

# Radioactive waste disposal and recycling in Sweden – focus on the circular economy approach applied to the nuclear sector

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# Cyclife, the decommissioning *expertise* combined with the strengths of the EDF Group



> EDF, the world's leading nuclear operator, manages 57 reactors in operation. EDF's purpose is to build a **net-zero energy future** through electricity and **innovative** solutions and services, contributing to the **preservation of the planet** while promoting well-being and economic development.



Electricity generation



Transport and distribution



Energy supply and energy services



Optimisation and trading



**€118.7 Bn**  
consolidated revenue  
in 2024



**191,444**  
employees in the  
world in 2024



**9 reactors**  
using four different technologies  
are currently being  
decommissioned in France



**2 reactors**  
in the pre-decommissioning  
phase

## Cyclife in *figures*

- By applying a unique waste-led approach, Cyclife supports nuclear operators in reducing their costs and waste production, optimising waste management programmes and promoting metal recycling.





## Cyclife Aquila Nuclear

### Twyford

Technical solutions in glove boxes, shielded systems, remote management, transport and packaging systems.



## Cyclife UK

### Workington's Facility and Newcastle-upon-Tyne

Metal treatment services for decontamination by cutting and/or blasting, for clearance and recycling. Support for optimization of waste management, implementation of dismantling projects.

Blasting : 3,000 t/year



## Waste2Glass

### Limay

Pilot unit for the GeoMelt® vitrification process for the treatment of specific radioactive waste..

UNE COENTREPRISE  
edf VEOLIA



## Graphitech

### Lyon and Beaumont-en-Véron

Innovative technical development for complex dismantling of reactors.

UNE COENTREPRISE  
edf VEOLIA



## Cyclife France

### Centraco's Facility and mobile machines

Treatment of burnables, metals, including large components and combustible liquids. Mobile waste management machines at customers' premises.

Melting: 3,500 t/year  
Incineration: 6,000 tons/year  
Cutting workshop for large components  
Segmentation: 200 tons/year



## Cyclife Sweden

### Nyköping's Facility

Treatment of burnable waste by incineration or pyrolysis, metal treatment, including very large components, for clearance and recycling.

Melting: 10,000 t/year

Incineration: 500 t/year

Pyrolysis: 50 tons/year



## Cyclife Germany

Hanovre, Karlsruhe and Dresde

Sales office dedicated to German, Swiss and Eastern European customers and partners to offer all products and services of the Cyclife Group. Dismantling work at the customer's site and radiation protection



## Cyclife (Holding)

Paris La Défense

Management of the Cyclife Group, cross-functional/functions and business development



## Cyclife Engineering

Lyon

Decommissioning and deconstruction technology. Investigation and design of facilities for the storage, management and treatment of nuclear waste. Dismantling work at customer sites.

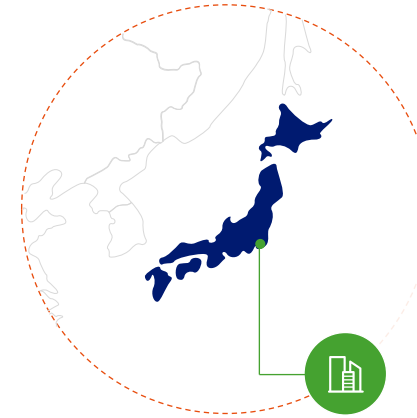


## Cyclife Digital Solutions

Bagnols-sur-Cèze,  
Lyon and Croissy-Beaubourg

Nuclear-friendly digital tools based on 3D technology to simulate and optimize scenarios and autonomous industrial digital twins.

# Cyclife in the world



## Cyclife Japan

### Tokyo

Supporting Japanese operators by providing them with expertise in nuclear decommissioning technologies powered by efficient waste management.

