



ANS[®] Winter Meeting & Expo 2022

INSC Workshop

02-22 Meeting, 2022-11-16
Phoenix AZ, USA

Europe

Luc Van Den Durpel

Founding Partner Nuclear-21



Nuclear is the #1 low-carbon source in the EU



104 Nuclear reactors in operation in the EU



1 million jobs

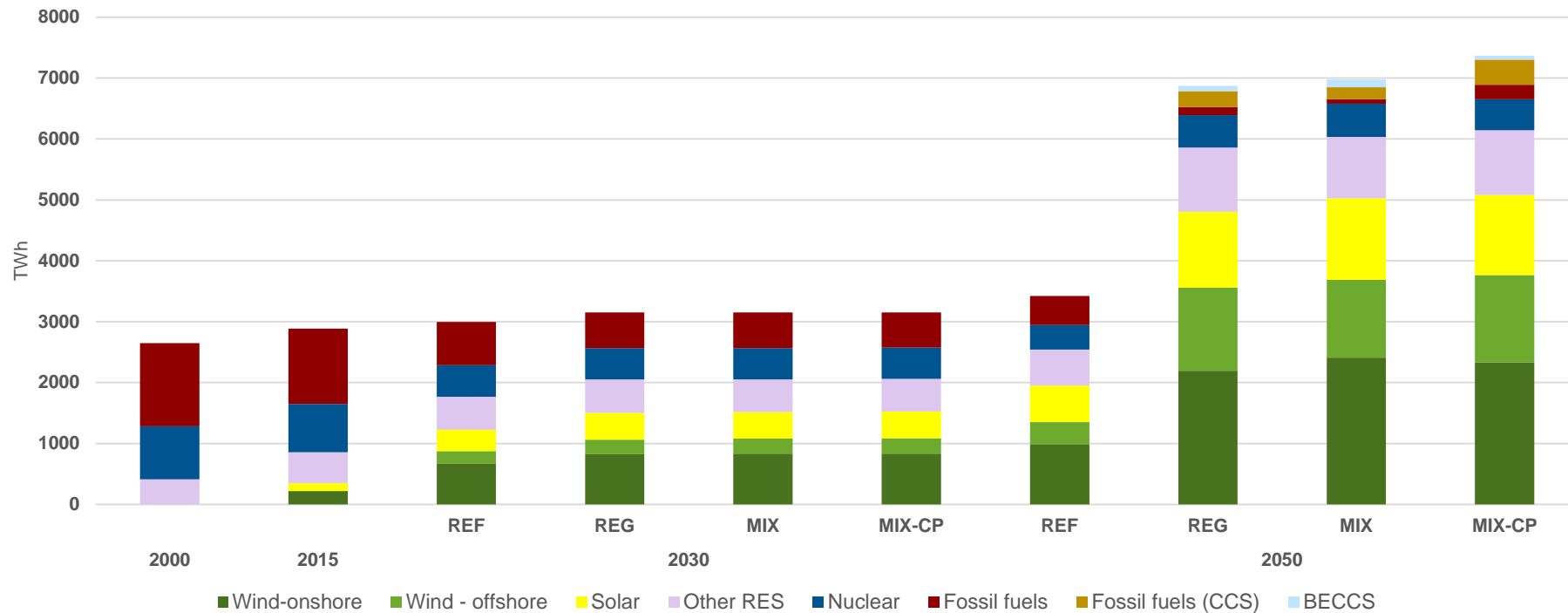
€ 100 billion/year



25% of the electricity production

Source: Nuclear Europe

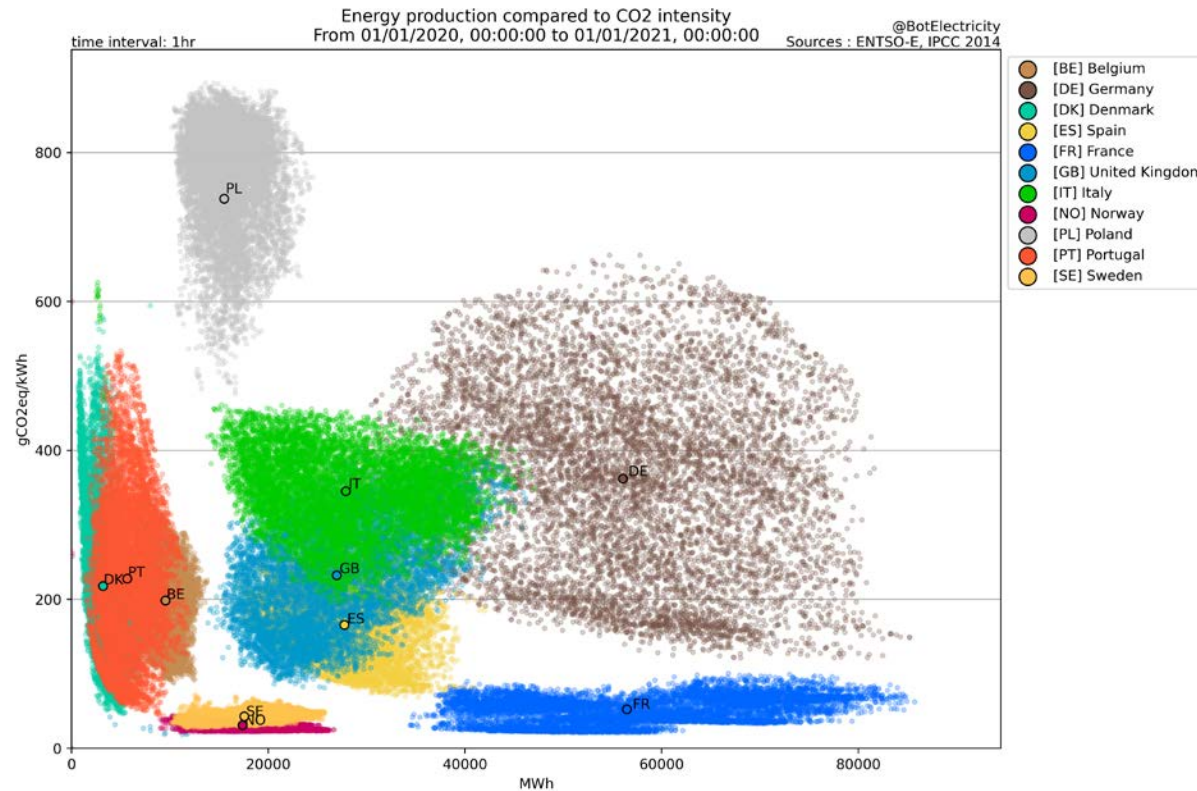
Gross electricity generation in the EU



	2030				2050			
Scenario	REF	REG	MIX	MIX-CP	REF	REG	MIX	MIX-CP
Gross electricity generation by nuclear (TWh)	519	512	515	513	404	532	545	511
Share of nuclear electricity production	17.3%	16.2%	16.3%	16.3%	11.8%	7.7%	7.8%	6.9%
Nuclear installed capacity (GW)	93.9				55	≈ 50	≈ 60	≈ 70
Capacity factor (%)	44	40	41	41	40	37	31	23

France, Sweden & Switzerland have already decarbonized their electricity thanks to nuclear and renewables

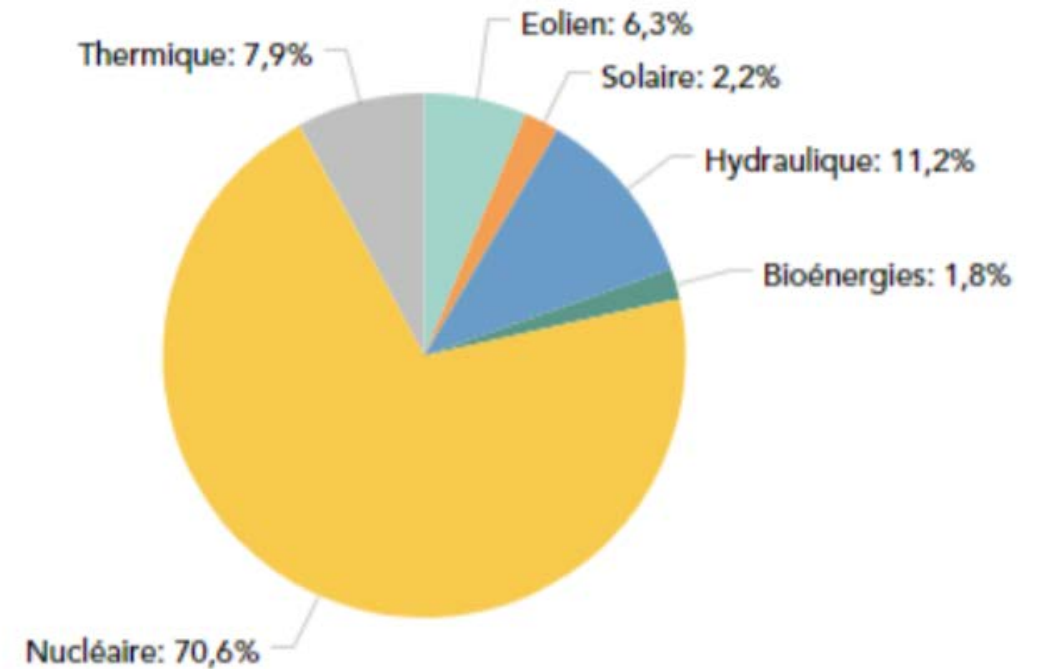
EU CO2 emissions by country- 2020



Source: ENTSOE, Thomas Auriel

France: low-carbon sources are more than 90%+ of production (2019)

