TYNDP 2022
Draft Scenario Report

Consultation Workshop

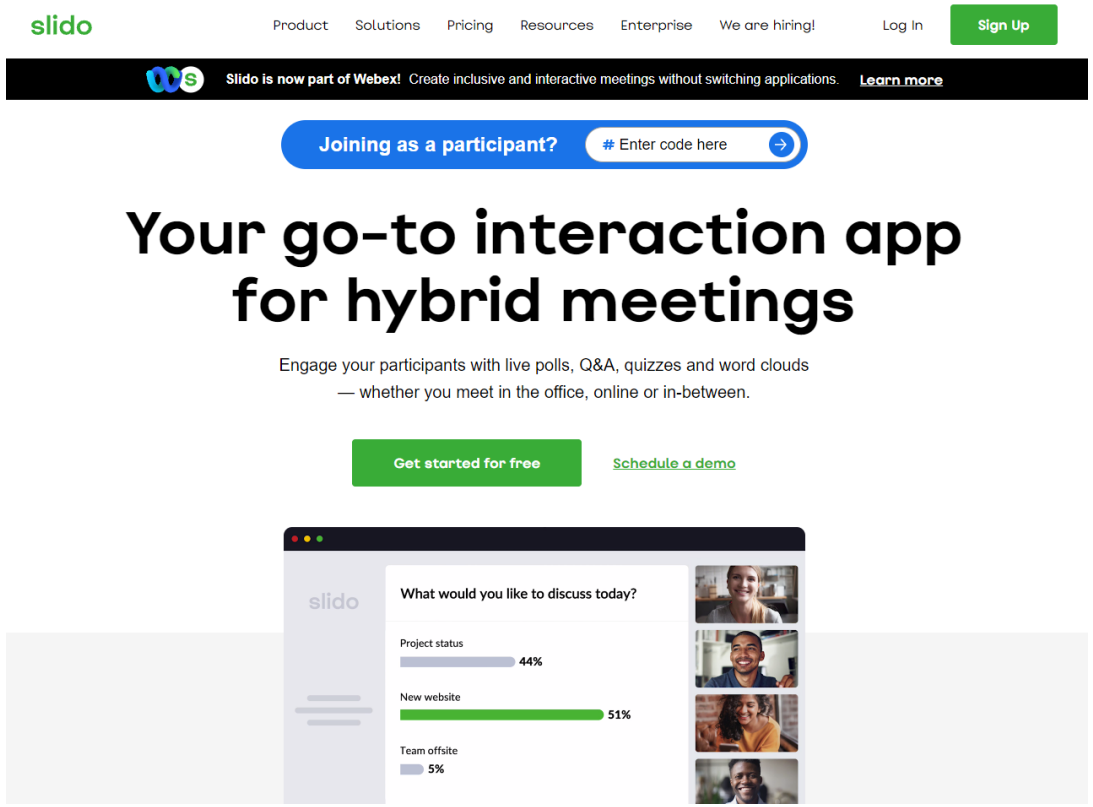
TYNDP 2022 Scenario Report

20 October 2021

Agenda

Time	Topic	Presenter
09:00 - 09:05	Introduction	Gideon Saunders, ENTSOG
09:05 - 09:15	Interactive Session	All
09:15 - 09:25	Stakeholder Engagement	Gideon Saunders, ENTSOG
09:25 - 09:35	Main Messages	Alan Croes, Tennet
09:35 - 09:50	Scenarios Process & Deliverables	Nalan Buyuk, ENTSO-E
09:50- 10:05	Modelling Methodology	Olivier Lebois, RTE
	Break for 15 minutes	
10:20 - 10:50	Demand Figures (inc. Benchmark)	Olivier Lebois, RTE
10:50 - 11:20	Supply Figures (inc. Benchmark & imports)	Pieter Boersma, Gasunie
11:20 - 11:35	Carbon Budget	Louis Watine, ENTSOG
11:35 - 11:40	Interactive Session	All
11:40 - 11:50	Next Steps	Nalan Buyuk, ENTSO-E
11:50 - 12:00	Closing Remarks	Louis Watine, ENTSOG

Get involved in the Workshop!



Throughout the workshop you can ask questions and leave comments. You can also take part in our interactive polls.

What to do:

1. Go to https://www.sli.do
2. Enter the event code “Scenarios"
3. Enter your name
4. Start asking questions

Please note that anonymous questions will not be answered

Interactive Session

Stakeholder Engagement

Transparency:

Stakeholders should be able to understand the scenarios and why they are the way they are.

Inclusiveness:

Stakeholders should have the chance to get involved in the scenario building process in a meaningful way.

Efficiency:

Stakeholders should ensure that methodologies and assumptions are relevant and up-to-date.

Goals for stakeholder engagement

Stakeholder Engagement from Day One	• Engagement events throughout the whole process, beginning with the kick-off in July 2020 (and we aren't done yet!)
Input on Key Parameters	• Consultation responses provide framework for two Paris-compliant scenarios.
Consultation on data – not just concepts	• Consultations are more numbers-based than in previous editions, using data ranges instead of +/-.
Transparent documentation of feedback and interactions	• All stakeholder feedback and bilateral meetings with external organisations are available for download.

Main Messages, Alan Croes, Tennet

Main Messages

The scenario building process for TYNDP 2022 has enabled the identification of key highlights for the future of Europe's energy system:

- Net-zero can be achieved by 2050 while ensuring the security of energy supply
- Energy efficiency is key to achieve the EU long-term Climate and Energy objectives
- Ambitious development of renewable energy across Europe
- Sector Integration provides efficient decarbonisation solutions
- Integrated energy systems: hydrogen is a game changer for gas and electricity systems
- Innovation is key to achieve a sustainable energy future

Scenarios Process & Deliverables, Nalan Buyuk, ENTSO-E

Purpose of TYNDP scenarios

TYNDP scenarios are designed for TYNDP infrastructure assessment

Will energy production develop centralized or de-centralized?

How be sure that infrastructure supports development?

Is it ready for the Green Deal development?

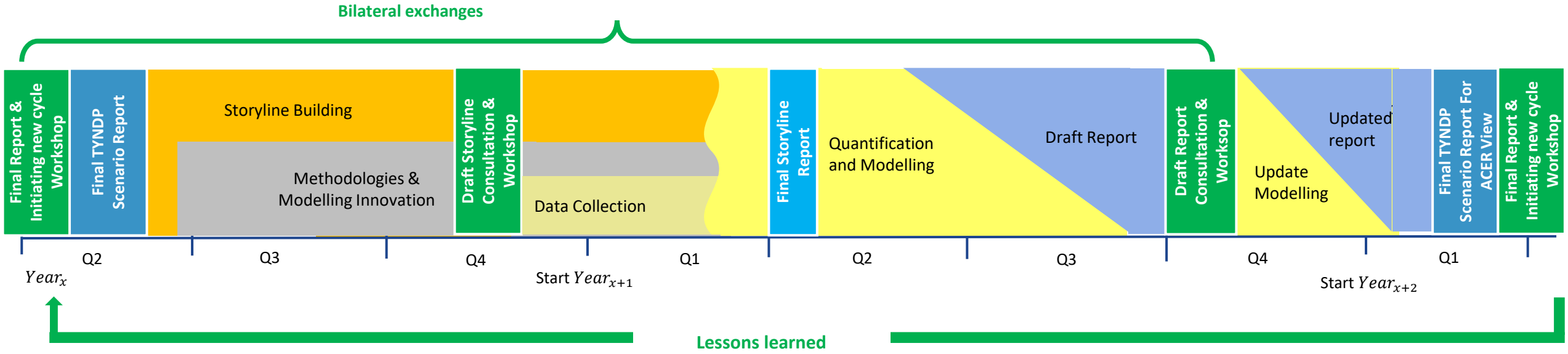
Can it deliver in terms of Security of Supply, Market Integration and Competition?

TYNDP scenarios are meant for analysis and information - not for predictions/forecasting

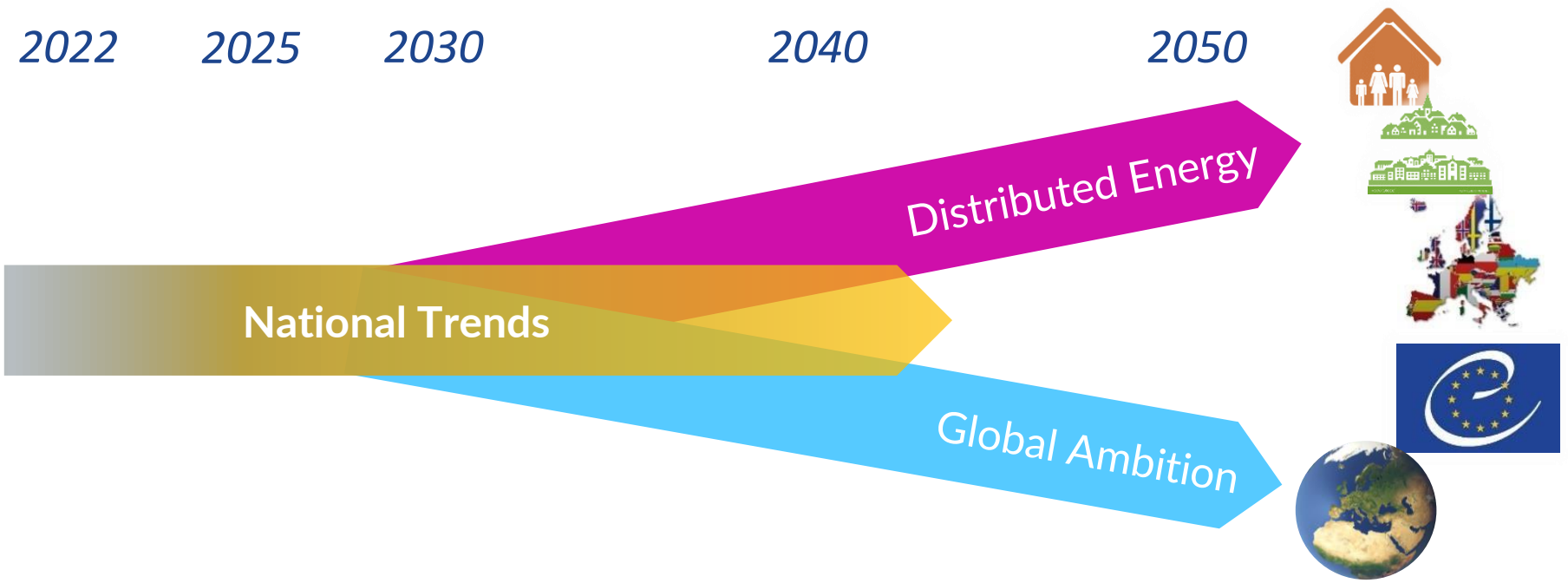
TYNDP scenarios complementary to EC's **Long-Term Strategy** scenarios – with focus on assessment of infrastructure readiness vis-à-vis possible - **contrasted** - futures

The Scenario Building Process

- A 2-year cycle starting one year ahead of TYNDP
  - **Year 1:** Defining **storylines** with stakeholders and **innovative modelling methodology**
  - **Year 2:** Scenario modelling with an update based on the public consultation of draft scenarios



Three Scenarios for the TYNDP 2022



Higher European autonomy with renewable and decentralised focus

Aggregation of national policies and strategies as stated end of 2020

Global economy with centralised low carbon and RES options

- A set of scenarios meeting regulatory requirement of aligning with:
  - **National policies:** National Trends scenario; reflect the most recent EU MS's national energy and climate policies and strategies
  - **European policies:** Distributed Energy and Global Ambition scenarios are in line with the COP21 and Green Deal targets