# Main features Cyclife Sweden

**Created in 2016 after the takeover by EDF of the waste management division and facilities at the site**

Located 100km south from Stockholm (Sweden) (\*)

**230+** employees (+100p in the last 2 years)

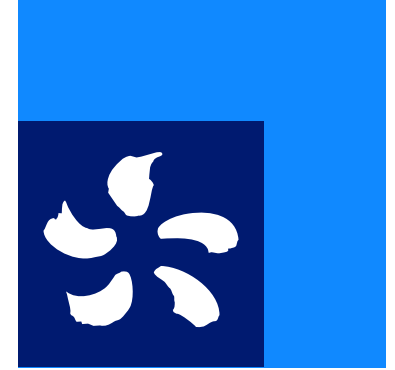
**Treatment services in waste management (VLLW and LLW) aiming for recycling and/or volume reduction**

- **Recycling and/or volume reduction of metal** (steel, copper, brass, aluminium, and lead)
- **Volume reduction by Incineration / Pyrolysis** (organic wastes)
- **Volume reduction for sealed source and non-nuclear waste**
- **Analysis laboratory**



*(\*) Located on Studsvik Technology Park, which was part of the development of the Swedish nuclear power program of the 50s, originally a state-owned research facility with several prototype and material test reactors until 2005.*

# Cyclife Sweden's Site

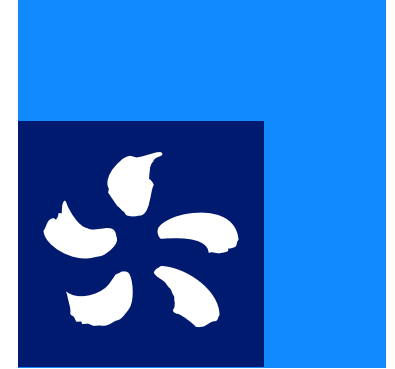


## Site overview

- 1 Metal Treatment
- 2 Extension Metal Treatment
- 3 Incineration
- 4 Pyrolysis
- 5 Non-nuclear radioactive waste
- 6 Analytical lab
- 7 Storage
- 8 Harbour



# Cyclife Sweden's facilities

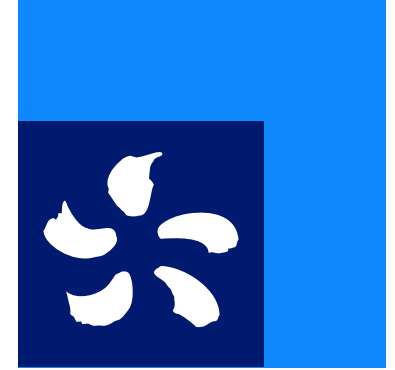


## Facility overview

- 1 Metal Treatment
- 2 Extension Metal
- 3 Incineration
- 4 Pyrolysis
- 5 Non-nuclear radioactive waste



# Cyclife Sweden's capacities for metal treatment



## Facilities

- 1 Metal Treatment
- 2 Extension Metal



## Key facts

1

- Treatment by melting of **Steel, Copper, Brass, Aluminium, Lead**
- **Containerised metals**
- **Large components**  
PWR steam generators, other heat exchangers, BWR turbines, RPV sections & RPVH, Fuel Racks & Flasks

## Key Experience

1

- More than **60 000 tons** of metal treated
- Casted ingots are recycled to conventional industry after clearance
- Recycling rate up to **95 %**

## Capacity and capability

1 2

- Nominal yearly capacity **10.000 tons**
- Treatment in **isolated campaigns**
- Facility equipped with advanced segmentation equipment (cold and thermal)
- **Multiple** mechanical decontamination units
- **Four induction** melting furnaces
- Dedicated PWR **steam generator line**
- Can welcome **very large components**

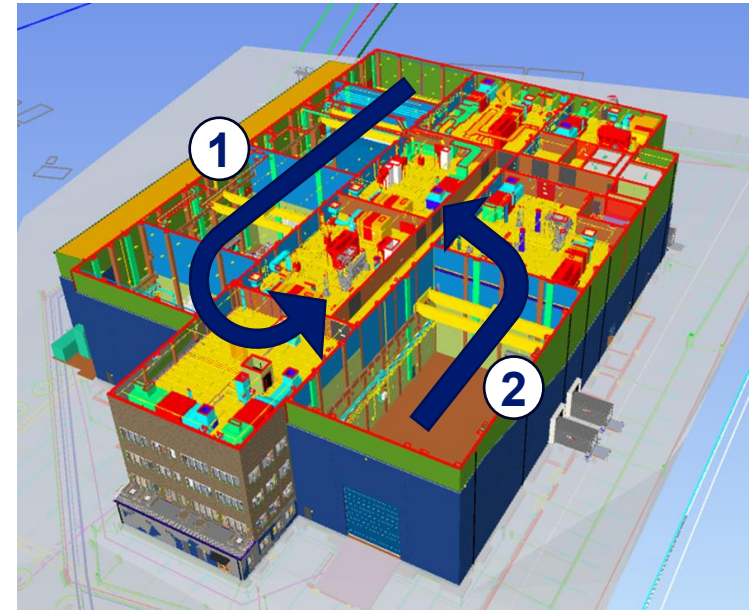
# Focus on our new facility “Extension”

