



Circular Economy in Nuclear Decommissioning

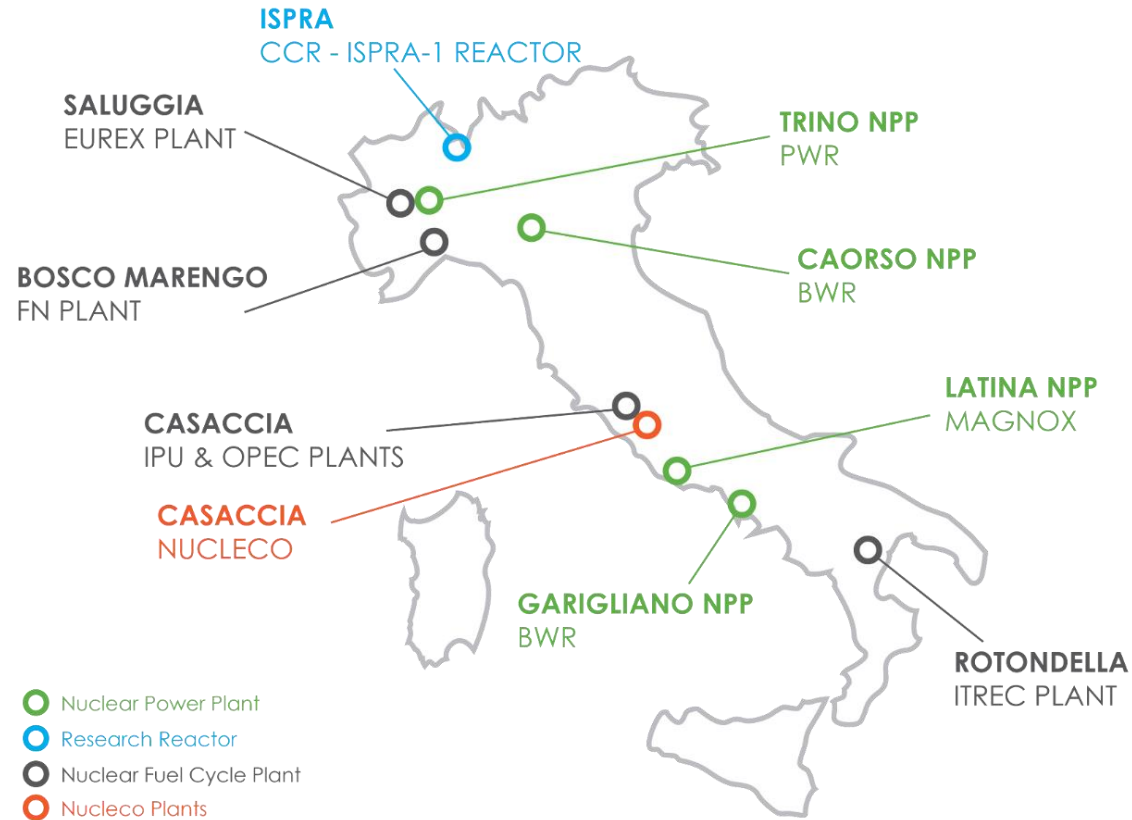
Sogin experience

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ACTIVITIES:

- **Safe maintenance and decommissioning** of Italian nuclear plants
- **Management of radioactive waste**
- Siting, designing, building and operating of the **National Repository and the Technology Park** for radioactive waste



CIRCULAR ECONOMY IN NUCLEAR DECOMMISSIONING



The decommissioning of nuclear plants involves complex processes and activities, governed by regulations on **radiation protection, security, health, environment, administrative** and **accounting**.

2 main assumptions to fulfil:

1. **Designing sustainable decommissioning projects**
2. **Increasing the amount of conventional waste sent for recovery**

Sogin has oriented its action towards the **minimization of produced waste** and the **maximization of recovered waste**



SOGIN STRATEGY FOR CIRCULAR ECONOMY



3 drivers:

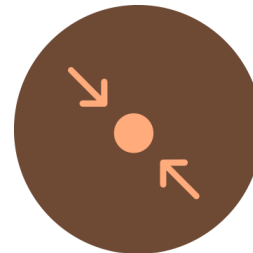
1. Re-use of structures, systems and components
2. Material Recycling
3. Environmental impact reduction

The full implementation of the actions can be carried out by implementing green engineering and green public procurement policies.



