La Belgique, au carrefour de l'Energie Nucléaire en Europe

5 Novembre 2024

PUBLIC | INTERNAL | RESTRICTED | CONFIDENTIAL

Nuclear power in Belgium

TRACTEBEL ENGIE

1962: Minister Spinoy pushes the start button of BR3

- **1944**: contract to export Uranium from Belgian colony Congo to USA

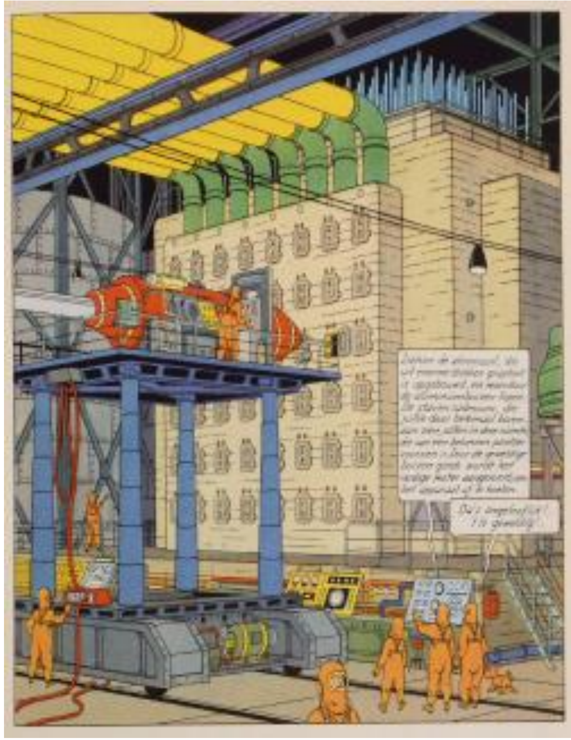
In exchange to Belgium:

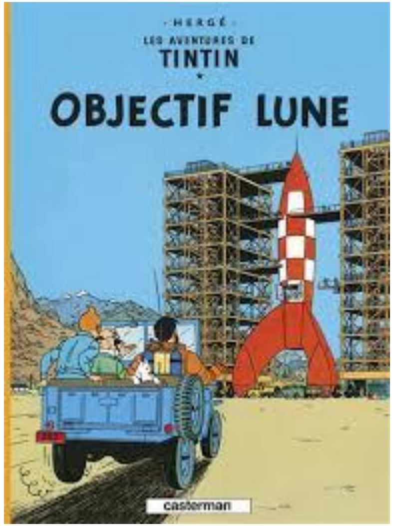
  - American nuclear knowhow (non-military applications);
  - 10 M$ investment in a Research Center for Nuclear Energy (SCK CEN).

- **1962**: Commissioning of the first European pressurized water reactor BR3 in SCK CEN;
- **60'**s: strong growing electricity needs in Belgium;
- **70'**s: oil crisis.

Belgian nuclear legacy even inspired Hergé

BR1: The Tintin album 'Rocket To The Moon' includes a cartoon version of the BR1 reactor. Hergé, the creator of Tintin, is said to have based this drawing on a 1953 design of the BR1 reactor.





INTERNAL

Standing on the shoulders of Giants

BR3 – first PWR connected to the European Grid

1962

1969 - 1985

Construction of the 7 Belgian Nuclear Units

HADES
Deep Geological Repository Prototype

1980 - 1987

1998 - 2036

MYRRHA
& Lead-cooled Fast Reactor Technology development

Contributing to the First SMR built in the Western World

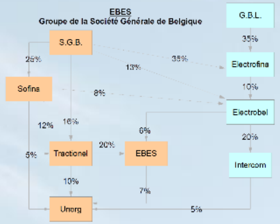
2023 – 2029

Tractebel history : more than 100 years experience

1895

Tractionel finds itis origin in « la *Compagnie Mutuelle des Tramways*. »

1929



Electrobel was founded by Gaz Belge, Société Générale de Chemins de Fer Economiques and Société Générale Belge d'Entreprises Electriques.

1976

Coyne et Bellier joined Electrobel . Coyne en Bellier was creasted in 1947, André Coyne build 70 dams in14 different

1986

Electrobel and Tractionel becomes Tractebel ..

1988

The French group Suez appears to be the arbiter of the company's destiny. At the end of a stock market battle, he took control of the holding company Société Générale de Belgique with the support of a new coalition of Belgian shareholders

1990

Ebes, Unerg and Intercom becomes Electrabel in charge of production and distribution of electricity in Belgium.

2008

Merging of Suez and Gaz de France, which becomes the world's largest liquefied natural gas company.'

2015

New branding met Engie

engie

Today, Tractebel

TRACTEBEL
ENGIE

TRACTEBEL, **5,500 employees, engineering** of the ENGIE group (100%) specializing in consulting and multi-métiers expertise in the fields of energy, complex buildings and infrastructure for carbon neutrality.

ENERGY

Power Generation

Renewable Energies

Power Transmission & Distribution

Gas & LNG

URBAN

Urban Design & Development

Environment & Climate Change

Transport & Mobility

Buildings and Complex Structures

Geo-Engineering

NUCLEAR

New Build

Advanced Technologies

Plant Operation Support

Radwaste, Decontamination & Decommissioning

WATER

Hydraulic Infrastructures

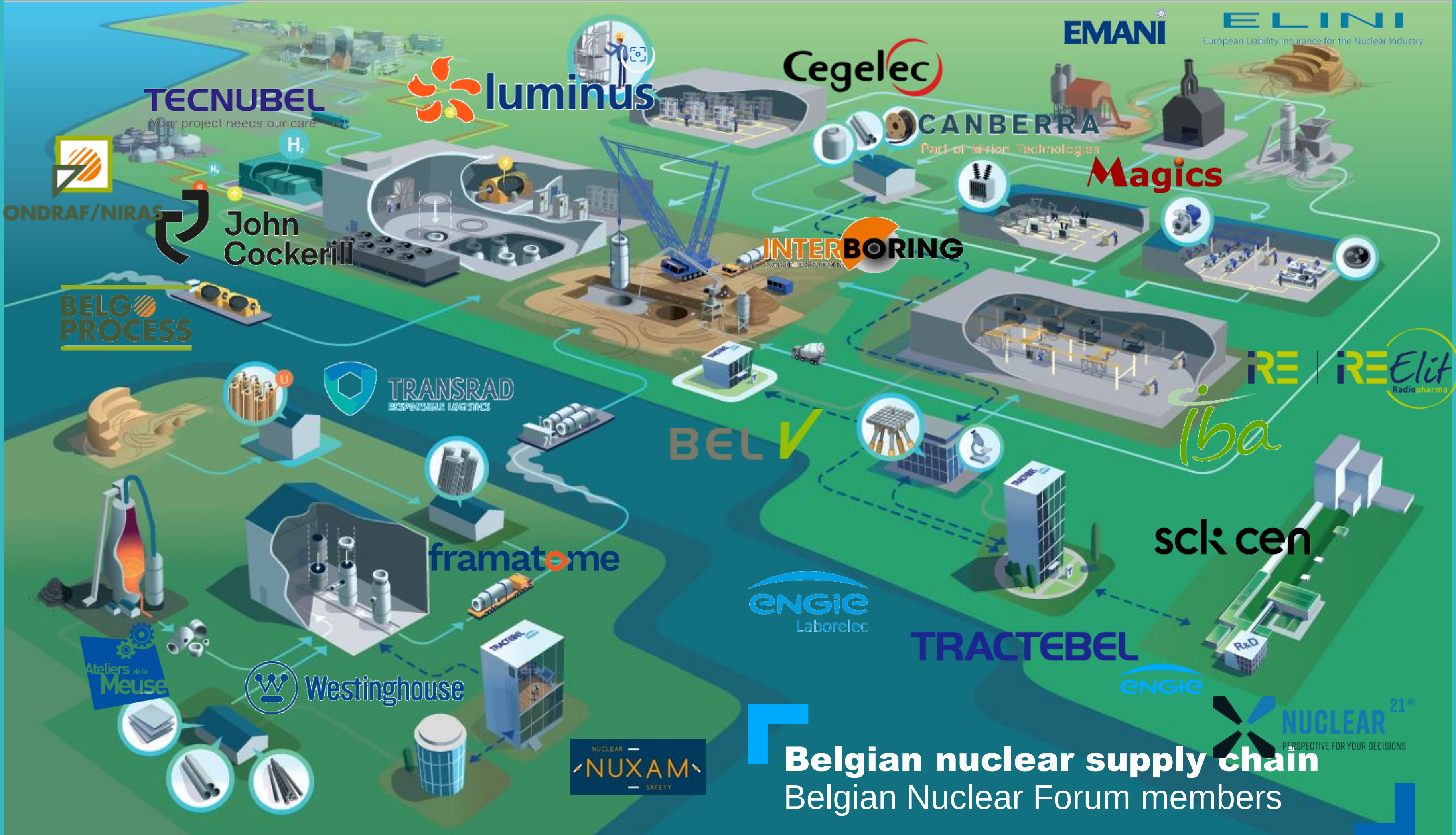
Hydropower

Coasts, Ports & Marine Facilities

Water Supply & Sanitation

Digital Services

Key Nuclear players in Belgium



Belgian nuclear supply chain

Belgian Nuclear Forum members

Belgium's world-class expertise

More than half of century of nuclear excellence

NUCLEAR QUALIFIED COMPANIES

+300

NUCLEAR PROFESSIONALS

~ 20,000

SUPPLY CHAIN

1st

PRESSURIZED-WATER REACTOR IN EUROPE

NUCLEAR EXPERIENCE

> 70

YEARS

Nuclear power plant : Doel and Tihange site

2 sites in Belgium with 7 reactors

TRACTEBEL ENGIE

Doel

- 4 Pressurized Water Reactors
- In service: 1916 MW
  - Doel 1 : 445 MW 15/02/1975
  - Doel 2 : 445 MW 1/12/1975
  - Doel 4 : 1026 MW 1/07/1985
- In decommissioning:
  - Doel 3 23/09/2022

Accounting for ~ 33 % of Belgium's electricity needs

3908 MW

Tihange

- 3 Pressurized Water Reactors
- In service: 1992 MW
  - Tihange 1: 962 MW 1/10/1975
  - Tihange 3: 1030 MW 1/09/1985
- In decommisioning:
  - Tihange 2 1/02/2023