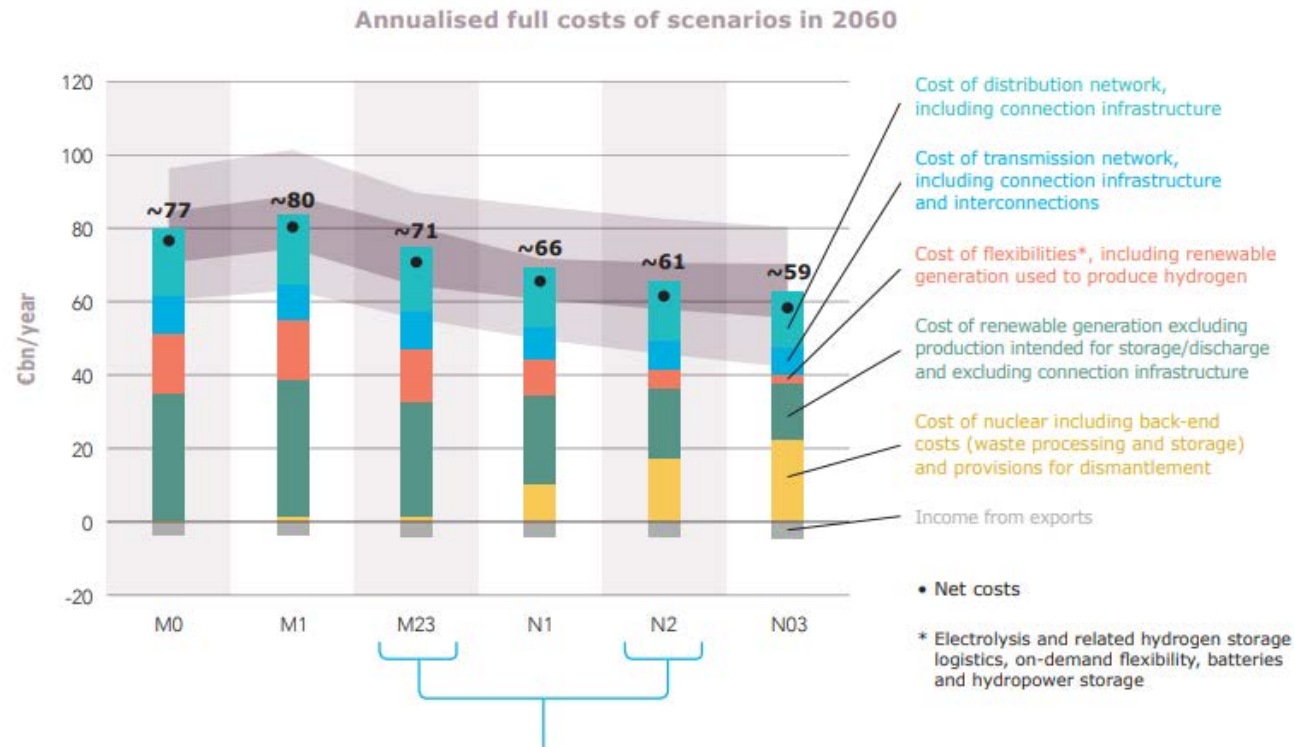
Source: RTE, bilan électrique 2020



France: Scénarios RTE BP 2050: System Costs make the difference



Key finding 6 Full costs (production + transmission + flexibility) in France per scenario (based on the baseline consumption trajectory) **in 2060**, for central scenario and variants



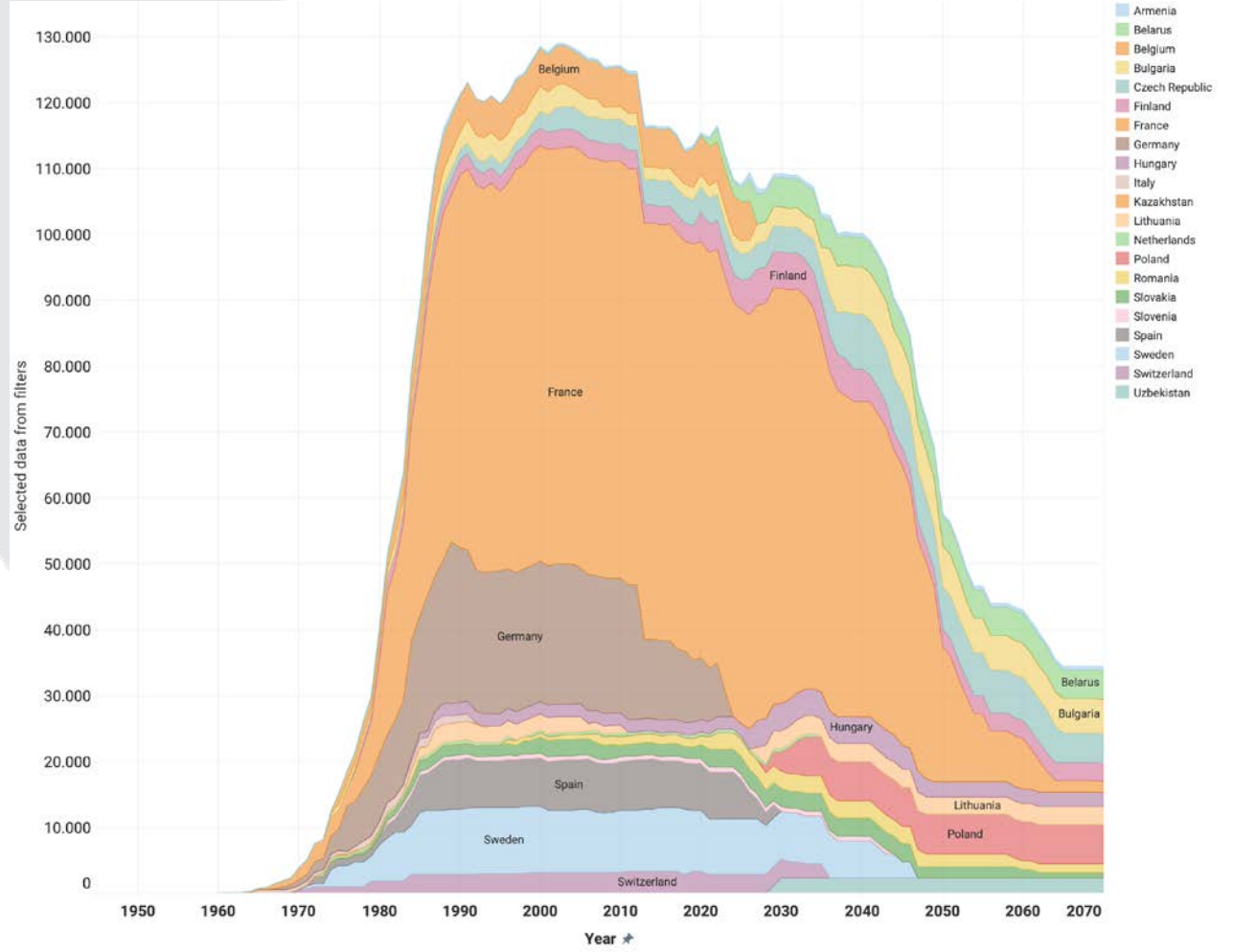
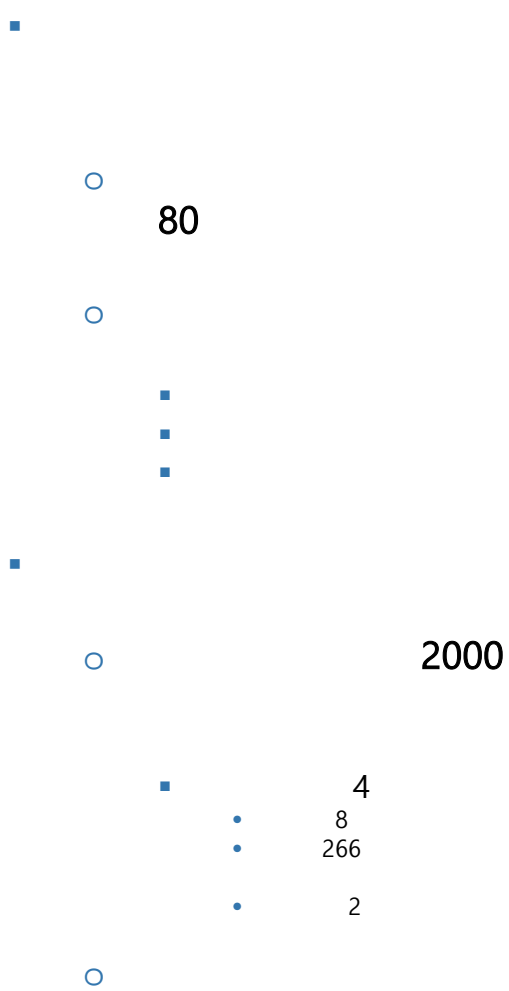
Trend in the difference between annualised full costs of the scenarios with different variants (Cbn/yr)

