

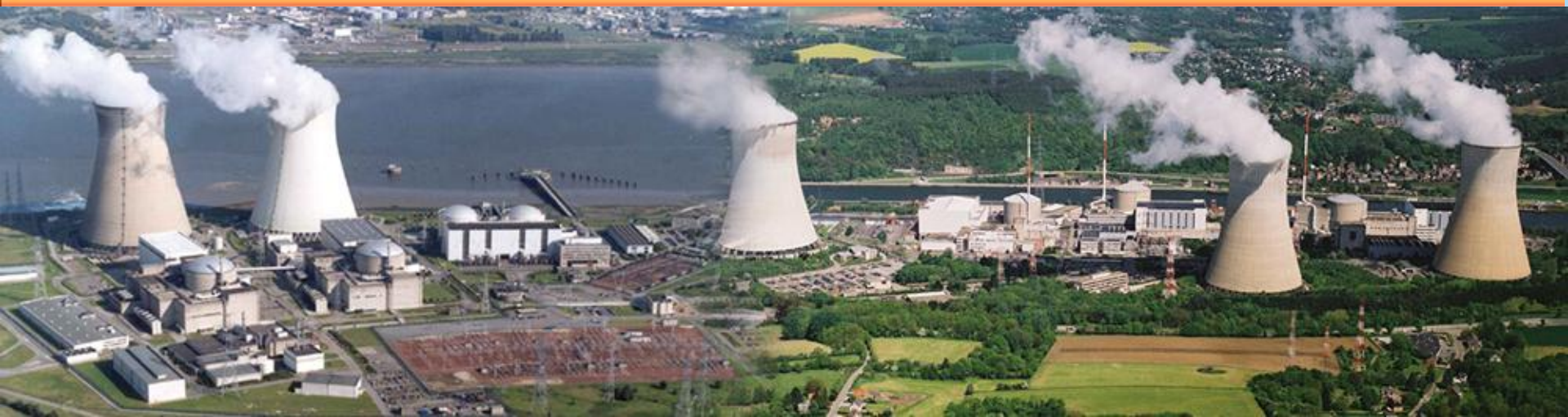
Electrabel

GDF SUEZ



A utility point of view on the justification for safe long term operation

Geert Backaert

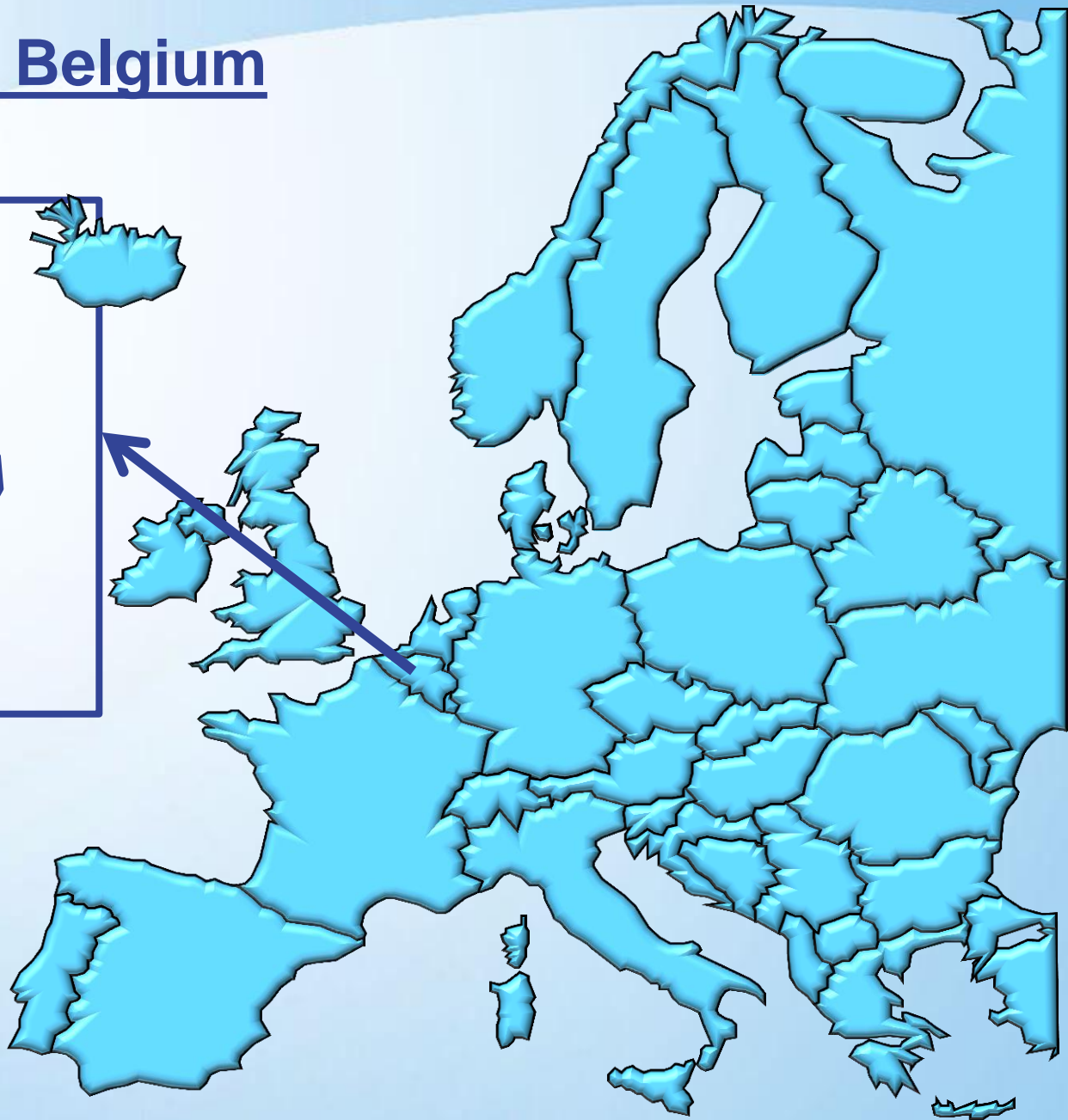
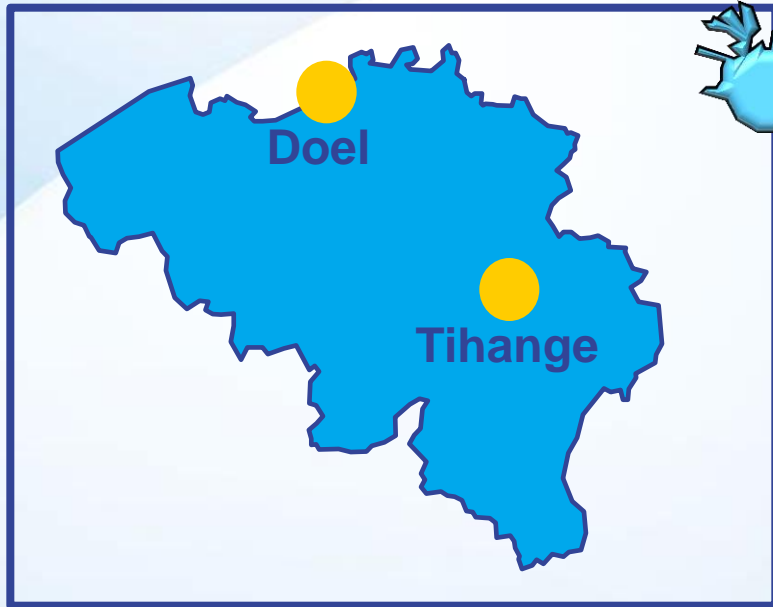


