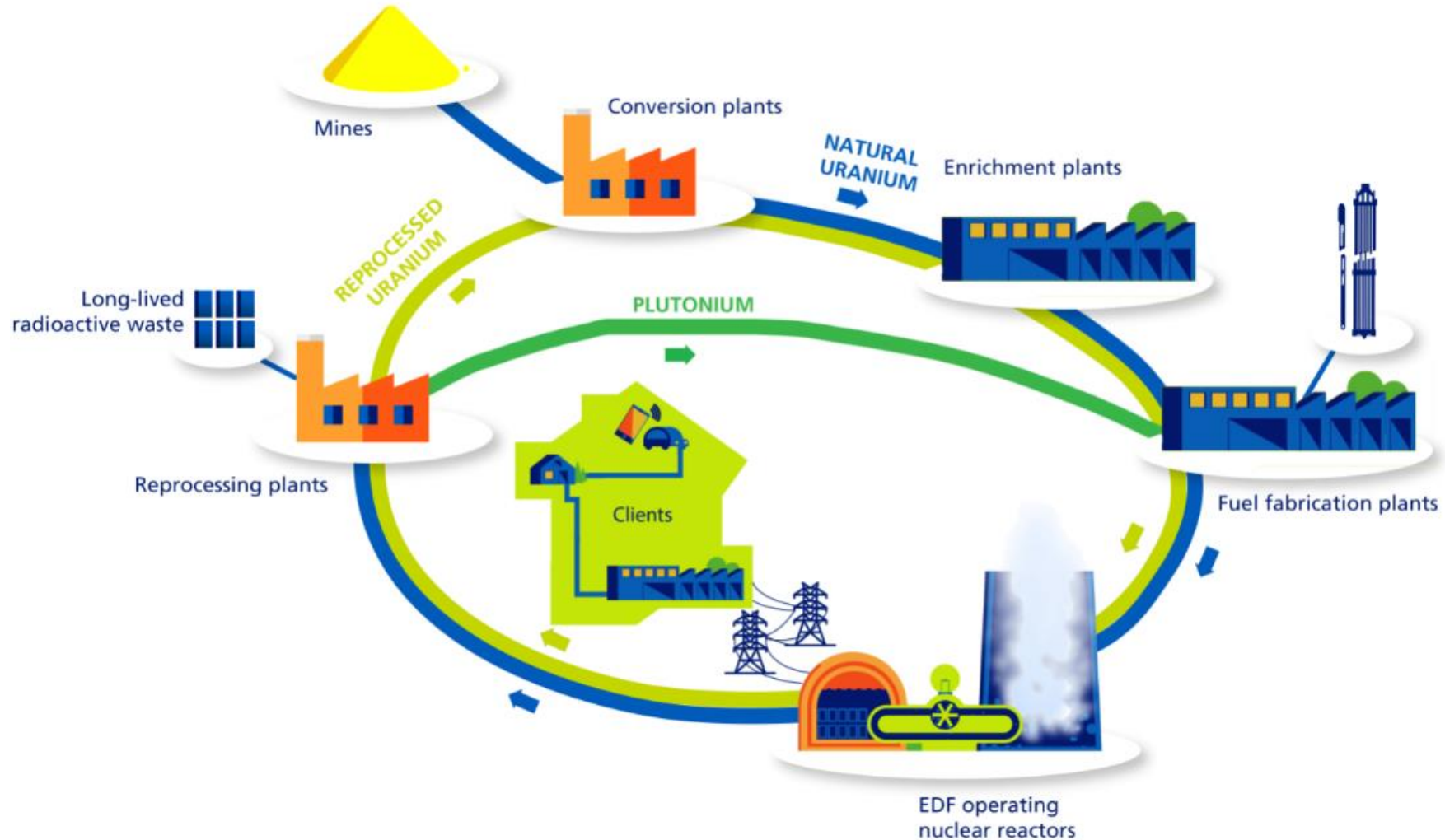




# Enhanced ATF: prospects at EDF

IAEA TM Opportunities  
and Challenges in the  
Back End of the Fuel  
Cycle for Enhanced-  
ATF June 14-17, 2022

