



ADAPTATION OF THE NUCLEAR FLEET TO CLIMATE CHANGE



Rapport on request of the Senate,
March 2023

EUROSAI WGEA – SPRING SESSION

May the 26th 2023

Only the written report commits the Cour des comptes.

I- CONTEXT

II- METHODOLOGY

III- MAIN FINDINGS

***PROGRESSIVE CONSIDERATION OF CLIMATE CHANGE BY
THE STATE AND EDF***

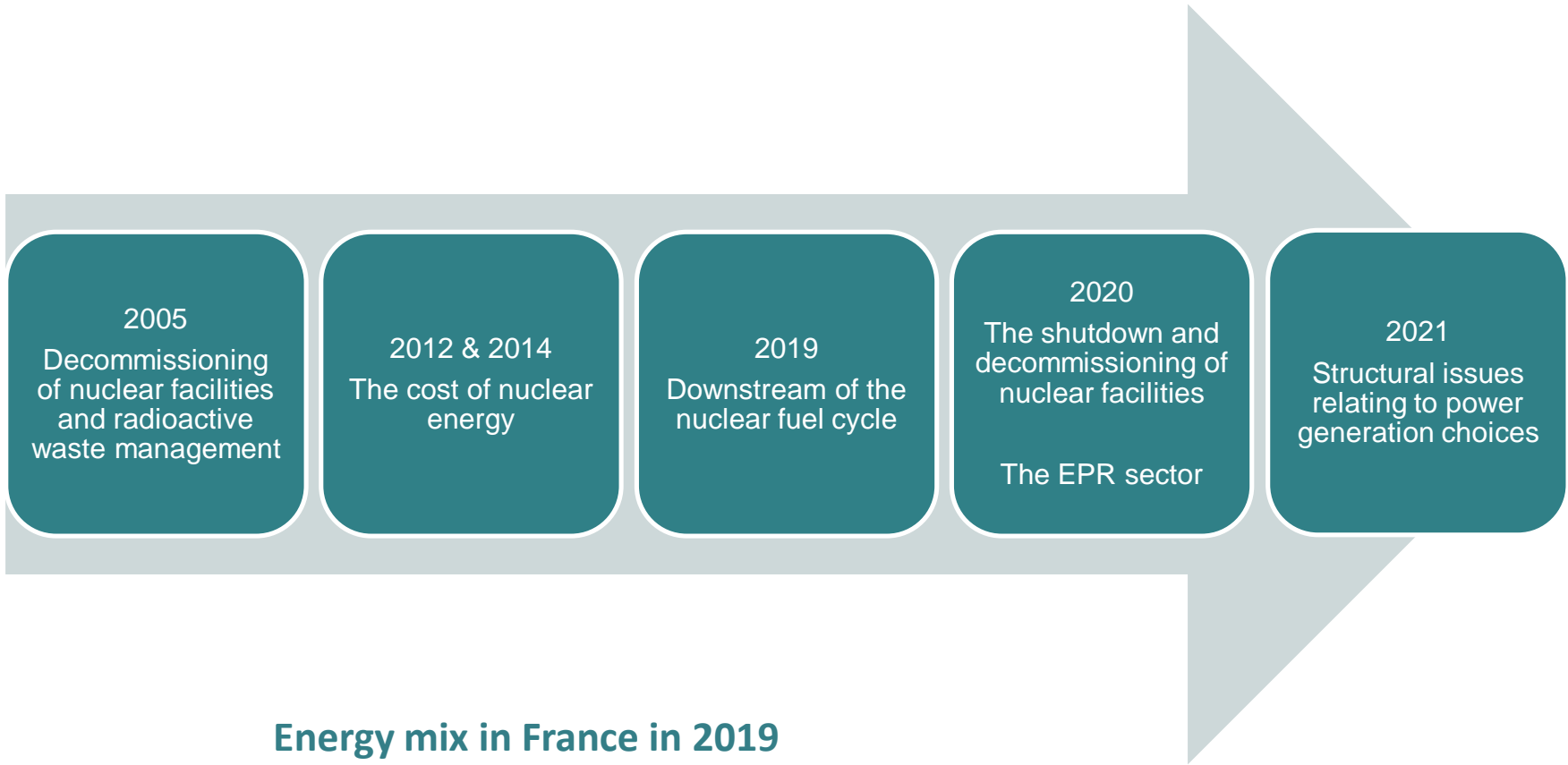
IV- MAIN FINDINGS

***CONSEQUENCES OF CLIMATE CHANGE AND THE FLEET –
PAST, PRESENT AND FUTURE***

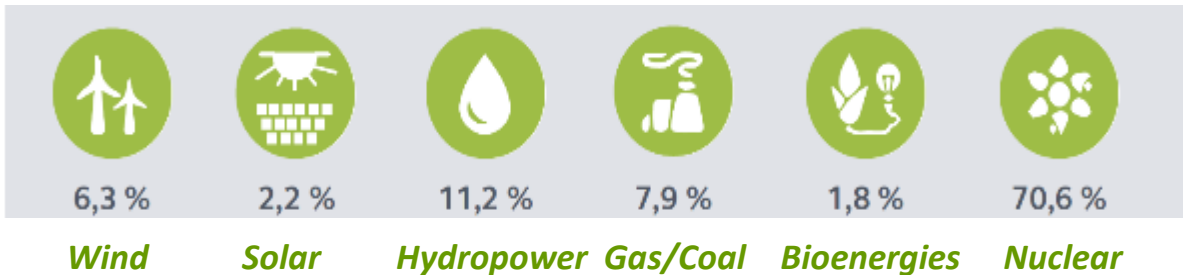
V- RECOMMENDATIONS

CONTEXT

NUCLEAR ENERGY: A RECURRING TOPIC FOR THE COURT



Energy mix in France in 2019



NUCLEAR ENERGY IS ON A FRESH NEW TREND IN FRANCE