AGENDA

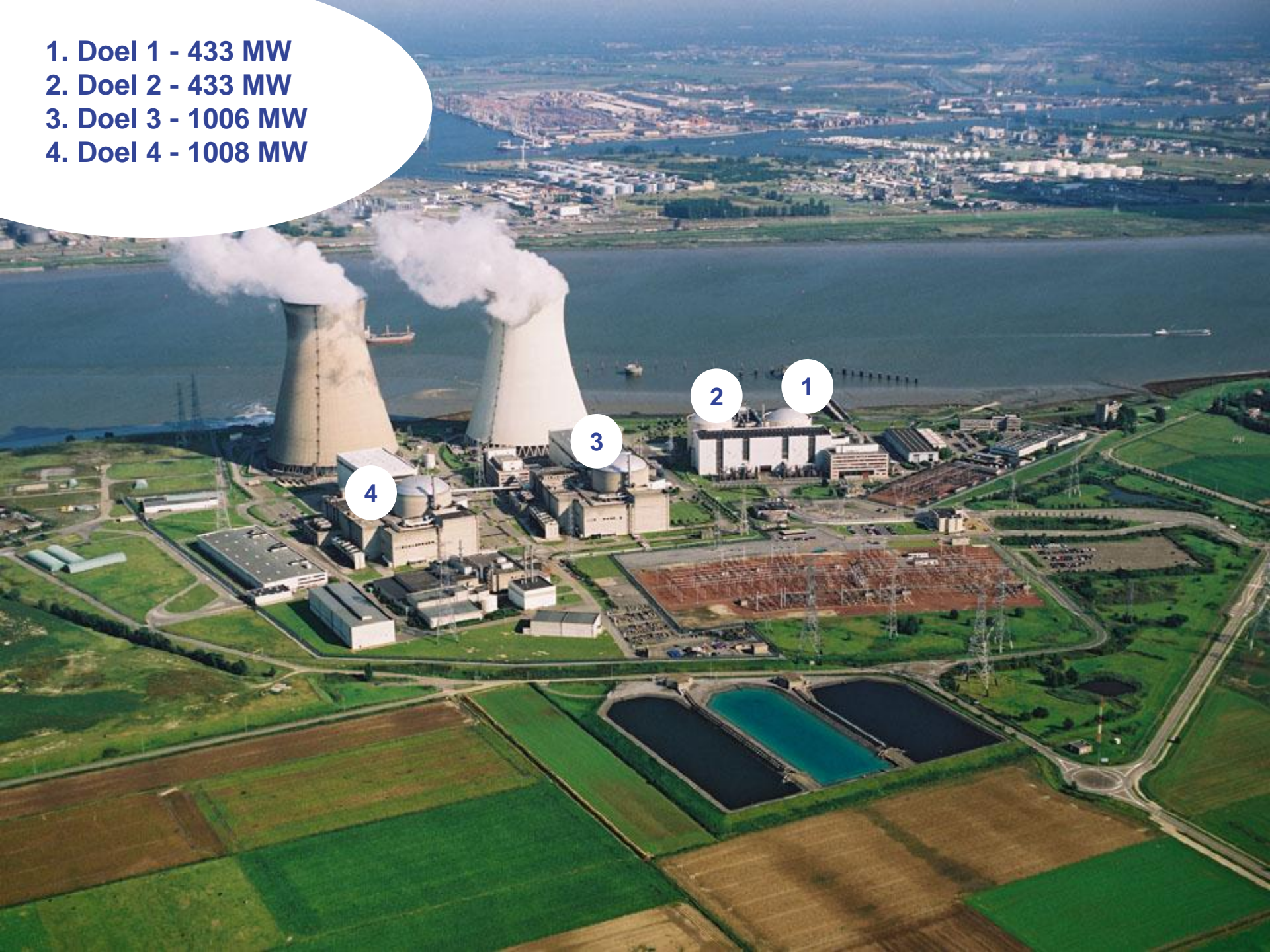


1. Positioning Tihange 1 & Doel 12
2. Regulatory context
3. Organisation
4. Approach Electrabel

Nuclear Power in Belgium



1. Doel 1 - 433 MW
2. Doel 2 - 433 MW
3. Doel 3 - 1006 MW
4. Doel 4 - 1008 MW



1. Tihange 1 - 962 MW
2. Tihange 2 - 1008 MW
3. Tihange 3 - 1015 MW





Units	Net capacity [MWe]	Date of 1st criticality	Design	Cumulative net load factor [%]	LTO relevant ?
Doel 1	433	1974	Westinghouse	85.1	YES
Doel 2	433	1975	Westinghouse	82.1	YES
Doel 3	1006	1982	Framatome	84.0	
Doel 4	985	1985	Westinghouse	83.6	
Tihange 1	962	1975	Framatome	79.0	YES
Tihange 2	1008	1982	Framatome	85.8	
Tihange 3	1015	1985	Westinghouse	86.6	

POSITIONING DOEL 1/2 AND TIHANGE 1

Name	Country	NSSS-supplier	MWe rating	Commercial operation date	Lifetime	NRC decision
Beznau 1	Switzerland	WEC	380	12/01/69	40+	
GINNA Unit 1	USA	WEC	602	07/01/70	60	2004
Mihama 1	Japan	WEC	340	11/28/70		
Point Beach Unit 1	USA	WEC	524	12/21/70	60	2005
Robinson Unit 2	USA	WEC	735	03/07/71	60	2004
Novovoronezh 3	RUSSIA	MHE	417	12/30/71		
Palisades Unit 1	USA	CE	842	12/31/71	60	2007
Beznau 2	Switzerland	WEC	380	03/01/72	40+	
Mihama 2	Japan	MHI	500	07/25/72		
Point Beach Unit 2	USA	WEC	524	09/30/72	60	2005
Surry Unit 1	USA	WEC	840	12/02/72	60	2003
Turkey Point Unit 3	USA	WEC	693	12/04/72	60	2002
Novovoronezh 4	Russia	MHE	417	12/31/72		
Surry Unit 2	USA	WEC	840	05/01/73	60	2003
Kola 1	Russia	MHE	440	06/29/73		
Oconee Unit 1	USA	BW	934	07/16/73	60	2000
Turkey Point Unit 4	USA	WEC	693	09/07/73	60	2002
Fort Calhoun Unit 1	USA	CE	499	09/26/73	60	2003
Borssele 1	The Netherlands	KWU	450	10/25/73	60	
Prairie Island Unit 1	USA	WEC	566	12/16/73	60	2011
Kewaunee Unit 1	USA	WEC	599	06/16/74	60	2011
Indian Point Unit 2	USA	WEC	1062	08/01/74		Under review
Three Mile Island Unit 1	USA	BW	890	09/02/74	60	2009
Oconee Unit 2	USA	BW	934	09/09/74	60	2000
Takahama 1	Japan	WEC	826	11/14/74		
Kola 2	Russia	MHE	440	12/08/74		
Oconee Unit 3	USA	BW	934	12/16/74	60	2000
ANO Unit 1	USA	BW	845	12/19/74	60	2001
Prairie Island Unit 2	USA	WEC	593	12/21/74	60	2011
Doel 1	Belgium	WEC	392	02/15/75		
