

Conference 100 TWh
Blue Point 20 03 2024

Quelle Stratégie Nucléaire pour la Belgique après Juin 2024 ?

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- 2. Le cadre **européen** et au-delà
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- 4. Du **passé au présent** nucléaire en Belgique
- 5. Le futur nucléaire en Belgique – « Que faire ? »
Vision stratégique de 100 TWh

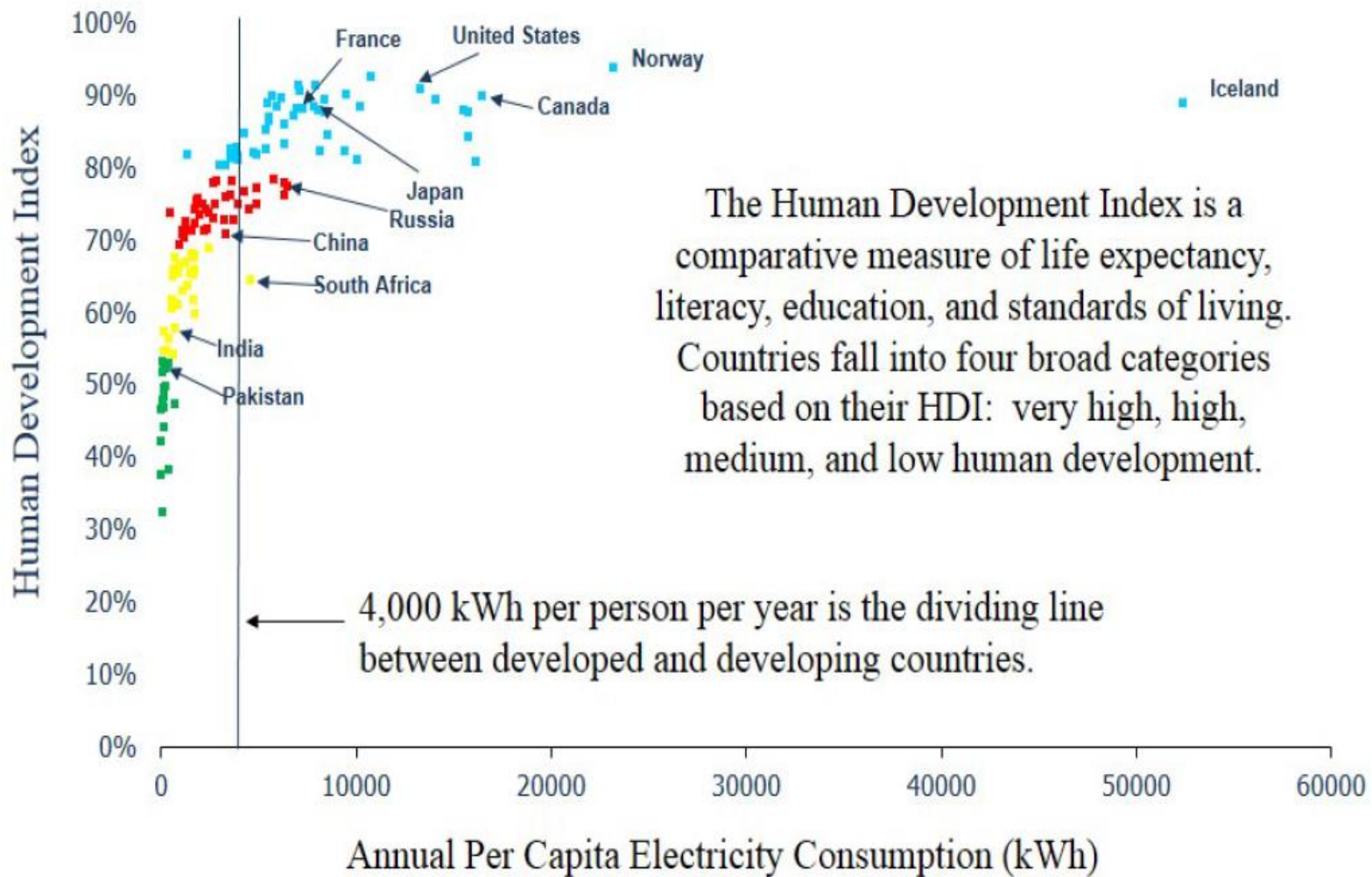
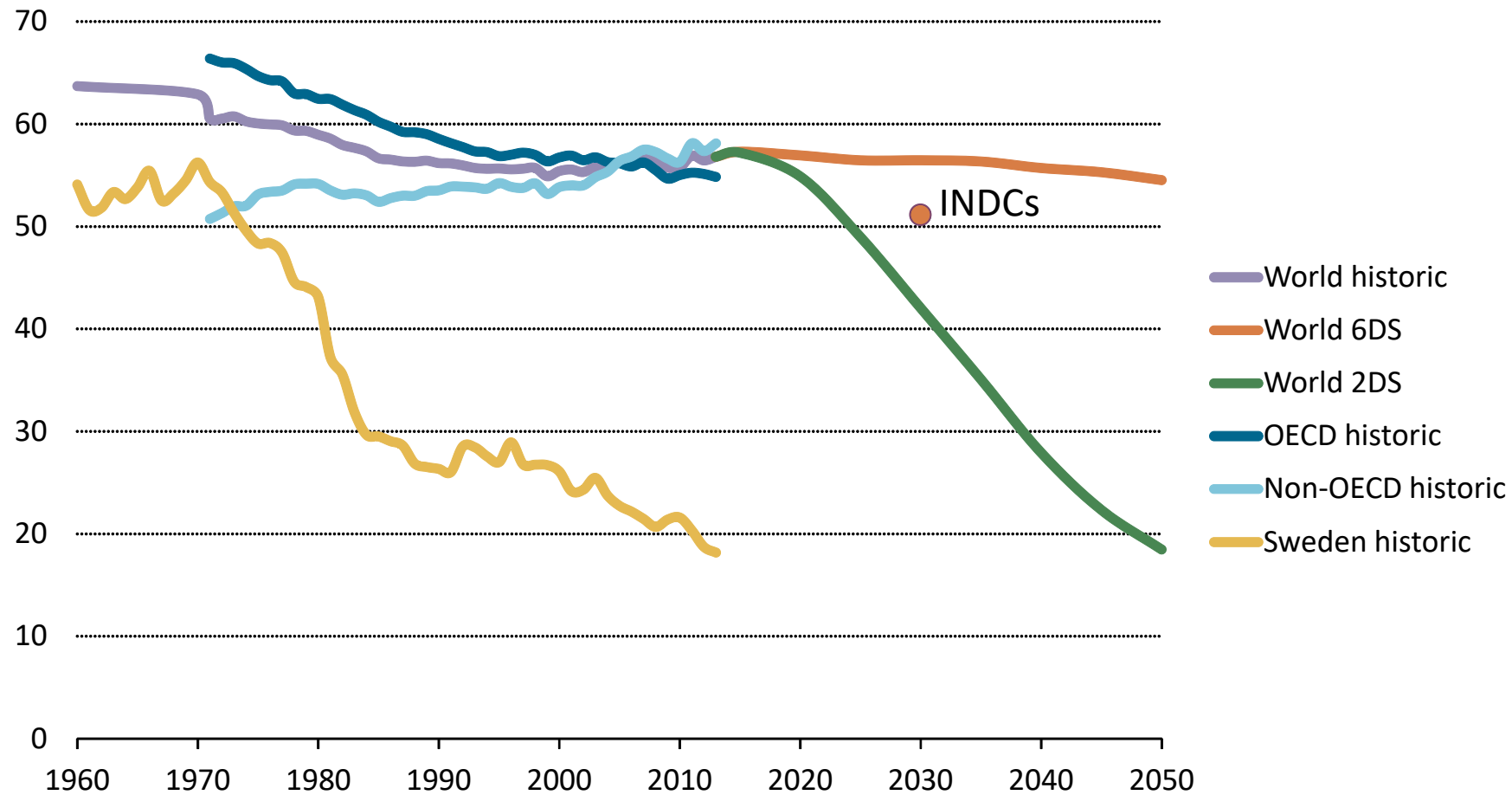