INTERNAL

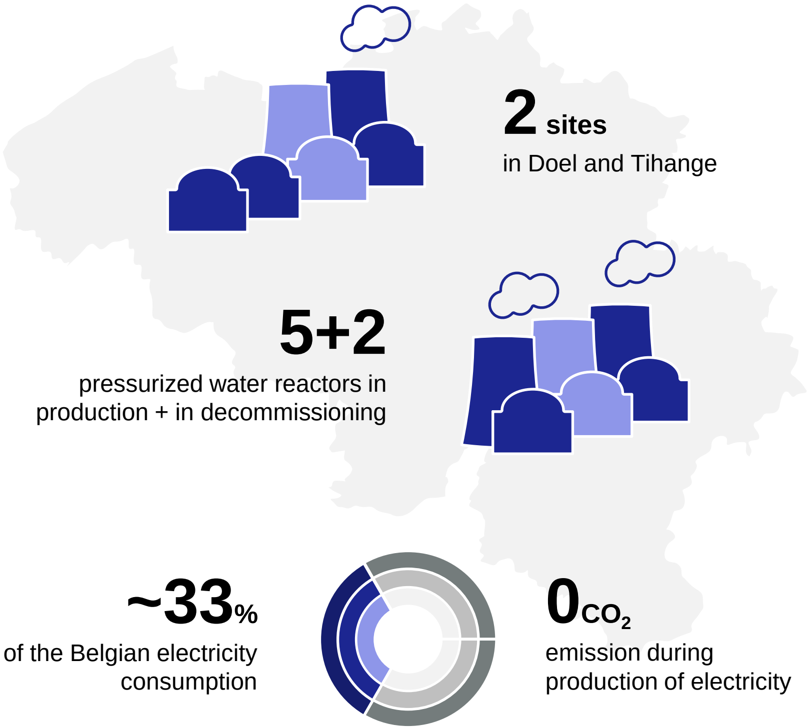
Nuclear power in Belgium

TRACTEBEL ENGIE

- **1968**: first order for twin Doel 1 and 2 power plants;
- Commissioning:
  - Feb. 1975: Doel 1 (NSSS : Westinghouse);
  - Oct. 1975: Tihange 1 (NSSS : Framatome);
  - Dec. 1975: Doel 2 (NSSS : Westinghouse);
  - Oct. 1982: Doel 3 (NSSS : Framatome);
  - Feb. 1983: Tihange 2 (NSSS : Framatome);
  - July 1985: Doel 4 (NSSS : Westinghouse);
  - Sept. 1985: Tihange 3 (NSSS : Westinghouse) .

The construction of Doel 1

The Belgian nuclear power plants



Design

- Except Doel 12, no common design
- Steel containment for Doel 12

Protection system

- 2 protection trains at D12, T1
- 3 protections trains at T2/D3, D4/T3
- Second level of protection systems
  - 2 containments
  - Second control room in case of external event with appropriate safety systems

Fuel strategy

- Base load
- 18 months cycle
- MOX at D2/T2
- D1 : 8 pieds
- T1 : 12 pieds
- T2/D3 : 12 pieds
- T3/D4 : 14 pieds

Major projects

Steam Generator Replacement

Scope

TRACTEBEL ENGIE

- All steam generators were replaced due to stress corrosion cracking
- This major activity were coupled with :
  - Primary Power uprate
  - Fuel cycle up to 18 months requiring an increase of fuel enrichment
  - Use of Mox fuel

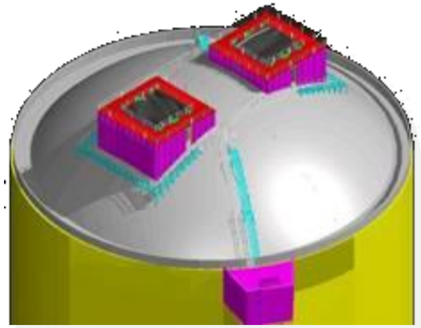
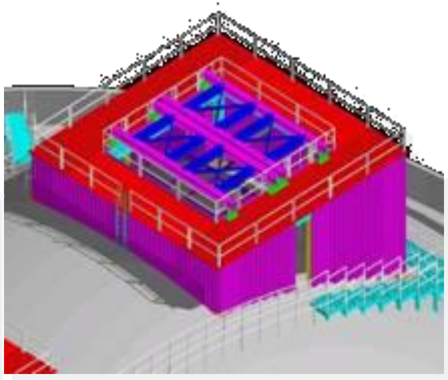
	SGR&PU	Power uprate(%)	Uprated NSSS power (MWth)
Doel 1	2009	10	1311
Doel 2	2004	10	1311
Doel 3	1993	10	3064
Doel 4	1996	0	3000
Tihange 1	1995	8	2875
Tihange 2	2001	10	3064
Tihange 3	1998	0	3000

INTERNAL

Unit	SG Supplier	Studies	Replacement
Doel 3 (SGR & PU)	Siemens	Siemens & TE	Siemens
CNT1 (SGR &PU)	Mitsubishi	Westinghouse Framatome & TE	Framatome
Doel 4 (SGR)	Framatome	Westinghouse Framatome & TE	Siemens
CNT3 (SGR)	Framatome	Framatome & TE	PCI (W)
CNT2 (SGR & PU)	Mitsubishi	Framatome & TE	PCI (W)
Doel2 (SGR & PU)	Mitsubishi	Framatome GmbH Westinghouse & TE	PCI (W)
Doel1 (SGR & PU)	Mitsubishi	TE	PCI (W)

SG replacement Doel 1/2

TRACTEBEL
engie

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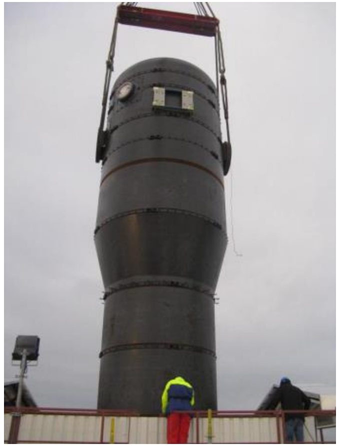
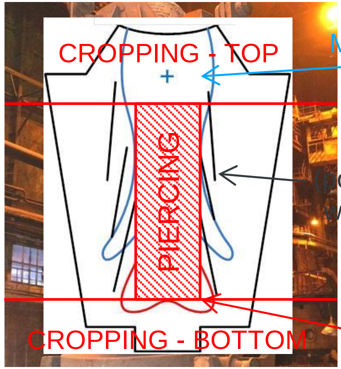
SG replacement Doel 1/2



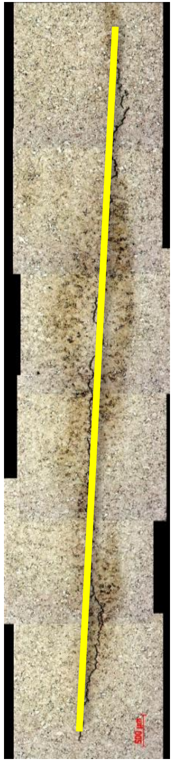
Hydrogen Flakes in the D3/T2 RPVs
Origin and nature of hydrogen flakes

Casting of ingot



Forging of shells

Assembly of RPV



- H accumulates in ghost lines in MnS inclusions
- H ⇒ H_2 ⇒ pressure increase **+** stresses (forging) **+** micro-structure ⇒ flaking
- Major contributors to flaking
  - — No de-hydrogenation heat treatment at 600°C
  - — Cool-down below 200°C after forging

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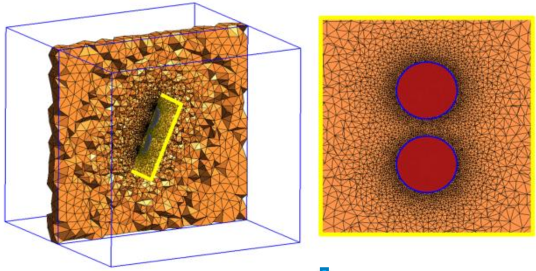
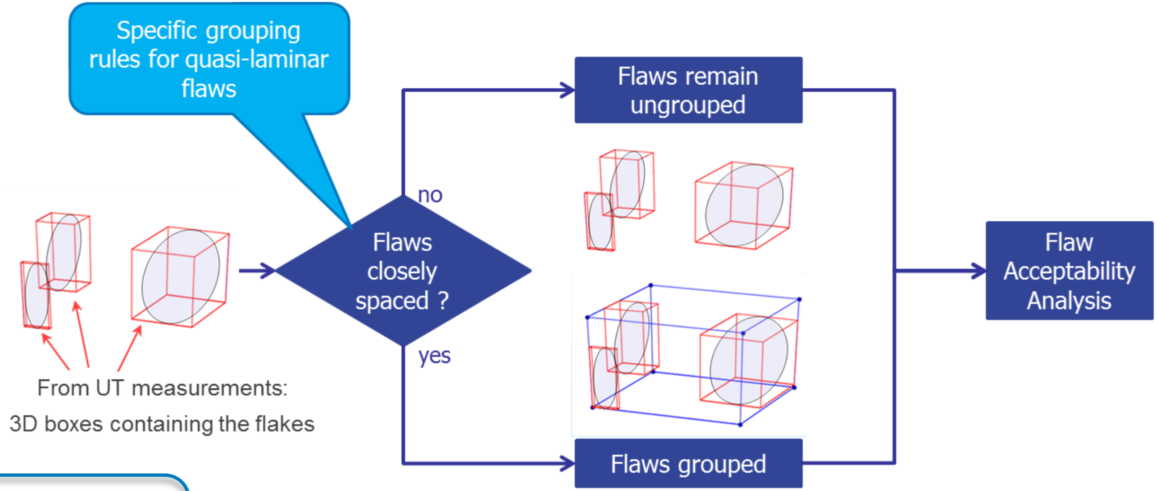
Hydrogen Flakes in the D3/T2 RPVs
Development of Grouping Rules - Methodology

- Development of proximity rules based on
  - Experimental Interaction Results
  - Numerous 3D XFEM Calculations