- Altogether the contrasted scenarios are designed to explore different pathways with regard to the identified scenario drivers, with the purpose of covering uncertainty in the possible use of energy infrastructure

The Storylines for the COP21 Scenarios

	Distributed Energy Higher European autonomy with renewable and decentralised focus	Global Ambition Global economy with centralised low carbon and RES options
Green Transition	At least a 55% reduction in 2030, climate neutral in 2050	
Driving force of the energy transition	Transition initiated at a local/national level (prosumers)	Transition initiated at a European/international level
	Aims for EU energy autonomy through maximisation of RES and smart sector integration (P2G/L)	High EU RES development supplemented with low carbon energy and imports
Energy intensity	Reduced energy demand through circularity and better energy consumption behaviour	Energy demand also declines, priority is given to decarbonisation of energy supply.
	Digitalisation driven by prosumer and variable RES management	Digitalisation and automation reinforce competitiveness of EU business.
Technologies	Focus of decentralised technologies (PV, batteries, etc.) and smart charging	Focus on large scale technologies (offshore wind, large storage)
	Focus on electric heat pumps and district heating	Focus on hybrid heating technology
	Higher share of EV, with e-liquids and biofuels supplementing for heavy transport	Wide range of technologies across mobility sectors (electricity, hydrogen and biofuels)
	Minimal CCS and nuclear	Integration of nuclear and CCS

Draft TYNDP 2022 Scenarios Deliverables

- The draft TYNDP 2022 Scenario Report will include following deliverables and can be reached at Scenarios dedicated website:

Draft Scenario Report 2022

- Required by TEN-E regulation
- Scenario Results in both gas and electricity focus
- Benchmark against other scenarios
- Two COP21 (top-down) scenarios for 2030 & 2040 & 2050
- National Trends scenario for 2025 *(for gas data only)* & 2030 (*2040 will be included into the final version*)

Draft Scenario Building Guidelines

- Transparency in the methodologies used for developing scenario
- Help reader to better understand the results and the scenarios development process itself

Visualisation platform

- Scenarios at a glimpse

Draft Dataset

- User-friendly dataset for use by stakeholder in their own analyses
- Open licence setting the framework of data use

Modelling Methodology, Olivier Lebois, RTE

Main improvements of TYNDP 2022 Scenarios

A wider and result-oriented stakeholder engagement

- Building on stakeholders' feedback received through public consultation on last edition and updated storylines
- Looking for sectorial knowledge through several rounds of bilateral discussions

Innovative modelling to better capture the dynamics of a fast-changing energy system especially with regards to sector coupling:

- Electrolysis Modelling
- Prosumer & EV Modelling
- District Heating

A new climatic database starting to capture global warming impact on energy demand

- Already used for National Trends scenarios
- To be factored in the updated version of COP 21 Scenarios

A wide, transparent and efficient engagement process

Sector integration has increased the need to engage with partners to adapt methodologies and collect data

- Energy carriers (Eurelectric, Eurogas & Hydrogen Europe)
- Local network operators (E.DSO, EuroHeat & Power)
- Generation technologies (WindEurope & SolarPower Europe)
- We invite all parties to join this technical partnership approach

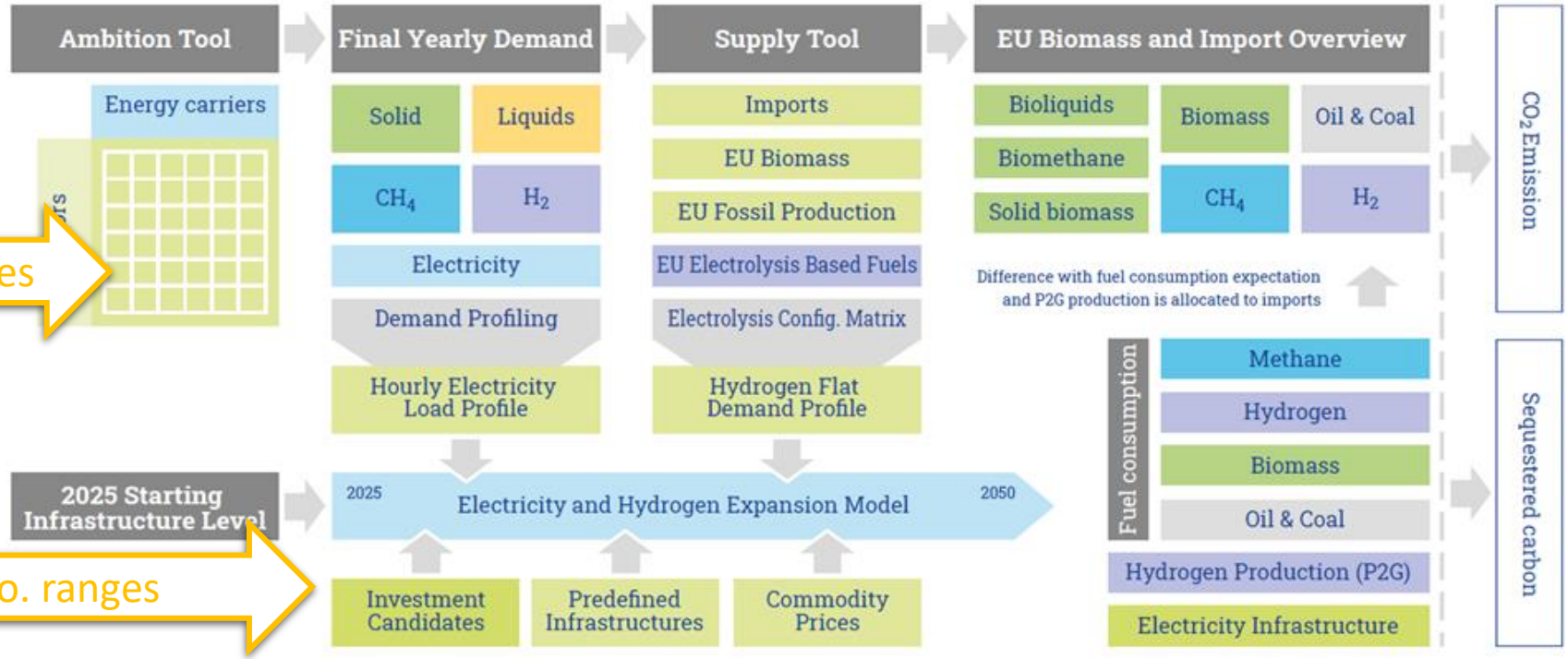
Discussions have always shown a shared dedication to picture proactive path to carbon neutrality and to knowledge sharing

We are always open to suggestions and comments on how to further improve the scenarios for TYNDP

ENTSO-E and ENTSOG thank all stakeholders for their feedback and support in the scenario building process

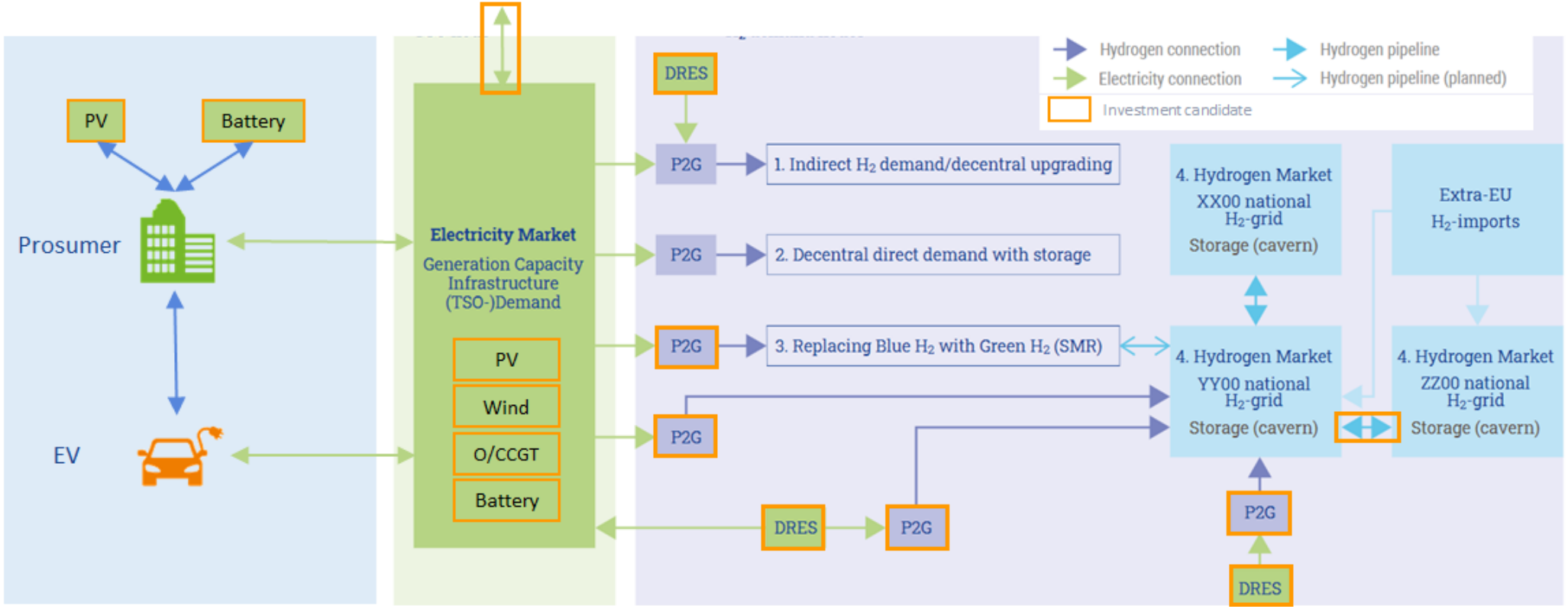
Building blocks of COP 21 scenario process

Final storyline report
April 2021
(resulting from public consultation)



- The scenario building process consists in translating storylines into scenarios detailed enough to be used for infrastructure assessment in TYNDP
- The split of demand per carrier and sector (Ambition Tool) and the expansion of the electricity and hydrogen infrastructures are the key steps of this process