## *Our 20-years' operating experience as a ground*



### KEY FEATURES

- The only nuclear facility currently under construction in the Nordics.
- Compacted time plan for the project – 2 years from construction to testing phase
  - Pre-studies started in 2021
  - Building Permit mid 2023
  - Approval of Preliminary Safety Case in December 2023
  - Construction started in January 2024
  - On-going testing (November 2025)
- Enhanced process treatment with automatization
- Cyclife Sweden's current and new facilities have a total capacity of up to **10,000 tons per year** – equivalent to the weight of one Eiffel Tower.



① Steam generator flow



② Large components and scrap metal flow



Furnace pits



Mould handling line



Blaster (1 out of 3)

# Cyclife Sweden's capacities for incineration / pyrolysis



## Facilities

- 3 Incineration
- 4 Pyrolysis



## Key facts

3

- Incineration of Dry Active Waste, Oils and other **liquids**, Activated **charcoal**, Ion Exchange **resins**
- Treatment in **isolated** campaigns
- License yearly capacity of **500 tonnes**
- **Volume reduction about 97 %**
- Inert final product

## Key facts

4

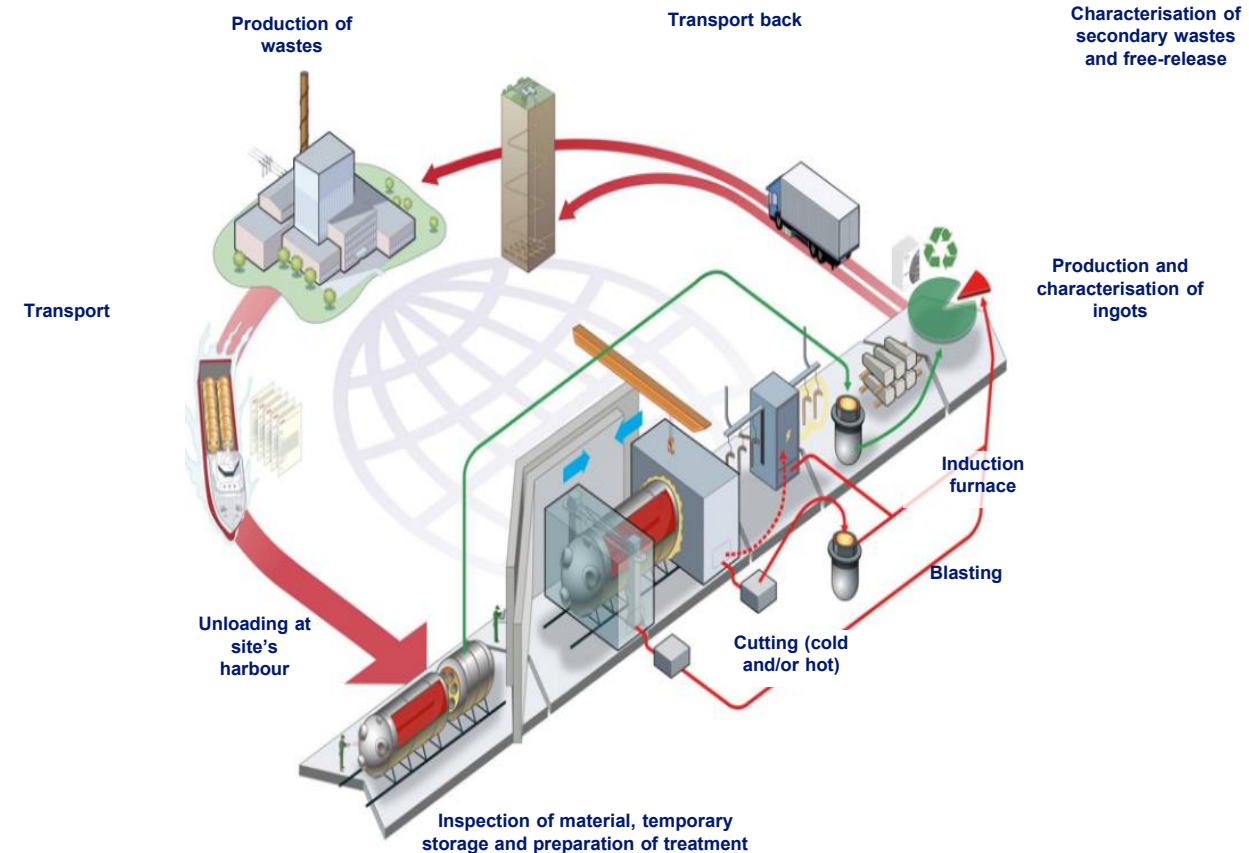
- Pyrolysis of Dry Active Waste from **nuclear fuel factories**
- Batch processing
- License yearly capacity of **100 tonnes**
- High **volume reduction**
- Allow **uranium recovery** from ashes for return to fuel manufacturing process