Fig. 1.1. Human Development Index versus Annual Per Capita Electricity Consumption

2°C requires a drop in the carbon intensity of primary energy (tCO₂/GJ)



...which has been stable on a global level over the last 50 years.

France/Allemagne ???

Electricité 2022 – ordre de grandeur:

DE: total 550 TWh – dont **250 TWh** EnRIs avec **150 GWe** EnRIs

FR: total 450 TWh – dont **300 TWh** Nucléaire avec **60 GWe** Nucléaire

DE: **500** Milliards Euros Subsidés 2005-2025 EnRIs (lifetime 20 years) +
Réseaux: **150** Milliards 2005-2025 + **450** Milliards 2025-2045 (CoA DE)

FR: **50** Milliards Euros 2020-2035 pour grand carénage nucléaire LTO – pour 20 ans
de fonctionnement supplémentaires – 2025-2045

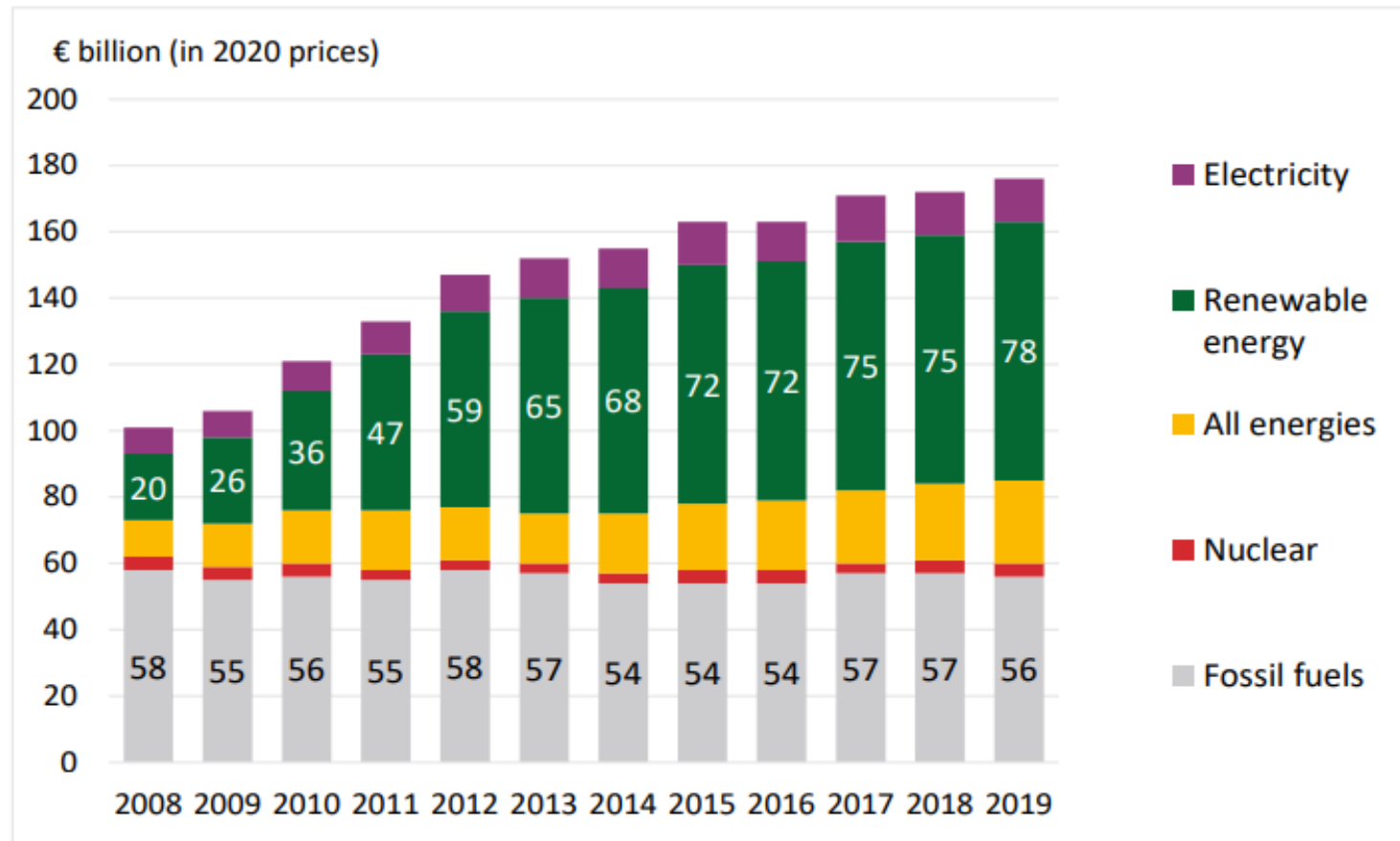
DE: 385 gr CO₂/kWh - **FR:** 85 gr CO₂/kWh

Energiewende : succès ou échec ??? modèle à suivre ???