- On one hand the « Belfort Speech » by the President, on the necessity to relaunch the Nuclear sector in France
 - *Cheaper energy*
 - *Decarbonisation of the industry*

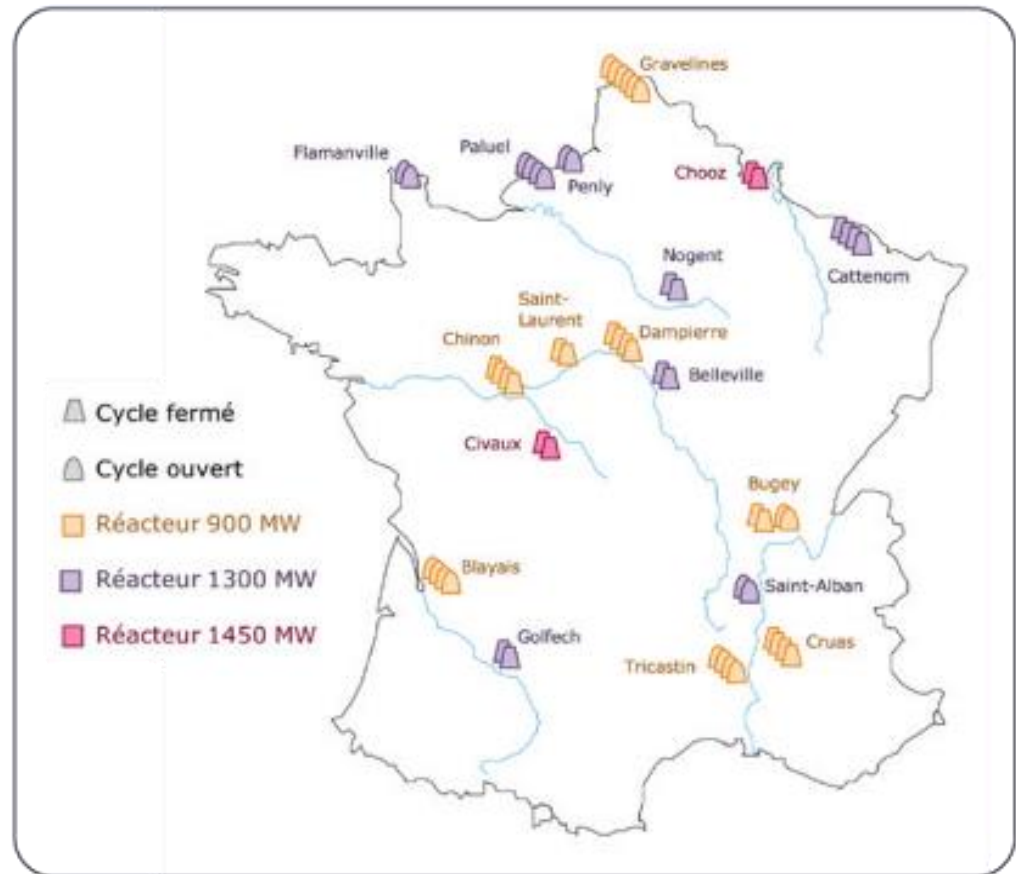


- On the other hand: the reality of climate change
 - *Submersion*
 - *Drought*



18 NUCLEAR POWER PLANTS THAT RELY ON TWO DIFFERENT TECHNOLOGIES

- **Nuclear fleet represents :**
 - Half of France's annual water withdrawals
 - 98% of this volume is discharged again in the water system
- **2 cooling systems**
 - In **open circuit** : with important water withdrawal but very limited consumption
 - In **closed circuit** : with reduced water withdrawal but increased consumption (through evaporation)



