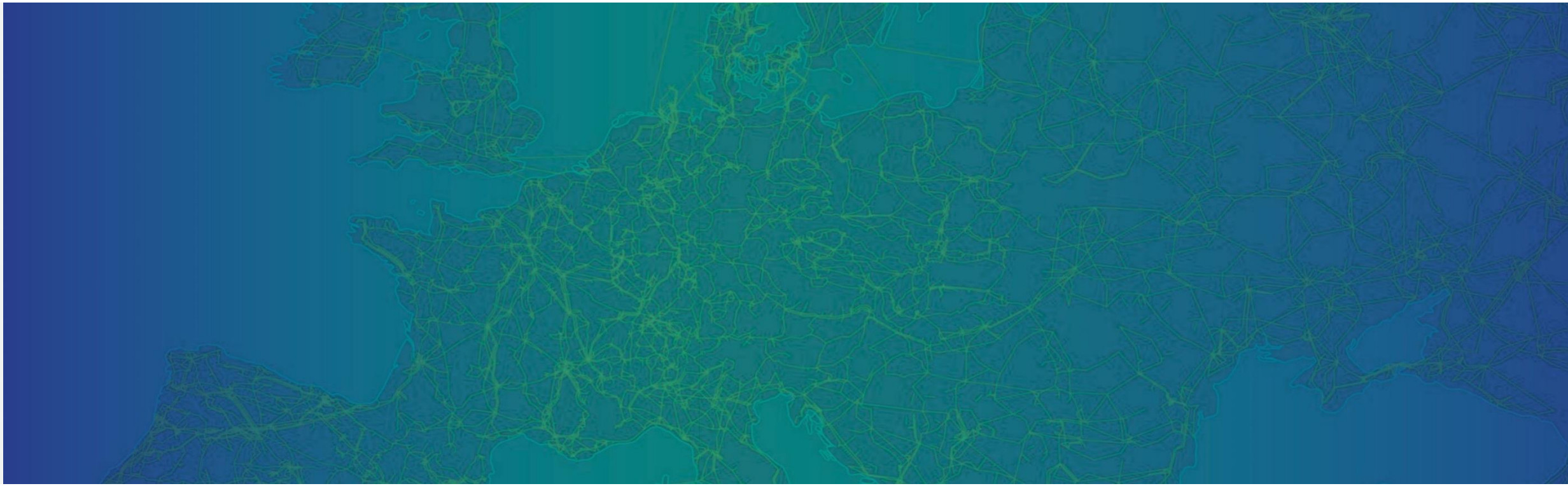
Flexibility and resilience for long-term variability

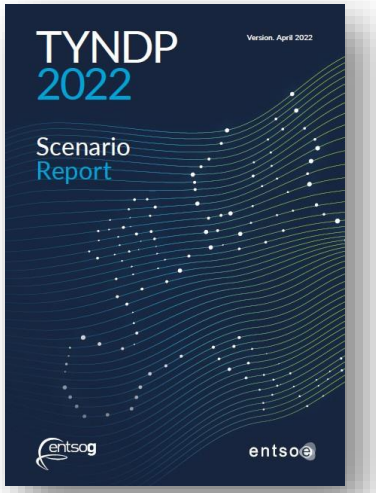
9th Annual EPRI-IEA Challenges in Decarbonisation Workshop – 7 October 2022



Olivier Lebois, RTE Expert, ENTSOE TYNDP Scenario convenor

entsoe
Reliable Sustainable Connected

Providing European and national insights at the 2050 horizon

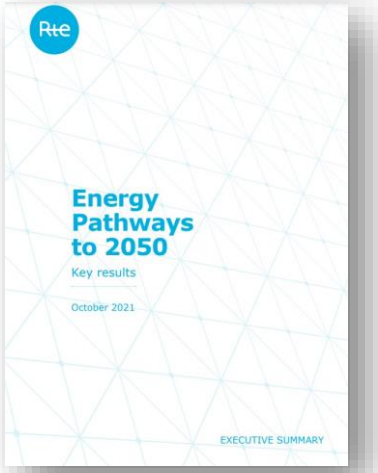


Joint ENTSOE and ENTSOG scenarios for TYNDP 2022

Regulatory requirement to provide a consistent basis for:

- electricity and gas TYNDP
- infrastructure project assessment for the selection of Project of Common Interest (accelerated permitting, European financing…)

Jointly developed every other year by the associations of electricity and gas TSOs



RTE Energy pathways to 2050

Part of RTE legal obligation to perform adequacy studies on a 10/15-year time horizon

A ministry request to explore the electricity system at the 2050 time horizon as an interim step between the present and next national Long Term Strategies

TYNDP 2022 Scenarios – Approach to flexibility needs

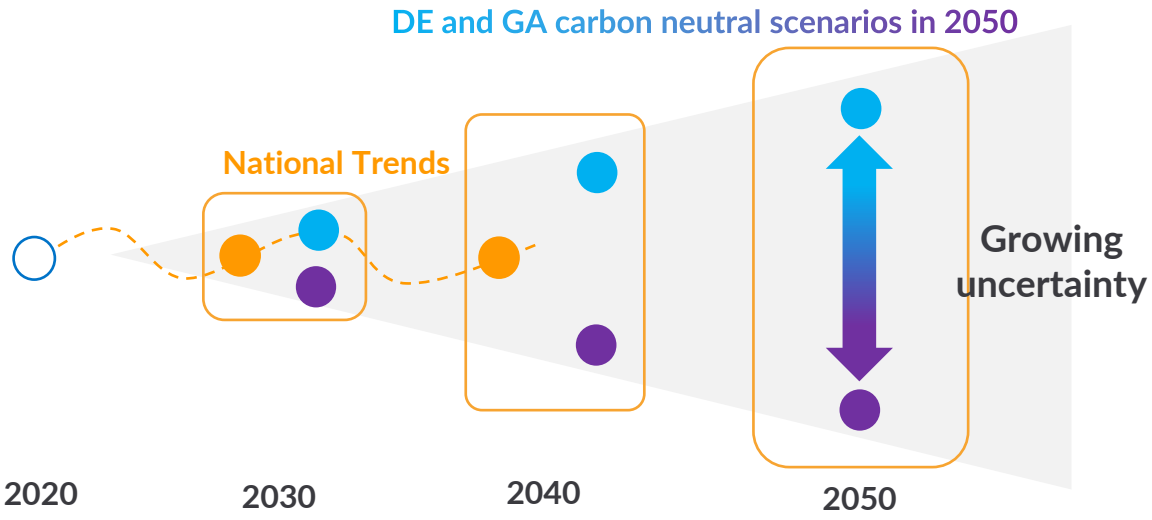
Different scenarios with different needs

Scenarios explore different paths related to energy demand, generation mix and flexibility options based on their narrative

Every scenario includes a wide range of flexibility options with a different focus:

- Distributed Energy: higher prosumer engagement (V2G, battery…)
- Global Ambition: higher role for low carbon flexible generation

Scenarios do not aim at defining the best flexibility mix but illustrate the operation of flexibility options



Technical challenge

Based on predefined electricity and hydrogen demand, the capacity mix is built through an expansion loop defining wind, solar, thermal generation, electricity and hydrogen interconnections

