



Distilling critical energy transition features in net-zero scenarios

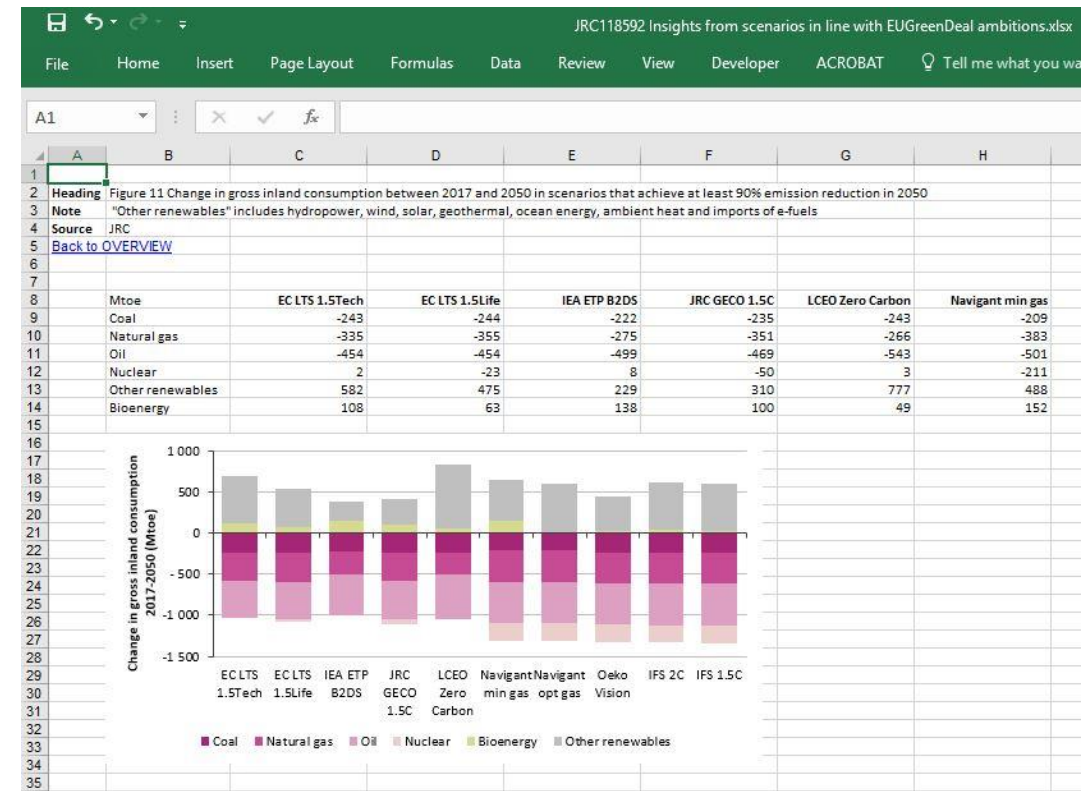
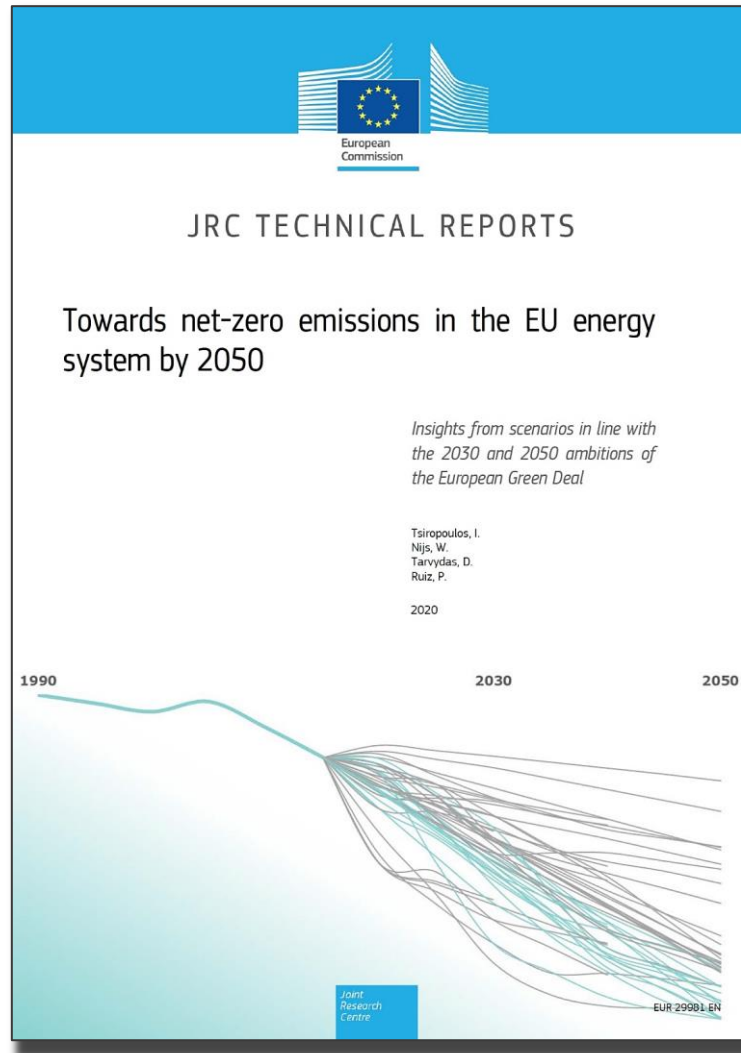
Setting the scene for discussion