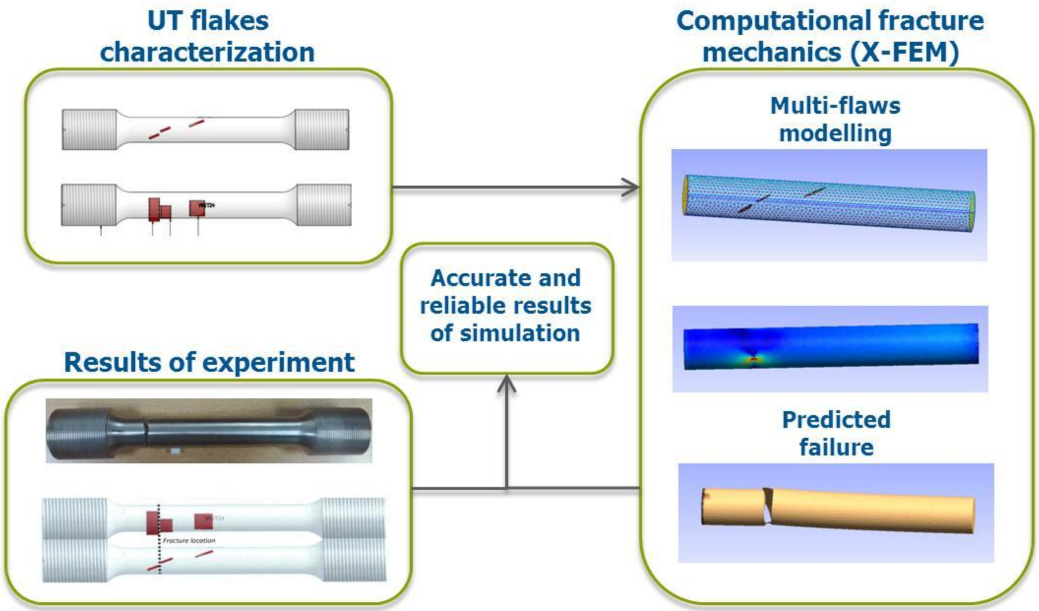


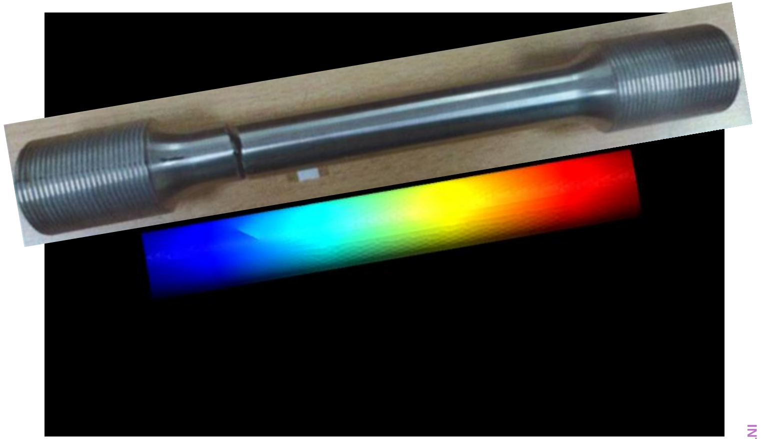
ASME Section XI Code Case N-848
"*Alternative Characterization Rules for Quasi-Laminar Flaws*"

INTERNAL

Hydrogen Flakes in the D3/T2 RPVs
Large Scale Tests - Validation of the SIA methodology

Calculation of brittle and ductile failures





Hydrogen Flakes in the D3/T2 RPVs Findings and Conclusions

TRACTEBEL ENGIE

- In the frame of the SIA of Doel 3 and Tihange 2 RPVs, a deterministic **conservative ASME XI-oriented** methodology was developed to address
  - Crack Initiation Analysis
  - Global Failure Analysis
  - Flaw Stability Analysis

- The acceptability of all the flaws was demonstrated **with important margins**

- The verification of each of these points demonstrated the **Fitness-for-Service of both RPVs**
- Large scale tests have validated and highlighted the conservatisms of the methodology
- The SIA methodology has been approved by external ASME experts

INTERNAL

BEST
Belgian Stress Tests

Context

- After the events in Fukushima (Japan, 11 March 2011), Europe decided to subject all nuclear power plants to resistance tests, the so-called "Belgian Stress Tests“;
- To assess the safety margins of nuclear power plants under extreme conditions, such as natural phenomena;
- In Belgium, the safety authorities decided to also evaluate the resistance to human acts such as terrorism and cyberattacks;
- The tests showed that the Belgian power stations are among the most robust in Europe;
- Electrabel wanted to go a step further and decided to invest an additional 200 million EUR in the safety of the power stations;
- These investments contribute to the continuous improvement of the nuclear safety of the installations and make them resistant against the most extreme situations.

INTERNAL

BEST
For a strong nuclear safety

BEST investments Doel & Tihange

- Dedicated filter installation for all reactor buildings;
- Additional protection of installations against flooding (e.g. the wall in Tihange);
- Extension of fire protection infrastructure;
- New earthquake-resistant infrastructure with additional safety features built for exceptional external conditions; (e.g. diesel generators, pumps, fire fighting equipment and vehicles, extra control room in bunker, etc.);
- Reinforcing the earthquake resistance of important safety systems;
- Extension of certain safety systems (e.g. the systems that ensure the cooling of the reactor core in accident conditions);
- Strengthening training programs to manage events on several units simultaneously.

Permanently supported by solid preparation of our people and organization for extreme events:

- Emergency planning organization that guarantees 24-hour intervention
- With strict training and exercise program
- Presence of primary and redundant emergency plan coordination centers
- Regular exercises in cooperation with FANC, Crisis Center, ...

INTERNAL

Current nuclear situation in Belgium

Nuclear situation in Belgium

2003 — **31/01/2003 : Gradual phase-out of nuclear energy (electricity production)**
- Life time of a nuclear power plant : 40 years
- No new nuclear power plant
- Can be rediscussed in case of enegy supply theat

2012 — Based on the study package for a LTO on T1 and D12, political agreement to have an LTO on T1

2013 — 18/12/2013 : modification of the 2003 law **: 10 years extension for T1**

2015 — 28/06/2015 : modification of the 2003 law **: 10 years extension for D1 and D2**

2023 — 13/12/2023 **: final agreement 10 years extension for D4/T3**

2024 — After the federal election, negociation for a future governement **: What will be the place for nuclear energy ?**

INTERNAL

Evolution of the role of nuclear energy in Belgian energy policy

- Until the end of 2021 Belgian government's intention, in line with the 2003 nuclear exit law, **to close all nuclear power plants by the end of 2025;**
- 2022 start of **war in Ukraine** with known consequences for global energy markets;
- Therefore, to help ensure energy security, the government opted to **extend the Doel 4 and Tihange 3 nuclear power plants by 10 years;**
- After intensive talks, ENGIE and the government, after several interim agreements on the terms, concluded **the final agreements on 13 December 2023;**
- Every effort will be made to restart the plants in **November 2025** so that they can supply electricity to the country as early as winter 2025-2026.

What has been agreed between ENGIE and the Belgian government?

TRACTEBEL ENGIE

- Doel 4 and Tihange 3 will be extended for 10 years, with best efforts made to restart in November 2025;
- Doel 4 and Tihange 3 will be owned by a new joint venture (50% ENGIE - 50% Belgian State);
- No impact on employees' working conditions;
- Balanced distribution of risks and opportunities in the joint venture, including a bilateral "Contract for Difference" mechanism.

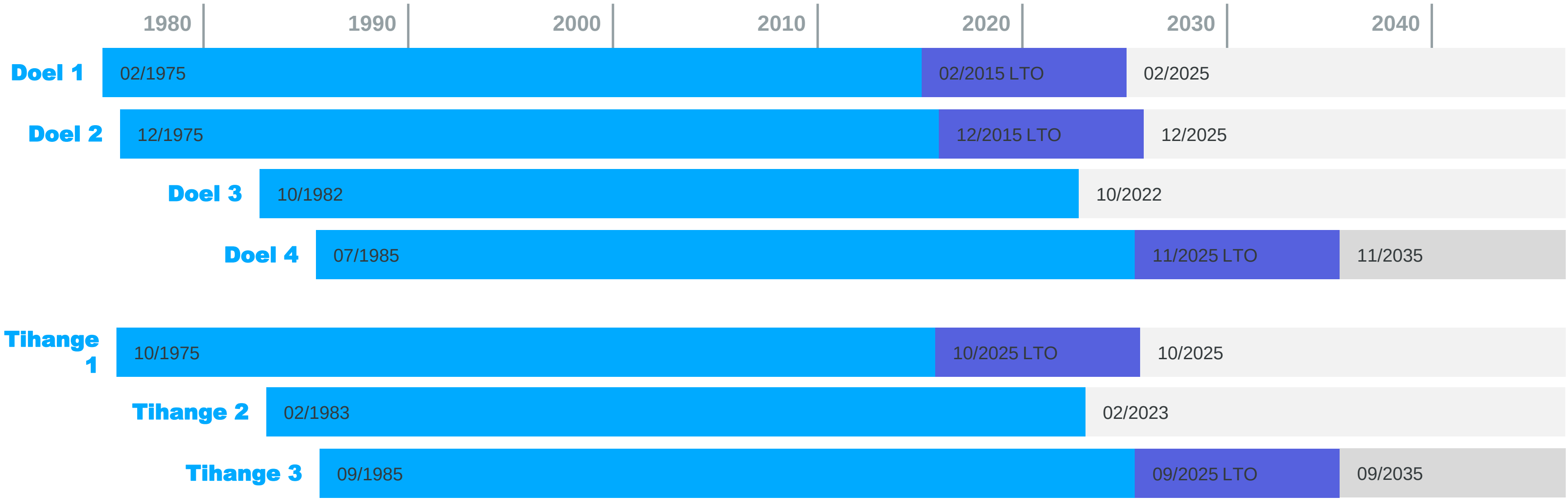
Important for autonomous security of supply in Belgium

- ENGIE remains responsible for all decommissioning activities and the temporary storage of waste on its sites;
- Transfer of responsibility for nuclear waste to the Belgian State for a fixed amount (€15 billion) to be paid by ENGIE:
  - Based on the estimated costs and volumes of waste identified by ONDRAF;
  - Including a premium, in addition to existing nuclear provisions, to cover future uncertainties.