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS

1. **Safe maintenance, radioactive waste management and nuclear decommissioning activities carried out in the same industrial area of the nuclear plants**
2. **adaptation of pre-existing buildings** to temporary storage areas for radioactive waste
3. **reduction of the amount of conventional and radioactive waste**
4. **Movable systems and components that** can be used for similar projects in different sites



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS



CAORSO & GARIGLIANO NPP Turbine buildings



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS

GARIGLIANO NPP Diesel and compactor



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS



CASACCIA PLANTS OPEC 2



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS



TRINO NPP
Test Tank



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS

LATINA NPP
GECO LECO



RE-USE OF STRUCTURES, SYSTEMS AND COMPONENTS



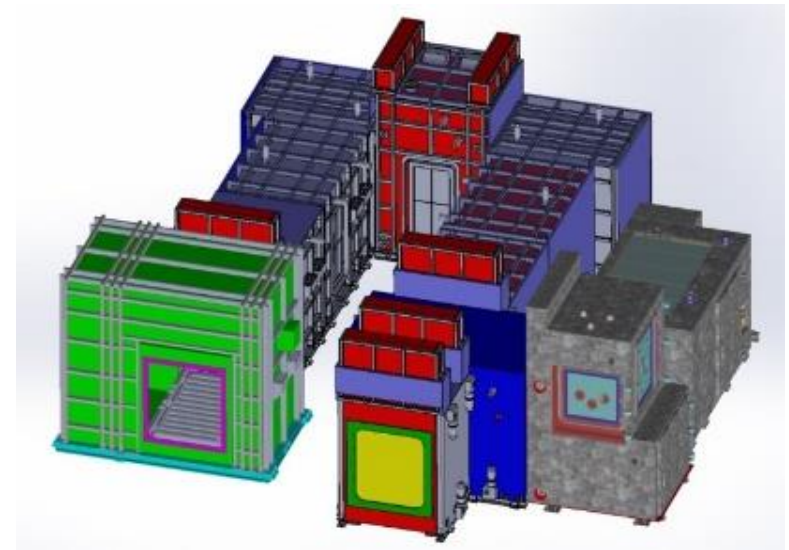
ALL SITES

Mobile supercompactor

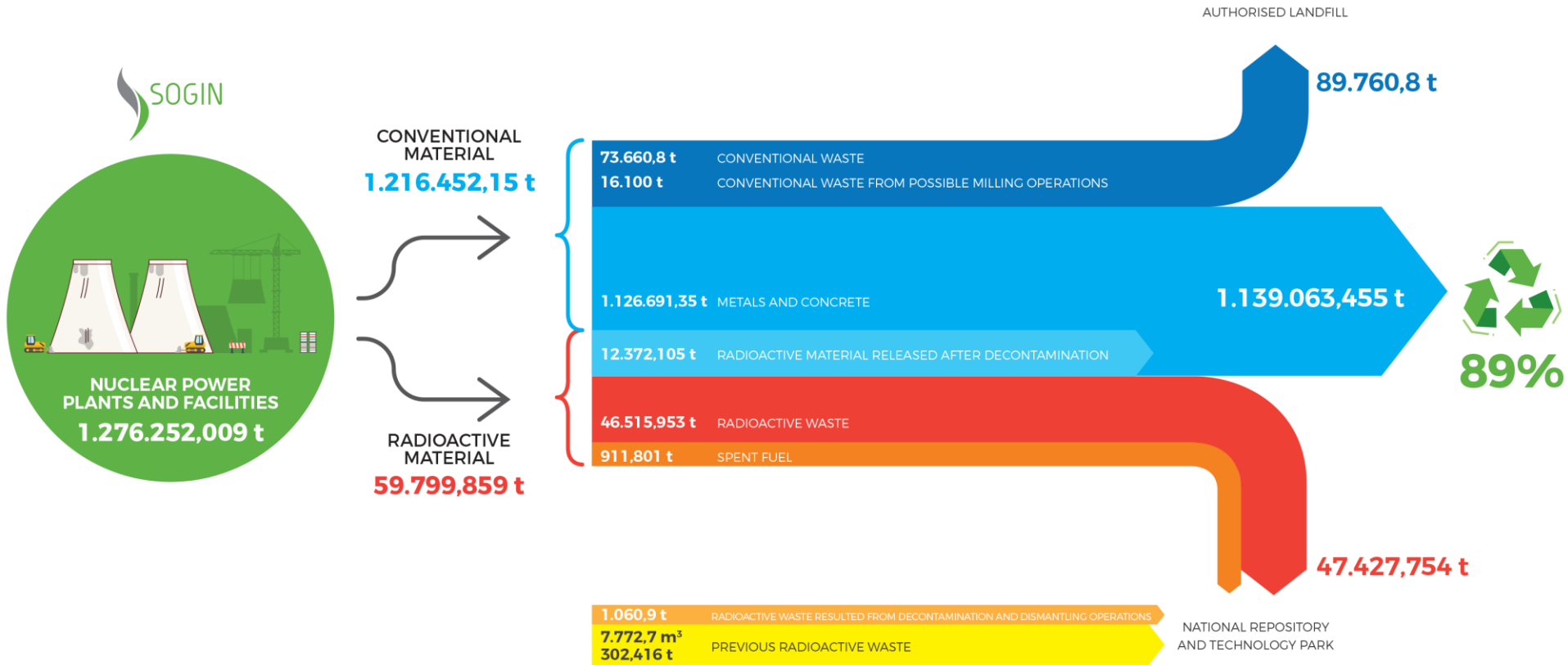


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MATERIAL RECYCLING



MATERIAL RECYCLING