Wouter Nijs

JRC.C7, Knowledge for the Energy Union

IRENA LTES Forum, 10 June 2021

Q1. How can scenarios be used to build consensus?



[Data behind the graphs](#), Towards net-zero emissions in the EU energy system by 2050, JRC118592, licensed under CC BY 4.0., © European Union, 1995-2020.

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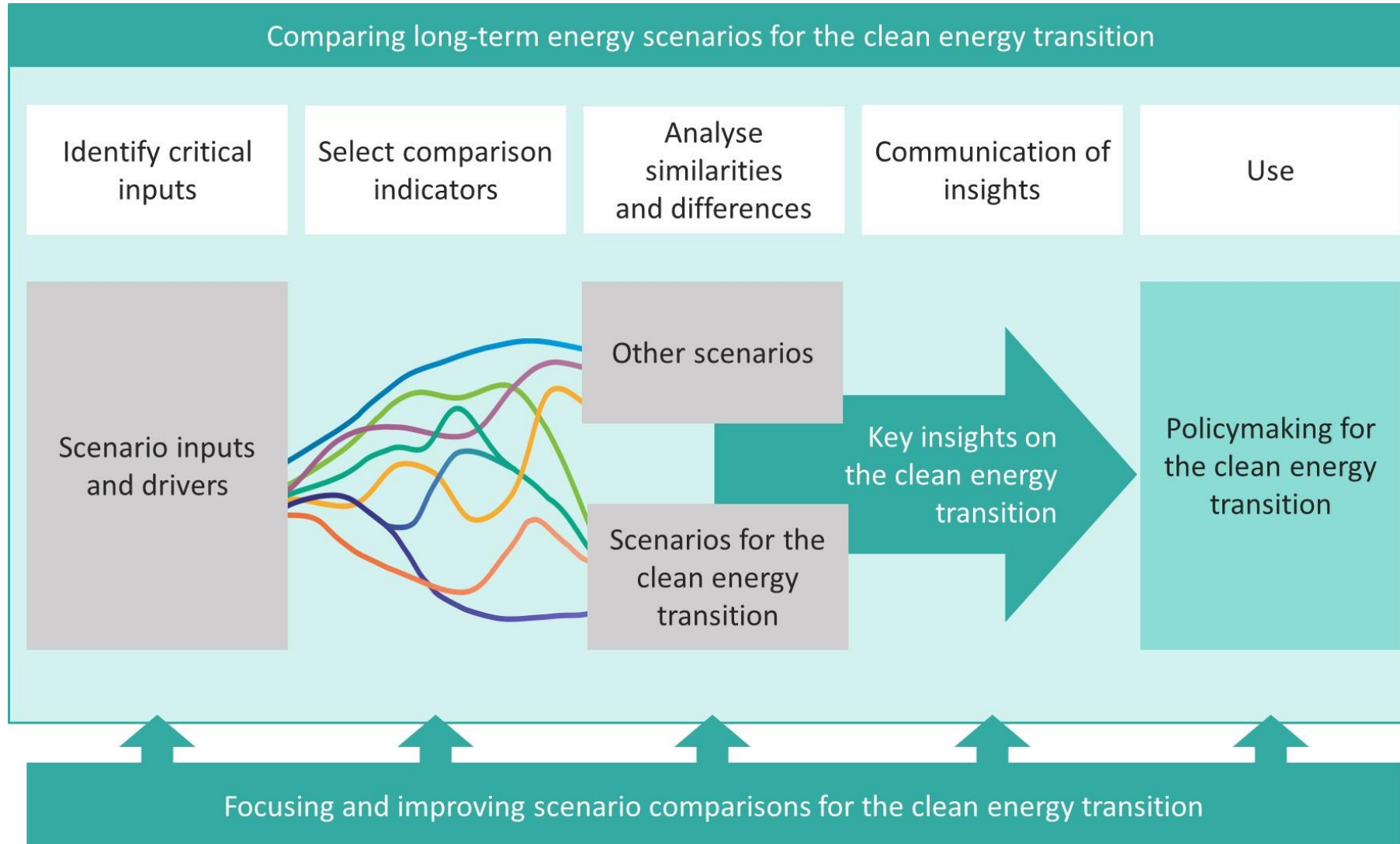
Purposes of scenario building	Purposes of scenario comparison
<ul style="list-style-type: none">● Provide an analysis of expected impacts of new policies <i>(Outlooks, policy scenarios)</i>● Identify pathways to a normative, preferable future <i>(Road mapping, backcasting)</i>● Enable decision making under uncertainty <i>(Narrative-led and plausibility-based)</i>	<ul style="list-style-type: none">● Improve comparability of indicators, narratives and values● Identify commonalities and trade-offs for decision-makers● Explore a range of scenario results from different frameworks