**Différence between N2 & M23
(baseline): 10Bn€/year**

**Total Investment: €750-
1000Bn over 30 years**

**Projected increase of
electricity cost: 15%**

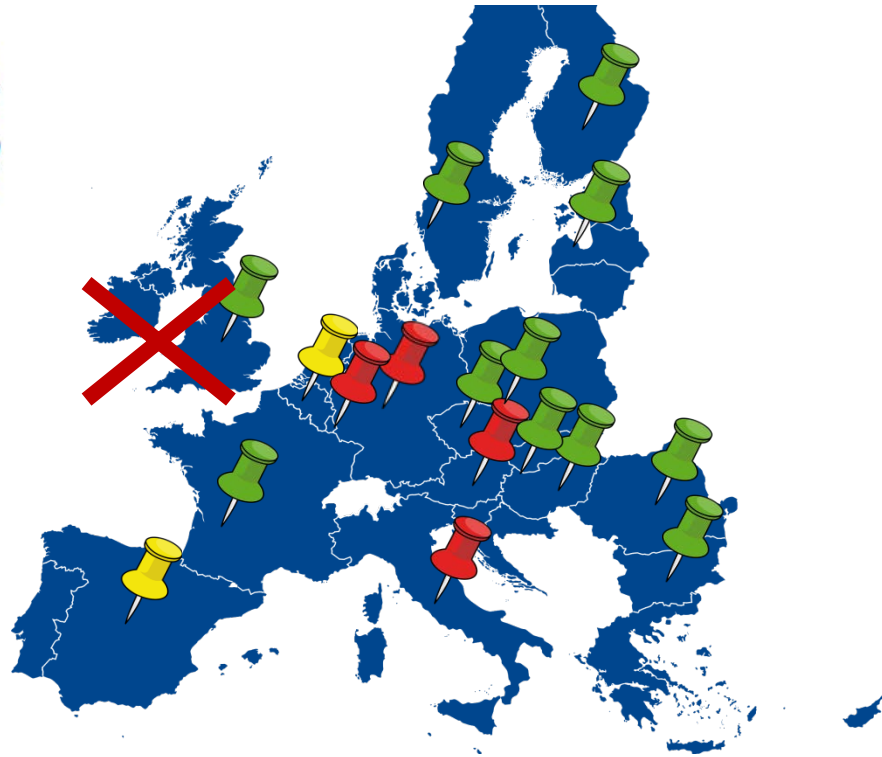
Source: RTE FE2050



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A new interest in nuclear energy & a new balance of power



13 (out of 27) countries plan to invest in or continue using nuclear energy:

- Bulgaria
- Czech Republic
- Croatia
- Estonia
- Finland
- France
- Hungary
- Netherlands
- Poland
- Romania
- Slovakia
- Slovenia
- Sweden

3 units under construction and close to commissioning.
5 projects for building 6 more units are underway
7 countries have plans to build about 20 additional units

No single licensing process!!

The conversation around nuclear energy in the EU has shifted



EU Energy Commissioner Kadri Simson
Prag, Nov 15
Source: WNN

- ✓ *REPowerEU* (May 2022): security of energy supply
- ✓ Priority is renewables, but will need be complemented with a stable baseload electricity production
- ✓ Modelling studies: about **15% share of nuclear by 2030-50**
- ✓ To maintain nuclear generation capacity at today's levels:
 - 350-450 Bn€ in new build to replace retiring units
 - 45-50 Bn€ for LTO
- ✓ Financing essential: 1st step is inclusion in the EU taxonomy
- ✓ EU SMR partnership

EU Energy Policy: Brief History

- 1951 **CECA**; 1957 **Euratom Treaty**: a promotional energy Treaty as a « project » to implement the vision of the European Communities... a model...
- 1987 The Single Act: assembling all three Treaties and Communities under one Framework focused on open liberalised market policies... towards the **electricity market**...
- **Kyoto Protocol Signed 1997/EiF 2005 – EU target GHG minus 8% vs 1990 for 2012**
- 2005 EU Emission Trading Scheme **ETS**... towards a **carbon market**...
- 2007 **Lisbon Treaty**: energy policy becomes a shared EU/MS competence but each MS keeps the right to choose its energy mix (Art 194 TFEU)
- 2007: Launch of SET Plan and SNETP; Creation of ENEF – among a number of Energy Fora...
- **2010 Climate and Energy Package**:
EU Energy Strategy for a « competitive, sustainable, secure » energy
3x20 targets: 20% GHG reduction vs 1990, 20% RES, 20% EE – in 2020
Binding at EU level and translated into national binding targets for all MS

EU Energy Policy: Brief History

- **2011 Energy Roadmap 2050: 80-95% GHG reduction in 2050 vs 1990**
« NOTED » by Council (Presidency – no full consensus)
« Adopted » by EP
7 Scenarios mixing EE, RES, Nuclear, and CCS – reduction of global energy consumption but increased electricity demand – **ENER D analysis made for PINC: nuclear 140 GW in 2050...**
- Preparation/Adoption Budget 2014-2020 – the Fukushima effect on Euratom FP H2020...
- 2014 Start Juncker Commission – « La Commission de la dernière chance »... Financial Crisis
GR PO ES reshuffle the priorities...
- **2014 EU Energy Strategy 2030 + EU Energy Security Strategy (recurring gas crisis)**
40% GHG reduction binding EU and MS, 27% RES + 27% EE binding EU not MS:
Governance Mechanism
+ 10% Interconnexions helping security of supply of electricity and grid stability...

EU Energy Policy: Brief History

- 2015 « Energy Union » Package
Security of Supply, Energy Market Integration, Energy Efficiency, Emissions Reduction, Research and Innovation (reinforce SET Plan)
- **End 2015 COP Paris Agreement: Max + 2°C – target + 1.5°C in 2100**
- 2017 Publication Euratom **PINC: 100 GWe nuclear in 2050** (based on MS plans)
- **2018 « A Clean Planet for All »... « CLEAN »**
New roadmap scenarios 2050:
Comm Canete(Energy): **RES will be the backbone of the EU electricity mix with nuclear... 80% and 15%.... (this last figure in line with PINC)**
Therefore 2030: 40% GHG Reduction, 32% RES and 32% EE, 15% Interconnexion
National Energy and Climate Plans NECPs (EE, RES, GHG, Interconnect, R&I) to be finalised and reviewed by EC for 2020
- **2019 EC Proposal « EU Green Deal »... « GREEN »**: very wide embracing all policies of EU:
« Carbon Neutrality » for 2050

EU Energy Policy: Brief History

- 2019 von der Leyen Commission – «A more geopolitical EU »
- **2019 « EU Green Deal » (resp: EC VP Frans Timmermans)**
Carbon Neutrality in 2050 : Council – but Poland / Adoption EP
- 2019 EC Budget Proposal 2021-2027: 1000 Billion Euros
- **Financing mechanisms and tools (EC VP V Dombrovskis)**
ex: InvestEU (post Juncker Plan), Modernisation and Innovation Fund (post NER300), Structural and Regional Funds, Just Transition Fund, Research Framework Programme, EIB Lending Policy,... **nuclear most of the time excluded...**
- « **Taxonomy Sustainable Financing** «: TEG... Adoption by Council and EP... nuclear left outside initially (mainly because HLW mgmt « not demonstrated »)... ref to potential role for «energy transition »...