Hazardous and Non-Hazardous Waste (tonnes) generated by Sogin and Contactors - 2015-2018

Waste categories classification (European Waste Codes- EWC)	Total amount (Hazardous and Non- Hazardous)	Recovery	% Recovery
CER 170904 - mixed construction and demolition waste	22.041	22.030	100%
CER 170405 - iron and steel	2.609	2.609	100%
CER 170409 - metal waste contaminated with hazardous substances	11	11	98%
CER 170504 - soil and stones	33.246	30.343	91%
CER 170503 - soil and stones containing hazardous substances	14.337	0	0%
CER 170101 - concrete	3.001	2.221	74%
CER 170203 - plastic	31	24	76%
CER 170302 - bituminous mixtures	2.576	2.143	83%
CER 170402 - aluminium	8	8	100%
CER 170407 - mixed metals	8	8	100%
CER 170411 - cables	41	41	100%
CER 170201 - wood	44	44	100%

MATERIAL RECYCLING



CAORSO NPP - OFF GAS BUILDING 7,200 TONNES OF CONCRETE



Partially re-used to fill the excavations resulted from the dismantling of the underground systems

MATERIAL RECYCLING

GARIGLIANO NPP - ELECTRICAL GENERATOR 401 TONNES OF IRON, COPPER AND PLASTIC



ENVIRONMENTAL IMPACT REDUCTION 1/2

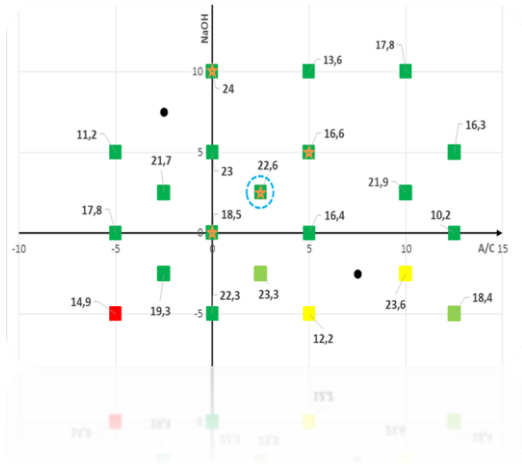


Reduction of radioactive waste. Some examples:



Treatment of slightly contaminated metals

- Separation of the radioactivity content by melting the contaminated metals coming from the decommissioning of Garigliano, Latina and Trino NPPs
- Treatment of some **1.800 t** of steel. **90% recycled**



New CEMEX conditioning approach

- Innovative processes for the conditioning of liquid radioactive waste
- New approach on the solidification of liquid radioactive waste from Saluggia CEMEX plant will reduce the final waste package volume of some **40 cubic meters**

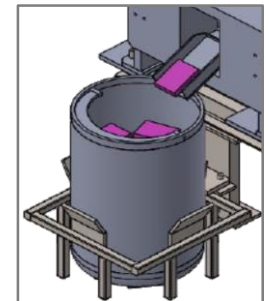
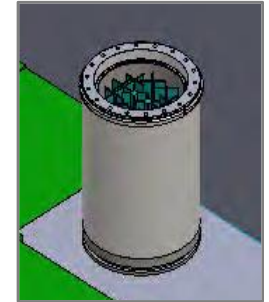
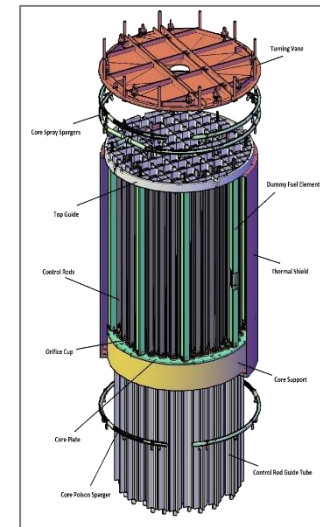
ENVIRONMENTAL IMPACT REDUCTION 2/2



RPV INTERNALS dismantling

GARIGLIANO NPP

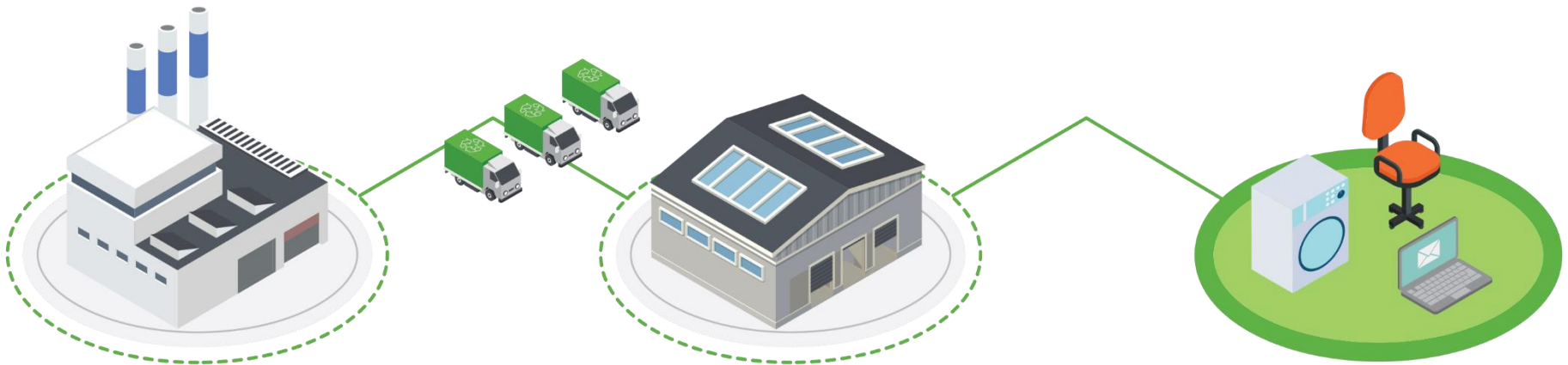
- **Removal, cutting and packaging of activated and/or heavily contaminated components of the Vessel Internals**
- **From 53 to 44 containers** thanks to a different cutting and loading strategy
- This optimization has been focused on the treatment of control rods:
 - The first hypothesis envisaged to cut each rod in 4 sections and to insert in vertical position inside 21 containers
 - The new approach foresees smaller spools and a subsequent crushing in order to reduce the volume.