# Our added value to our customers

## *A turn-key solution for recycling of metallic wastes*



- Management of **transport** of the waste from / to customer or final depository
- **Storage** on our site before and after treatment
- **Volume reduction** up to 95%
- **All type of components** – from Steam Generators to scrap metal – and **all type of metal**
- Characterization of secondary wastes, associated analysis and conditioning of **final packages**
- Management of **ingots** produced (characterisation, free-release and selling to conventional industries)



# From a liability to an asset

## *A turn-key solution for recycling of metallic wastes*



### PRODUCED INGOTS

- Characterized, free-released and sold to **conventional industries**
- Production of ingots of **600Kg**
- **Conventional product not subjected to any radiation protection measure**



Up to 95%

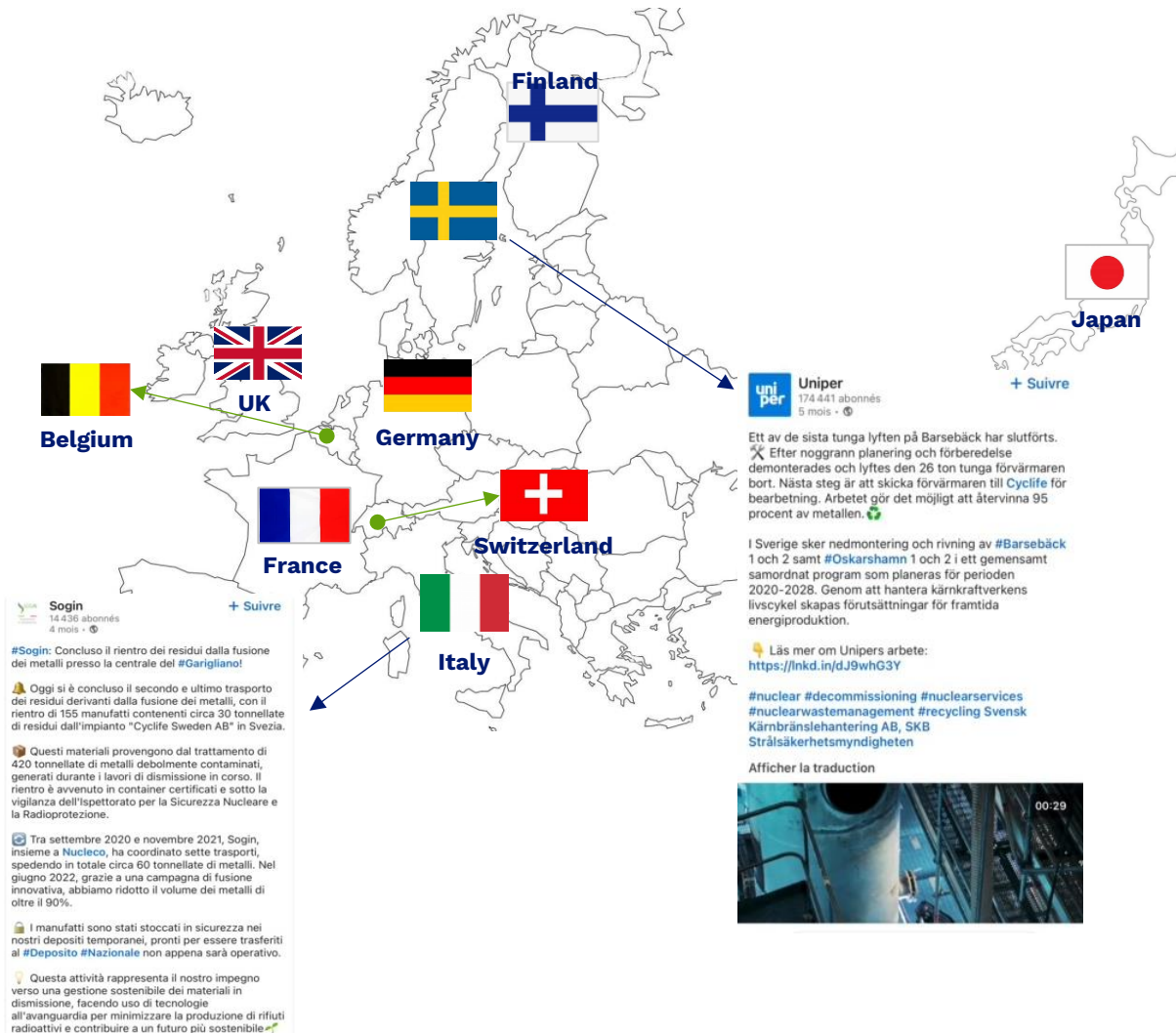