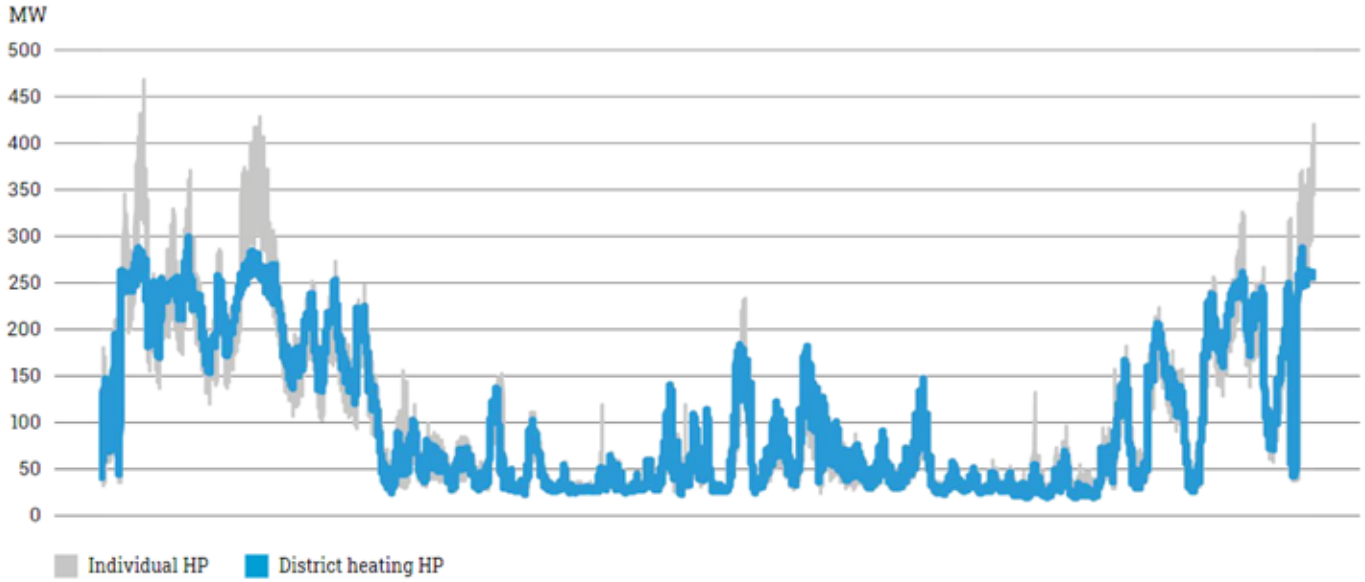
Overall modelling topology



- Sector coupling (electrolysis, prosumer, EV) results in a wide expansion of the modelling topology
- A wide range of investment candidates and configurations: PV, wind, batteries, electricity and gas interconnections, gas O/CCGTs
- Hydro, biomass, small thermal and nuclear capacity are predefined in both scenarios

Capturing district heating dynamics through input data

- District heating combines local energy sources (e.g. geothermal, biomass) with electricity and gas grids
- An opportunity for a smart design and management of heat pumps compared to household units

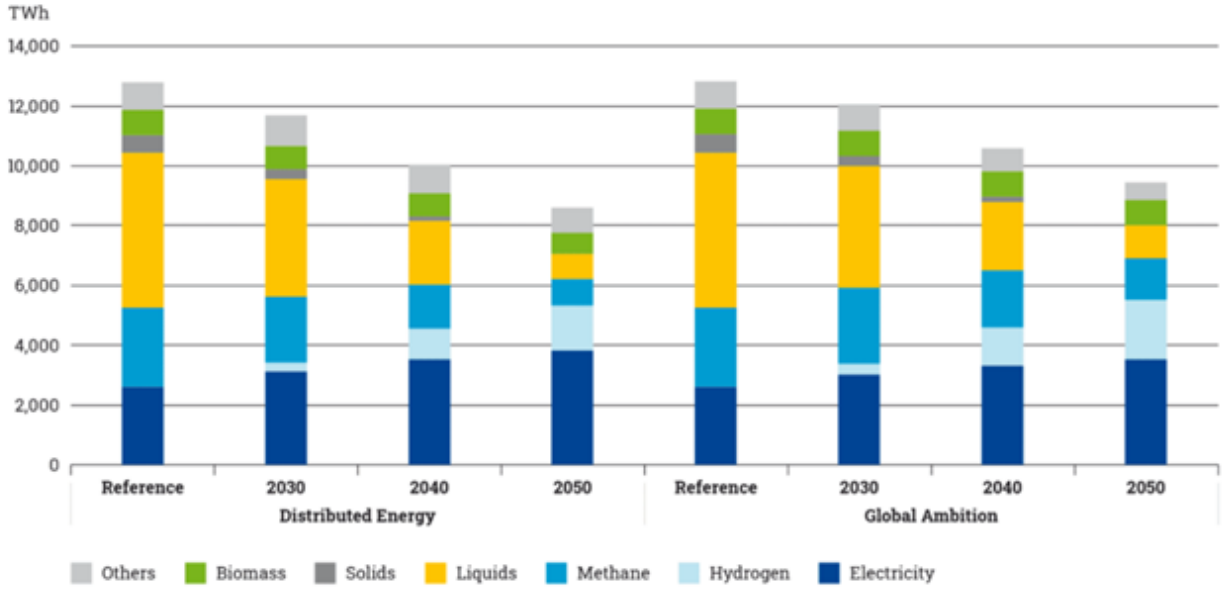


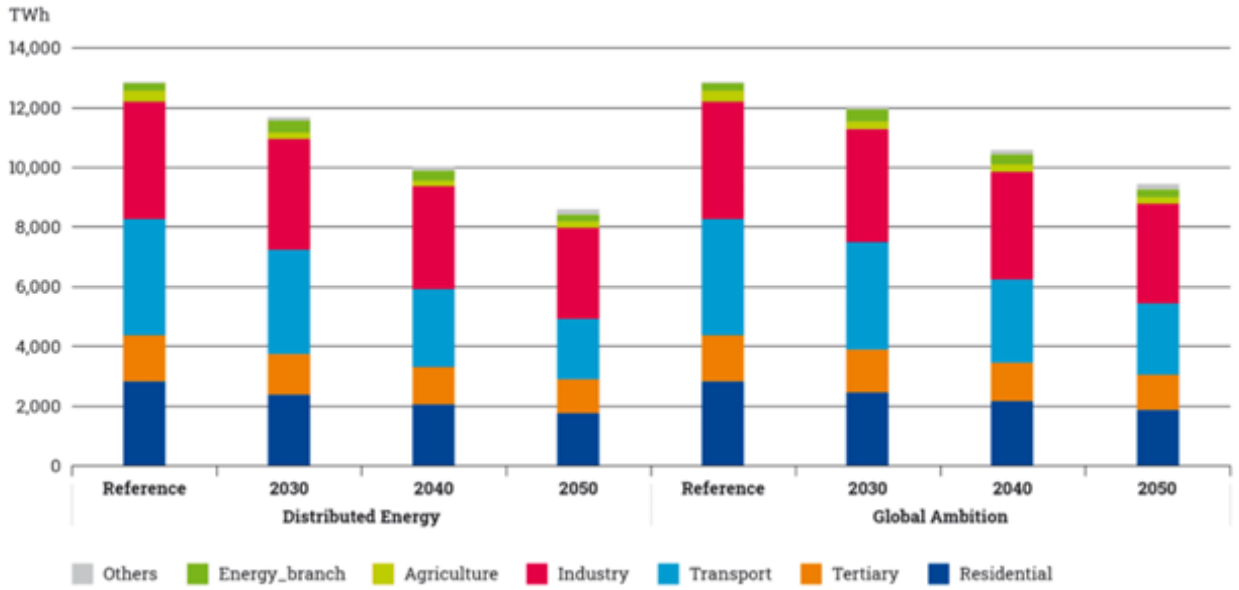
- The hourly load profile of district heating heat pumps used as an input for simulation captures the air-temperature optimisation (e.g. thermal storage and/or boilers at very cold temperature)
- Further optimisation based on the adequacy of the electricity grid is not taken into in the 2022 edition

Break for 15 minutes

Demand Figures (inc. Benchmark), Olivier Lebois, RTE

Final energy demand

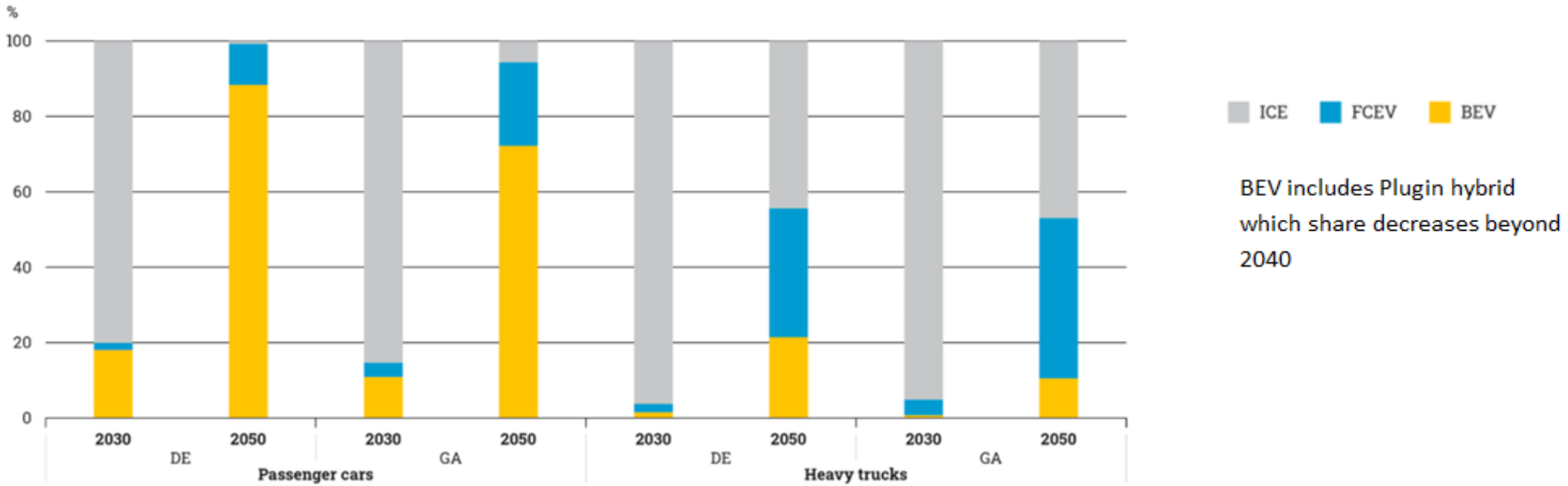




- **Final energy demand decreases** in average by 1,8% p.a. in Distributed Energy (-1,4% in Global Ambition) with the strongest decrease in the transport sector (-48% for DE and -39% for GA on the period)
- **Distributed Energy** combines highest direct electrification (≈50% of energy use in 2050) and efficiency (partly due to electricity technologies such as HP and EV)
- **Global Ambition** shows a more diverse energy mix deriving from low-carbon imports including hydrogen

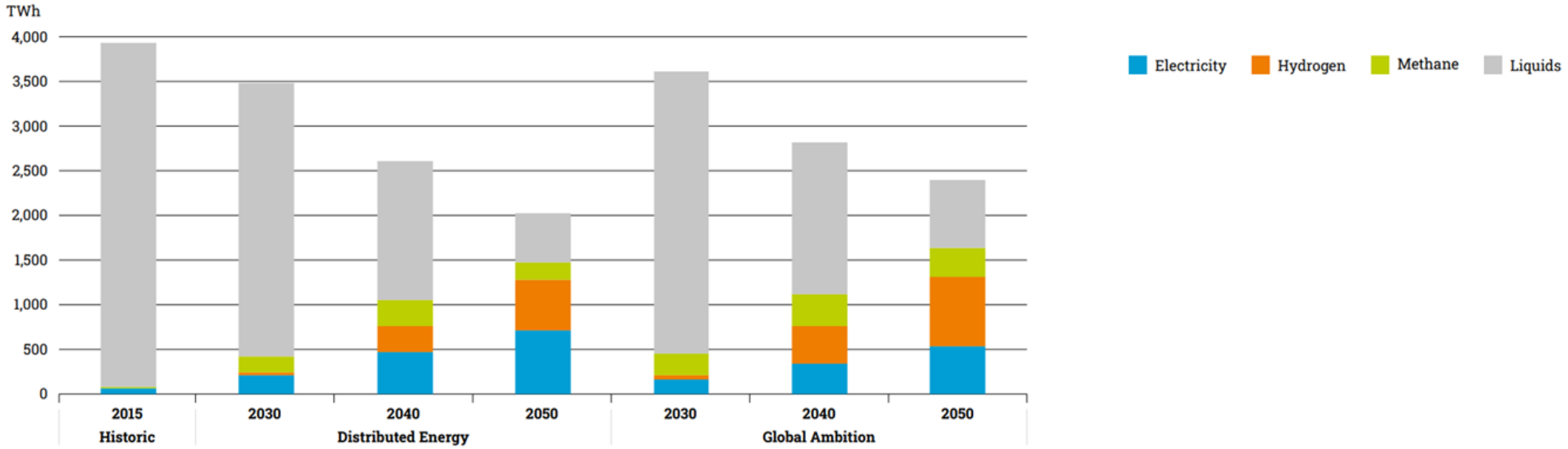
Energy efficiency: the EU can significantly reduce its energy demand by 2050