Biblis A	Germany	KWU	1225	03/01/75		
Ringhals 2	Sweden	WEC	875	05/01/75	40+	
Calvert Cliffs Unit 1	USA	CE	925	05/08/75	60	2000
Cook Unit 1	USA	WEC	1077	08/23/75	60	2005
Tihange 1	Belgium	ACLF	962	09/01/75		
Genkai 1	Japan	MHI	559	10/15/75		
Takahama 2	Japan	MHI	826	11/14/75		
Doel 2	Belgium	WEC	433	12/01/75		
Millstone Unit 2	USA	CE	883	12/26/75	60	2005

AGENDA



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Regulatory context

Regulatory context to operate the Belgian nuclear units

- The Belgian units are in constant evolution; through the mandatory process of **decennial reviews** and EBL policy of continuous improvement. This concerns as well the design as the way to operate.
- The plant itself has **no technical defined lifetime**. Some components have a limited lifetime, but most are replaceable (e.g. steam generators).



Regulatory context

Nuclear phase out law (2003)

- **Until 2003 the only legal limit on the lifetime was the obligatory decennial review**
- **In 2003 a nuclear phase-out law was voted by the Belgian parliament limiting the lifetime of Nuclear power plants to 40 years**

This law mentioned also: If electricity supply is threatened, the appropriate measures can be taken.....

- **In 2009 a Protocol Agreement signed by the Belgian State and GDF SUEZ**

Both parties agreed to several commitments, in particular the life time extension of Doel 1 & 2 and Tihange 1 with 10 years

Regulatory context

LTO-file

- **Electrabel decided to prepare an LTO file for Doel1 and 2 and Tihange 1**
- **These were submitted to and approved by the nuclear safety authorities in June 2012 (Agreement on Design upgrade)**
- **In July 2012 the government announced its intention to prolong the lifetime of the Tihange 1 NPP to 50 years, to assure electricity supply, while the closure of Doel 1 and 2 after 40 years was confirmed.**

Regulatory context

- Preparation of the LTO file based on Strategic note issued by safety authorities in 2009:
 - ✓ Preconditions
 - ✓ Ageing
 - ✓ Design
 - ✓ Knowledge and competence management and behavior