### SECONDARY WASTES

- Characterized
- **Conditioned for disposal** (according to requirements from the customer)
- **Sent back to the customer or directly to final depository**



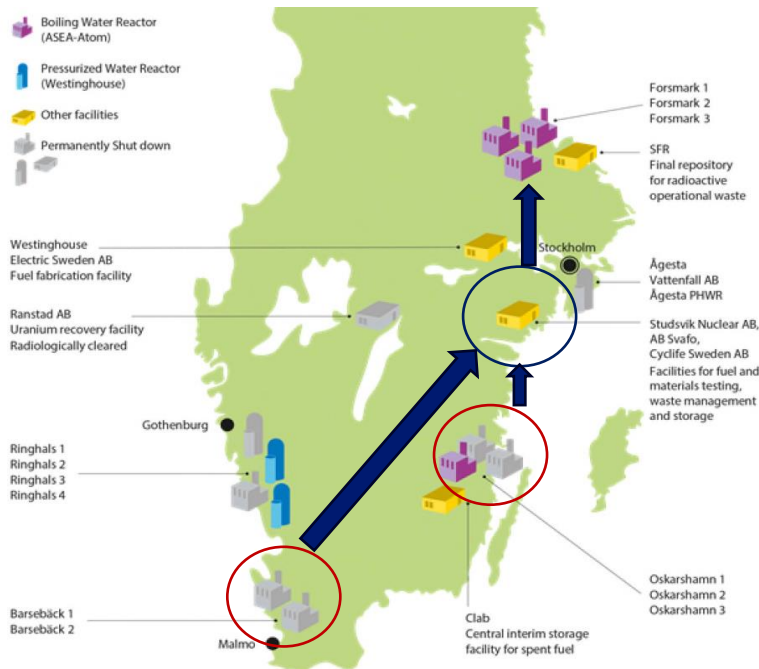
Less than 5%

# 85% of satisfied customers



- In Nordics:
  - **UNIPER** (main volumes as today)
  - **Vattenfall** (contract just signed for Forsmark & Ringhals, regular campaigns for SVAFO)
  - **TVO & WESTINGHOUSE**
- In Germany – **GNS** (historical customer both for metal treatment and incineration) and 16 Steam Generators treatment contracted with **Preussen Elektra** in 2021 (4 to be delivered in **November 2025**)
- In Italy – **SOGIN** contracts (2 campaigns already treated, 1 on-going, 1 contract won on incineration of liquids in 2025)
- In France – 6 Steam Generators from **EDF** (6 Upper Parts already treated, 3 Lower Parts to be delivered in October 2025)
- Studies performed for **Japanese customers**