Focus on mobility



- Electricity and hydrogen play an essential role in the decarbonisation of the transport sector
- For passenger cars EV becomes the mainstream technology in 2050 as ICE is today
- Heavy trucks show a more diverse technology mix with a significant uptake of FCEV technologies
- Decarbonisation of fuels for ICEs is a third path for heavy goods vehicles transportation

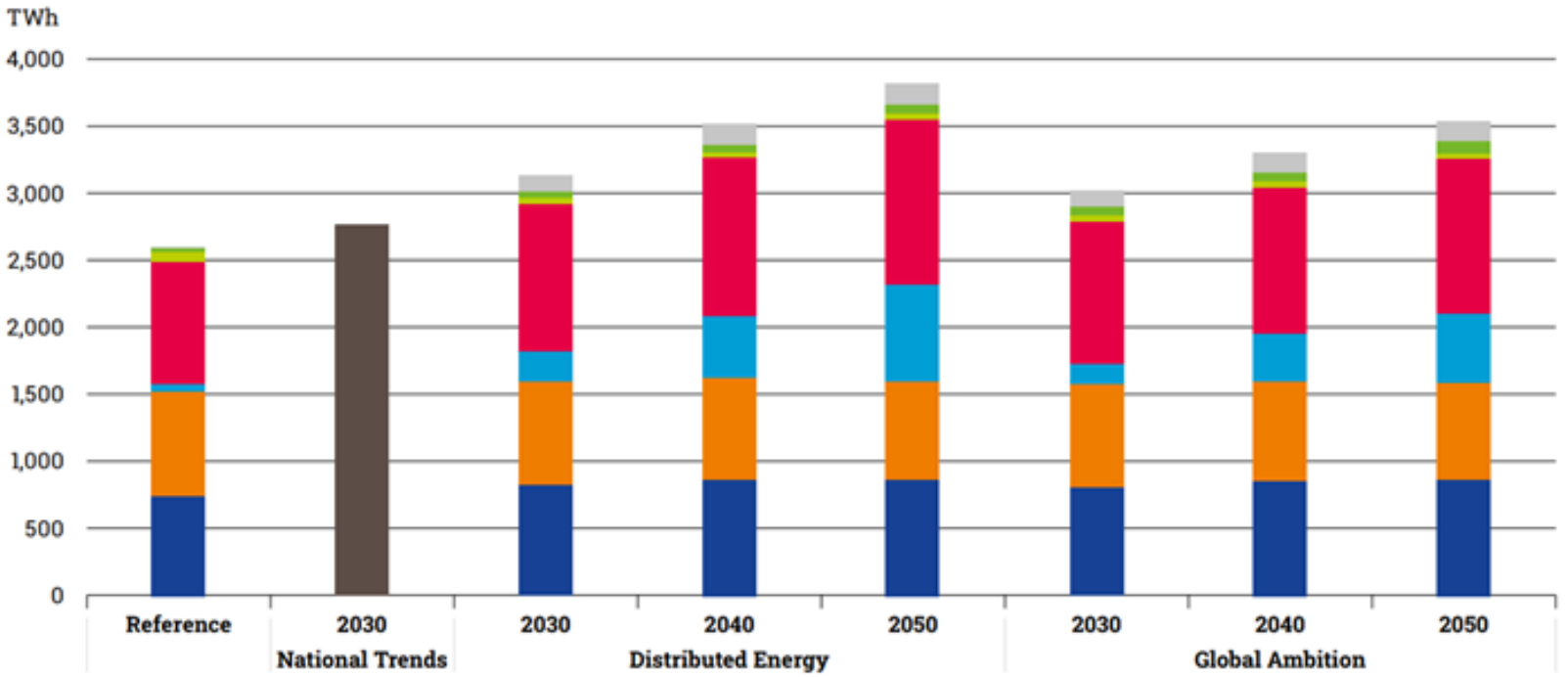
A wider transport perspective



- Decarbonisation of the whole economy requires to go beyond the direct electrification of light road transport with significant and complementary roles for hydrogen (FCEVs) and methane (ICE)

- Decarbonisation of heavy road mobility, shipping and aviation relies on a wide range of technology revolution on the vehicle side and fuel side

Electricity demand

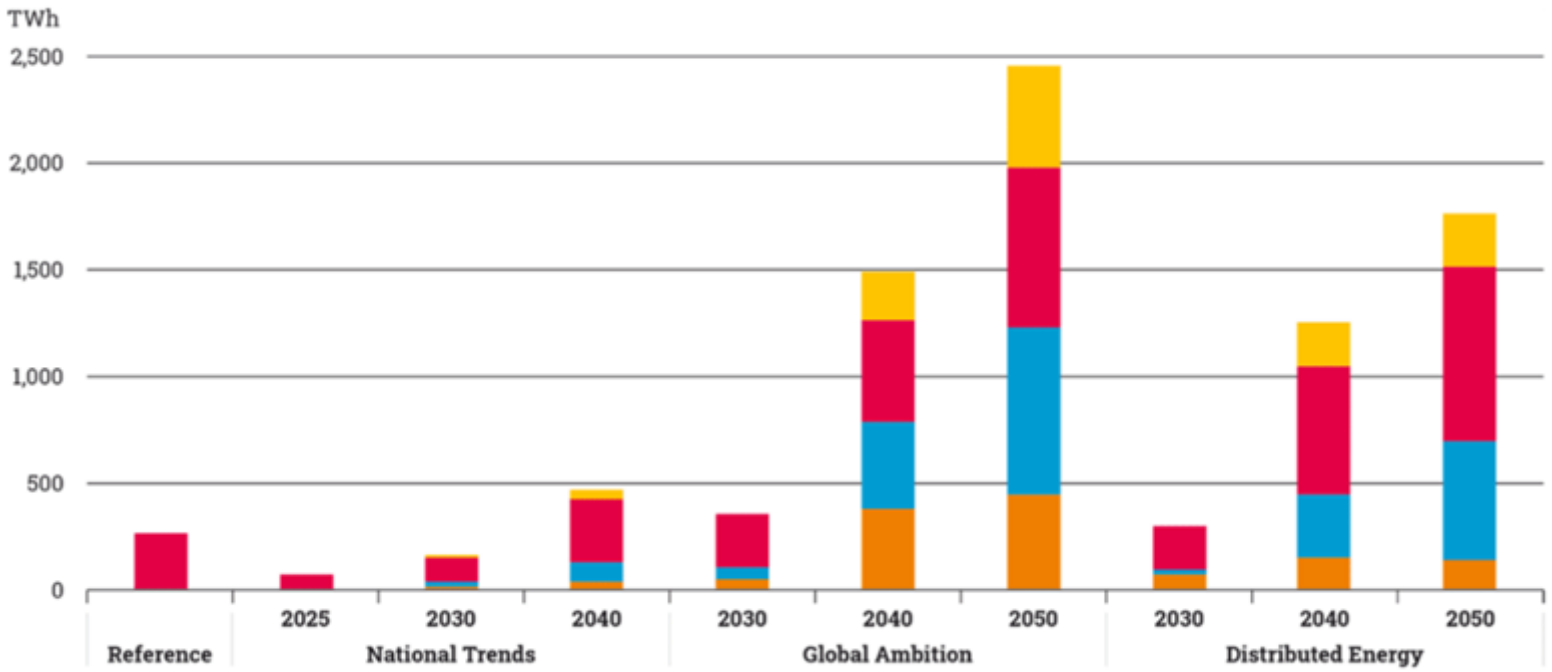


Electricity breakdown by sector

Others · Energy branch · Agriculture · Industry · Transport · Tertiary · Residential

- Final electricity demand increases by 1.4% and 1.8% per a. in Global Ambition and Distributed Energy
- Peak final electricity demand increases slightly faster (DE: +57% vs. +51% and GA: +57% vs. +40%)
- The transport and industrial sectors show both:
  - The largest difference between scenarios with a higher electrification in Distributed Energy
  - Steepest increase: **ten-fold in transport** and around **+30% in the industry**

Hydrogen demand

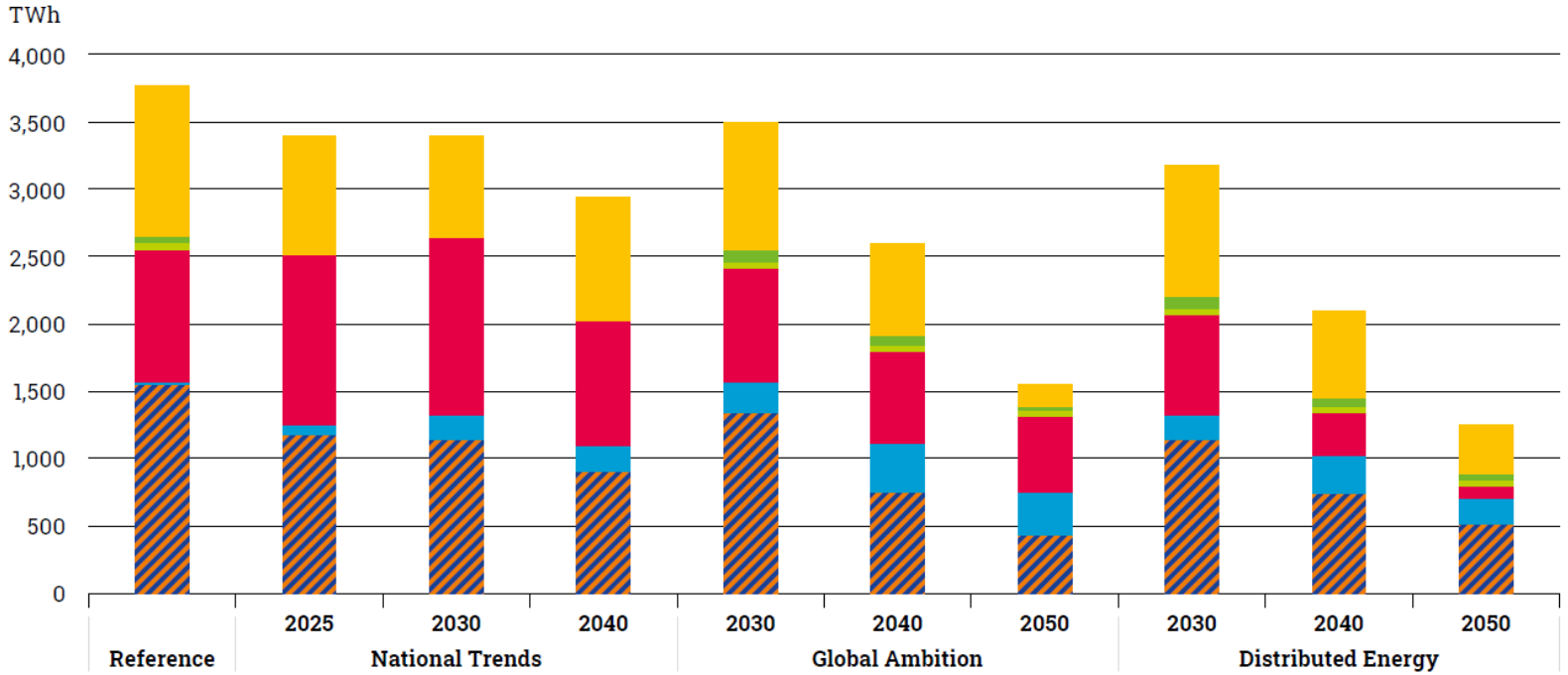


Hydrogen breakdown by sector

Residential & Tertiary | Transport | Industry | Agriculture | Consump. Energy Branch | Power Generation