EU Energy Policy: Brief History

- 17 September 2020 State of the Union Speech vL at the EP :

2030 Climate Target Plan:

- EC Communication Stepping up Europe's 2030 Climate Ambition
- Based on Accompanying Impact Assessment and EU-wide Assessment of the NECPs
- **Draft European Climate Law with target of at least minus 55% GHG emission by 2030 (vs 1990):** is realistic and feasible – but requiring investment boost: green recovery post COVID...

30% of the overall Budget to be climate-relevant (noting an estimation of needed investment for 2021-2030: Annually 350 billion more than previous decade – 180 billion)

Announcing numerous Implementation Actions (Directives and Regulations):

By June 2021: EU ETS, Effort Sharing Reg, Land Use Reg, EE Dir, RES Dir, CO2 cars/vans Reg
Later: Energy Buildings Reg, Ecolabel Dir, legislation to roll out TEN-E TEN-T, Alternative Fuels Infrastructure Dir, Reg on Governance Energy Union and Climate Action...

EU Energy Policy: Brief History

... 2020... 2021...

- **Increased financing means (Covid impact): Budget + Next Generation EU (Recovery Package 750 billion)**

Proposal by the EC under discussion by Council and EP (on equal footing)

Total order of 1.8 trillion...

Nuclear still excluded from a number of financing tools... ia Green Bonds...

- **Taxonomy** : Implementation by EC through Delegated Acts helped by a Sustainable Finance Platform (Commitology) + Dedicated review of nuclear sustainability by the JRC and other environmental experts (Art 31 and DG SANTE – radiation protection perspective...)
- EU Energy System Integration Strategy + **Hydrogen Strategy for a Climate neutral Europe (creation of the European Clean Hydrogen Alliance)**

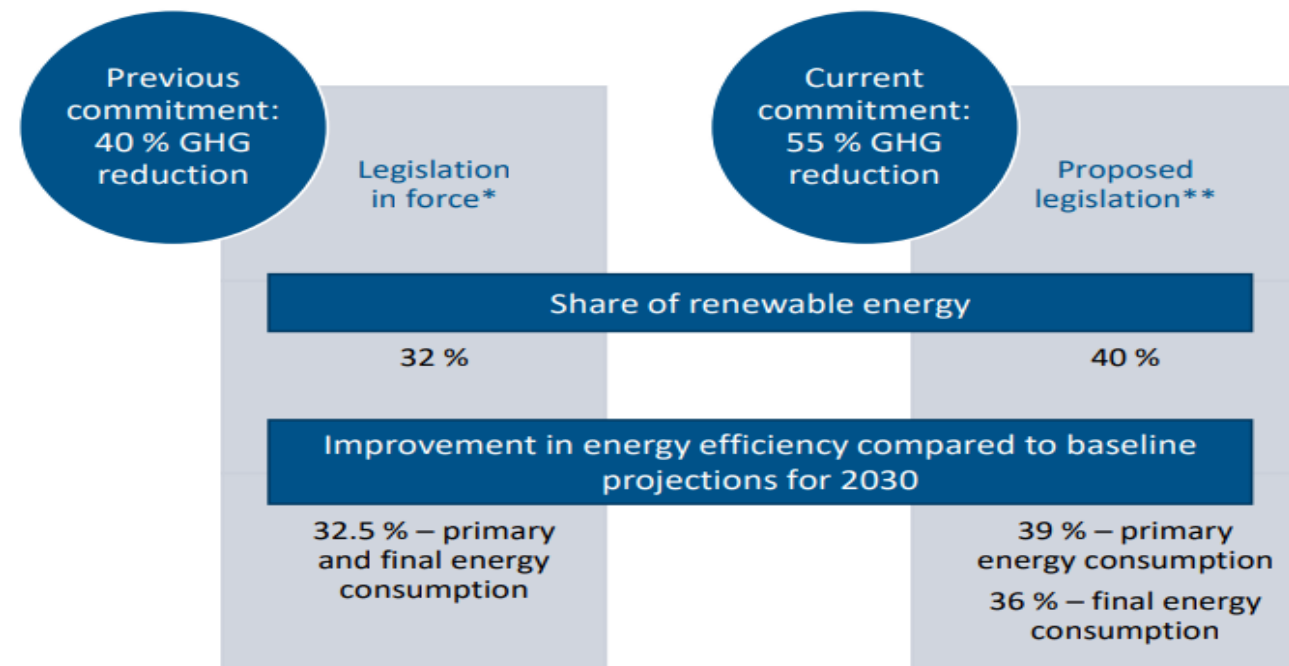
EU Energy Policy: Brief History

Where are we today ???

- EU Green Deal ? **FIT FOR 55 Package**...
- **Taxonomy** for Sustainable Financing... 1st DA approved end 2021 and Complementary DA for nuclear and gas – for the transition – to be approved ???
- Gas crisis – supply and prices - **REPowerEU**
- **Hydrogen** ???