Energy Subsidies in EU

European Court of Auditors 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.

Éléments récents de contexte européen

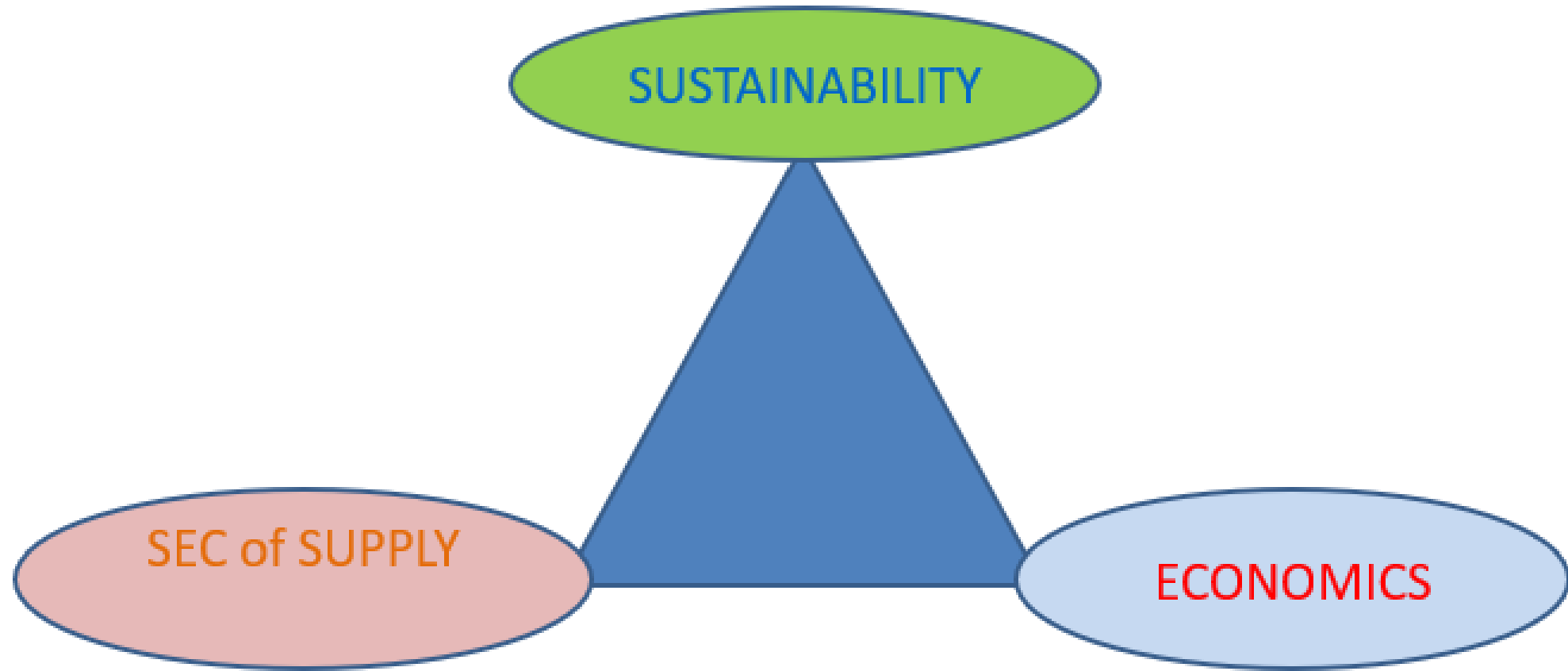
- 2019+ **Green Deal** (Paquet Fit-For-55 + REDIII) :
Cibles 2030 : 55% CO2, 42.5% RES, +12% EE
- **Taxonomie** Finance Durable... yes... but...
- Crise Russie-Ukraine – **REPowerEU**
300 Milliards Euros – RE=RES and no nuclear
- **Alliance** Etats Membres Nucléaires – 12
- Réforme du **Marché de l'Electricité** – CfD nuclear
- **Net Zero Industry Act** – Nuclear strategic techno

Éléments récents de contexte européen et +

- 2024...
- Février - Première vision Commission pour **2040 : 90% CO2 (95%) – IA !!!**
SMR Industrial Alliance
- Crise – **questionnement du Green Deal**
- **EU Nuclear Alliance** poursuit son chemin – 12 EMs - Déclar Conseil Energie
- **Elections !!!** Parlement Européen 9 juin 2024 – en place en septembre
Commission en octobre
- **COP28** : 22 pays - 3x electricité nucléaire en 2050
Sommet Mondial Energie Nucléaire à Bruxelles le 21 mars