Definitions taken from WEC (2019)

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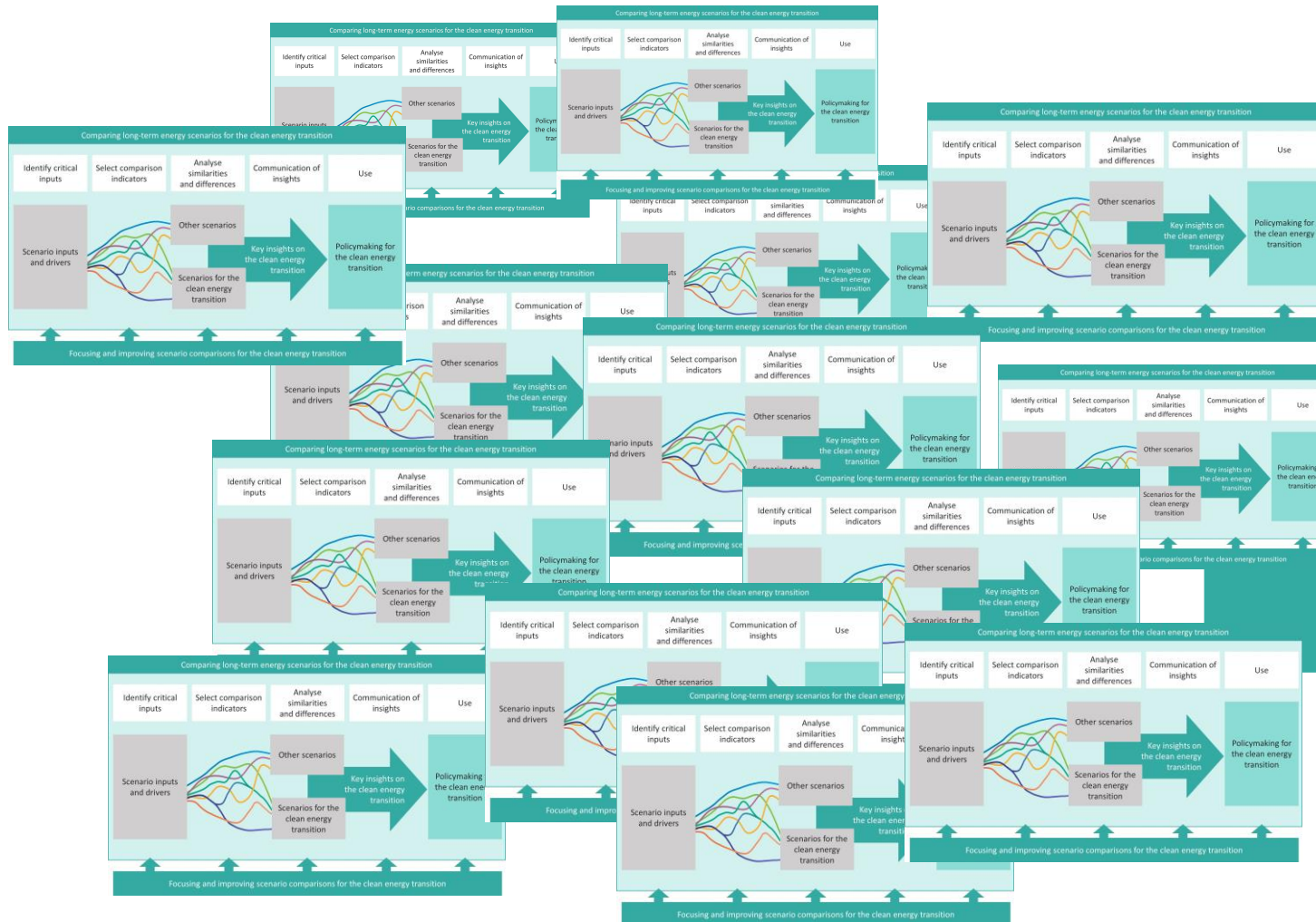
Q1. How can scenarios be used to build consensus?