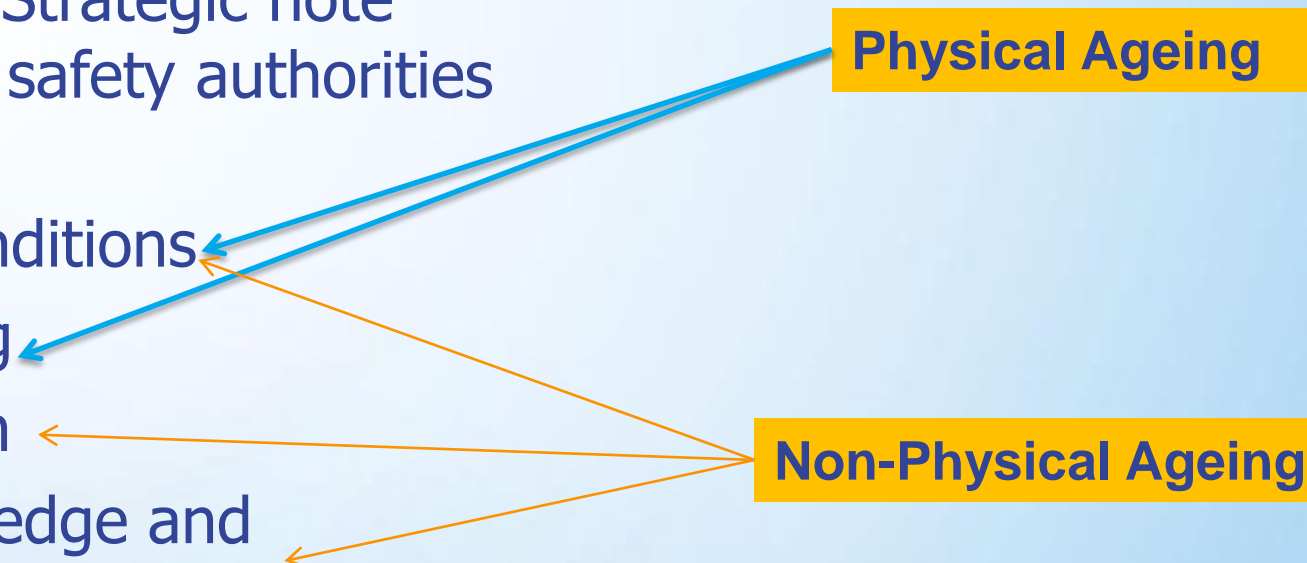
Regulatory context

- Preparation of the LTO file based on Strategic note issued by safety authorities in 2009:

- ✓ Preconditions
- ✓ Ageing
- ✓ Design
- ✓ Knowledge and competence management and behavior

Physical Ageing

Non-Physical Ageing



Regulatory context



Milestones in strategic note

2009	Discussion on methodology and approach
End 2011	Submit LTO-file: <ul style="list-style-type: none">✓ Re-evaluation of the design: proposal for design upgrades and related planning✓ Ageing management: documentation conform 10CFR54
2012 (T ₁₀ -3.5y)	Define final 'agreed design upgrade' (ADU)
2015 (T ₁₀)	Submit: <ul style="list-style-type: none">✓ Revision or supplement of the Safety Analysis report (including ageing management, LTO-actions...) Implementation completed of ageing management program
<2020	Realization of modifications in design ('agreed design upgrade')

AGENDA



1. Positioning Tihange 1
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Organisation PRINCIPLES



- ONE project - ONE plan - ONE team
- Two sites: two separate but **coherent** files, the same structure of the LTO file and applying the same methodology, resulting in a balanced content
- One integrated organization for the two sites and for the different entities involved (Electrabel, Tractebel, ...)

AGENDA



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Electrabel approach

- Electrabel's LTO-project was outlined according to the 4 domains:
 - Preconditions
 - Ageing
 - Design
 - Knowledge, competence and behaviour