Clear visibility and sharing of risks – removal of uncertainties linked to future responsibilities for nuclear waste

INTERNAL

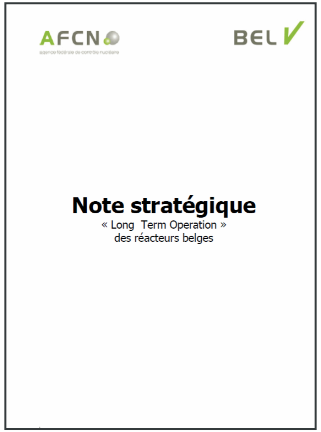
Timeline Doel and Tihange NPP production



LTO program

LTO-G1 (Tihange 1 / Doel 12)

LTO-G1 - FANC framework


AFCN
BEL V
Note stratégique
« Long Term Operation »
des réacteurs belges

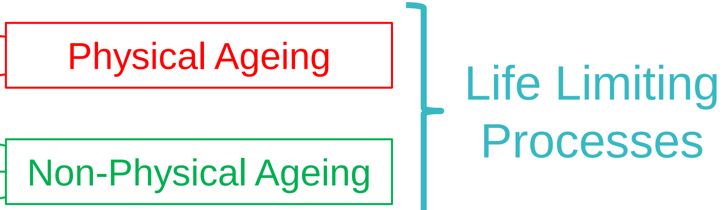
- FANC strategic note (rev0) issued in October 2009

  → Specifies FANC's expectations with respect to LTO

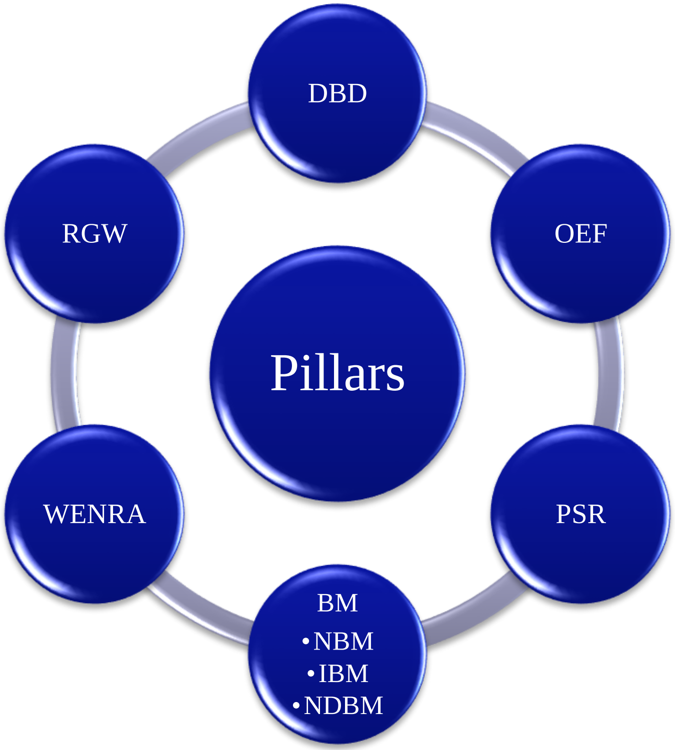
- Nuclear Safety needs to be ensured at the level of:
  (1) **Hardware**: structures, system and components
  (2) **Organisation**: personnel, organization, procedures

- 4 areas

  - **AGEING** management
  - Revaluation of **DESIGN** and identification of '**Agreed Design Upgrades**' (ADU)
  - **Pre-conditions**
  - **Competence and Knowledge Management and Behavior**



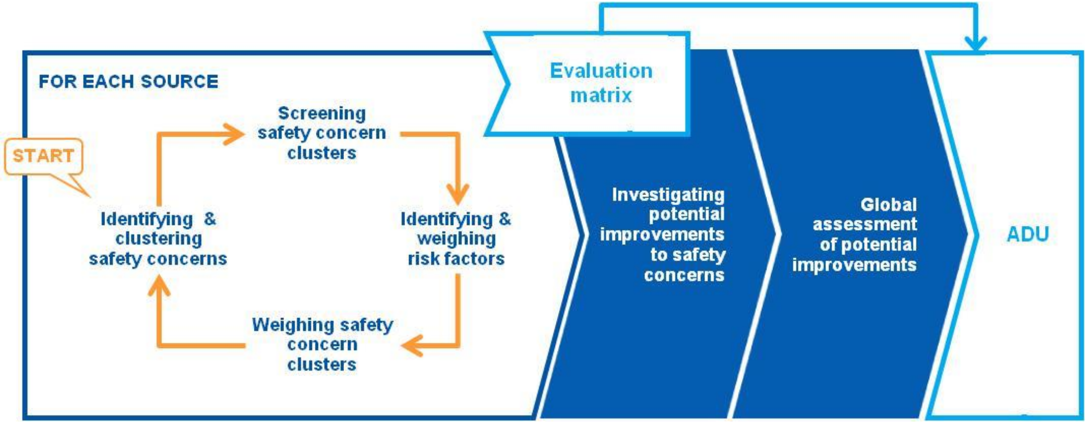
LTO-G1 - Design



- OEF: Operating Experience Feed-back
- PSR: Periodic Safety Review
- BM: Benchmark (National International and New Design)
- WENRA: Western European Nuclear Regulatory Advisory
- RGW: Regulatory Watch
- DBD: Design Basis Documents

TRACTEBEL ENGIE

→ No **Design Extension Conditions** (DEC) yet…



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Example LTO T1 Design : SUR étendu Objectives

TRACTEBEL ENGIE

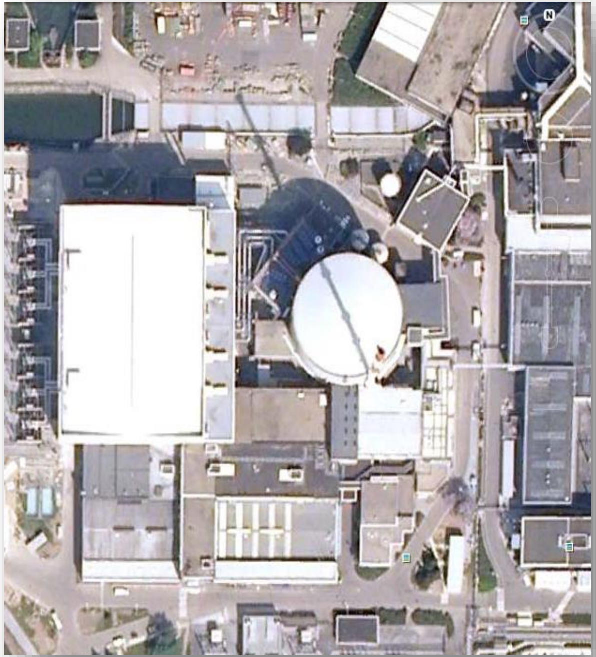
- Give an answer to Two Weaknesses from the original design of Tihange 1
  - The existing emergency protection system is partially located in the Electrical Building in which physical separation is limited
  - The cold shutdown state can not be reached with existing second level protection system (require a 6kV source)

➔ Design and build an extension of the existing Backup Safety system of Tihange 1 -> **Extension of Backup Safety System (SUR-e)**

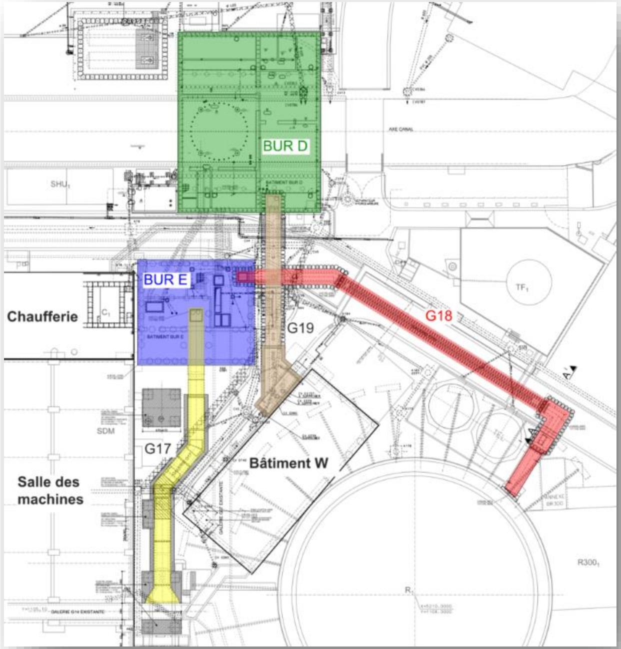
The SUR-e makes it possible to reach a cold shutdown state in the event of loss of the main control room or complete loss of electrical power supplies (1st and 2nd level)