# Nuclear fuel cycle in France



**➔ Reprocessing is a major step to ensure the consistency of the French nuclear fuel cycle**

# Cr-coated Zr claddings / Doped pellets: fuel cycle back-end issues

- **Selected design : Cr-coated Zirconium cladding** with or without doped pellets
  - ✓ Depending on the supplier, doped pellets are:
    - $\text{Cr}_2\text{O}_3$  doped  $\text{UO}_2$
    - $\text{Al}_2\text{O}_3$ - $\text{Cr}_2\text{O}_3$  doped  $\text{UO}_2$
  - ✓ Main assets :
    - Improvements expected with respect to accident conditions (notably LOCA)
    - No major unwanted side effect in normal operation (e.g. low neutronic penalty)
    - Available on a presumably reasonably short-time basis
    - For doped pellets : large-grain microstructure leading to lower fission gas release (FGR) and increased viscoplasticity, with enhanced PCI performance
- EDF plans to irradiate experimental rods as soon as possible including :
  - ✓ Cr-coated cladding without doped pellets
  - ✓ Cr-coated cladding with doped pellets

# Cr-coated Zr claddings / Doped pellets: fuel cycle back-end issues

## ➤ Doped pellets:

### ✓ Reprocessing

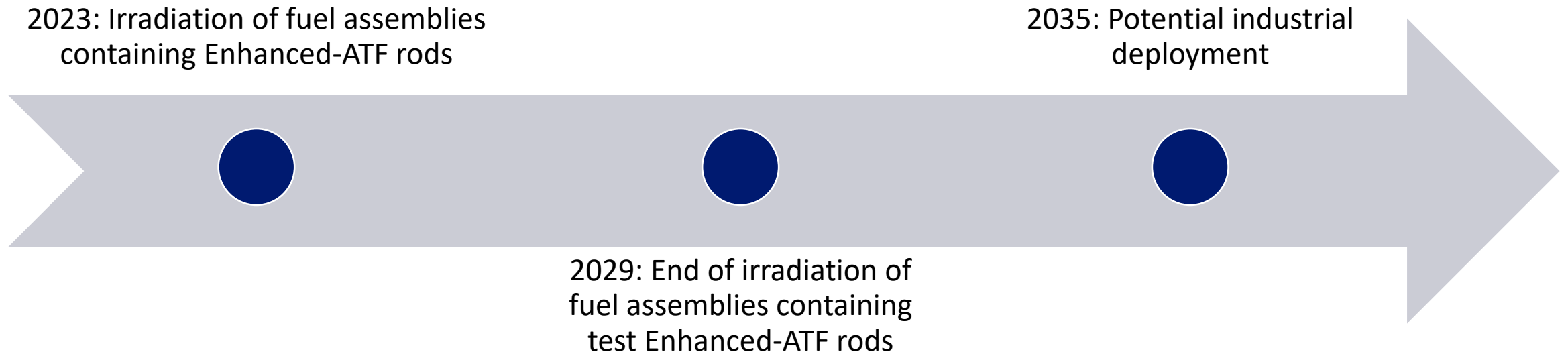
- Dissolution rate:  $\text{Cr}_2\text{O}_3$  doped  $\text{UO}_2$  or  $\text{Al}_2\text{O}_3$ - $\text{Cr}_2\text{O}_3$  doped  $\text{UO}_2$  microstructure will have an impact
- Dissolved Cr might induce corrosion issues on some equipments of the reprocessing facility, if the initially trivalent Cr in  $\text{Cr}_2\text{O}_3$  becomes hexavalent Cr along the process
- The current limit on Cr content of vitrified waste for long term geological storage might be reached:
  - a solution could be the dilution of doped-fuel with reprocessed flows associated to non-doped fuel, which supposes that doped pellets would not be used on all EDF reactors
  - Relaxation of the limit on Cr content of vitrified waste would need to rely on long term (and costly) R&D

## ➤ Cr-coated Zr cladding:

### ✓ Reprocessing:

- Impact of the Cr coating on shearing needs to be checked (some Cr fine particles may be left with the fuel to be dissolved), for all Cr-coated cladding designs considered by EDF
- That may increase the corrosion and vitrification issues already identified for doped pellets

# Overview on EDF roadmap for Enhanced-ATF



**Horizon for potential industrial deployment ~2035 depending on the capability of moving forward to industrial scale fabrication and on the outcome of the experimental tests (last results expected in 2030)**





Thank you



*Centrale nucléaire de Cruas  
EDF*