Preconditions

LTO-preconditions

Plant programmes

Management system

Safety analysis
TLAA

Licensing basis documents

Maintenance

In service inspection

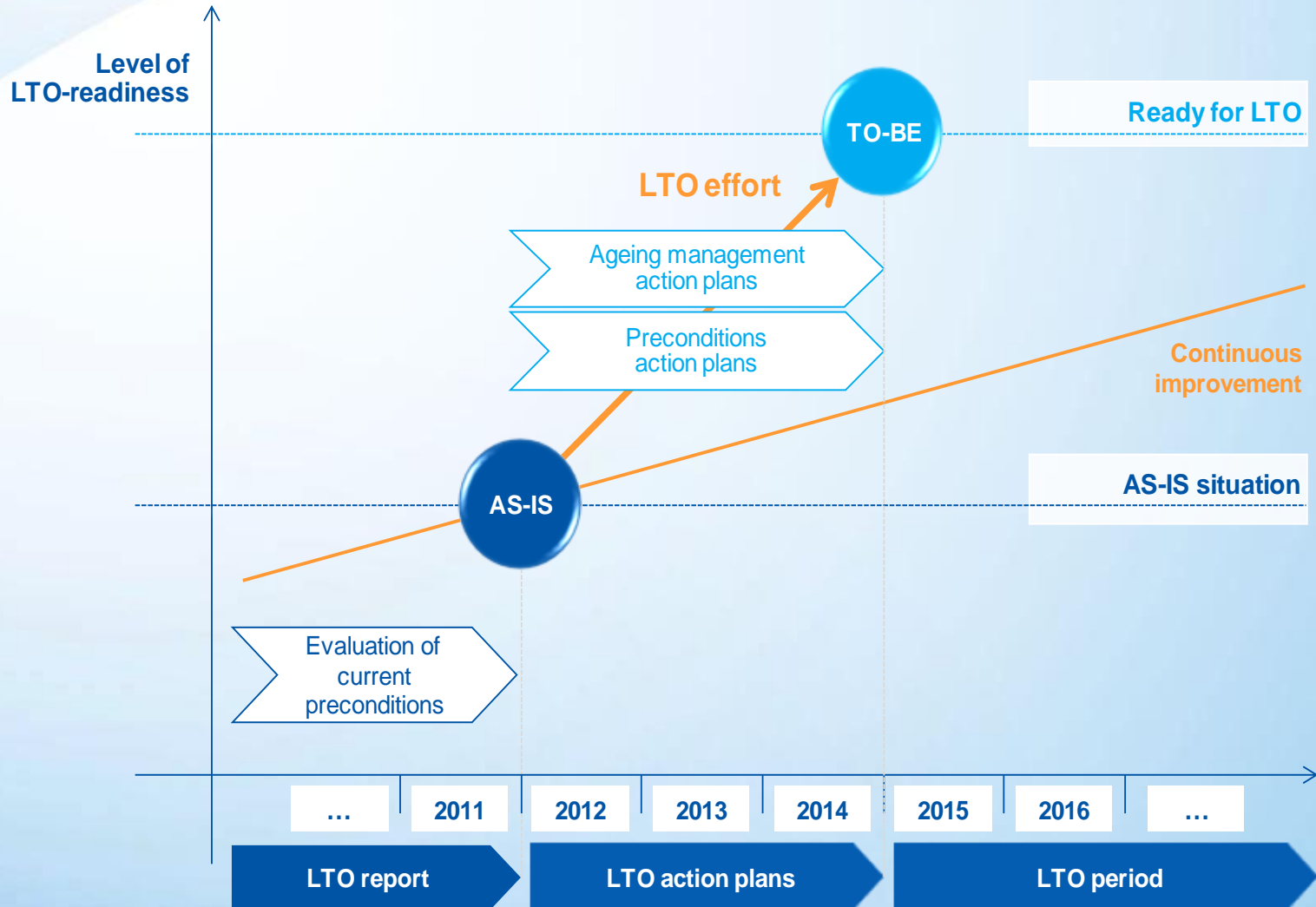
Configuration management

Equipment qualification

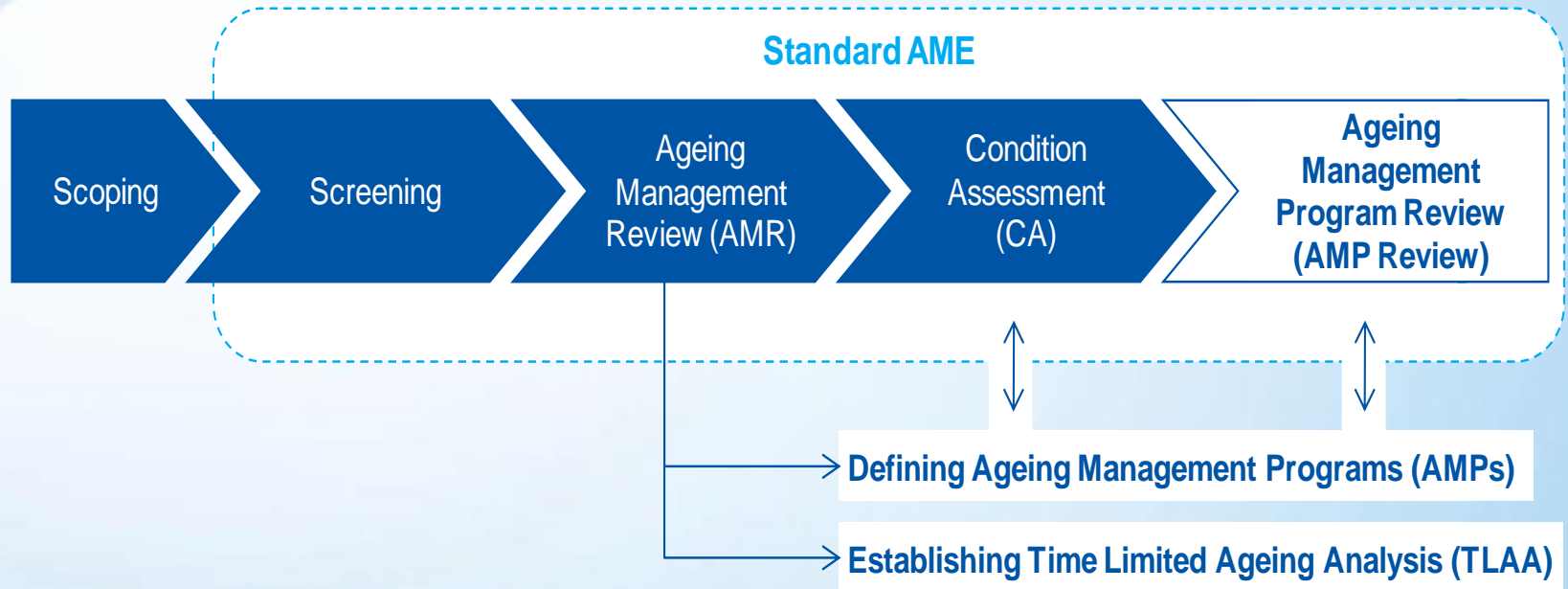
Surveillance and monitoring

Chemistry programs

Preconditions: interpretation IAEA expectations