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Q1. How can scenarios be used to build consensus?



Upcoming report on benchmarking of 14 scenario comparison studies for the clean energy transition

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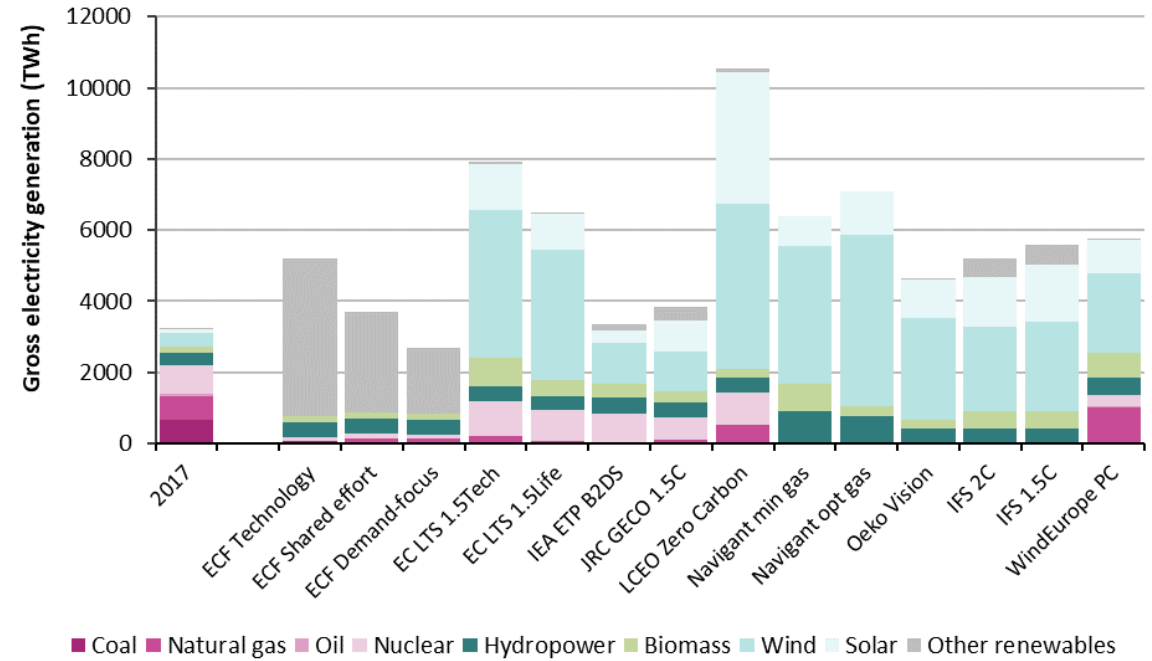
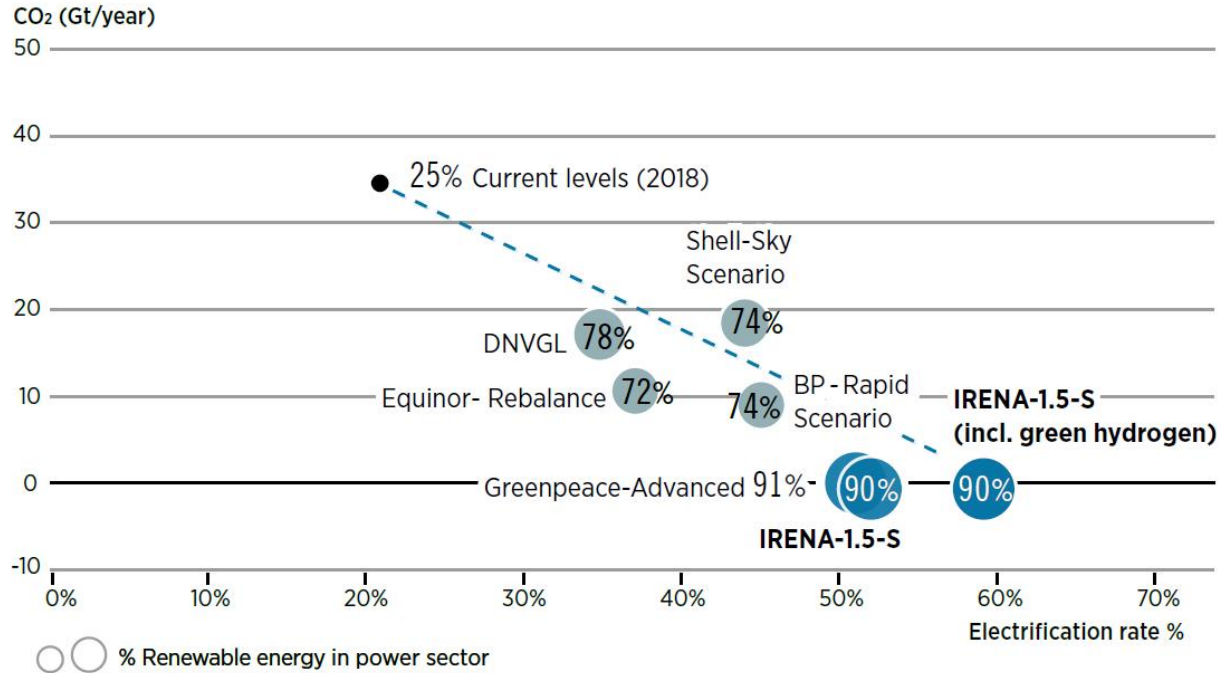
Q2. Critical energy technologies

- Massive **electrification** of end uses
- High shares of **variable renewable** energy in power generation
- An unprecedented scale-up of disruptive technologies
 - New technology mix in transport, led by **electric vehicles**
 - **Low carbon heating systems** in buildings
 - **Hydrogen and derived fuels** becoming a main energy commodity, strongly impacting the growth of wind and solar
- The use of ‘negative emissions technologies’ (NETs), also referred to as **Carbon Dioxide Removal (CDR)** to offset remaining emissions

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Q2. Critical energy technologies



Preview of IRENA (2021), World Energy Transitions Outlook: 1.5 °C Pathway, International Renewable Energy Agency, Abu Dhabi.