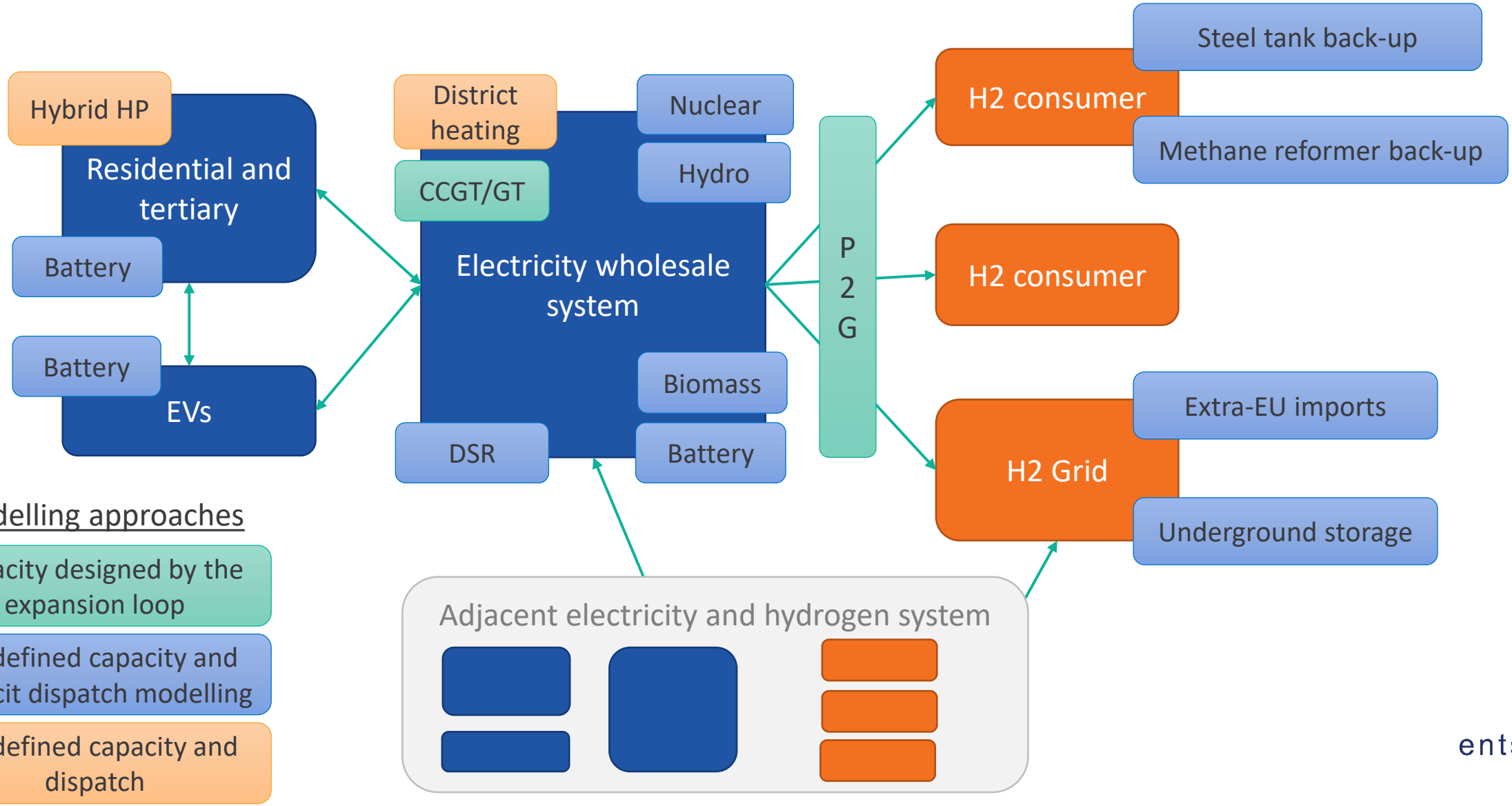
Need to split computational resources between time horizon (trajectory to 2050) and system resilient (hourly resolution)

Enhancements under investigation for the TYNDP 2024 scenarios

- Increasing the number of climatic years
- Defining battery capacity through the expansion loop
- Dynamic modelling of heat and H2-to-Power