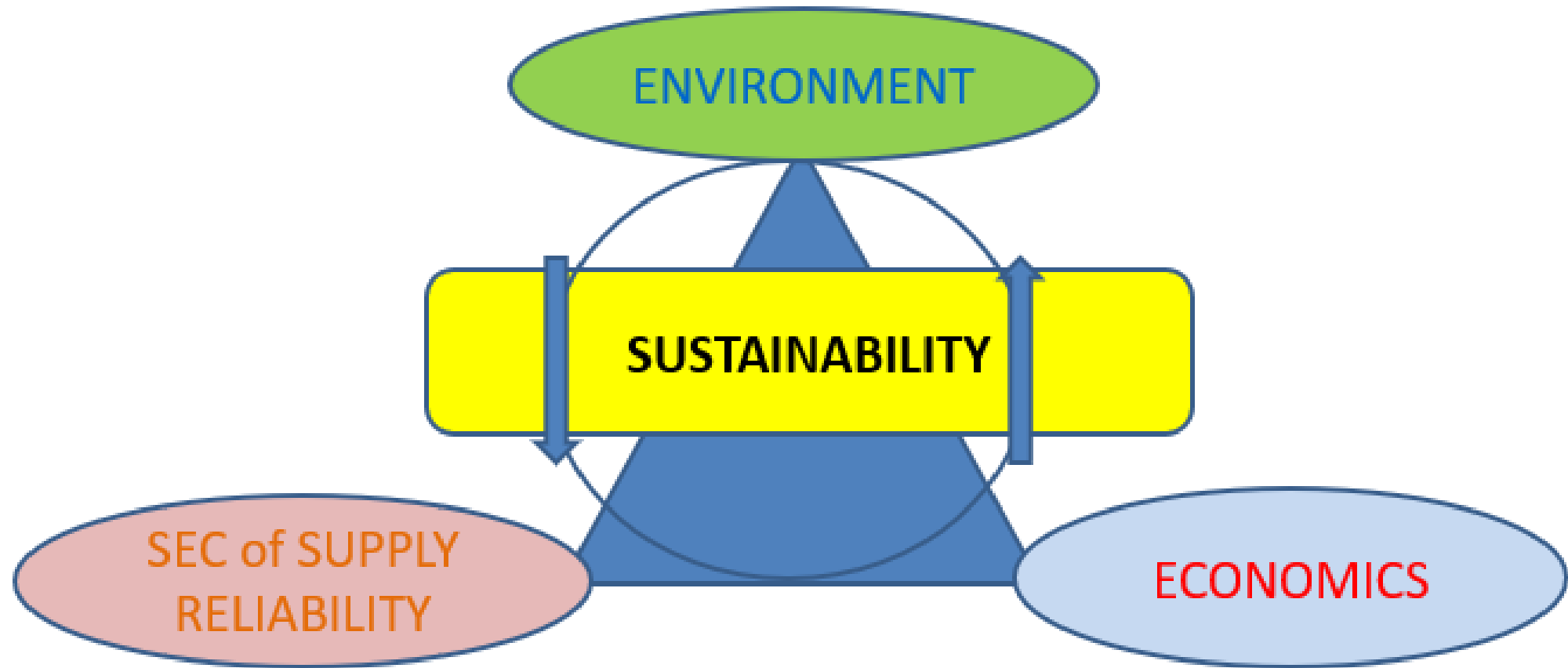
Beyond CO2... Global Challenges

The triangle of Energy Policy

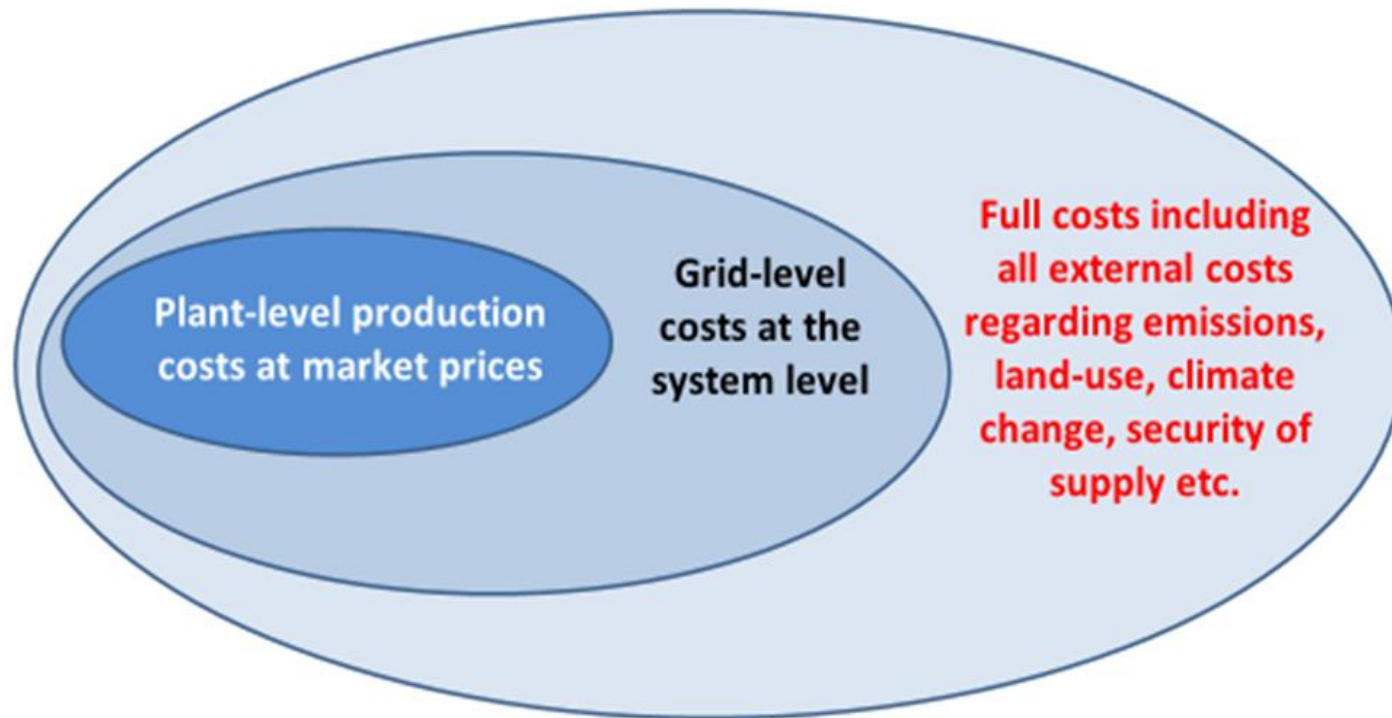


Beyond CO2... Global Challenges

A better Triangle for Energy Policy