INTERNAL

Example LTO T1 Design : SUR étendu
General view



Tihange 1 before SUR-e construction

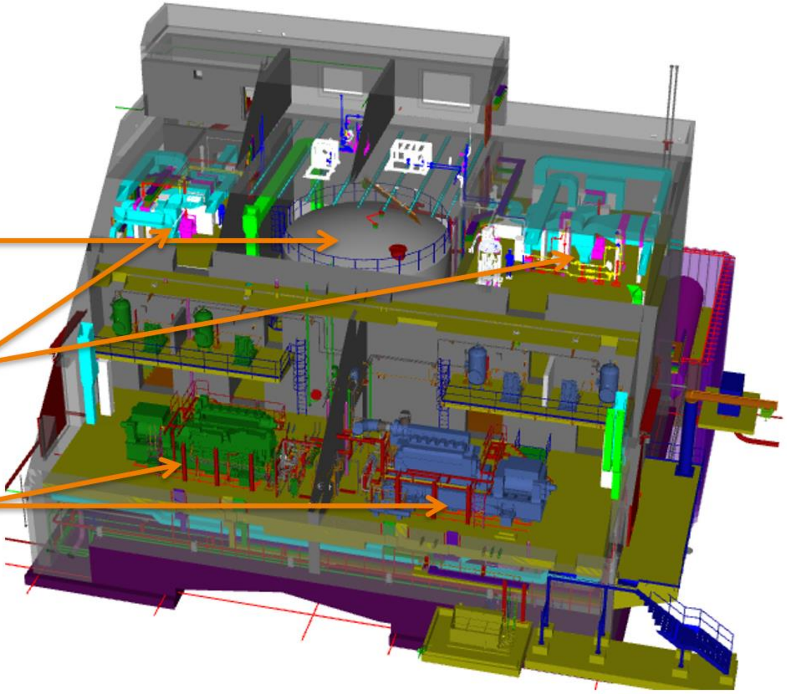


Layout of the 5 new structures related to SUR-e

INTERNAL

Example LTO T1 Design : SUR étendu General view

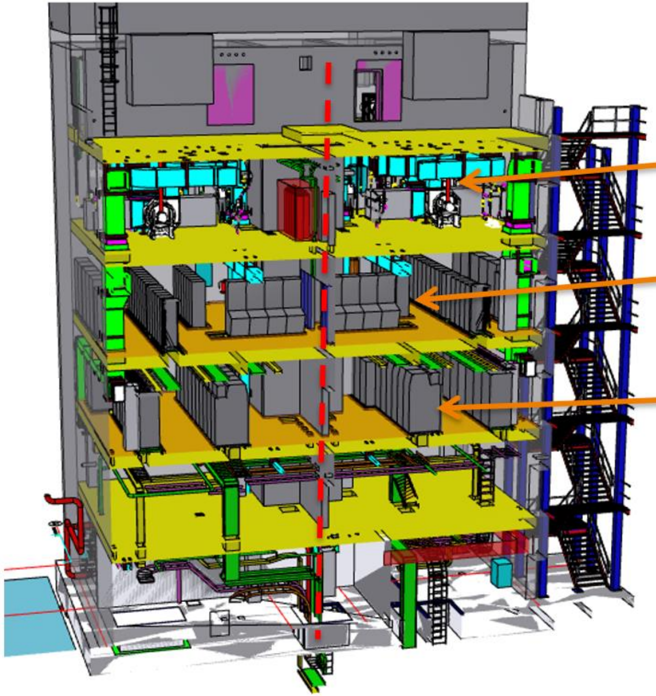
Diesels Building (BUR-D)



INTERNAL

Example LTO T1 Design : SUR étendu General view

Electrical Building(BUR-E)



Safety requirement: Two separate safety trains
Fully redundant

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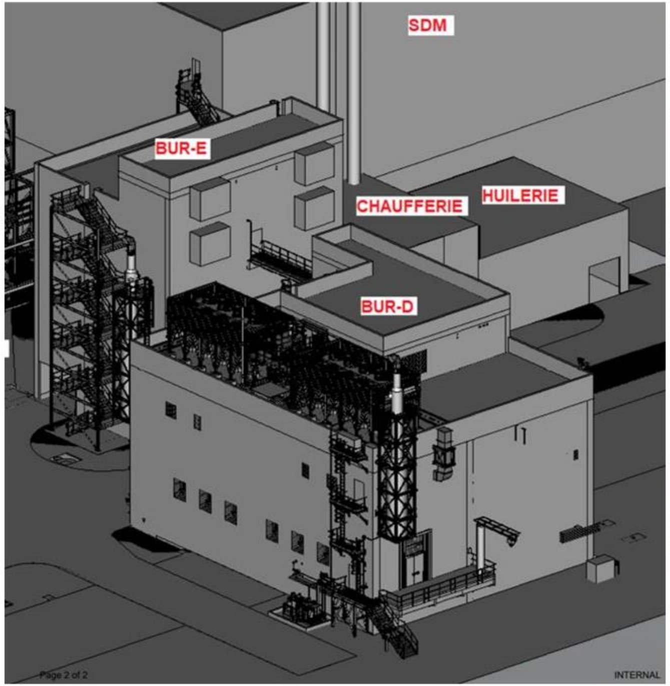
Example LTO T1 Design : SUR étendu
Final situation

TRACTEBEL ENGIE



Connection of the different buildings to the power plant, test and commissioning (6 months period during shutdown of he plant in 2020 :

More than 20 000 connexion deconnexion in the existing plant

INTERNAL

LTO G2 (Tihange 3 / Doel 4)

PSR LTO-D4/T3

FANC framework

- **FANC strategic note (rev2)** issued in July 2023

→ Specifies FANC's **final** expectations with respect to the LTO of KCD4 and CNT3

→ **6 areas**:

- Preconditions
- Ageing Management
- Design upgrade
- Knowledge Competence & Behavior
- Test & Inspections (NEW)
- Environmental Impact Assessment (NEW)

INTERNAL

Overview main activities & gates of the program

TRACTEBEL engie

2023	2024	2025	2026	2027	2028	2029 – …

2023 -2024 (2 years)

2026 – 2028 (3 years)

2024 - 2025 (2 years)

2025-2035 (10 years) – LTO OPERATIONS

PSR LTO STUDY PHASE

- Set up PSR LTO program and organisation
- Perform all PSR LTO studies and assessments in compliance with FANC requirements
- Develop overall implementation schedule
- Prepare implementation team

Gate 1 – 1/1/2025

PSR LTO Report

- Global action list with planning developed
- Plan for management of human resources available
- Test & Inspection program available
- Exhaustive list of deviations (JCO / NCR) with resolution plan
- List of components to be replaced before initial restart or within 3 year

PSR LTO IMPLEMENTATION PHASE 1

- Feasibility studies, basic design,..
- Optimise implementation schedule
- Negotiate and procure scope
- Fix the LTO CAPEX budget
- Set up Implementation organisation
- Conformity Outage (2025) and initial restart

Gate 2 – 1/11/2025

LTO UNITS Restart

- Approval PSR LTO report with implementation schedule
- No open long-standing NCR's in agreement with S.A.
- All SSC's important to Safety are qualified for start up
- Conformity Outage succeeded

PSR LTO IMPLEMENTATION PHASE 2

- Execute the agreed Action plan according to schedule (Global Action List)
- Ensure winter availability
- Provide quality work for LTO operations

Gate 3 – T0 + 3 years*

PSR LTO Completion

- All Actions Global Action list completed
- CAPEX Financial report developed
- End of LTO Program

* T0 KCD4: 1/7/2025
T0 CNT3: 1/9/2025

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Decommissioning

Every unit passes through the same phases

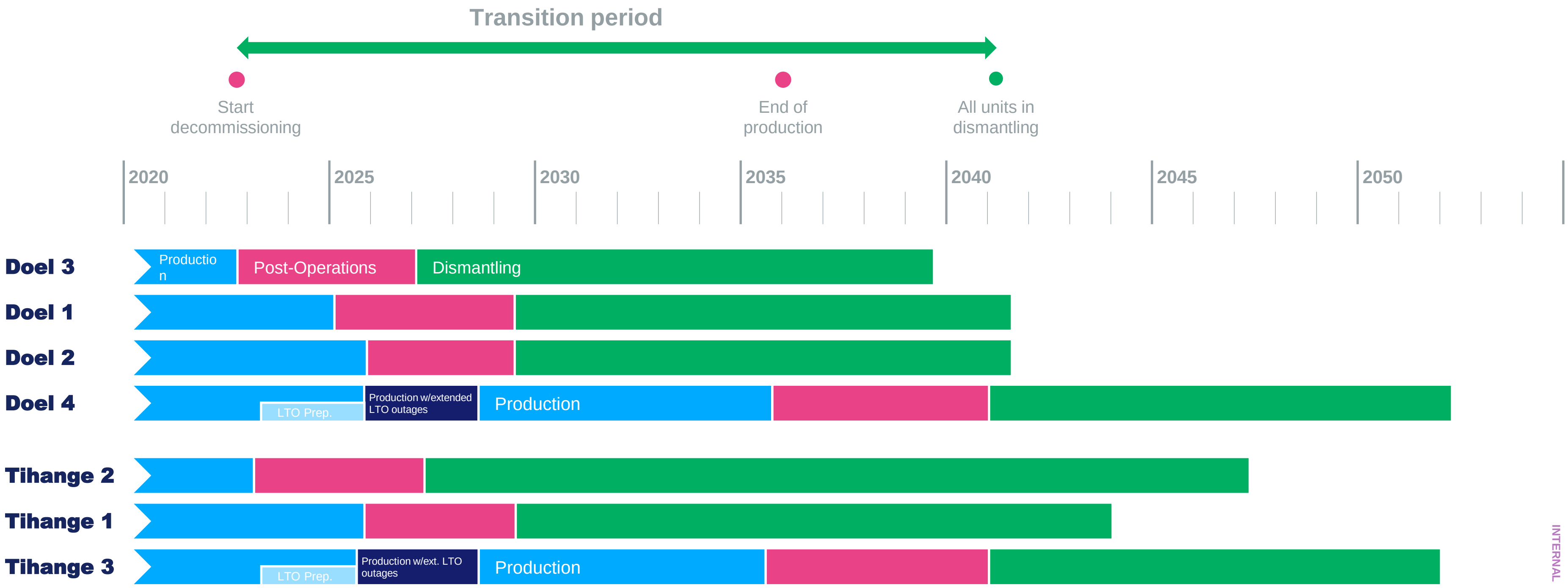
Decommissioning is part of the life cycle of a nuclear power plant. It includes all administrative and technical measures taken from the final shutdown decision to the release of the site for new industrial activities.

MATERIALS AND WASTE are treated on site in designated buildings**.**

OUR AMBITION: Maximum waste reduction and recycling of parts and materials.