TYNDP 2022 Scenarios – Modelling flexibility options

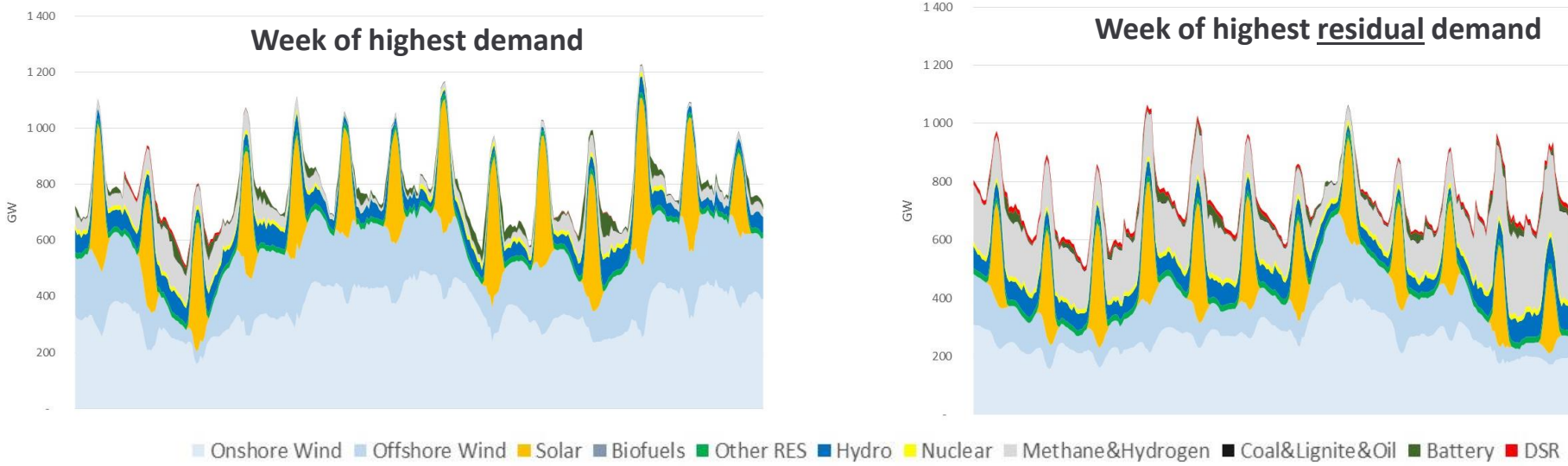
Pan-European electricity and hydrogen modelling of EU27 + UK + NO + BH + Balkan



Modelling approaches

- Capacity designed by the expansion loop
- Predefined capacity and explicit dispatch modelling
- Predefined capacity and dispatch

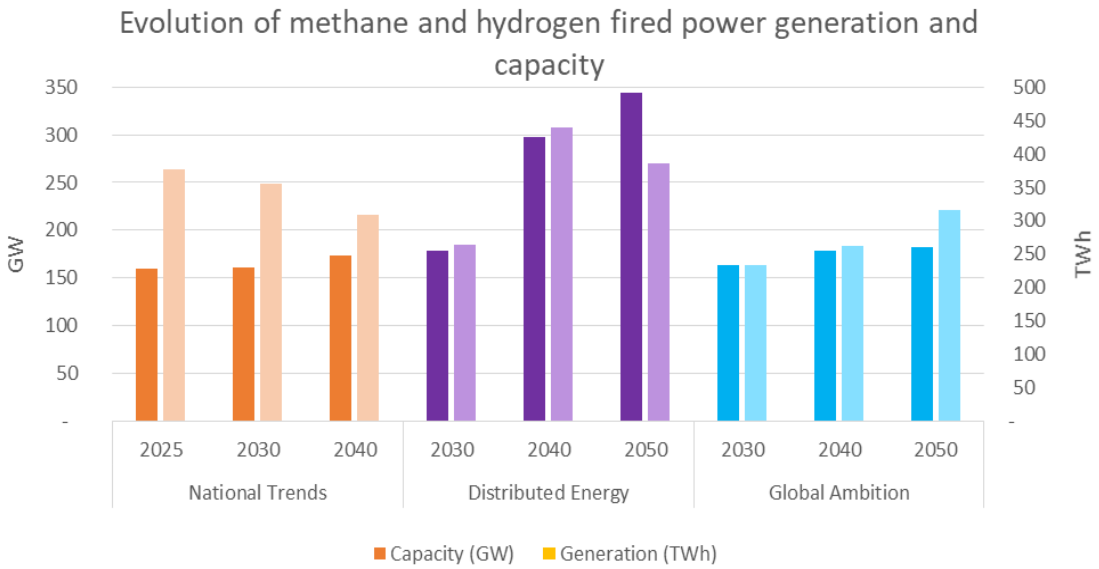
TYNDP 2022 Scenarios – Flexibility results

