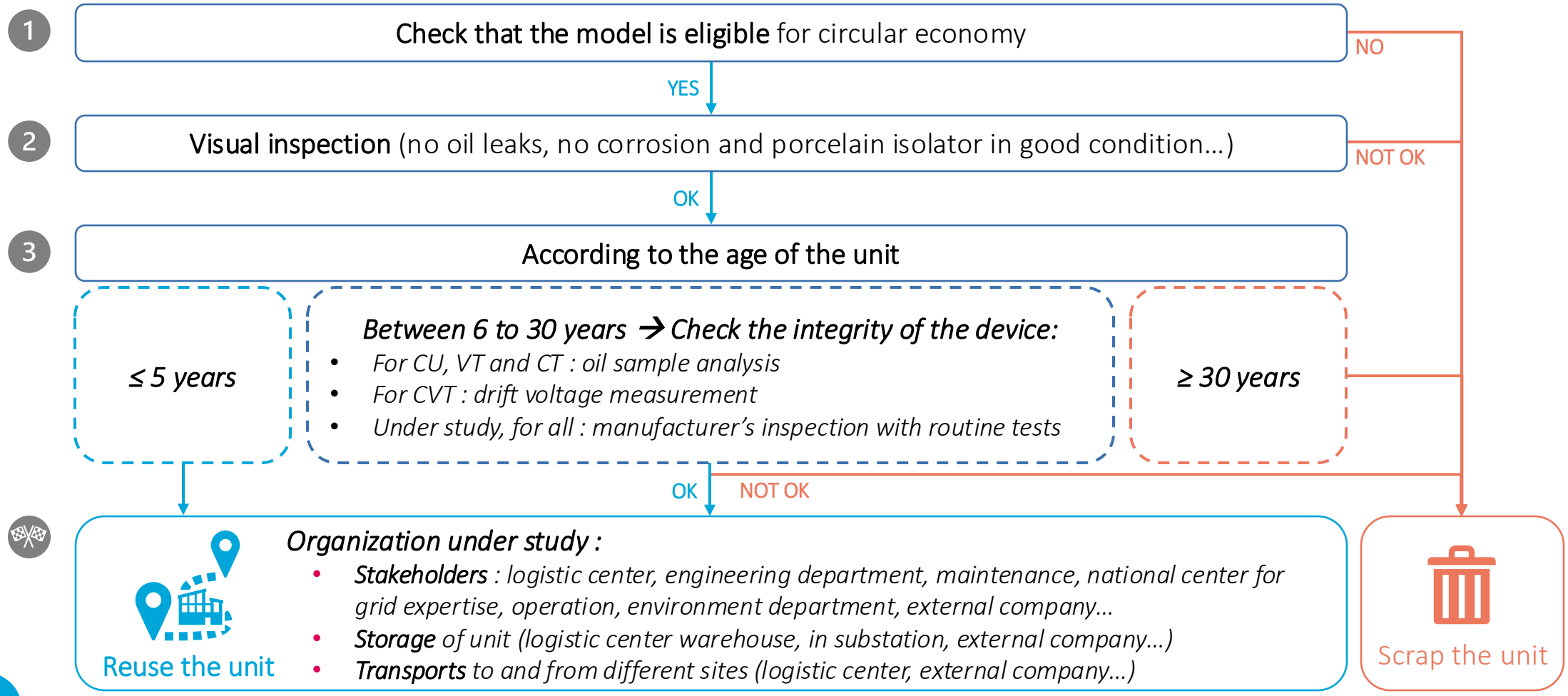
225kV-400kV

1) Devices with safety and environmental risks, replaced as soon as possible
2) Run to fail units, unit pool create with engineering, maintenance, and operation department (low operating consequences, limited safety risk, diversified)
3) Equipment replaced according to age criteria, between 24 to 55 years based on a risk analysis (cost of failure vs probability)

Is there a possibility of reusing dismantled young equipment ?