Transitioning from production to decommissioning

Based on Master Schedule V7.00



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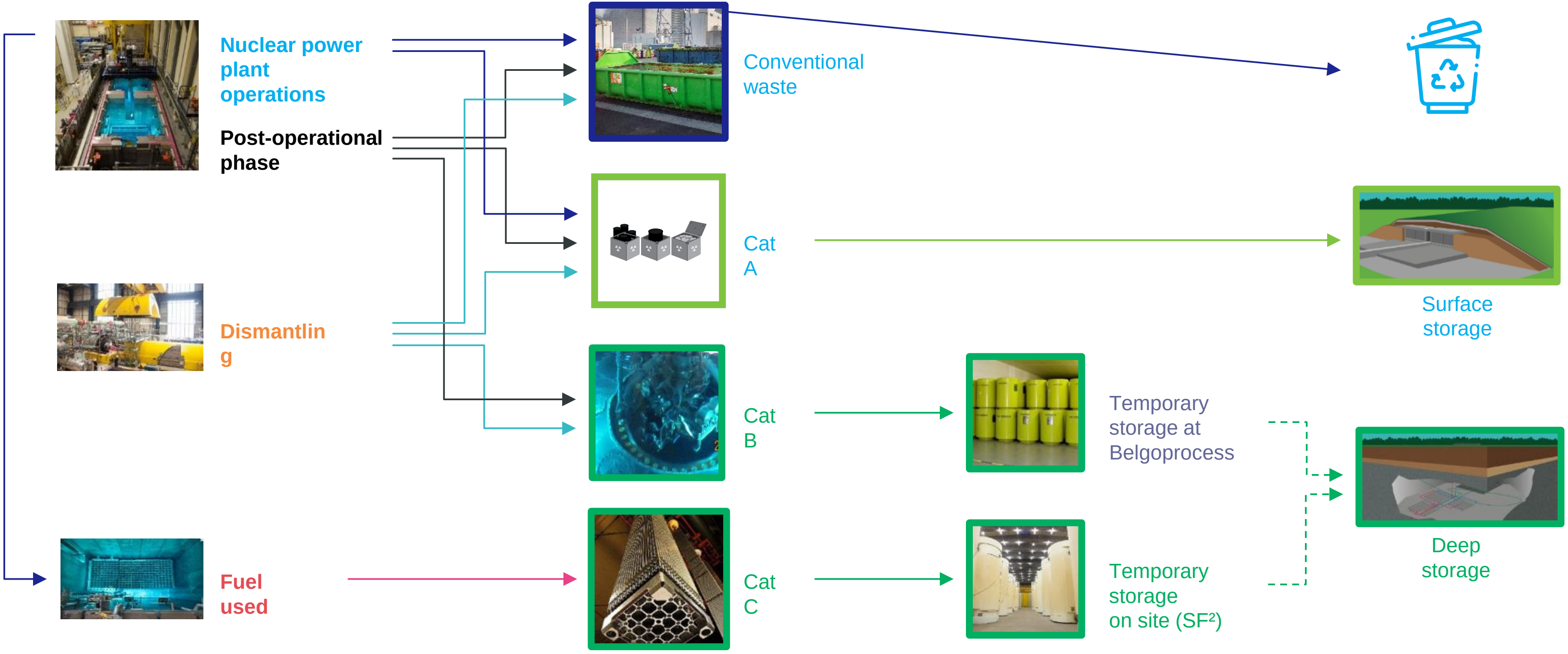
Waste flows

Radioactive waste		Radioactivity		
		Low	Medium	High
Half-Life	Short	Cat A		Cat C
	Long	Cat B		

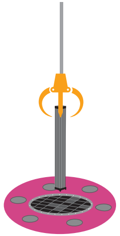


Post-Operations

TRACTEBEL
ENGIE

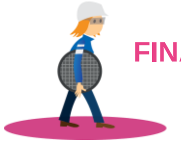
GRADUAL DECOMMISSIONING OF CIRCUITS
REMOVAL OF ALL HAZARDOUS PRODUCTS AND LIQUIDS

REACTOR DISCHARGE
(± 1 month)



REMOVAL OF RADIOACTIVE PARTICLES FROM THE PRIMARY CIRCUIT (CSD)
(± 6 months)

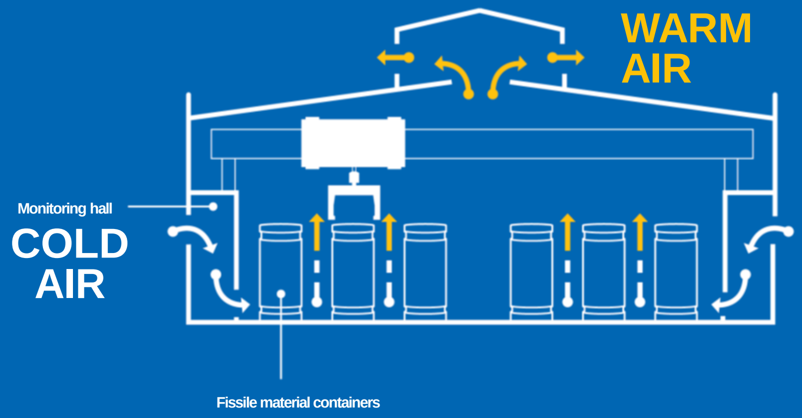
LOADING OF FUEL IN CONTAINERS AFTER COOLING PERIOD OF ± 3 YEARS
(± 24 months)



FINALE CLEANING OF CIRCUITS
(± 4 months)

Temporary Fuel Stroage
Fuel building

- The concrete building provides additional radiological protection;
- The passive ventilation allows residual heat to be dissipated;
- Withstands extreme outdoor temperatures due to climate changes;
- Storage capacity for 165 fuel containers.



Activities in France

Coyne et Bellier expertise
From the beginning of Nuclear Activities

TRACTEBEL ENGIE

- Nuclear Power Plant from first generation (UNGG type reactor)
  - The first study dates from 1954 “for the design of a prestressed caisson" which led to the studies and the construction of the G2 and G3 caissons of Marcoule (250 MW Nuclear Power Plant - graphite-gas) ancestor of the UNNG power plants of Chinon - St-Laurent – Bugey
  - Caisson of 14 m in diameter,
  - 20 m long resistant
  - and watertight to 30 bars
  - Execution in 1957 – 1958
  - Interpretation of the auscultation

INTERNAL

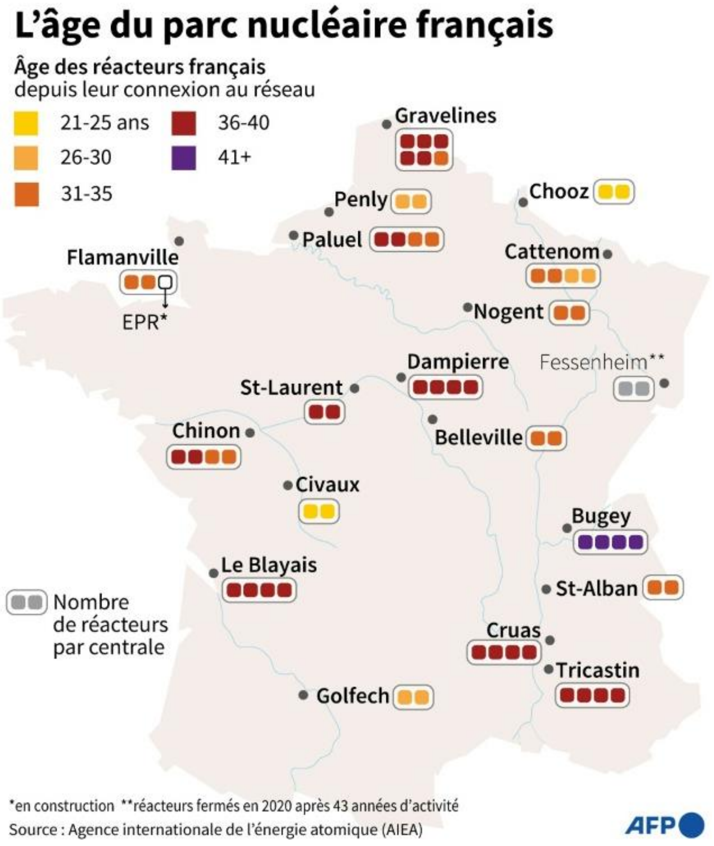
Coyne et Bellier expertise

- **66** Containment Buildings were built from Tractebel drawings (from 1975 to 2024) (28 900 MW in France, 8 900 MW for export, 24 1300 MW or 1450 MW in France + 1 EPR France + 5 EPR export)

- **21** Reactor Buildings were built from Tractebel drawings (12 P’4 + 4 N4 + 1 EPR) (+ 4 EPR export) = Containment + Internal Structures

- **4** BAN buildings were built (900 MW for export)

- **37** turbo-alternator group tables (GTA) were built (900 MW CP2,1300 MW and 1450 MW) + 5 EPR (1 EPR France + 4 EPR export)



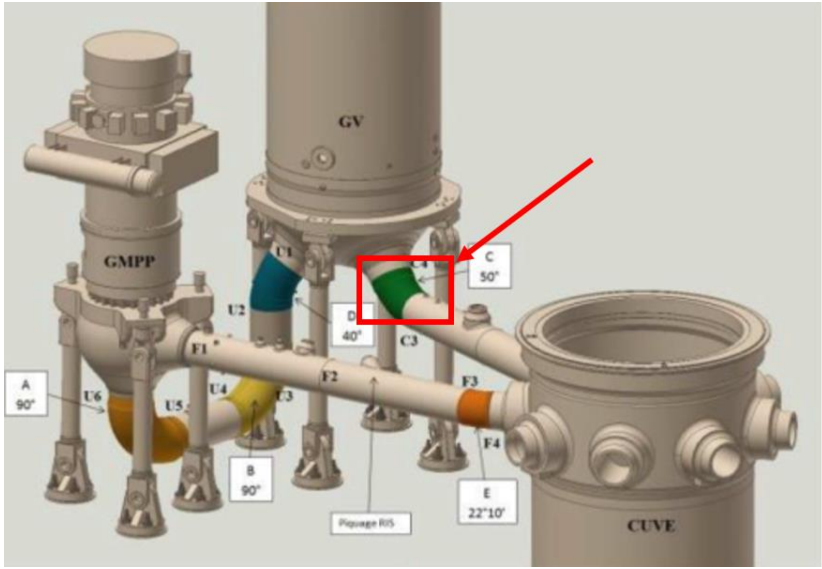
INTERNAL

In France, Tractebel is now a multi disciplinary engineering

TRACTEBEL engie

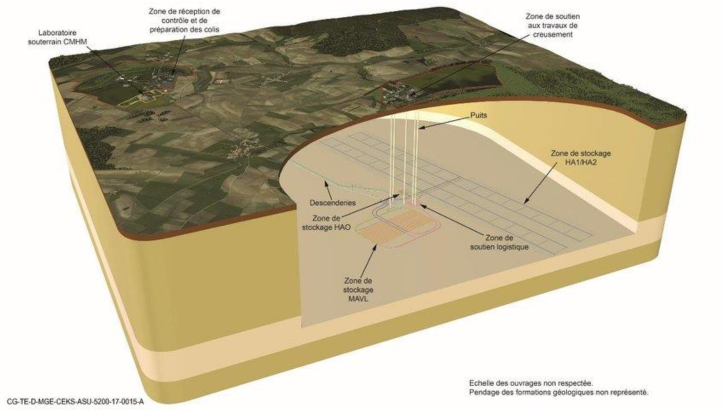
Coudes primaires

Replacmeent of « C » elbow on the primary circuit in the Nuclear Power Plant Blayais



Cigeo

- Storage of high-level and intermediate-level radioactive waste
- The galleries are located at -520 m in a layer of clay serving as a barrier
- 2 subsystems on which we work :
  - SS2: surface nuclear installation
  - SS4: underground installation