METHODOLOGY

A REQUEST FORM THE SENATE TO BRING LIGHT ON A SPECIFIC TOPIC OF CONCERN

- **Article 47-2 of the French Constitution** : *“The Court of Auditors assists the Parliament in the control of the Government's action”*
- **Article 58 of the Organic Law on Financial Laws (“LOLF”, our financial Constitution)** : *The mission of assistance to Parliament entrusted to the Court of Auditors includes in particular: Carrying out any **investigation** requested by the [Parliament] on the management of the services or bodies it audits. The conclusions of these investigations must be **communicated within eight months** of the request*

Two main questions:

- **Is the French nuclear fleet ready to face climate change?**
- **Otherwise, what should the Gouvernement do to ensure it will?**

ISSAI 3000 – RESULT-ORIENTED APPROACH

MAIN FINDINGS

PROGRESSIVE CONSIDERATION OF CLIMATE CHANGE BY THE STATE AND EDF

A PROGRESSIVE CONSIDERATION OF CLIMATE CHANGE BY THE STATE AND EDF

- **Water resources : the main climate change issue for nuclear powerplants**
 - Availability of water is mandatory for cooling nuclear power plants
 - An existing **scientific and technological consensus** on the major consequences of climate change on rivers (Availability, etc.) and for coastal areas (Sea level / Sea flooding)
- **The use of IPCC reports as a basis of analysis for the operator**
 - + : up-to-date models are used to forecast consequences of climate change on the nuclear fleet
 - – : those models grant limited visibility on short-term (10-20 years) and on local situations
- **Adaptation issues gradually being addressed by the State and EDF**
 - Two national plans for adaptation to climate change have enabled the development of new policy tools
 - EDF started its own approach in the 90's: research, creation of a climate service in 2014, a desire to deploy a site-by-site approach by 2025

MAIN FINDINGS

CLIMATE CHANGE AND THE FLEET PAST, PRESENT AND FUTURE

CLIMATE CHANGE TAKEN INTO ACCOUNT IN TERMS OF SAFETY, STILL LIMITED FOR THE EXISTING FLEET,

- ***PAST: a consideration of safety risks at the design stage and during periodical safety reviews***
 - The current fleet **was designed against known or anticipated hazards**, with a continuous reassessment of the risks and a reinforcement of prevention against natural hazards after the Fukushima accident
- ***PRESENT: limited losses but a concerning trend with limited knowledge to manage properly the foreseeable future***
 - **Limited production losses (less than 1%)**, arising from limits on water temperatures or limits to withdrawals
 - **But increasing risks for the network**
 - The need to **better grasp the foreseeable water constraints** and to strengthen R&D on their impacts
 - **A cost of adaptation that is not fully measured**

NEW CHALLENGES FOR THE POTENTIAL NEW FLEET

- ***FUTURE: next-gen fleet will be subject to high requirements due to long-term consequences of climate change***
 - Potential technological developments could be considered, **based on other countries' experience**
 - The need to have an **integrated approach** site by site (new climate scenarios, technological break, choice of location taking into account access limitations in extreme events for instance)

RECOMMENDATIONS

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- **Short term recommendations (2023) :**
 1. Identify and measure the **costs of adapting to climate change** for the nuclear generation fleet, in terms of operation and investment (EDF, 2023).
 2. Measure and publish the **impacts of water stress on nuclear power plants** located on the banks of rivers or estuaries and, if necessary, adapt their storage capacities before discharging liquid effluents (EDF, MTE, 2023).
 3. Consolidate and **update the scientific basis** for the regulatory limits applicable to thermal discharges from nuclear reactors (MTE, ASN 2023).
 4. **Strengthen research and development on water-saving cooling** systems and on biocidal treatment systems that are more economical in terms of chemical reagents released into the natural environment (EDF, 2023).

RECOMMENDATIONS

- **Medium term recommendations (call for change by 2025) :**
 5. Develop a **common approach to adaptation to climate change** for new nuclear power plants, integrated and broken down by site (MTE, ASN, IRSN, EDF, 2024).
 6. Produce **pre-feasibility studies taking into account climate change** for the eight EPR2 in option (DGEC, EDF, 2025).

THANK YOU FOR YOUR ATTENTION