EU Green Deal

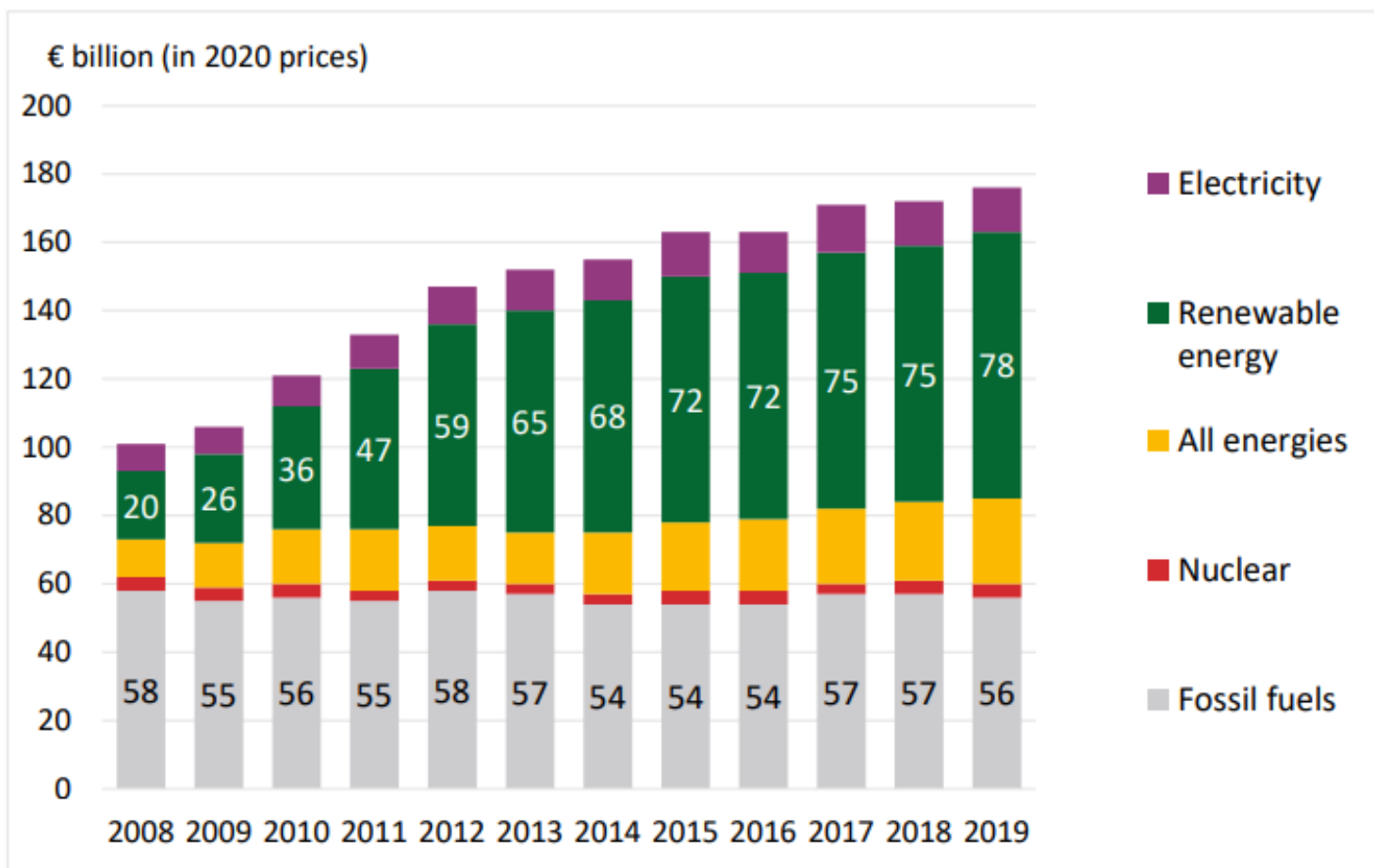
Figure 2 – Updates to climate targets





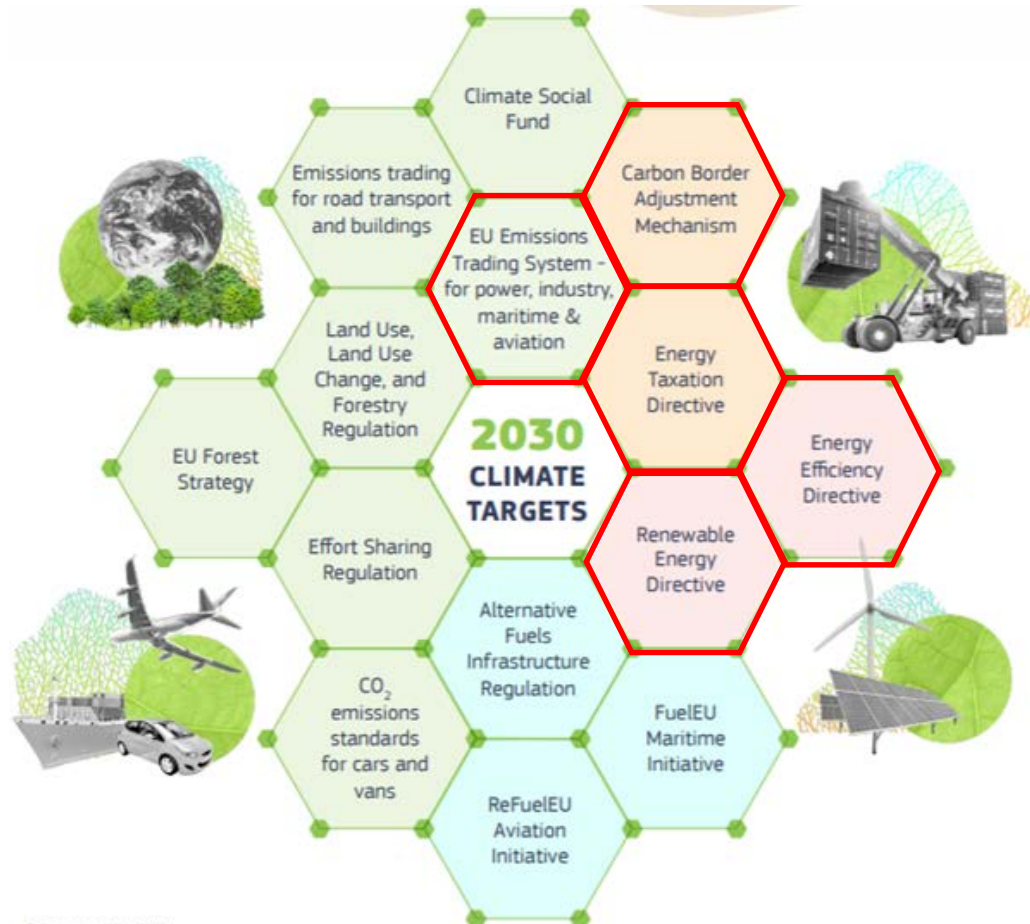
2022

Figure 10 – Energy subsidies by category between 2008 and 2019



Source: ECA based on the *Study on energy subsidies and other government interventions in the European Union*, October 2021.

Fit for 55 package



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- **Renewable Energy Directive review**

- Validity of guarantee of origin of renewables energy
- Renewable/Clean hydrogen production forecast

- **Energy Efficiency Directive review**

- Following the issue of the Primary Energy Factor (PEF) for nuclear (more details can be found in [FORATOM's reaction to the "Clean Energy for All Europeans" package](#) – April 2017)

- **EU-ETS**

- Any measure that will lead to increasing the carbon price is welcome
- Stability of the price is also needed

- **Revision of the Energy Taxation Directive**

- Guarantee affordable access to low-carbon energy for the competitiveness of the European industry and for all European citizens

- **Carbon Border Adjustment Mechanism**

- Potential opportunity for the non-EU FORATOM members

REPowerEU



1. Urgent Actions on prices
 - Keep retail energy prices in check
 - Guidance for temporary tax measures on windfall profits
 - State Aid measures
 - Market actions to improve elec market design
2. Refilling gas storage for next winter
 - Legislation on minimum gas storage
 - Coordination gas refilling operation
 - Investigation into behavior by operators (Gazprom)
3. RepowerEU to cut dependance on Russian gas
 - More renewables (solar, windpower, reduce time for permitting)
 - More heat pumps and energy savings
 - Diversify gas supplies
 - Decarbonise industry by electrification and renewable hydrogen for processes
 - Doubling biomethane
 - Create an Hydrogen Accelerator

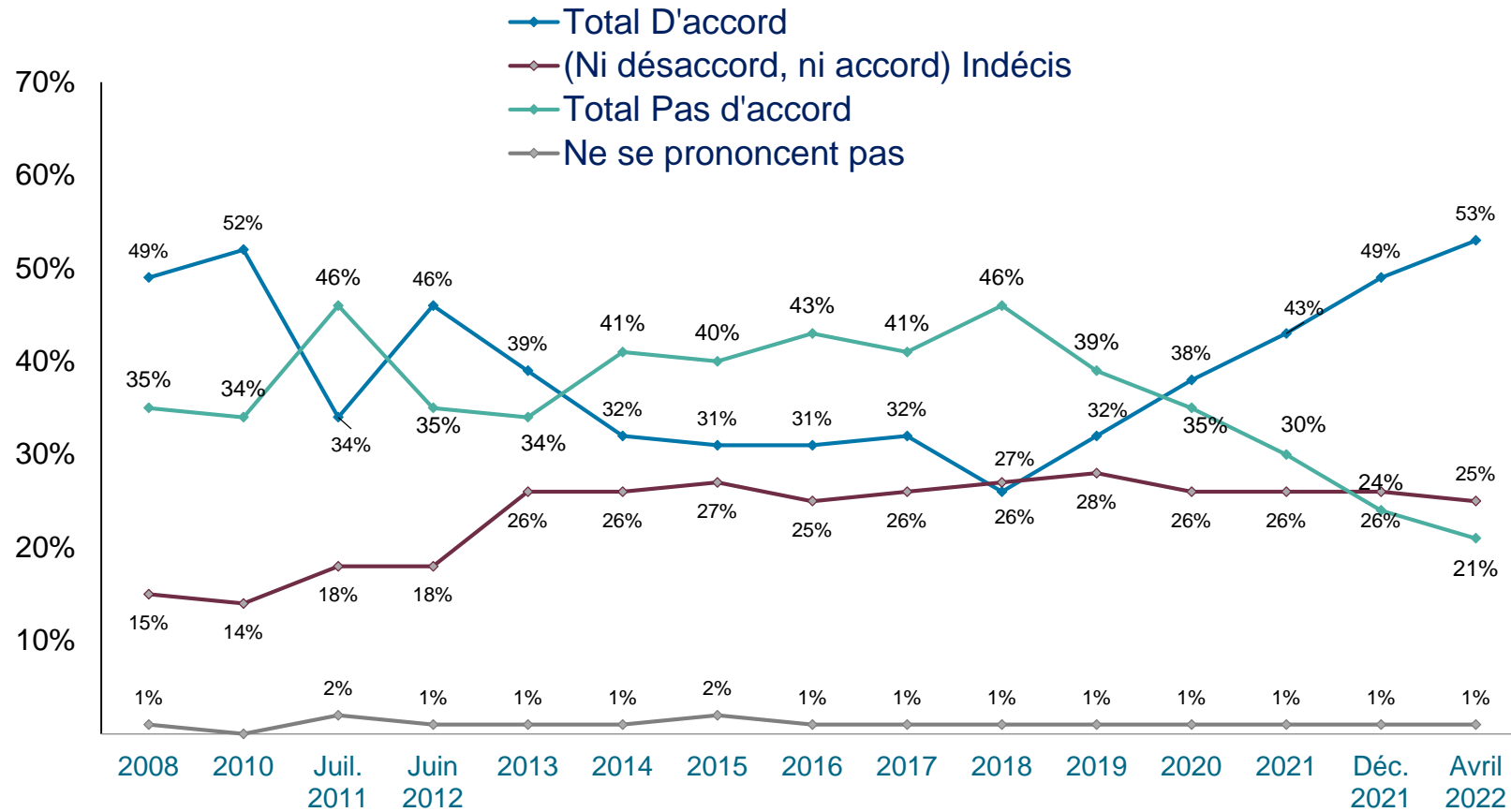
NO MENTION OF... NUCLEAR !!! Business as usual for nuclear at EU level !!!