Reusing instrument transformers

Reusing instrument transformers that have been discarded prematurely
in relation to their lifespan by developing a circular economy

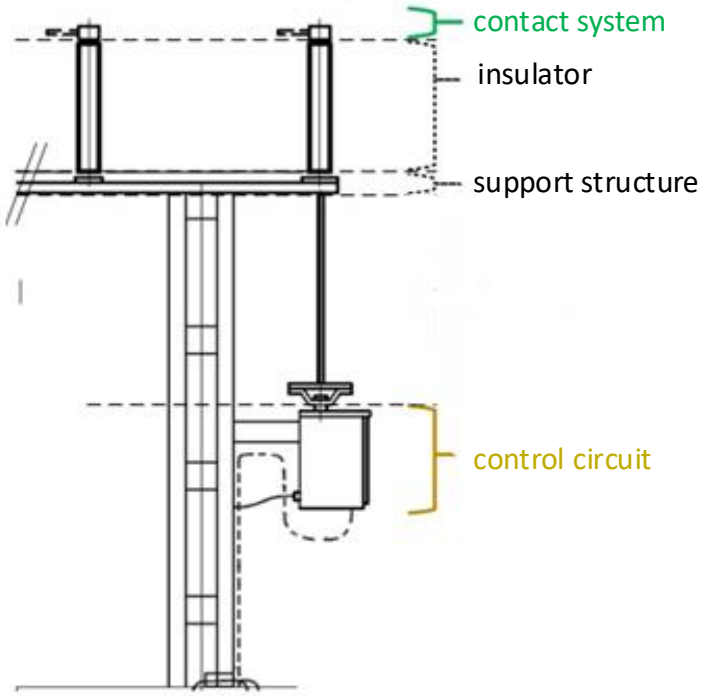


Exploring actions to reuse, repair and refurbish disconnectors

Current situation

2 options:

- Full renewal: disconnector removed and scrapped
- Renovation of 2 elements: contact system / control circuit



Opportunity for a complete renovation

Recovery of components (insulators, contact system, control circuit)

↓

Diagnosis + refurbishment of these components

↓

Reuse of the refurbished disconnector

Benefits

- ✓ Significant impact on CO2 balance (reuse of insulators) following LCA studies
- ✓ Reduction of costs / lead time compared to new equipment
- ✓ Local employment

Experiments on overhead conductors using recycled aluminum

In collaboration with several partners, RTE conducted an experiment to produce new overhead conductors using recycled aluminum from previously used conductors

- The results showed that these recycled conductors successfully passed all technical tests
- They performed on par with those made from virgin material
- At this stage, no significant technical barriers to feasibility or quality have been identified

Future experiments with recycled materials

- Underground and submarine cables
- Power transformers

Other challenges

- Establishing and adapting industrial bases that can effectively manage large-scale quantities of recycled materials in grid components
- Encouraging stakeholders across the value chain to adapt existing processes in response to the evolving context

Conclusions (1/2)

Related to methodology :

- LCA is the best tool for assessing the environmental impacts of a product throughout its life cycle
- LCA methodology raises awareness of environmental impacts, promotes ecodesign, and supports decision-making
- PCR standard for electrical and electronic products (EN IEC 63366 ED1) utilizes PEF methodology and sets LCA quality requirements for environmental product declarations
- Applying PCR standards to define PSR for power transformers and cables, is essential for supply comparability
- LCA results should drive changes in practices, particularly in design across all life cycle stages

Related to quality data and database :

- Trustable and reliable product lifecycle data is essential to ensure comparability between grid solutions
- Raw Material Passport drives material reduction and increased used of recycled resources
- A sector-specific, open-source database, regularly updated, will ensure robust data on grid technologies

Related to sustainable procurement :

- LCA results help defining sustainable environmental criteria for procurement
- CSR criteria enable TSOs to use sustainability as a differentiator in power grids supply chain
- CSR criteria improve supply chain sustainability by promoting sustainable and circular products

Conclusions (2/2)

Related to circularity :

- Collaboration within the power grid industrial ecosystem is vital for developing raw materials recycling and processing capabilities, helping to prevent downcycling
- Specialized skills and industrial expertise are essential for improving waste sorting, stream identification, and recycling process to achieve high recovery rates
- Establishing robust industrial bases for processing and recycling grid technologies is crucial given the high decommissioning rates expected over the next decade
- Technical studies and experiments between users and manufacturers are necessary to identify acceptable levels of recycled materials while maintaining electrical, mechanical and chemical expected functionalities

Related to supply chain resilience :

- Availability of grid technologies is essential for deploying grid infrastructure and meeting electrification goals
- Strengthening the resilience of the grid supply chain is crucial because of limited resources, steep rise in demand and geopolitical tensions
- More circular and resource-efficient grid components can mitigate vulnerabilities and reduce dependencies

Coordinated action and collaboration among industrial ecosystem stakeholders are essential to implementing a circular economy approach for a more sustainable and resilient power grid

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Thank you !