- By 2030, focus is on decarbonisation of existing H2 production
- **Distributed Energy** shows a **focus** on "hard to abate" sectors: industry and transport (heavy mobility)
- **Global Ambition shows development in a wider range** of sectors including residential and tertiary
- In 2040, hydrogen starts to substitute methane in the power generation sector with new and retrofitted plants

Methane demand



Methane breakdown by sector

Residential & Tertiary
Transport
Industry
Agriculture
Consump. Energy Branch
Power Generation

- Methane demand shows a continuous decrease in all sectors (DE: –66% and GA: –60%) except mobility where it is supported by heavy transport
- Significant transfer of use can be seen towards:
  - Electricity in the residential and tertiary sectors
  - Hydrogen in the industry (aside electricity for low enthalpy heat) and power generation to provide flexible capacity aside RES

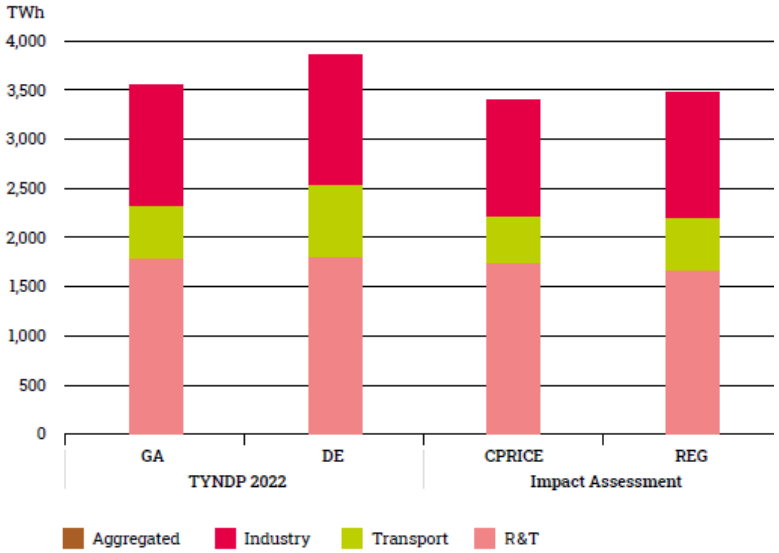
Demand benchmark with EC Impact Assessment

Final energy demand

COP 21 Scenarios are only 4% above EC scenarios

Main difference is in residential and tertiary

Final electricity demand

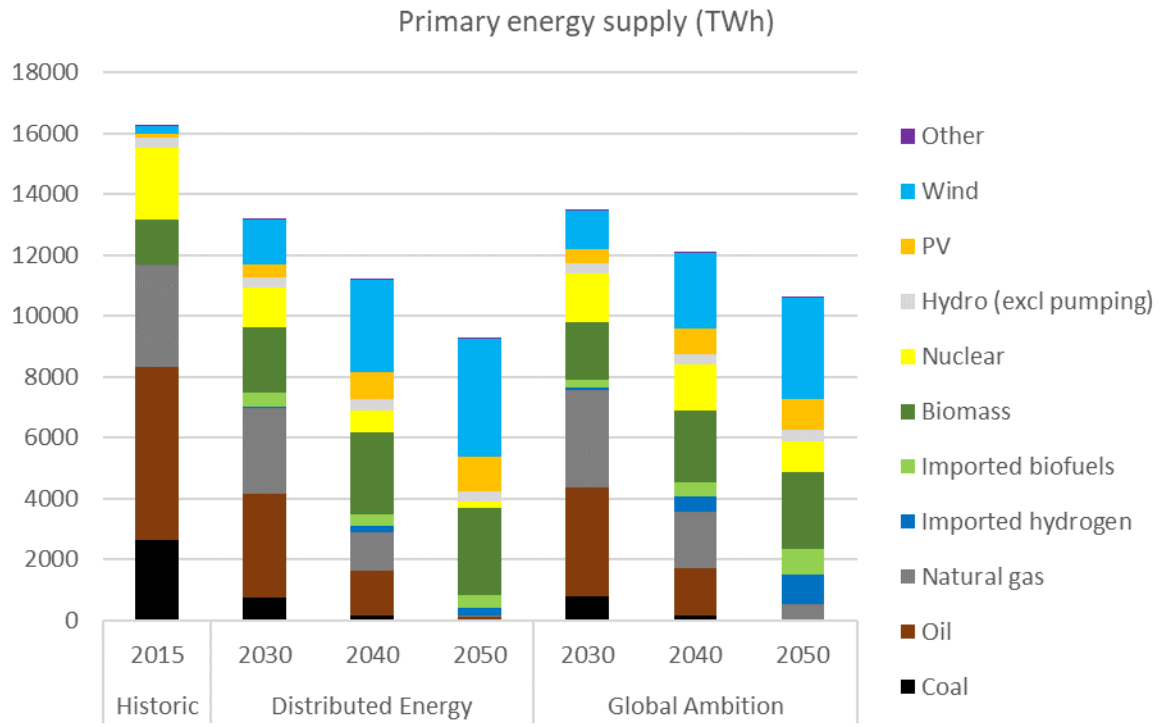


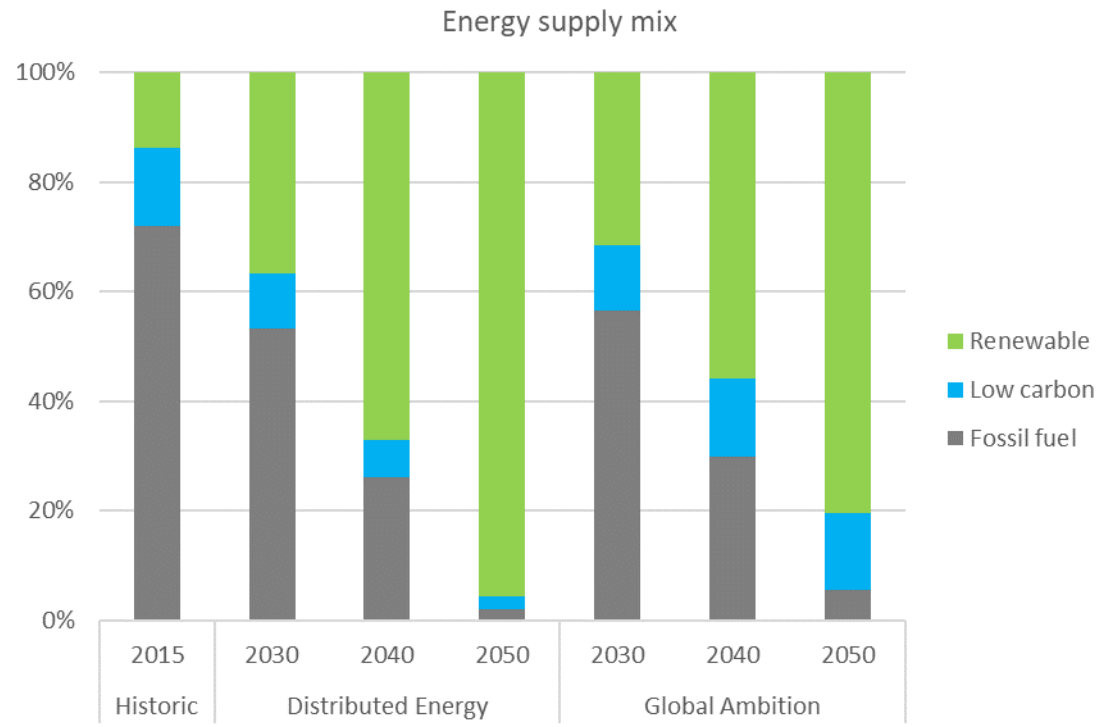
Final electricity demand is slightly higher (DE +10% and GA +5%) illustrating a deeper direct electrification

Supply Figures (inc. Benchmark & imports), Pieter Boersma, Gasunie

Primary energy supply

Primary supply of fossil fuels (oil, coal, natural gas) declines sharply in both scenarios. By 2050 80% to 96% energy supply is renewable.