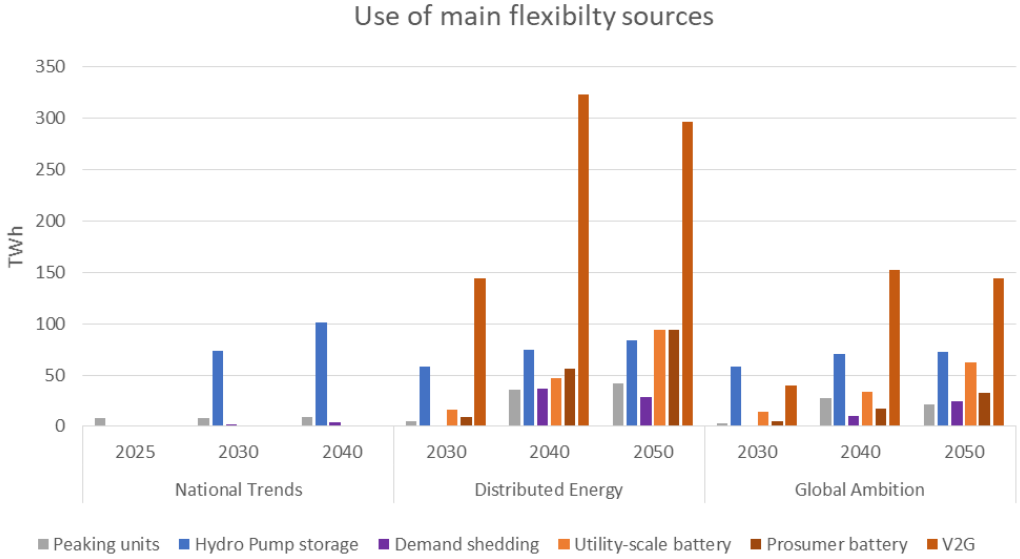


Onshore Wind | Offshore Wind | Solar | Biofuels | Other RES | Hydro | Nuclear | Methane&Hydrogen | Coal&Lignite&Oil | Battery | DSR

Residual load becomes the relevant parameter to measure climatic stress and flexibility needs

Electrification of the mix and RES development will increase flexibility needs. The extent of the challenge and the technologies to face it may differ as illustrated by TYNDP 2022 scenarios.