INTERNAL

Collaboration between EDF and Engie Electrabel

TRACTEBEL ENGIE

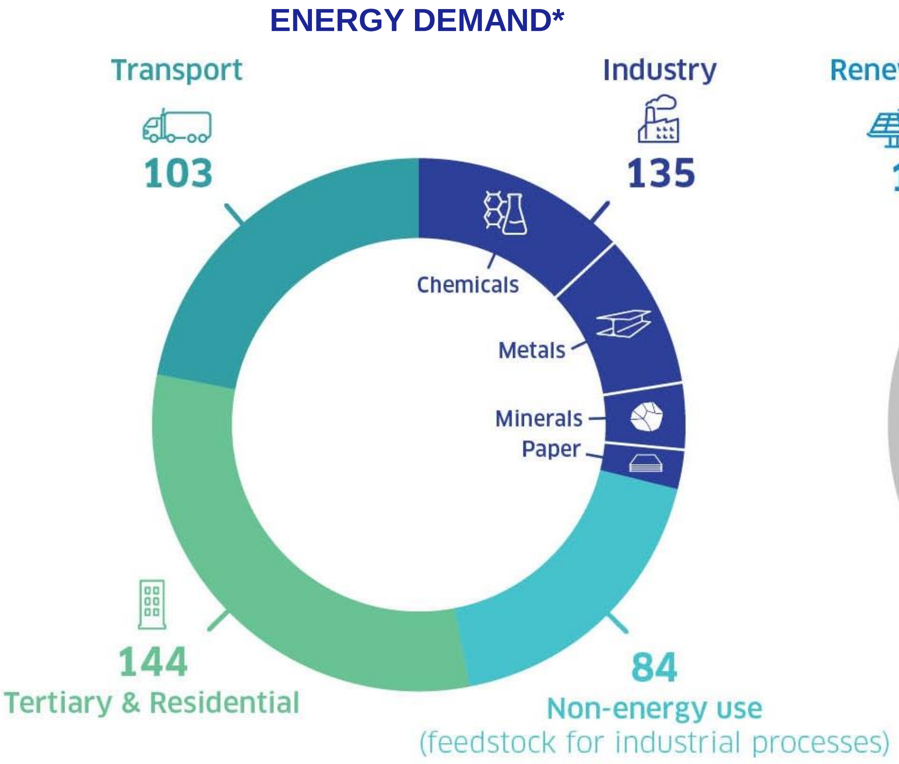
Begins also at the beginning of the nuclear activities

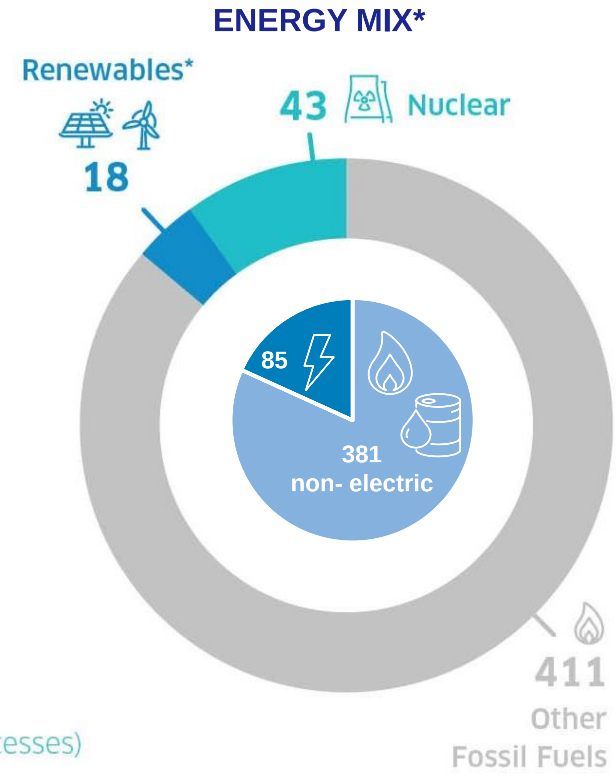
- **Chooz A** was a PWR design by Westinghouse, built and operated by EDF and Belgian (SENA : Société d'énergie nucléaire franco-belge des Ardennes). It was shut down in 1991 after an operational life of 22 years. The containment building of this unit was underground.
- **Tihange 1**
- **Tricastin**
- **Chooz B1/B2**

INTERNAL

Electricity Mix in Belgium

Current Belgian energy landscape
2019





*Energy in TWh

INTERNAL

2050 Belgian energy landscape will require new solutions

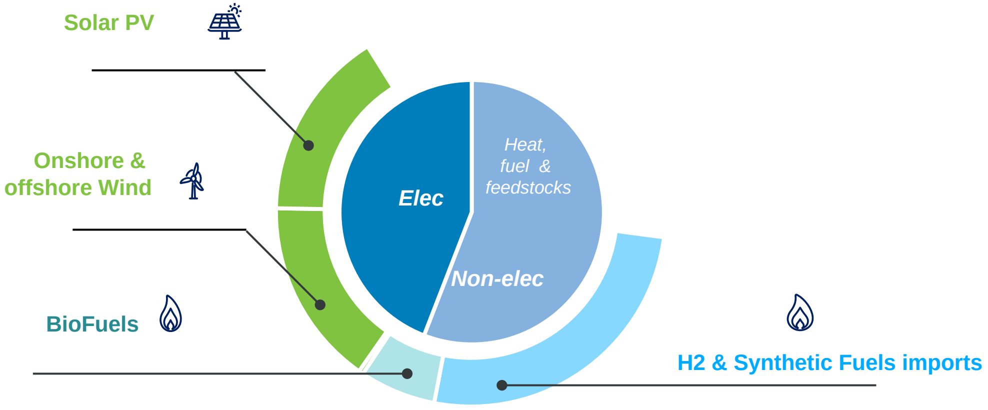
TRACTEBEL ENGIE

Energy Ville

~150 TWh
Renewables potential

.be
Vision and strategy Hydrogen

125 to 200 TWh
Domestic demand of H2 by 2050



Electrification

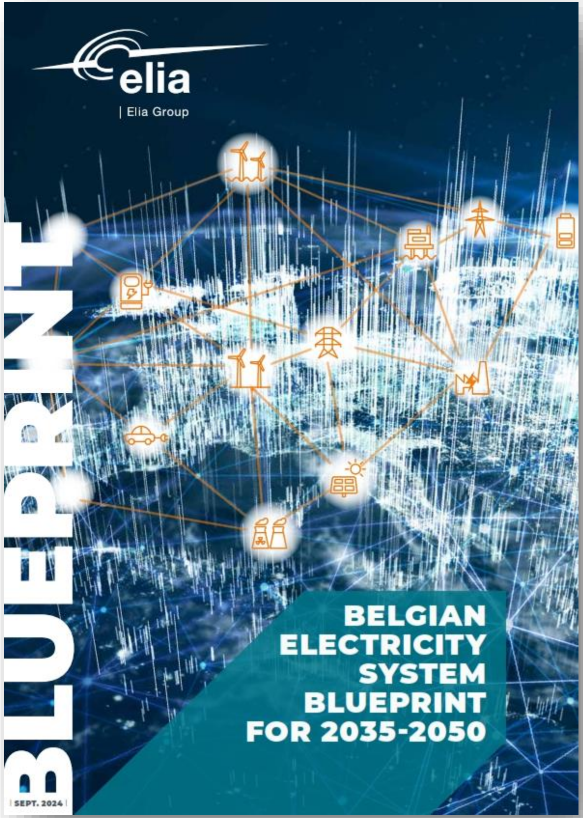
Energy efficiency

Building renovation

Dvlpt of public transportation

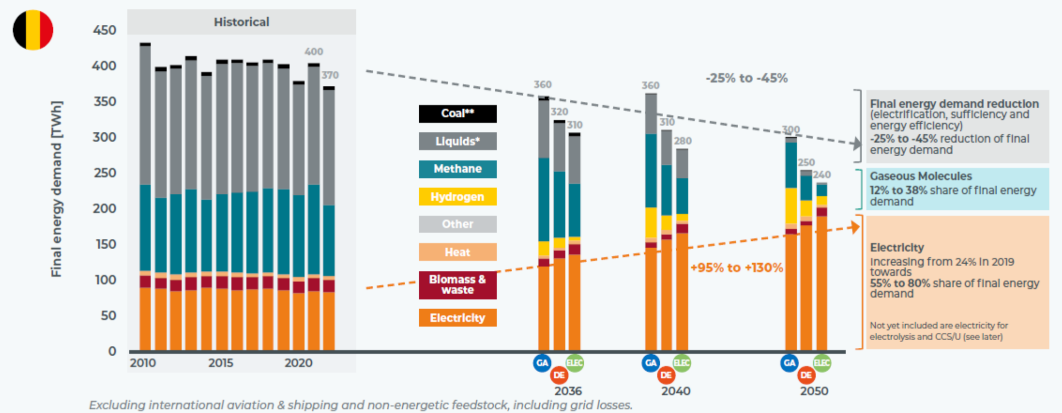
INTERNAL

Latest Belgian TSO study for 2050 energy demand



FINAL ENERGY DEMAND IN BELGIUM

The figure below depicts how Belgium's total energy demand (in TWh, excluding international aviation & shipping and non-energetic feedstock) is assumed to change over time. The different colours represent the different energy carriers. Belgium's historical energy demand is on the left-hand side of the diagram, whilst the different scenarios are simulated over three time horizons on the right-hand side.