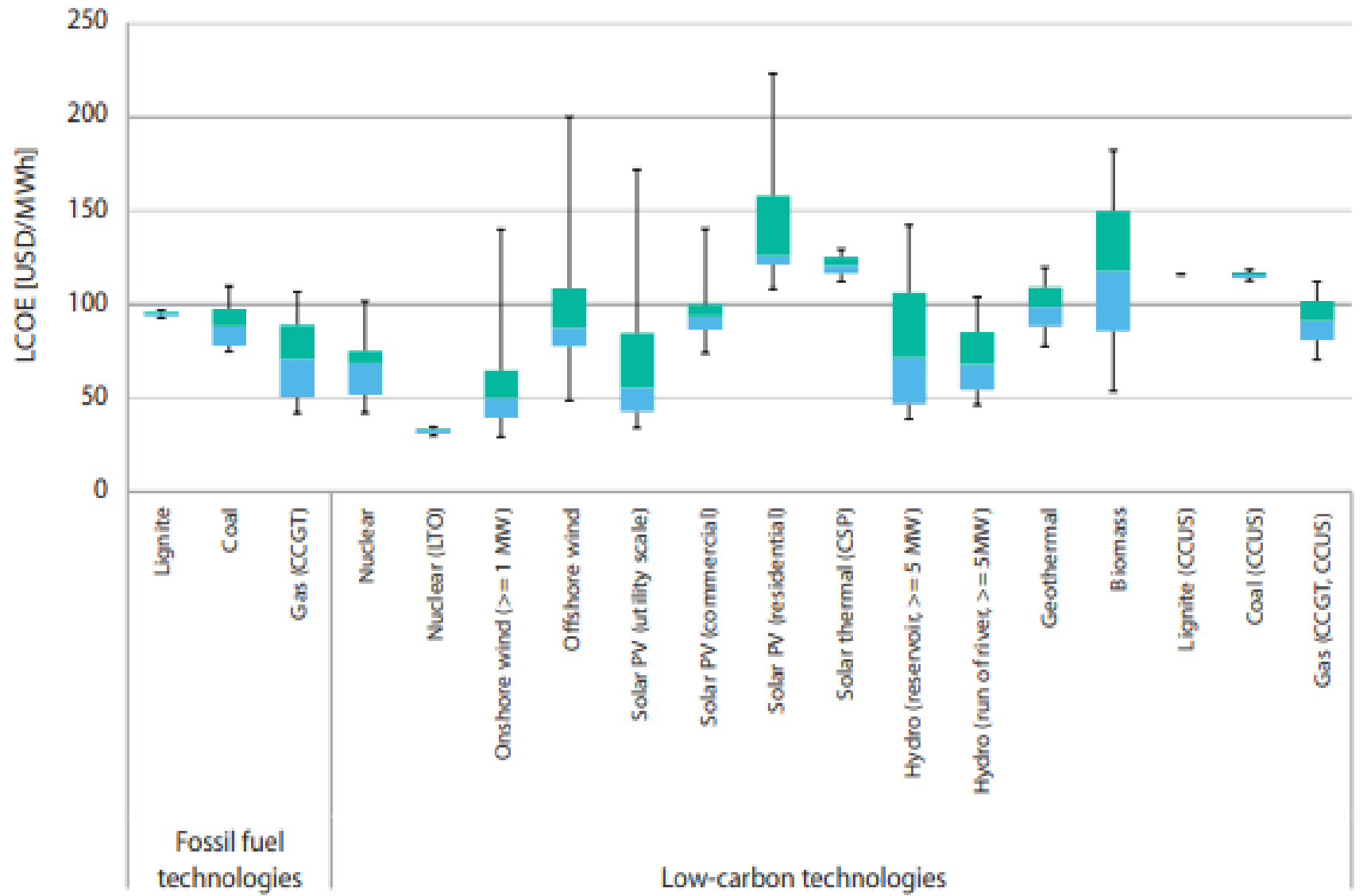
BEYOND LCOE... Full Cost Approach



Working Party for Nuclear Energy Economics (WPNE), OECD NEA, Paris, 28 May 2015

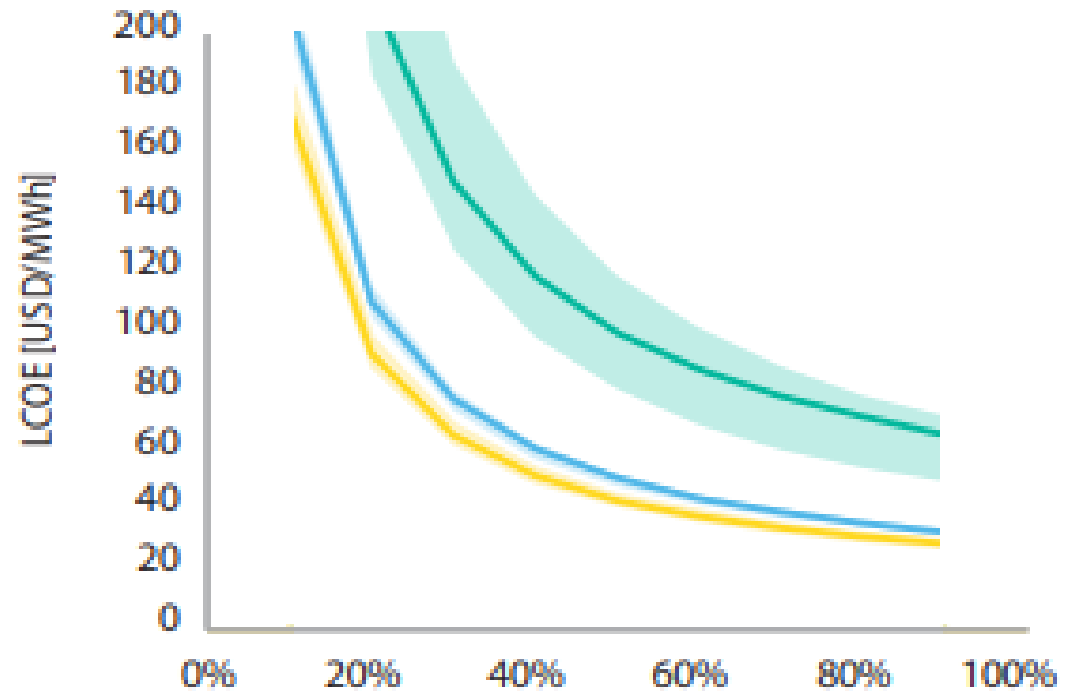
Economics Beyond LCOE...