Ageing



Design

LTO-DESIGN: Sources for design upgrade

**Other information sources
for design re-evaluation**

(a) Regulation watch

(b) WENRA reference levels

(c) Benchmarks

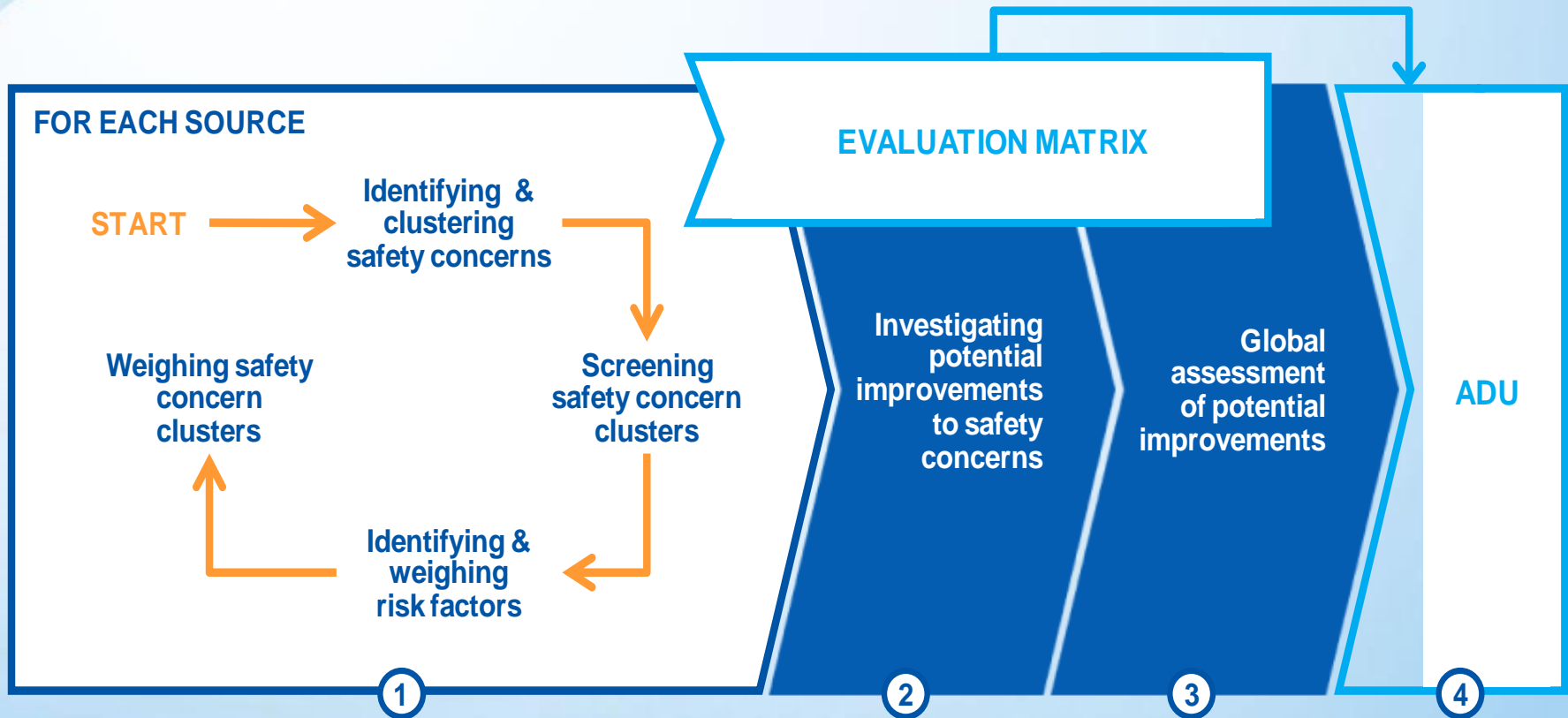
(d) PSR look-back

(e) Operational experience feedback

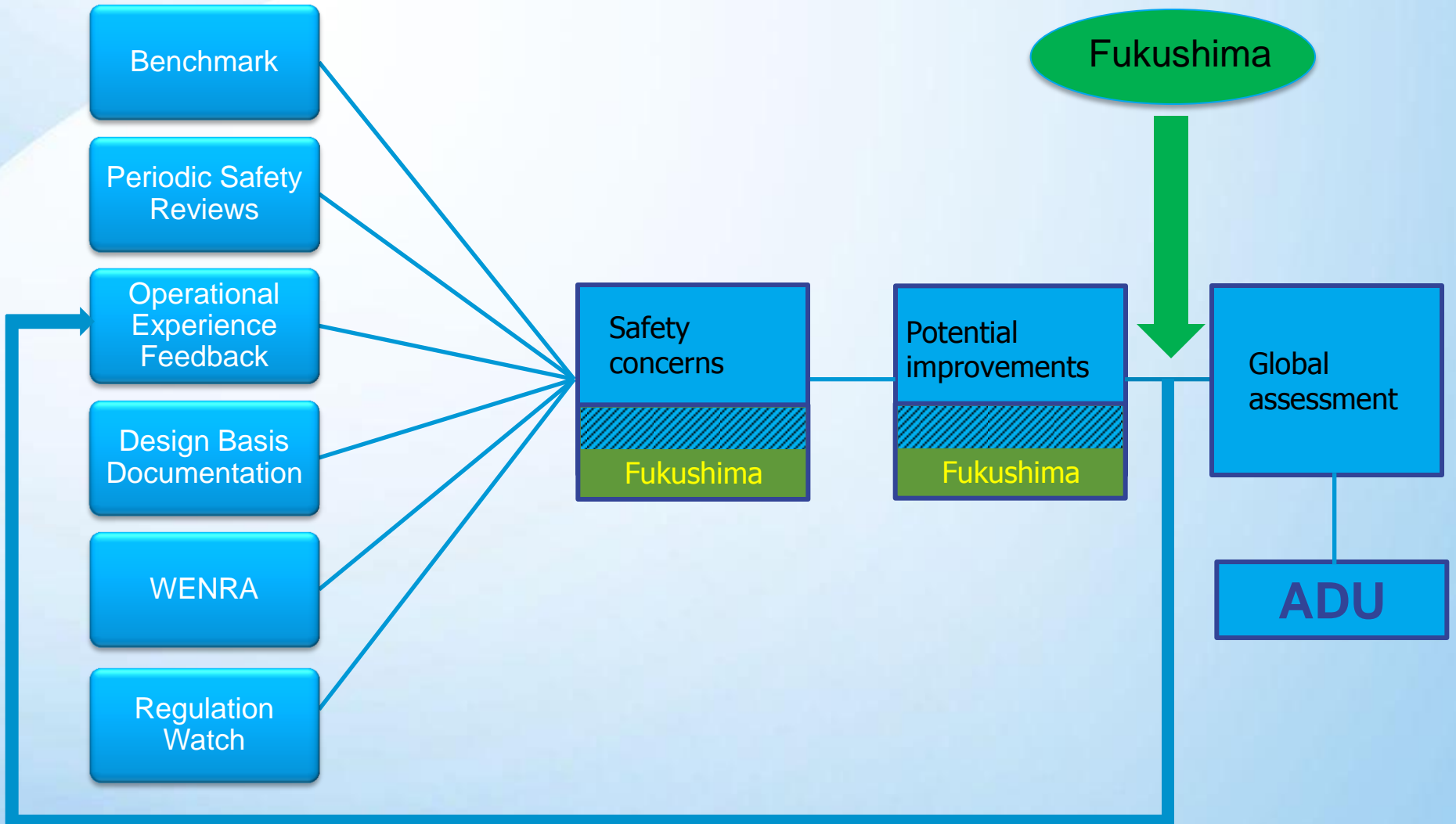
(f) Design basis documentation

Design

Process for design upgrade



Design



Competence, Knowledge and behaviour

- 3 points of view were identified:
 - ✓ The **Nuclear Safety culture** and the supporting behaviour and attitude
 - ✓ Processes linked with **Management and development of competences.**
 - ✓ **Knowledge management**, in particular related to the Design basis, in the process 'management of modifications'.