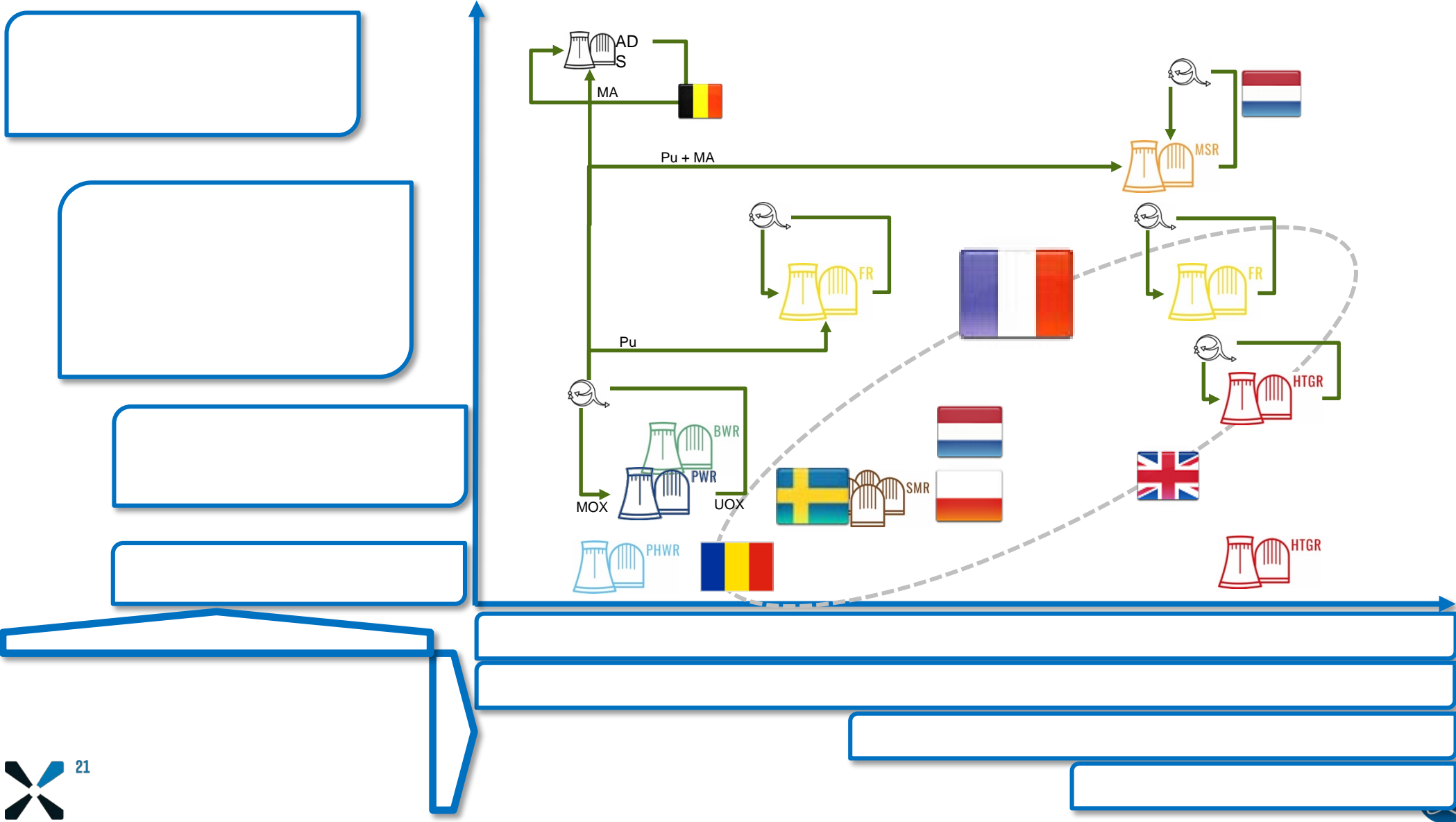


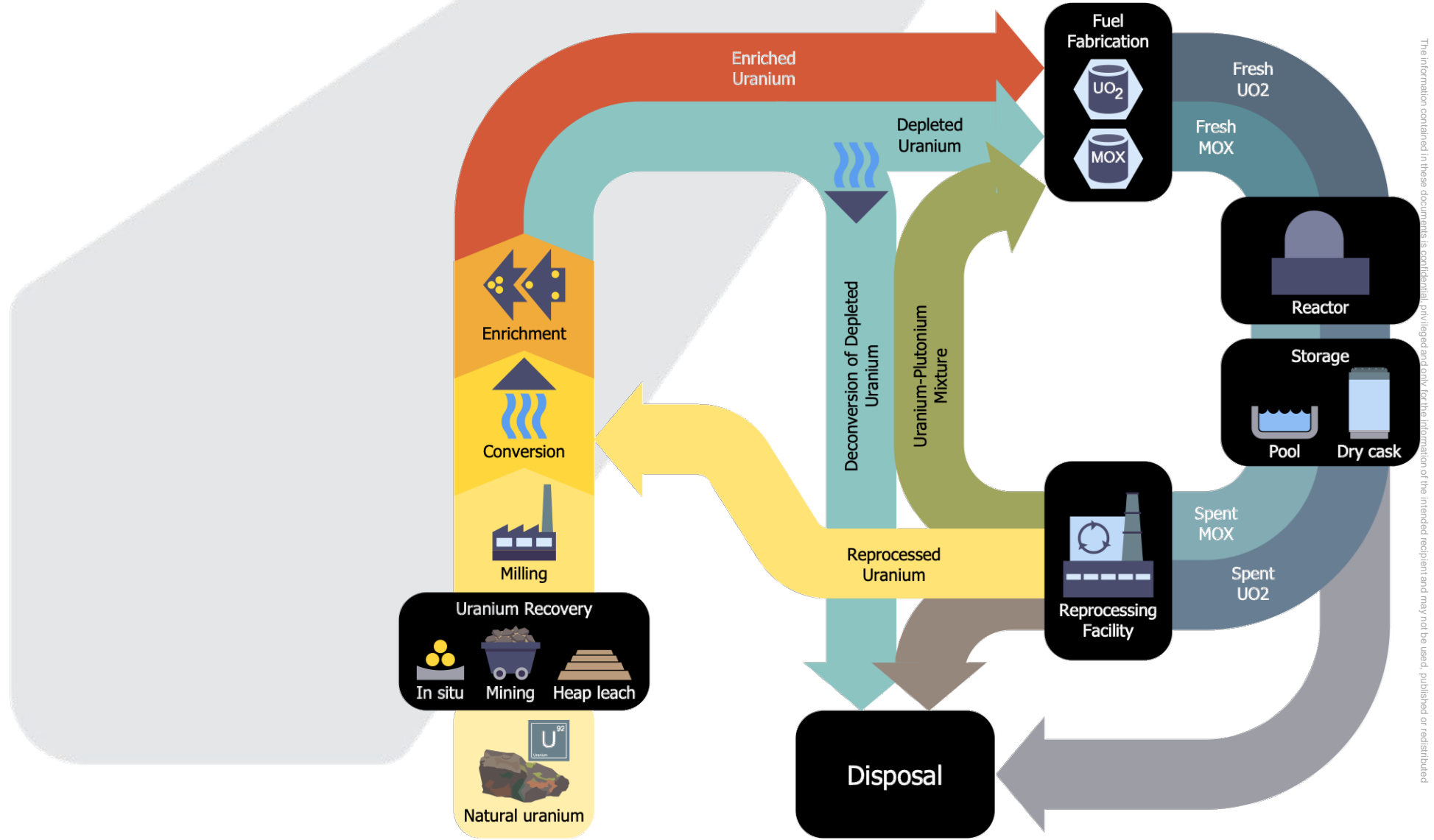
EU Green Deal: myths or realities: Hydrogen ?