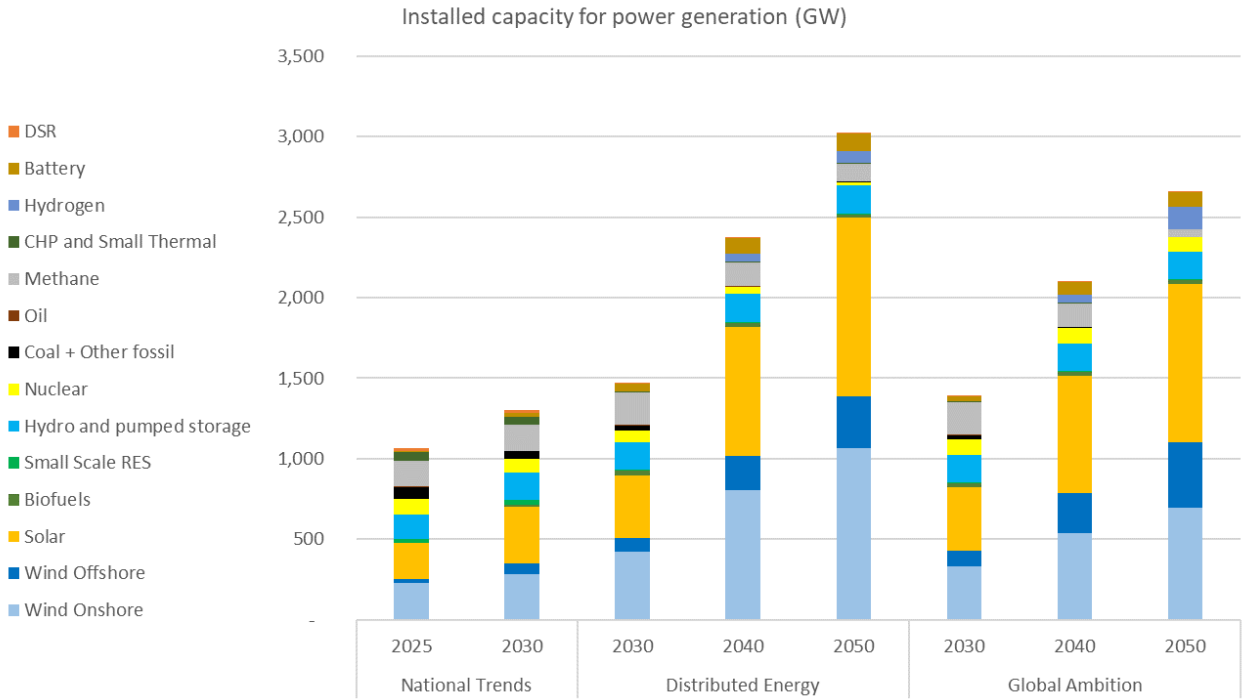


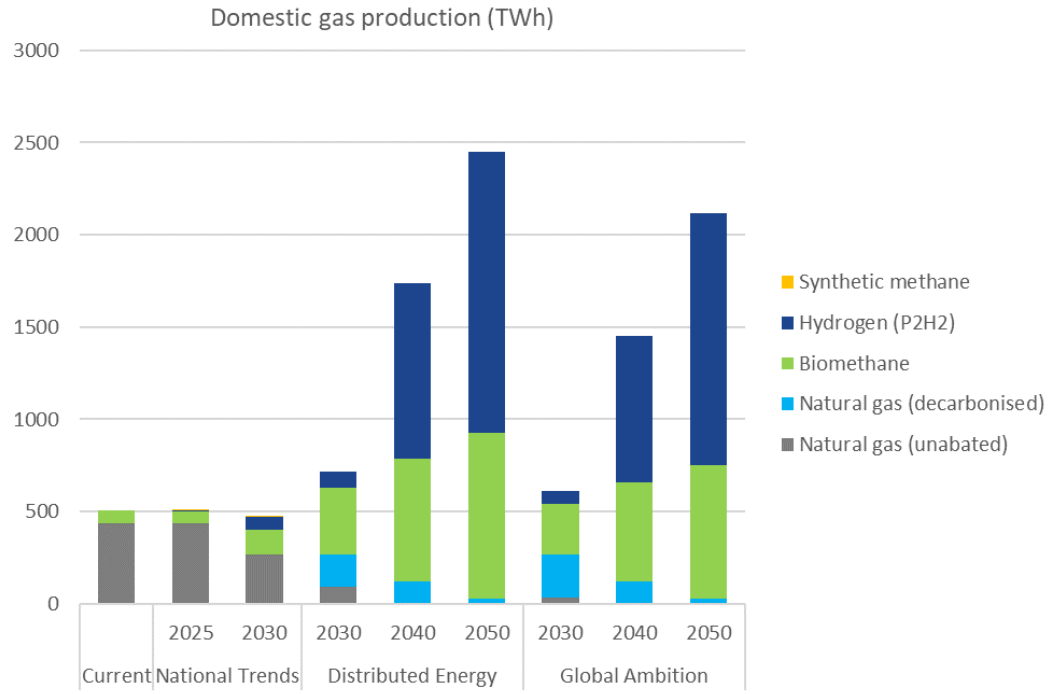
Note: As National Trends scenario is only quantified for gas and electricity, a full energy picture is not available.

Energy production

Ambitious development of renewables across Europe

- Renewable capacities increases significantly in all scenarios. In electricty the capacities for solar and (onshore and offshore) wind increase sharply. Fossil fuels capacities decline.
- Development of biomethane and hydrogen is essential to decarbonise the energy supply. Furthermore, the uptake of renewable electricity enables the production of hydrogen through electrolysis.



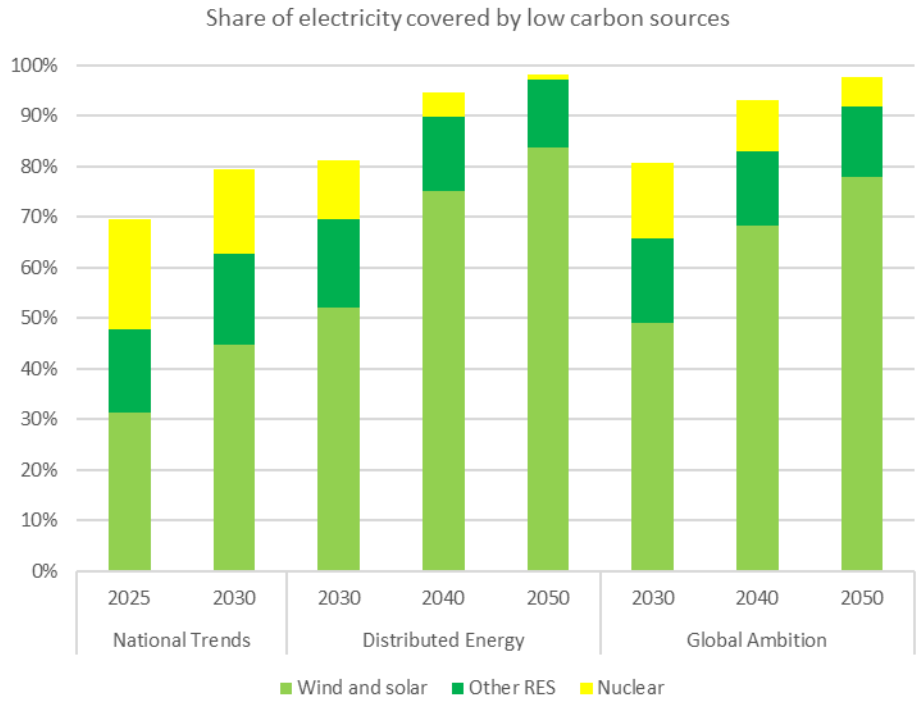


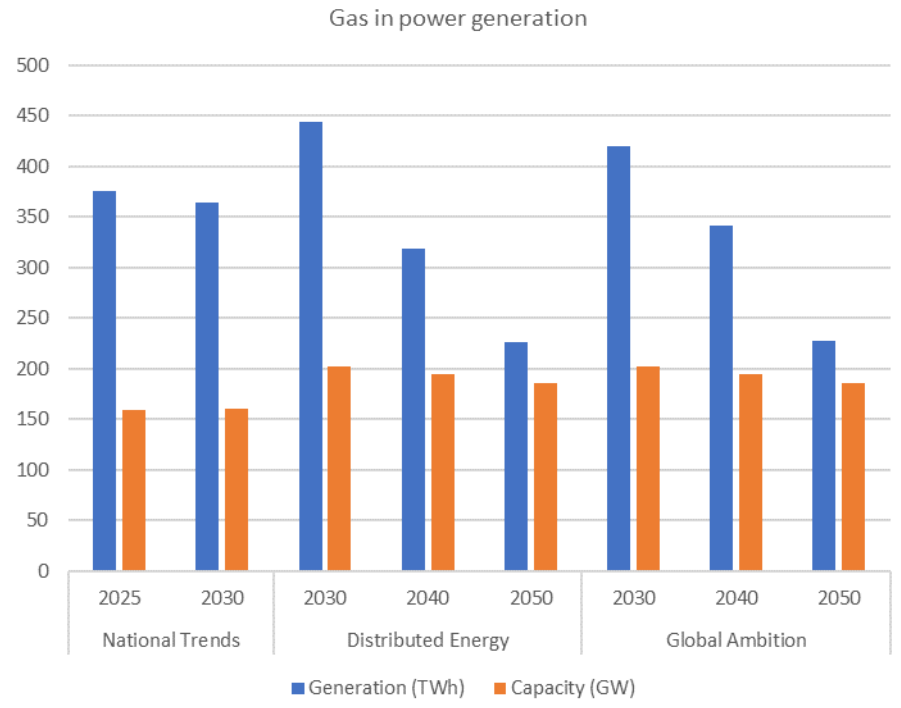
EU electricity and gas production rely on one another to reach carbon neutrality by 2040

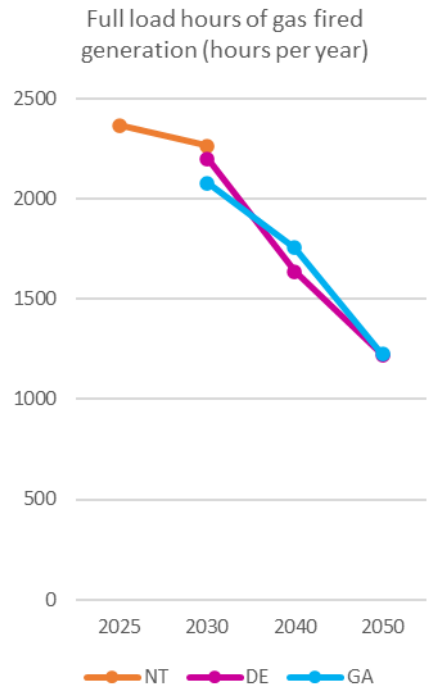
Electricity production

Sector integration can achieve net zero 2050 while ensuring security of supply

- Strong increase of renewable electricity production. Relatively high production from wind, due to high load factor.
- Gas fired capacities remain remain quite stable over time but annual generation reduces. Power plants (methane and hydrogen) and other flexibility options remain essential back-up for variable solar and wind.





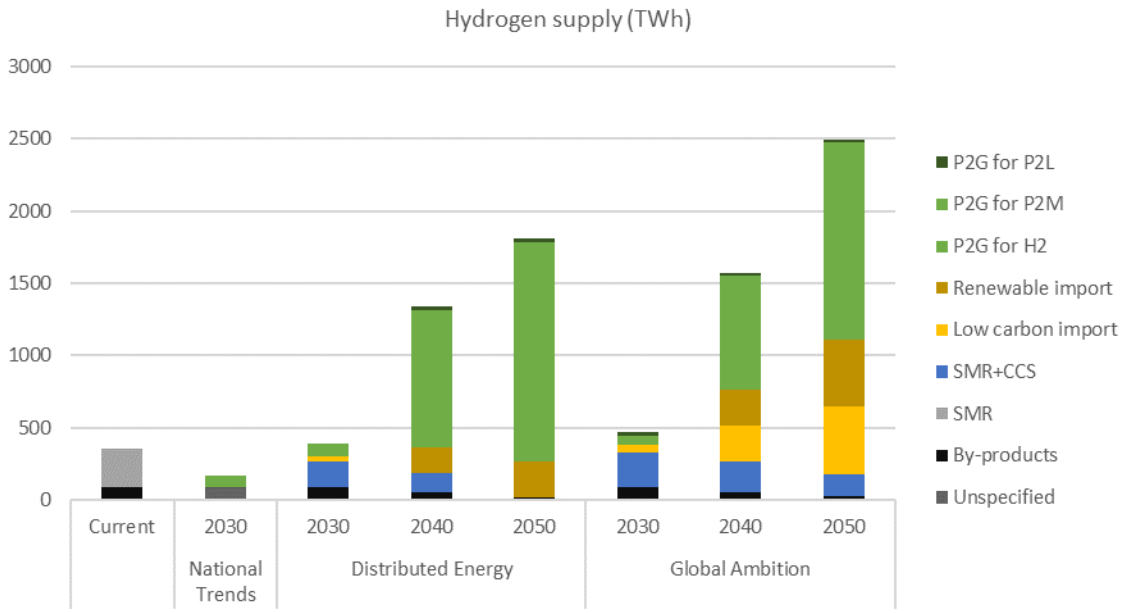


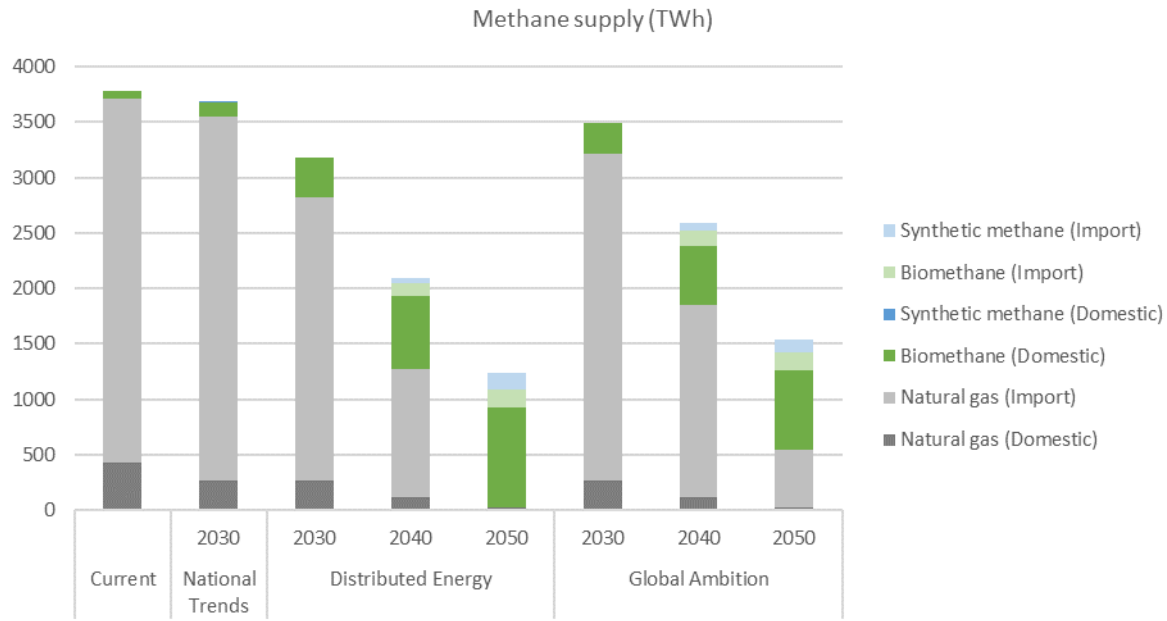
Note: An adequacy assessment is not yet performed at the draft scenario stage. As a result the capacity needed for security of supply might be underestimated