Levelized Cost of Electricity LCOE IEA NEA PCGE 2020



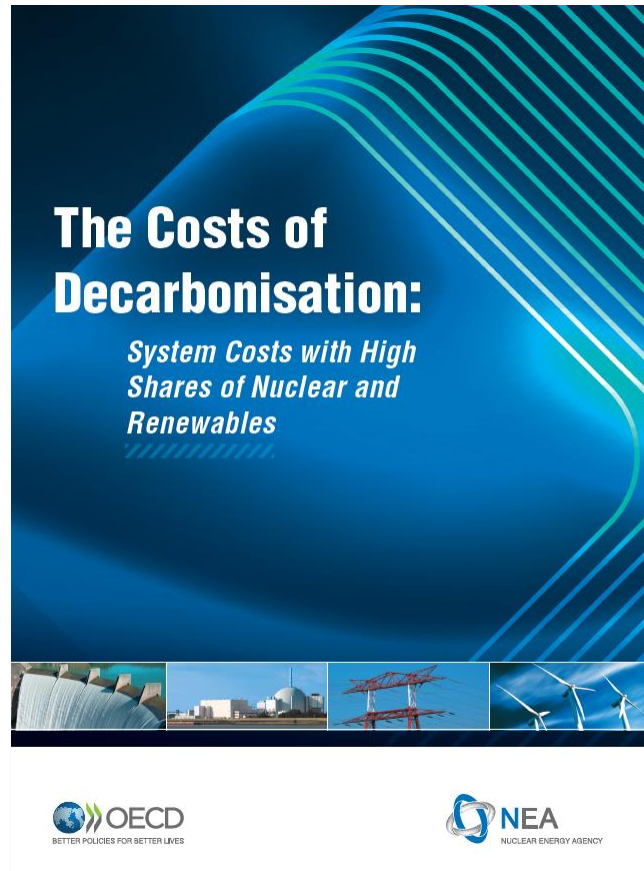
Note: Values at 7% discount rate. Box plots indicate maximum, median and minimum values. The boxes indicate the central 50% of values, i.e. the second and the third quartile.

Levelized Cost
of Electricity
LCOE
IEA NEA PCGE
2020



■ New build ■ 10-year extension ■ 20-year extension

Note: Values at 7% discount rate. Lines indicate median values, areas the 50% central region.



THE COSTS OF DECARBONISATION

SYSTEM COSTS WITH HIGH SHARES OF NUCLEAR AND RENEWABLES

Global System Approach: NEA « System Costs »

- **Report NEA 7299/2019:** The Cost of Decarbonisation: System Costs with High Shares of Nuclear and Renewables... (Electricity)

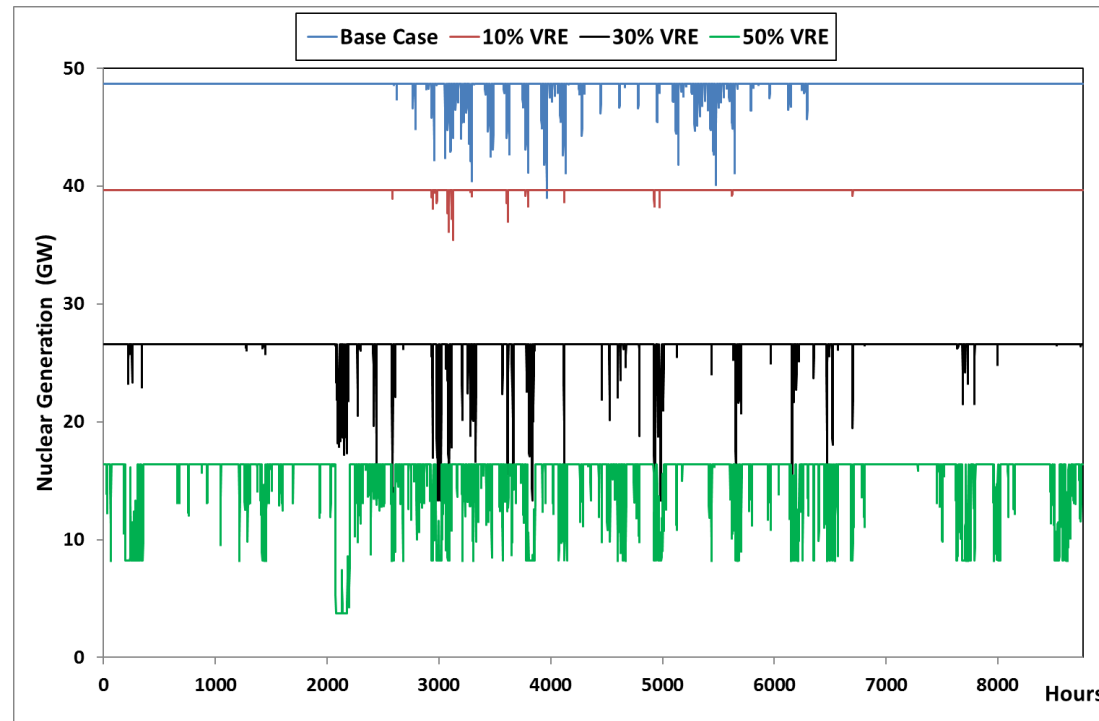
MAIN CONCLUSION:

Assuming 50gr CO₂/kWh in 2050... (meaning limiting gas!!!) – going from 0 to 75% VRE...

- Going from zero to 75% VRE multiplies the necessary installed capacity by 3
- With 75% VRE System costs are increased by 50 USD/MWh (+ networks costs to add)
- More VRE means more volatility in electricity prices (at 75% 4000 hrs negative prices) and discourage investment – subsidies always needed
- Market value of VRE reduces with increasing shares (more for solar than wind), also discouraging investment