# Case Study #1 – UNIPER's NPP decommissioning; the « waste-led » approach on domestic market



## ACTIVITIES



- Melting (both containerized scrap and large components)
- Free-release (DFA), starting phase with main focus on components that can't be accepted in SMA
- Incineration
- Consultancy – calculations (nuclide vectors)
- Site service and transport support

## CUSTOMER ADDED VALUE

*what we are doing for the client*

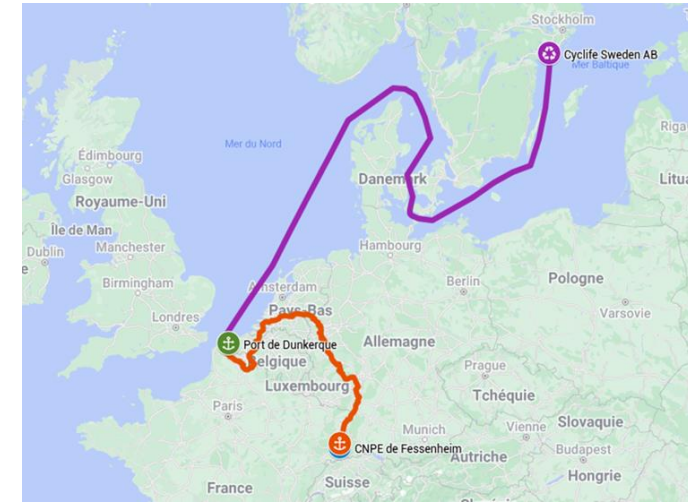


- Preparation and transport of the waste to our site
  - Treatment/volume reduction/return of containers
- > Enabling the customer to master his decommissioning schedule and associated costs**

- **15 792** tons of low-level metallic waste from the dismantling of 4 Nuclear Power Plants in Sweden
- Signed contract in **2019**
- Delivery and treatment: **2019-2028**
- Target volume reduction: **95%**
- **Recycling of 15,000t of metal – equivalent to 31,000t of CO2 emissions avoided**

# Case Study #2 – Steam Generators (Upper Parts) from France; 100% of ingots generated recycled to the conventional industry

- **6 PWR steam generators (Upper Parts)** from France to Cyclife site in December 2021 (600t)
- **Treatment** performed in 2023
- **100% of the ingots generated recycled** to the conventional industry/residues disposed in France



Transshipment at Dunkirk harbour

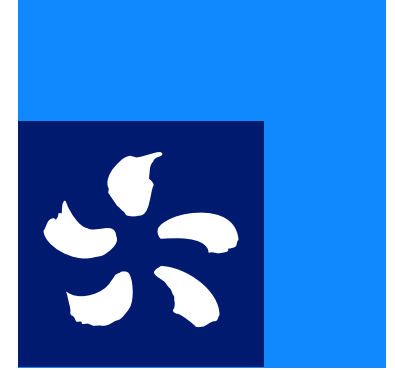


Unload at Cyclife site



Segmentation (hot cutting)

# Cyclife is giving the nuclear sector a sustainable future by...



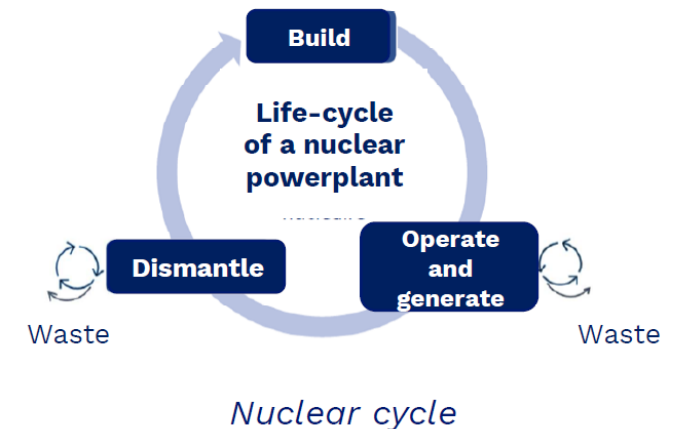
...Using safe and proven processes combined with last available techniques,

...Strong alignment with decommissioning programs,

...Maximizing the recycling rate of material.

Waste Management is **one pillar of Circular Economy** by **converting a liability into an asset.**

Waste Management is part of the nuclear cycle and as such key for **all New Built Nuclear Programs.**





ご清聴ありがとうございました  
*Thank you for your attention!*