Gas production

Biomethane, hydrogen and renewable electricity are key to unlock the full potential of gas to decarbonise the energy system

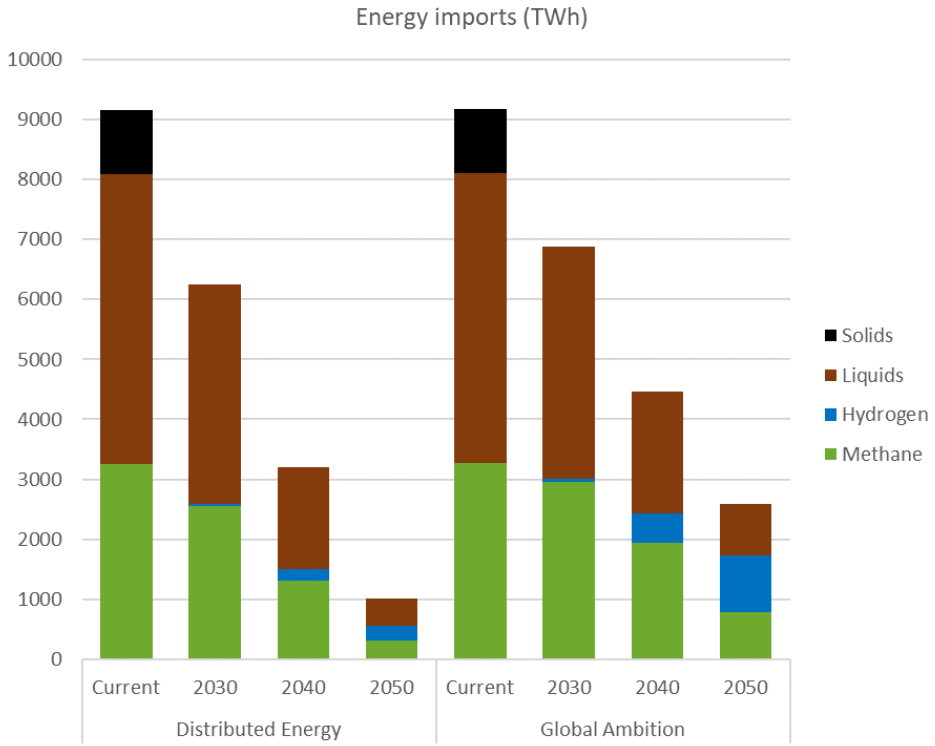
- Production of methane declines over time. Biomethane becomes the main source between 2040 and 2050
- Production of hydrogen increases substantially in both scenarios. Role of conventional production (steam methane reforming) reduces over time, electrolysis and imports increase. Hydrogen becomes the main gaseous energy carrier by 2050

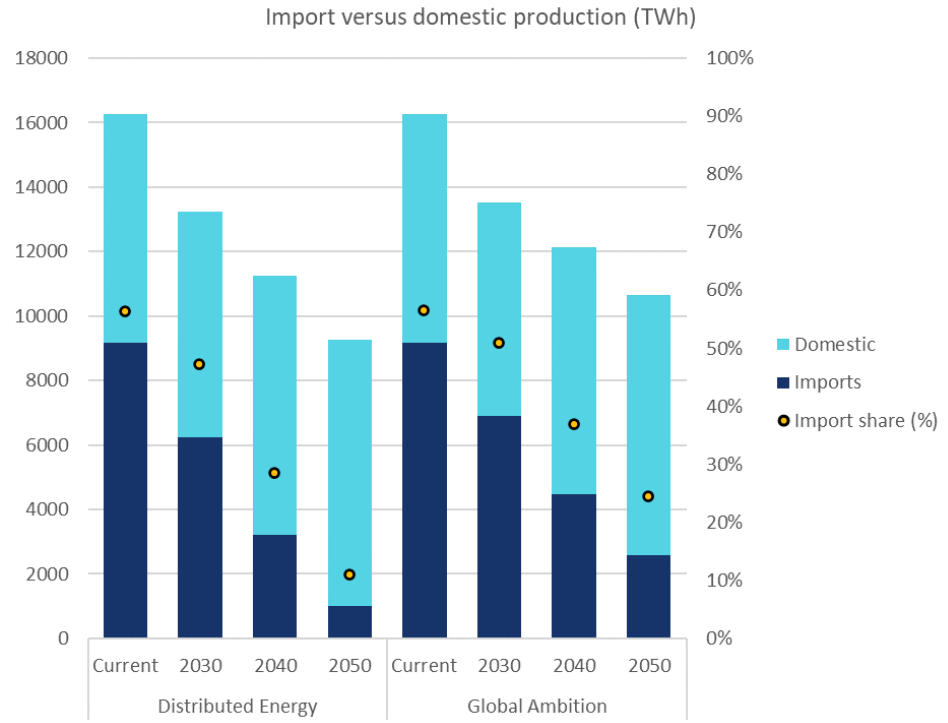




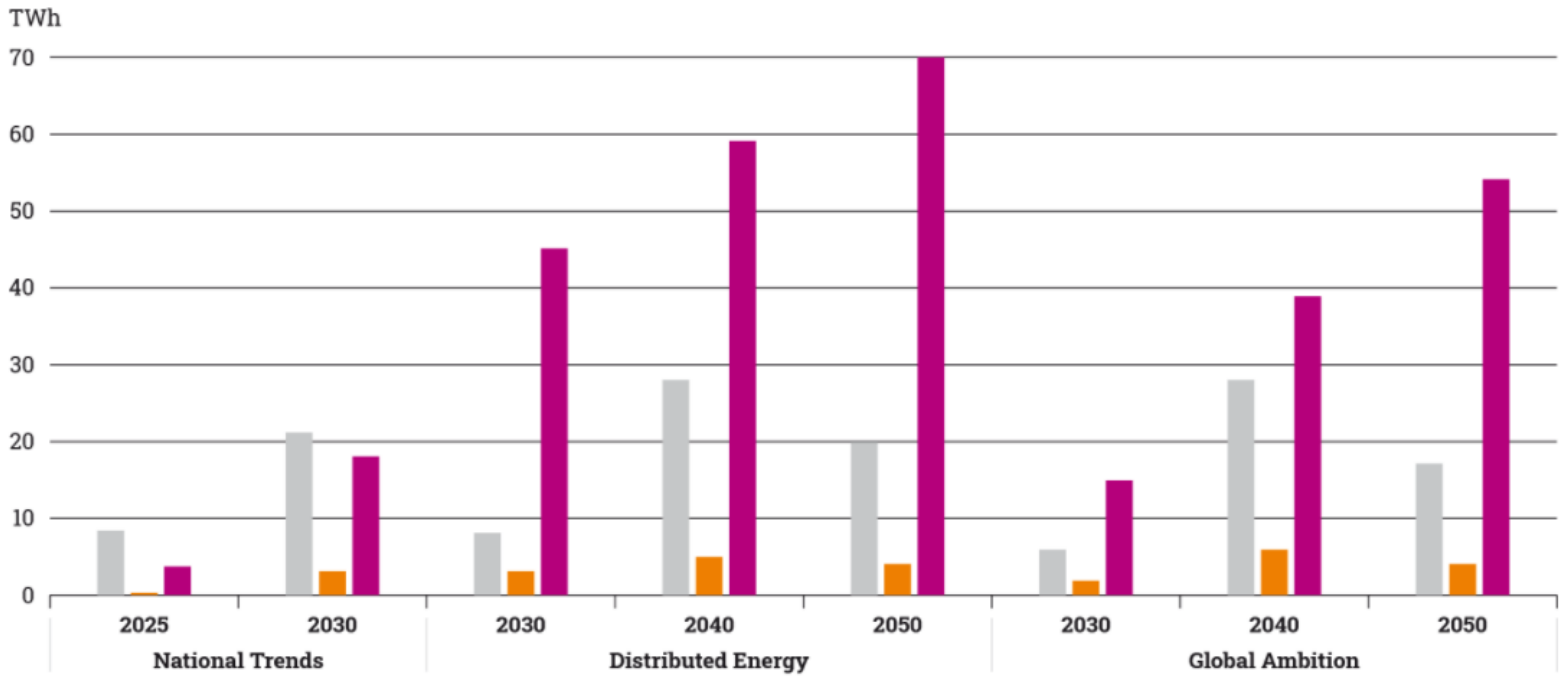
Energy imports

- With decarbonisation objectives and the development of renewables the EU becomes significantly less depedent on energy imports in both COP 21 scenarios.
- Import share in primary energy demand: about 10% Distributed Energy, 25% in Global Ambition.





Flexibility focus



Peaking units DSR Battery

Peaking units: gas and oil OCGT

Battery: utility-scale, prosumer and V2G

- The development of V2G and prosumer behaviour supports the uptake of batteries
- DSM is derived from National Trends 2040; further development is possible, technical insights are welcomed.
- The role of thermal units decreases in terms of delivered energy, but capacity need remains high
- The level of security of supply derives from a assumptions regarding value of lost load (VOLL) in the expansion model.