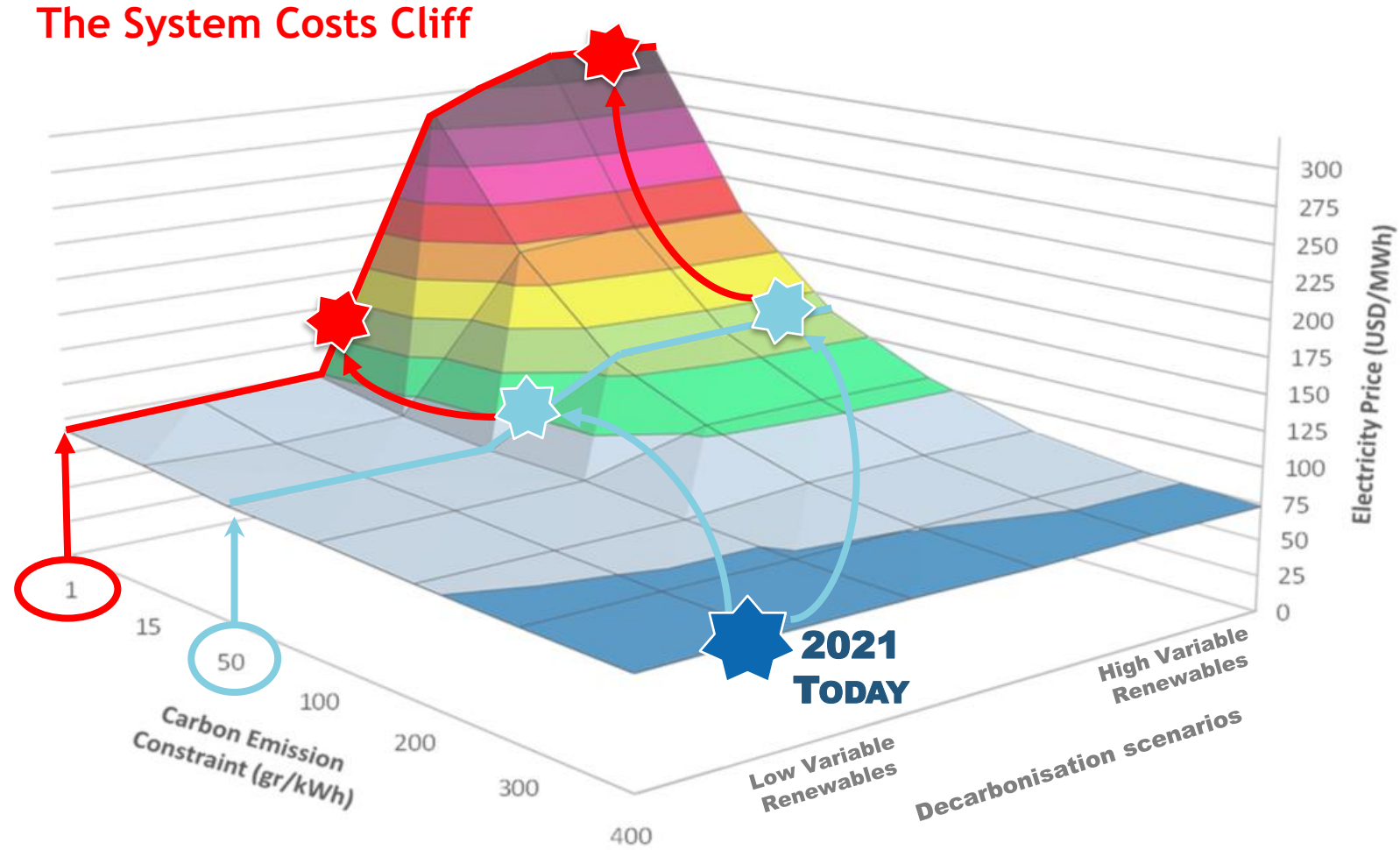
... there seems to be an « economic » upper limit for VRE of the order of 30 to 40%...

Result 4: Increasing demand on flexibility of nuclear power plants



- With increasing VRE shares nuclear capacity declines.
- The number and steepness of the ramps for load following (cycling) increases.
- This poses the question of sector coupling, *i.e.*, combining electricity generation with the production of another “storable” product (heat, desalination, hydrogen...).

Charting a Path to Net-Zero Electricity



Source: NEA

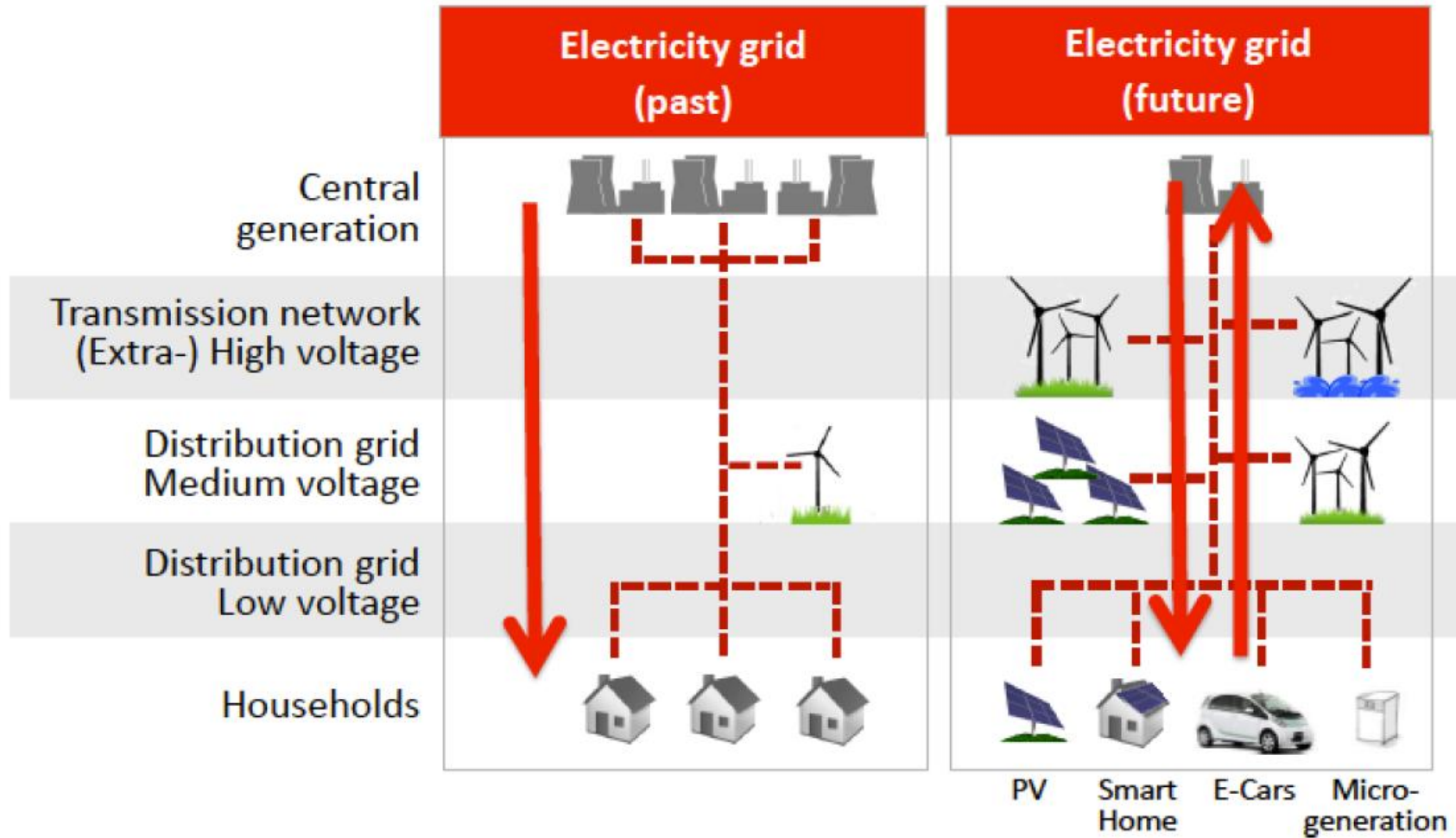


Fig. 1.3. Changing Structure of the Electricity Grid [J. Specht, E.ON, August 2014]