Sogin has always given maximum importance to adopting technological production processes aimed at **minimizing total and secondary environmental impacts**.

Sogin is implementing 2 main approaches:

1. **Use of materials that**, while complying with security standards, **have a lower total impact** in terms of Life Cycle Assessment
2. **General change in the strategies adopted to build plants and systems**, in order to minimize the environmental impacts of the whole Decommissioning and Waste Management activity



GREEN PUBLIC PROCUREMENT

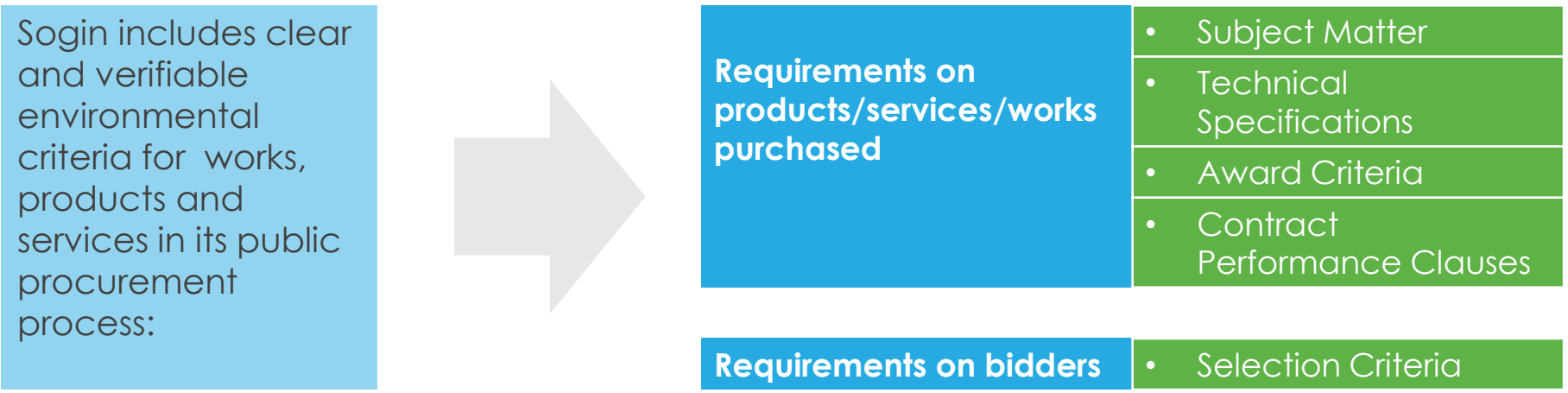


Green Public Procurement (GPP) is defined by the European Commission as "**a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact** throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured"



The proper management of **procurement is** an important driver and **an additional tool for the reduction of environmental impacts**, thereby promoting sustainable development. GPP represents a lever on which to base an effective application of the circular economy

- Compliance to CAM (**Minimum environmental Criteria**) regulation
- **Sogin applies several of Constructing CAM** principles in specific activities, although they are not mandatory: durability; disassemblability; evaluation of the real need to purchase; internal/external reuse; use of goods produced with secondary raw materials or containing recycled components or requirements to promote the recyclability of products at the end of their life



CONCLUSIONS 1/2

- Sogin has always complied with environmental legislation by minimizing the amount of waste produced and maximizing the materials sent for recovery
- The re-use of structures and plants allowed to **save soil and give a new life to components** that are no longer obsolete
- Green Public Procurement provided an additional element to **“drag” contracting authorities in the circular economy process**



CONCLUSIONS 2/2



Key issues:

- **Increasing recovery facilities.** Their uneven distribution results in long distances and transfers from the production site to the recovery facilities
- **Promotion of a different “sensitivity”** on behalf of the operators working in the recovery market and on behalf of licensing authorities
- **Creation of a “market” for specific types of materials**, such as concrete



We protect the present
We guarantee the future