Excluding international aviation & shipping and non-energetic feedstock, including grid losses.
Note that energy demand for transformations such as power-to-hydrogen and carbon capture are not included. Values are normalised for historical climate while in the simulations, a forward-looking climate database is used, therefore the simulated demand can differ from these input values.
** Methane & liquids could be fossil, bio or synthetically sourced, which is defined in the model.*
*** Coal as defined as final energy demand per EUROSTAT (i.e. excluding coal consumed in blast furnaces)*
Historical values based on EUROSTAT

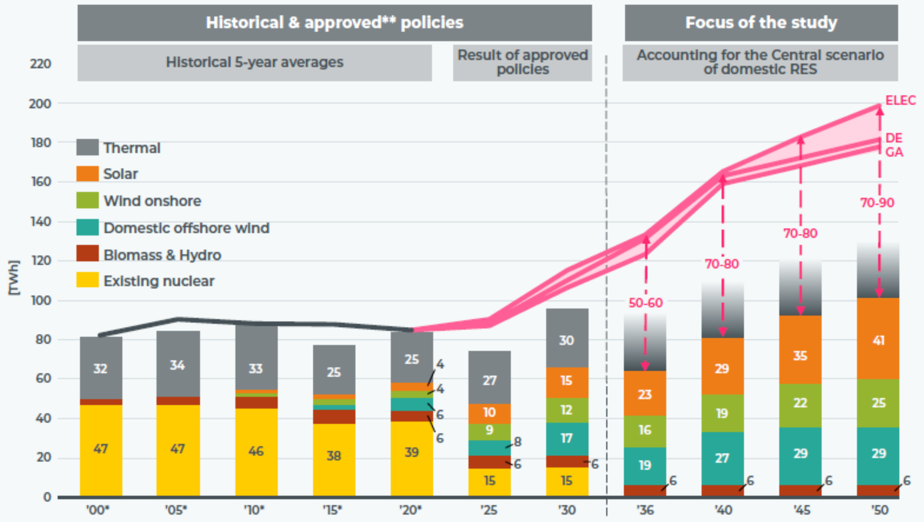
INTERNAL

Structural deficit for electricity supply in 2050 creates new appeal for nuclear

elia
Elia Group

EVOLUTION OF BELGIUM'S ELECTRICITY DEMAND AND SUPPLY IN THE LEAD-UP TO 2050

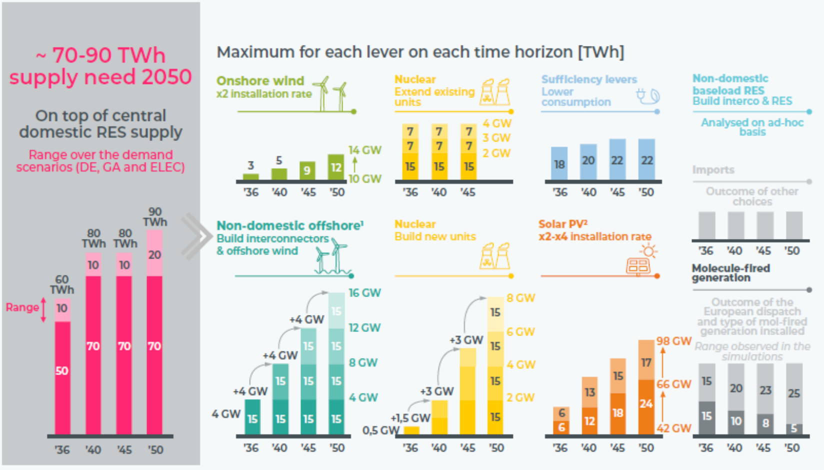
The figure below demonstrates the growing gap between the increasing demand for electricity (pink lines) and Belgium's domestic low-carbon supply. It shows how much electricity will be needed to cover the increasing electricity demand. This is separate from the adequacy requirement, which relates to maintaining the country's security of supply during peak moments.



* For year X, the 5-year average in the range [X-2,X+2] is shown instead
** Approved policies: Extension of offshore wind in Belgium to 5,8 GW, extension of D4/T3 for 10 years, National/Regional energy climate plans (domestic RES, electrification, energy efficiency...), CRM

MULTIPLE OPTIONS EXIST FOR COMPLEMENTING BELGIUM'S DOMESTIC BASE-CASE LOW-CARBON SUPPLY

The figure below outlines multiple levers which can be used to complement Belgium's domestic low-carbon supply. They serve as the building blocks of the country's 2050 energy mix. A strategic combination of these levers will be essential for bridging the 70-90 TWh gap that will emerge between Belgium's increasing electricity demand and its base-case domestic low-carbon supply. Various considerations and diversification strategies must be taken into account when selecting the most effective levers.



1. Non-domestic offshore refers to offshore wind capacity installed outside of Belgium's Exclusive Economic Zone (EEZ) which still counts towards Belgium's domestic supply given Belgian financing/support of the wind generation itself.
2. Note that the capacity factor in the highest solar PV scenario is lower, because some PV capacity is curtailed when generation exceeds the limits of what the distribution network can handle.

Seen in the Belgian press…

TRACTEBEL engie

L'Echo

Dotée de 100 millions, la recherche sur les petits réacteurs débute au SCK.CEN

'Le SCK.CEN est le cœur de la recherche nucléaire en Belgique', a rappelé le Premier ministre à l'oc
ans du centre de recherche. ©Photo News

SUDINFO

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ABONNÉS

Un nouveau réacteur nucléaire en Belgique d'ici 2035

Les négociateurs fédéraux veulent relancer l'industrie nucléaire en Belgique d'après la note du formateur, Bart de Wever.

L'Arizona souhaite prolonger nos réacteurs plus longtemps que jusqu'en 2035. - Photo News

LE SOIR

Energie : l'Arizona veut réactiver le nucléaire

La note « énergie » qui est sur la table des négociateurs du futur gouvernement fédéral confirme le retour en grâce de l'atome. Objectif : la mise en service du premier petit réacteur modulaire (SMR) en Belgique en 2035 au plus tard.

éservé aux abonnés

INTERNAL

Standing on the shoulders of Giants

TRACTEBEL
ENGIE

BR3 – first PWR connected to the European Grid

1962

1969 - 1985

Construction of the 7 Belgian Nuclear Units

HADES
Deep Geological Repository Prototype

1980 - 1987

1998 - 2036

MYRRHA
& Lead-cooled Fast Reactor Technology development

Contributing to the First SMR built in the Western World

2023 – 2029

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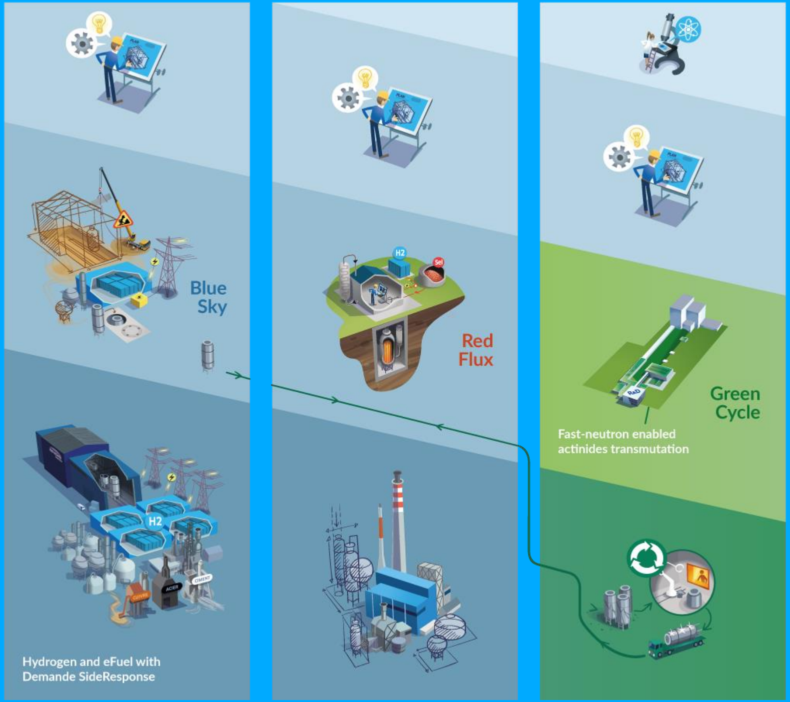
ENGIE

Multiple nuclear technology options

	Option 1 MATURITY	Option 2 INNOVATION	Option 3 DISRUPTION	
Today				R&D
				Preparation
2030				Pilot
2050				Scale up



Gen III *(1000 – 1700 MW)* Large reactors

Gen III *(50 – 400 MW)* SMRs

Gen IV *(20 – 200 MW)* Advanced Modular Reactors

SHORT-TERM DEPLOYMENT

Well-established technologies

Market initiators by the end of 2020s

DEEP DECARBONIZATION

Heavy industry

Heat and hydrogen production

CLOSED FUEL CYCLE

Reduction of nuclear waste

Circularity

INTERNAL

SMR

Tractebel: a European pioneer on SMRs

TRACTEBEL ENGIE

2018
First SMR commercial activities

moltex clean energy

2019 - 2021
Inclusion of LW-SMR in European Utility Requirements

EUR
HARMONISED REQUIREMENTS FOR NEW NUCLEAR POWER PLANTS

2020
Tractebel vision paper on SMR

2021 - 2023
EU SMR Pre-partnership Steering Committee

2021 -
Tier I partner of Nuward SMR

nuward SMR

2022
Tractebel Inc. Opening of Canadian Office

2023
Start of activities for Darlington SMR

ONTARIO POWER GENERATION

2023
Belgian Parliamentary Audition on SMR

2024
Thorizon Partnership Agreement

THORIZON

2024
SMR position paper on data centers

2024
EU SMR Alliance

INTERNAL

International banks express support for nuclear expansion

Monday, 23 September 2024

A group of 14 global financial institutions have expressed their support for the call to ... 2050.

Leaders commit to 'unlock potential' of nuclear energy at landmark summit

21 March 2024

Why Microsoft made a deal to help restart Three Mile Island

ould s

Amazon invests in X-energy, unveils SMR project plans

Wednesday, 16 October 2024

Amazon has announced it has taken a stake in advanced nuclear reactor developer X-energy, with the goal of deploying up to 5 GW of its small modular reactors in the USA by 2039.

Google to buy nuclear power for AI datacentres in 'world first' deal

Tech company orders six or seven small nuclear reactors from California's Kairos Power

Business live - latest updates

Google hopes the deal will provide a low-carbon solution to power datacentres. Photograph: Mike Blake/Reuters

INTERNAL

Small Modular Reactors

A business model that addresses the right questions

#1

Foster nuclear **investments**

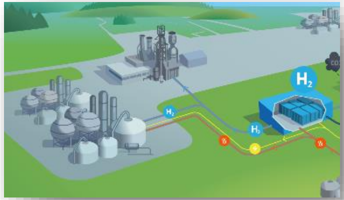
#2

Recreate **public trust** in nuclear

#3

Expand **role in zero-carbon transition**

Smaller
Simpler
Standardized



Back to the future:
First European SMR based on Belgian know-how?

INTERNAL


TRACTEBEL
engie
Engineering
a carbon-neutral
future