Bank of America (2023) [\[edit \]](#)

In 2023 Bank of America conducted a LCOE study in which it postulated that existing LCOE estimates for renewables do not account for fossil fuel or battery backup and therefore **levelized full system cost of electricity** (LFSCOPE) would be a more reasonable metric to compare sources in terms of providing 24/7 consumer electricity.^[91]

	LCOE	LFSCOPE (Texas, US)	LFSCOPE (Germany, EU)
Nuclear	82	122	106
Wind	40	291	504
Solar	36	413	1548
Biomass	95	117	104
Coal	76	90	78
Gas	38	40	35

A brief history of nuclear in Belgium 1/2

- SCKCEN founded in 1952 in Mol
- 4 reactors were built in Mol: 1956 BR1, 1962 BR2, 1962 BR3 (till 1987 – decommissioned), 1964 VENUS
- 1957 – 1990 Joint Undertaking OECD NEA Reprocessing Eurochemic Pilot Plant in Dessel - decommissioned
- 1973-1985: commissioning of 7 large PWRs (D1/2 2x500 W Mwe, T1 W 1000 Mwe, D3 and T2 W 2x1000 MWe, D4 and T3 W 2x1000 Mwe = 50% of the Belgian consumption of electricity.

A brief history 2/2

- 1973 **FBFC** in Dessel - till 2012 and decommissioned.
- 1973 **Belgonucleaire** in Dessel for MoX fuel – planned SNR-300 fast reactor. In 1986 MoX fuel for some of the Belgian PWRs. Stopped, with the reprocessing, for political reasons in 2000. Decommissioned to green field.
- 1972 - 1985 Fast reactor **SNR-300** (DE BE NL in Kalkar Germany) Project politically cancelled in 1991. Wunderland Park.
- IRE (RadioElements Institute) created in 1971 in Fleurus – dedicated to the production of **medical** radioisotopes in collaboration with SCKCEN
- Waste Management **Ondraf/Niras** with final disposal site for LLW in Dessel (under final stages of construction). Since 1980, deep Underground Research Laboratory **HADES** (operated jointly with SCKCEN) for geological repository of HLW in clay.
- Education: 2002 creation of **BNEN** consortium of Universities for a master-after-master degree in nuclear engineering, in collaboration with SCKCEN
- 550 MeV ADS FR **MYRRHA** – now AISBL
- EU **SMR** Industrial Alliance

State of play

- 2003 Nuclear PhaseOut Law : Stop NPP operation after 40 years
- 2013 changing decision: T1 for 50 years till 2025.
- 2015 changing decision: D1/2 for 50 years till 2025.
- Elections 2019, Vivaldi Coalition. October 2021, confirmation complete PhaseOut for 2025, based on study by the TSO ELIA 2021 – compensated by new gas plants (4 Gwe CRM/H2) and imports (30%).
- March 2022, changing decision: update by ELIA - D4/T3 +10y
- October 2022 Shutdown of D3, January 2023 Shutdown of T2
- 100 Meuros for SMR... SCKCEN report proposing LFR
- Negotiations between the Govt and the ENGIE on the conditions, including 50/50 and the transfer of financing of the legacy (waste management).
- Amending the PhaseOut Law (abrogation partielle) for T3/D4 for 10 years.

What could/should BE do in the next years

- ASAP **Scrap the Nuclear PhaseOut Law** of 2003 – replace by a pro-nuclear Law (Loi 2006 FR)
- ASAP Keep **all** possible safe (Saf Authority decision) NPPs **in LTO** (if economic)
- Evaluate realistically the **demand** in energy (electricity and heat) to tackle the economic and social challenges – target societal sustainability. Evaluate the reliability and affordability requirements. To be done in the European context BUT sovereignty (no structural imports) !!!
- Perform **global System (full cost) studies** to determine the balance of nuclear and RES (with their piggybag for intermittency).
- Evaluate and decide for new built **GenIII - large vs SMRs** (based on specific needs, timelines, pro and cons).
- Pursue proactive international collaborative RD&D (demos/prototypes) on **GenIV systems – large vs SMRs, Hybrid** – seek standardisation (licensing, supply chains). **Closing Fuel Cycle and Waste Management – Myrrha.**
- Engage dynamically the **YG** and the **supply chain**.
- Develop the effective **financing** mechanisms to attract investors.
- Contribute to the **structural reform of the electricity market.**

Un nécessaire outil d'expertise...

exemple du « Comité des Sages »

- Commission d'évaluation en matière d'énergie nucléaire créée en mars 1975 par le Ministre Oleffe sous la présidence de André Jaumotte (ULB) et Julien Hoste (RUG).
- Livre BNS Un Demi-Siècle de Nucléaire en Belgique – 1994
Chapitre page 669 rédigé par A Jaumotte
Conclusion du chapitre :

« Pendant plus de dix ans, la Commission a joué un rôle d'évaluation des programmes nucléaires et a informé les pouvoirs législatif et exécutif. Pour la première fois, les pouvoirs publics avaient chargé une grande Commission indépendante, interdisciplinaire, d'un travail de préparation technique et économique des décisions politiques à prendre. La voie suivie est un des moyens possibles pour que les pouvoirs législatif et exécutif disposent de l'information spécialisée nécessaire à leurs décisions ».

Autres exemples en France...

Commission Schellenberger... ou OPECST...

- Remarquables outils de l'Assemblée Nationale et du Sénat
- Jeudi 25 mai 2023
Colloque Palais du Luxembourg
Transmutation: technologies, impacts économiques, industriels et politiques
Speakers: Peter Baeten, Hamid Ait Abderrahim, Jean-Pol Poncelet...
- Lundi 11 mars 2024
Même endroit
Le renouveau du nucléaire en Europe
Speaker: Marc Deffrennes weCARE

Conclusion...

Above all we need a conducive political environment with long term vision, stability over time, ability to develop a strategy, to convert it in concrete programmes, readiness to engage with stakeholders and the society... but all based on real expertise not dogma and lobbying...

100TWh espère que le prochain gouvernement sera à la hauteur des enjeux... pour le bien commun... et est à sa disposition en tant que représentant de la société civile, compétent et totalement indépendant...