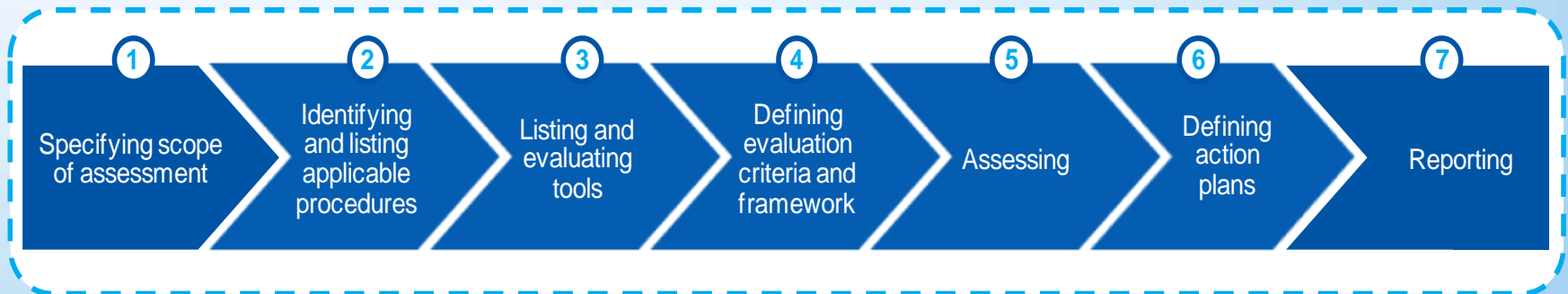
Competence, Knowledge and behaviour

Approach aligned
with LTO
precondition
approach

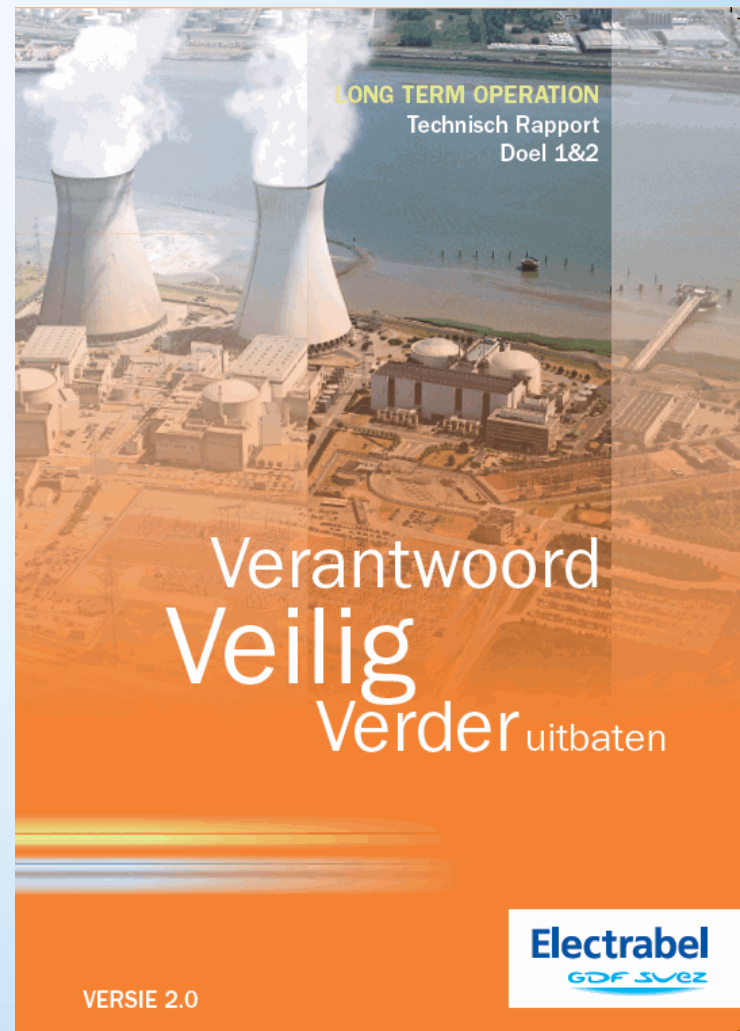
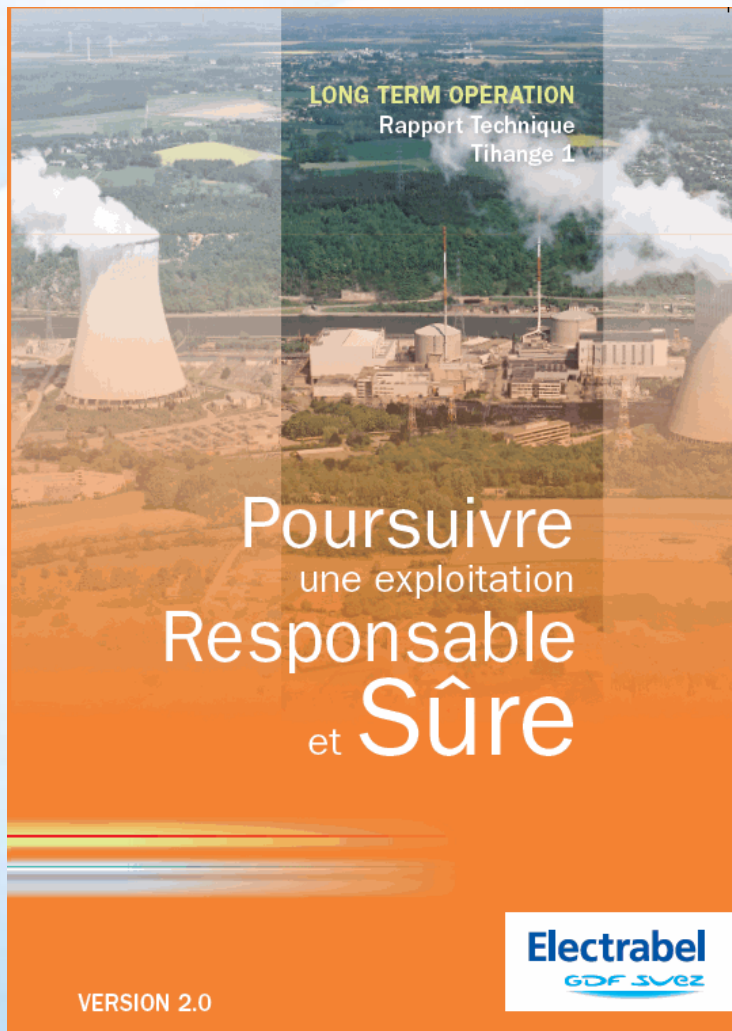
Nuclear safety culture
OSART

Knowledge management
Self assessments
Work groups

Competence management
OSART
Self assessments
Work groups



LTO reports

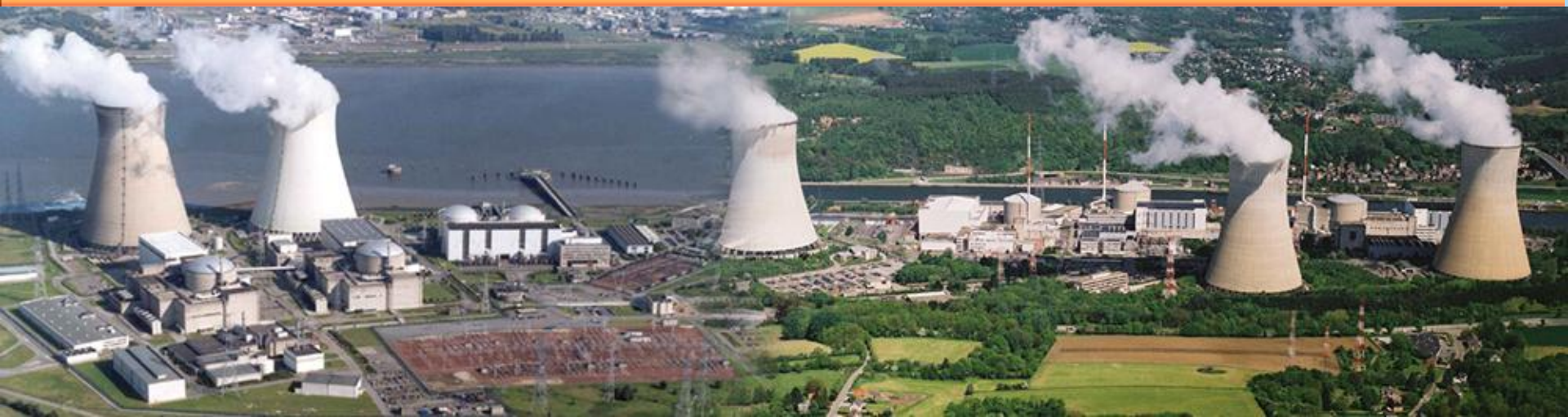


Conclusions

A utility point of view on the justification for safe long term operation

- ✓ The LTO file was an opportunity for a complete and systematic approach for Physical ageing based on international references
- ✓ The LTO file was also an opportunity for reflections and developing a clear strategy for Non Physical ageing

Thank you for your attention!



You've got the energy.

Electrabel
GDF SUEZ