- Why Hydrogen now ? Recurring « spike » or real opportunity for a low carbon future ?
- Hydrogen is a noble product, expensive to produce (cheaper methane reforming (CO₂!) vs expensive electrolysis) and not so easy to handle/transport – presently used as feed for industrial chemical processes
- Some visions/ideas on the table for the future:
 - Feed for additional industrial uses: ia steel making, synth fuels...
 - Fuel for transportation: synth fuels, EV fuel cells, « hydrogen » motors (also NH₃)...
 - P2P: Green Hydrogen = Renewable Hydrogen – storing intermittent electricity
 - CCUS: CO₂ + Hydrogen = CH₄
- Public sector support and financing commitments : initiated by DE, followed by FR, strong push at EU level (ia Next Generation EU – post covid Recovery Package) – intense lobbying for subsidies...
- Strong coalition between the RESi (going hydrogen to justify high deployment of RESi - by reducing curtailment through selling excess low value electricity, and by providing storage of electricity) and the gas sector (greening gas, ensuring usage of gas infrastructures, providing backup power for RESi)... towards an Hydrogen Market... another Energy Vector Market... !
- Risk and Opportunity for nuclear energy...

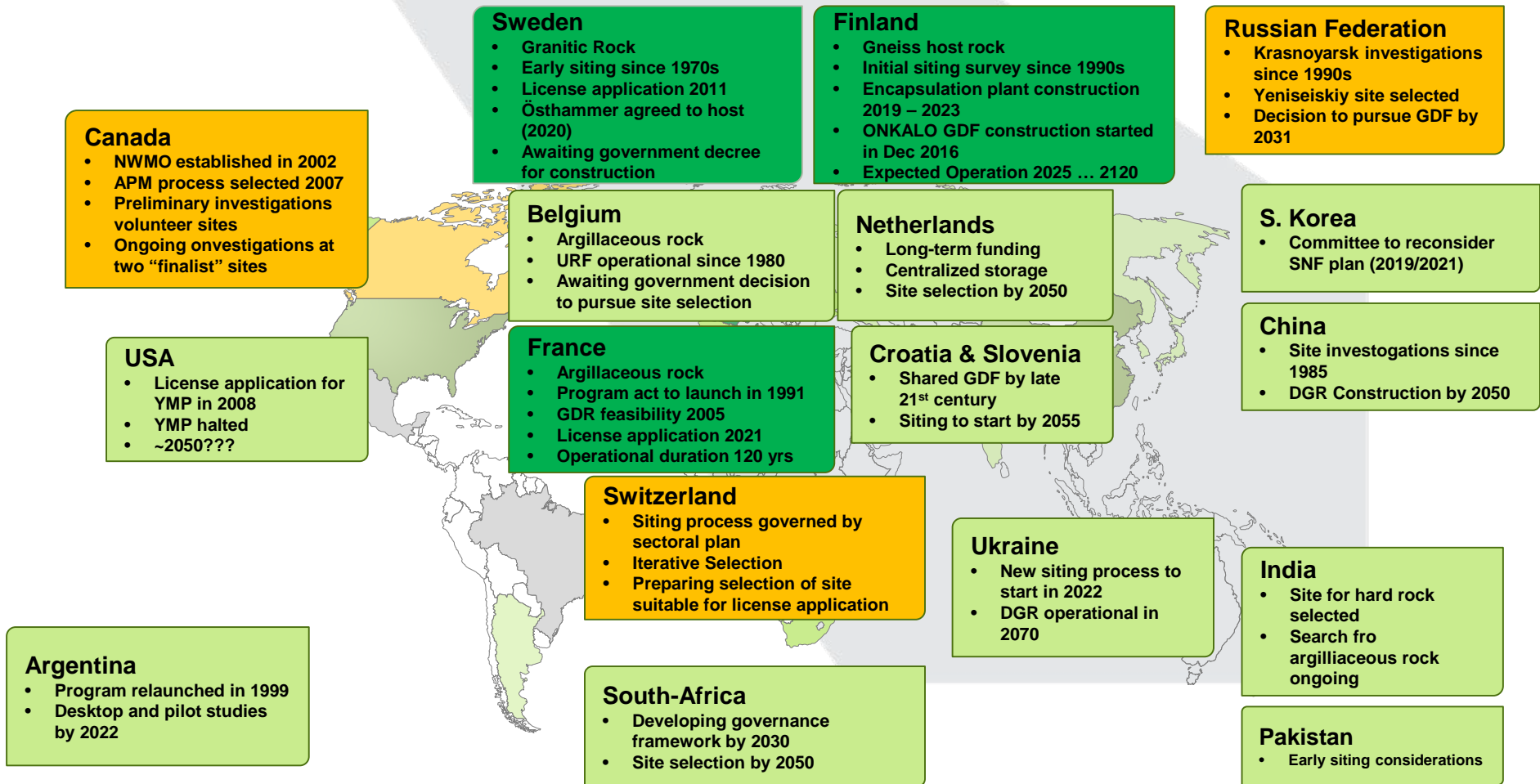
Public opinion on nuclear in France: recovery (source: EDF, CSA)