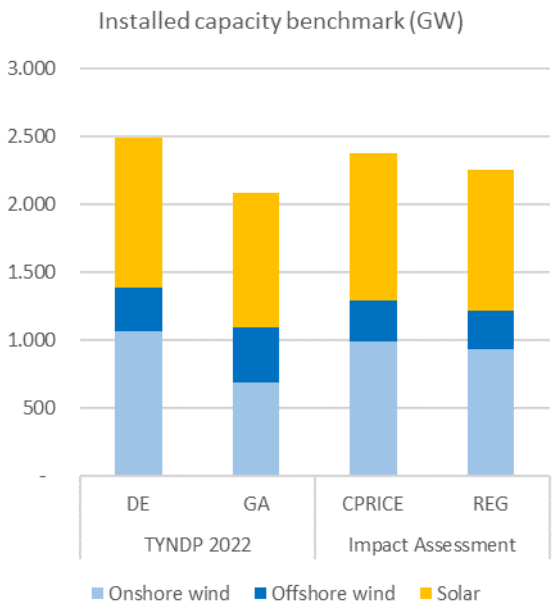
Supply benchmark with EC Impact Assessment

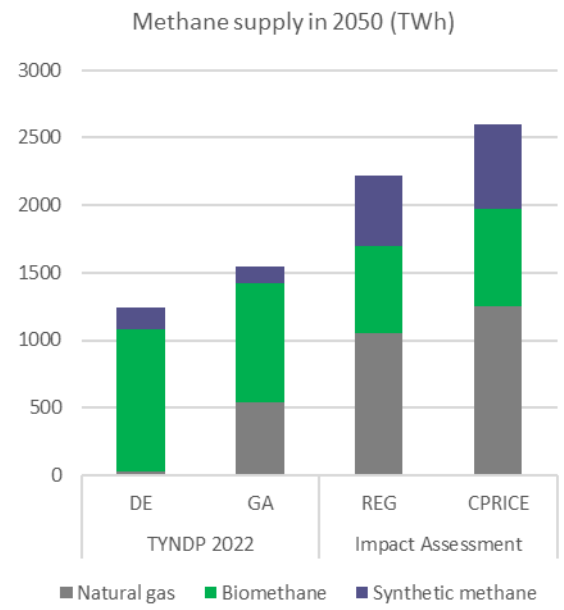
Full system integration can provide efficient decarbonisation solution and reduce import dependence

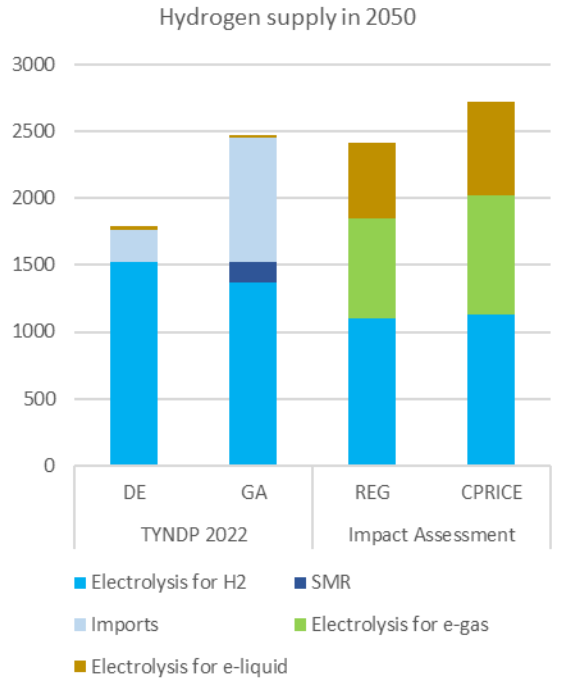
Energy efficiency fosters the development of the hydrogen demand and limits the need for synthetic methane production. A clean hydrogen economy creates opportunities for clean hydrogen imports

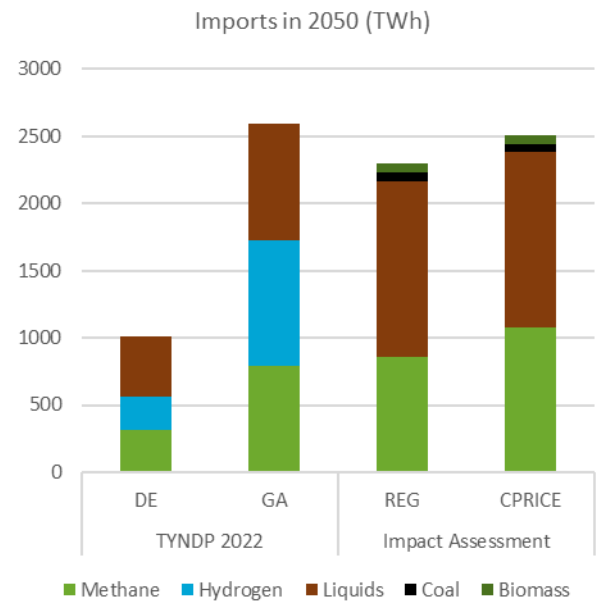
Remaining natural gas imports are 100% abated by 2050

Distributed Energy requires less imports than EC impact assessment scenarios







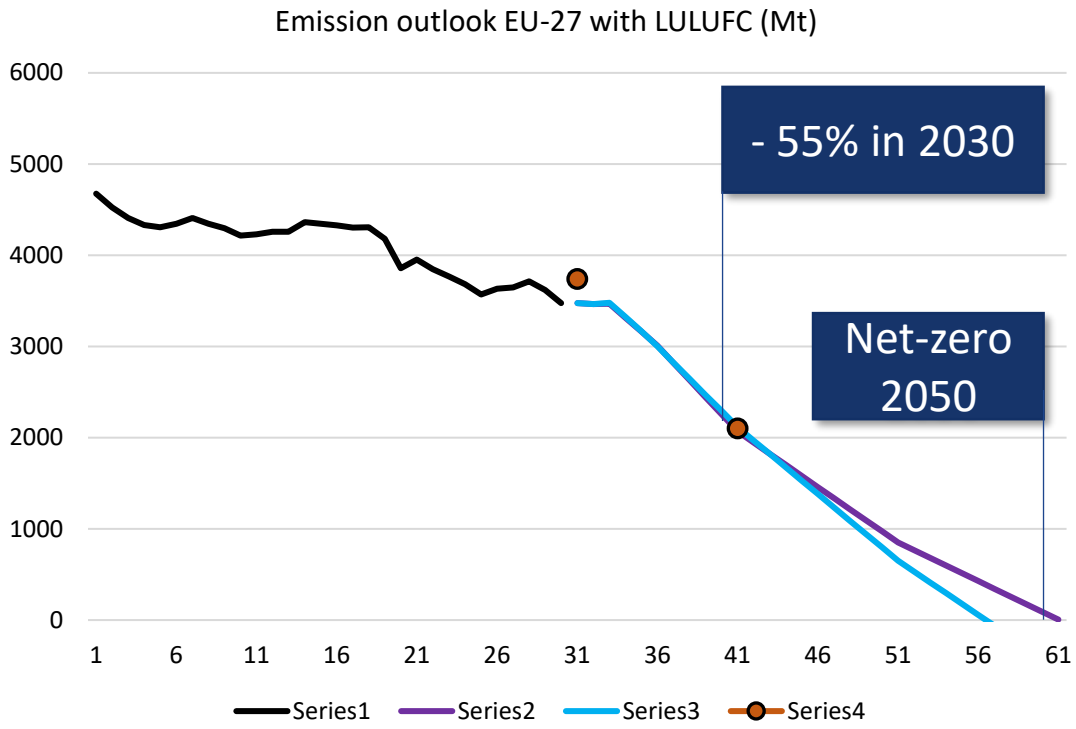


Carbon Budget, Louis Watine, ENTSOG

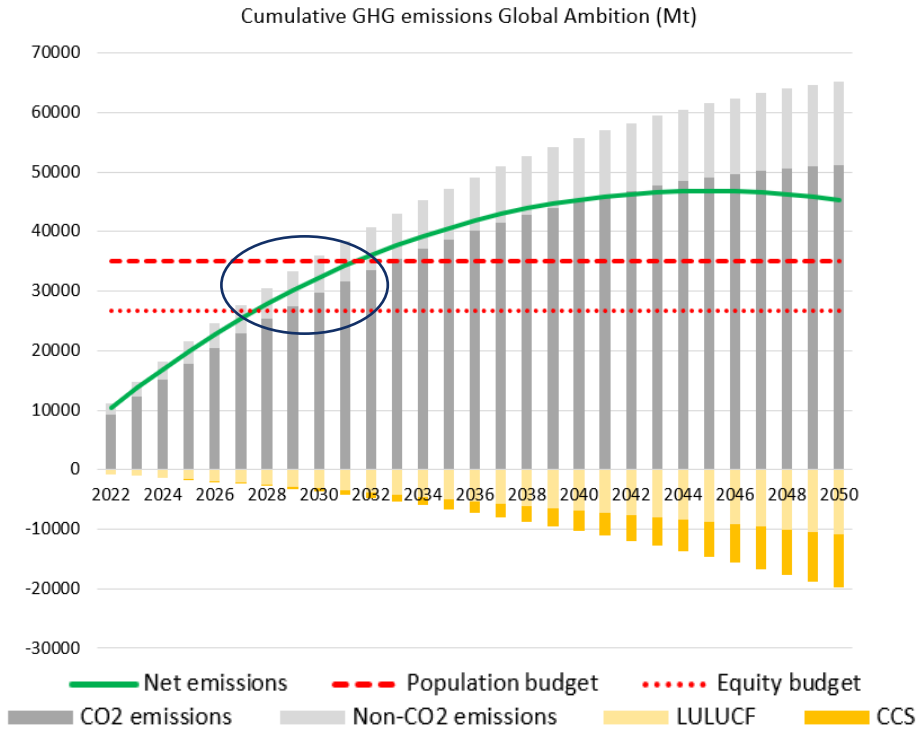
Decarbonisation pathways

Net zero can be achieved by 2050

COP 21 scenarios meet the 2030 targets and reach carbon neutrality by 2050.



Carbon budget overshoot before 2035 seems inevitable.
Technologies to achieve negative emissions (CCS) are essential to meet the COP 21 objectives.

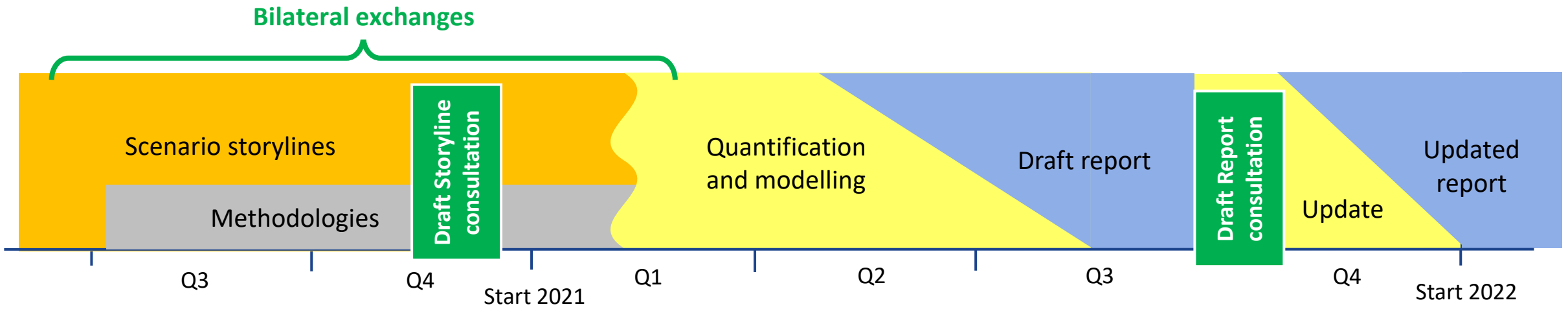


Interactive Session

Next Steps, Nalan Buyuk, ENTSO-E

Next Steps

- Draft TYNDP 2022 Scenario Report has been published on 7th of October.
- With the release of the draft report a public consultation has been launched until 18 November 2021.
- Your comments are greatly welcomed and are considered an essential part of the scenario development process.
- Received feedback will be used to establish the updated scenario report to be submitted for ACER opinion. This updated scenario report is expected to be published in Q1 2022.



Closing Remarks, Louis Watine, ENTSOG