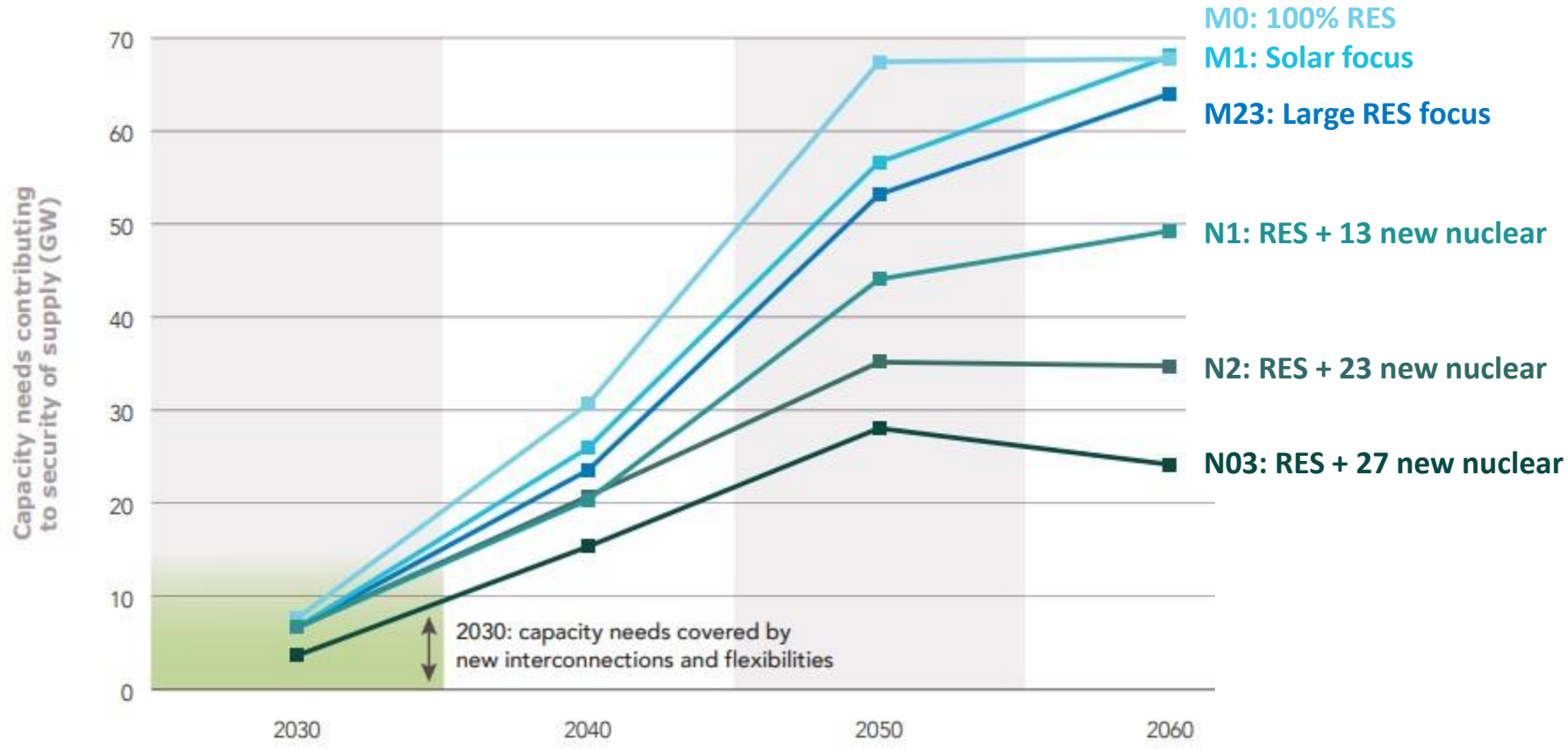




Flexibility needs in RTE Future Energy Pathways 2050

Significantly higher flexibility needs

- Digitalisation as a crucial part to manage decentralized flexibility options with new challenges (e.g. cybersecurity & data management)



- New interconnections as a significant source of savings by pooling flexibility options while increasing European interdependence in parallel to an increased overall energy independence as electrification enables the phase-out of fossil fuels
- Low carbon thermal generation to provide long term flexibility proportionally to RES development
- A wide range of options to manage daily to weekly modulation: demand-side response, hydro storage and batteries

Flexibility options in 2050 in Future Energy Pathways

M0: 100% RES

M1: Solar focus

M23: Large RES focus

N1: RES + 13 new nuclear

N2: RES + 23 new nuclear

N03: RES + 27 new nuclear

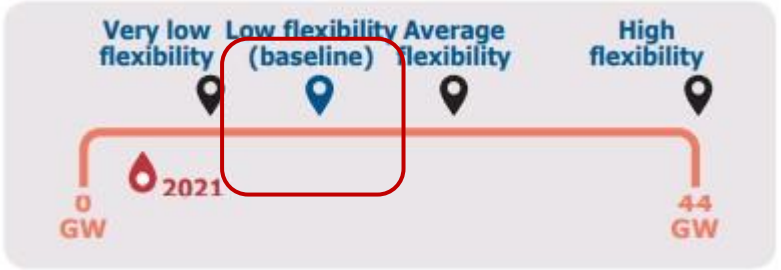
Stationary batteries

Development strongly linked to PV
Possible arbitration with DSR for short term flexibility

Dispatchable hydro

Redesigned of existing plants
Up to 3 GW of new pump storage

Demand-side response (DSR)



Supported by new electricity use (EV, electrolysis, industry…)
Prudent approach for scenarios

Low carbon gas-fired generation

Running on H2, bio or synthetic methane
Low number running hours varying from one year to the other

Interconnections

Balance between benefit and interdependence
Prudent approach below the economic optimum (45 GW)

Thanks for your attention!