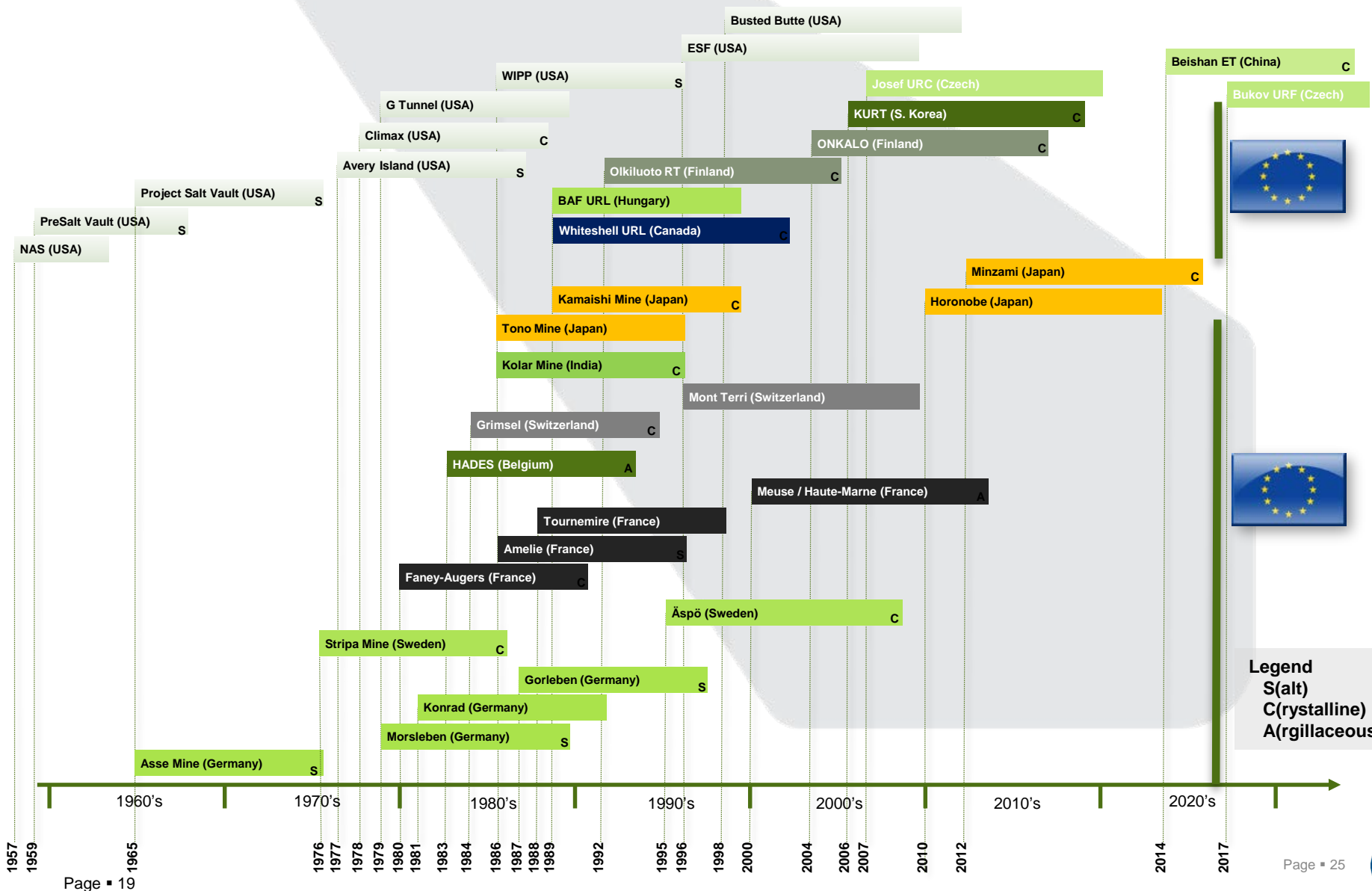






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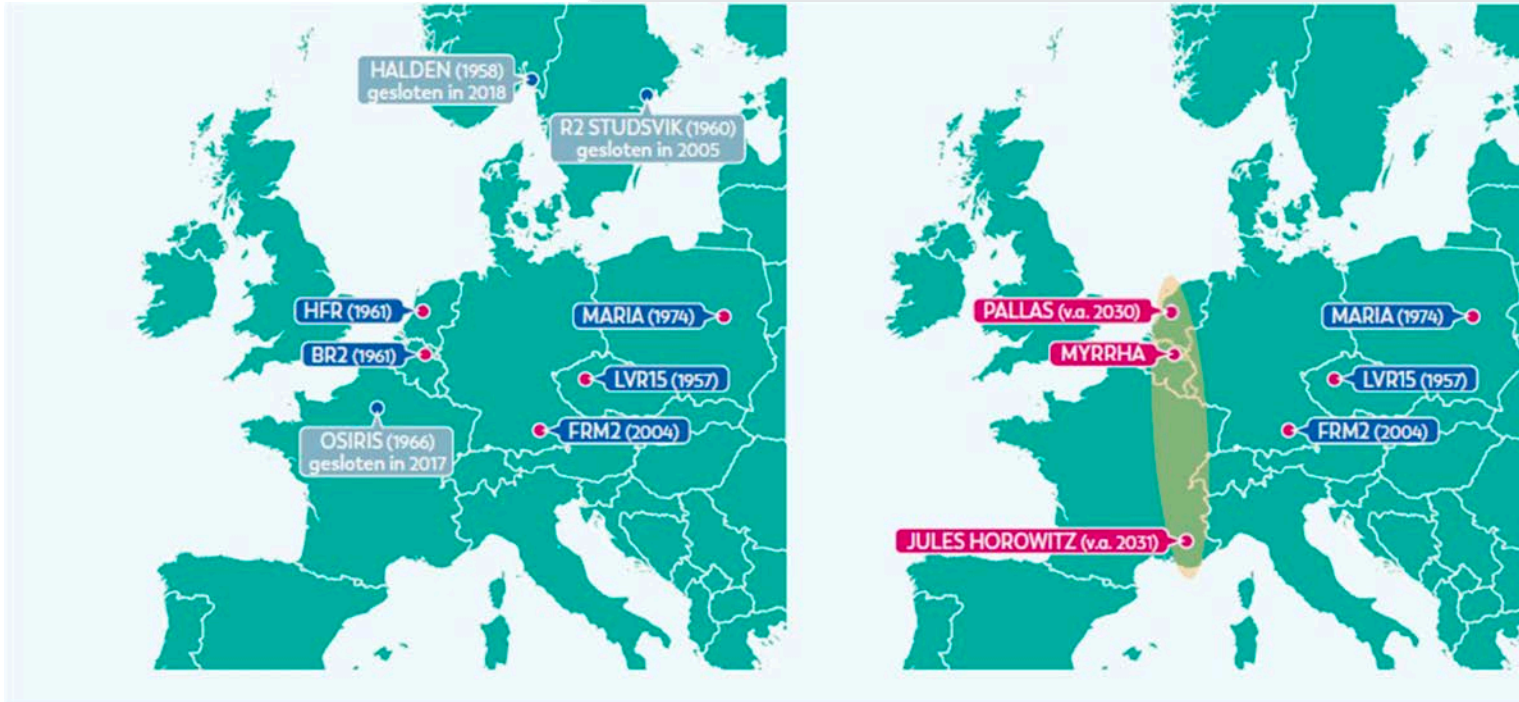






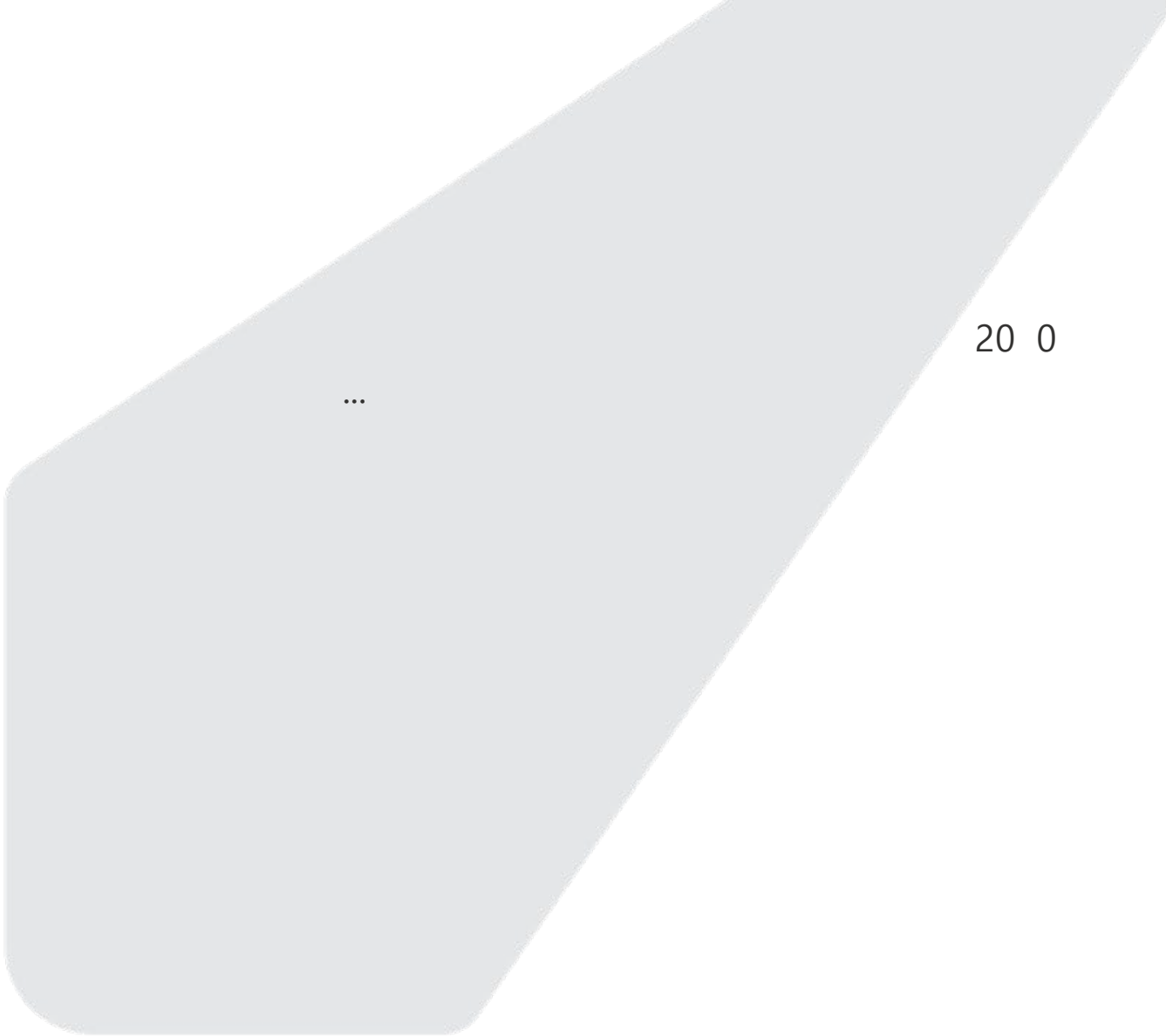
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