Tsiropoulos I., Nijs W., Tarvydas D., Ruiz Castillo P., Towards net-zero emissions in the EU energy system by 2050 - JRC118592.

Q2. Critical socio-economic transition features

- The increasing **complexity** of the energy system
- A fast phase-out of fossil fuels requiring a **speedy regulatory response**
- The necessity to enable investments and deep structural transformations through an integrated planning approach with room for **continuous social dialogue**.
- The necessity for long-term scenarios and policies to focus also on **the near future up to 2030**.

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Q3. Improving scenario development tools

	JRC	bp	dena	BNEF	IIASA	PIK	PBL	RMI	WEC	UoB	NREL	EMF	IEF	RFF	
Main focus	Energy transition and decarbonisation									Not specifically on decarbonisation					
Total supply															
1 Total supply of energy	Quantitative	Quantitative	Qualitative	Quantitative	Quantitative	Quantitative	Quantitative	Qualitative	Quantitative	Qualitative	Qualitative	Qualitative	Quantitative	Quantitative	
2 Coal, oil and natural gas	Quantitative	Quantitative	Qualitative	Quantitative	Quantitative	Quantitative	Quantitative	Qualitative	Quantitative	Qualitative	Qualitative	Quantitative	Quantitative	Quantitative	
3 Biofuels	Quantitative	Qualitative	Qualitative	Qualitative	Quantitative	Quantitative	Quantitative	Qualitative	Quantitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	
4 Share of renewables	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Qualitative	Quantitative	Qualitative	Quantitative	Qualitative	Quantitative	Quantitative	
Power															
5 Electricity by fuel	Quantitative	Qualitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Qualitative	Quantitative	Qualitative	Qualitative	Quantitative	Qualitative	Quantitative	
6 Share variable renewables	Quantitative	Qualitative	Quantitative	Quantitative	Quantitative	Quantitative	Qualitative	Qualitative	Quantitative	Qualitative	Quantitative	Quantitative	Qualitative	Quantitative	
7 Power-to-X capacity	Qualitative	Qualitative	Quantitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	

Legend Quantitative comparison Qualitative comparison or based on only one range

SUPPLY

POWER

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Q3. Improving scenario development tools

Main focus	JRC	bp	dena	BNEF	IIASA	PIK	PBL	RMI	WEC	UoB	NREL	EMF	IEF	RFF	
	Energy transition and decarbonisation									Not specifically on decarbonisation					
Demand															
8 Zero-emission vehicles	Quantitative		Quantitative			Quantitative			Quantitative				Quantitative		
9 Electric or district heating in buildings	Quantitative		Quantitative			Quantitative									
10 Sectoral use of biofuels	Quantitative		Quantitative		Quantitative	Quantitative		Qualitative	Quantitative				Quantitative	Quantitative	
11 Sectoral use of hydrogen and e-fuels	Quantitative	Qualitative	Quantitative		Quantitative	Quantitative			Qualitative	Quantitative					
12 Low carbon materials								Qualitative							
Energy efficiency															
13 Reduction of final energy	Quantitative				Quantitative	Quantitative	Quantitative		Quantitative						
14 Electrification final energy	Quantitative	Qualitative			Quantitative		Quantitative								
15 Building renovation	Qualitative		Quantitative			Quantitative									
16 Behavioral and modal shifts	Quantitative					Quantitative									

Legend Quantitative comparison Qualitative comparison or based on only one range

DEMAND

EE

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Q3. Improving scenario development tools

	JRC	bp	dena	BNEF	IIASA	PIK	PBL	RMI	WEC	UoB	NREL	EMF	IEF	RFF	
Main focus	Energy transition and decarbonisation									Not specifically on decarbonisation					
Emissions															
17 CO2 emissions	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative	Quantitative					Quantitative
18 CO2 utilisation		Qualitative			Quantitative	Quantitative									
19 CO2 sequestration	Quantitative	Quantitative			Quantitative	Quantitative	Qualitative								
20 Afforestation and other natural carbon sinks		Qualitative			Quantitative	Quantitative									
21 CO2 removal technologies (neg. emissions from DAC or BECCS)	Quantitative	Qualitative	Quantitative		Quantitative	Quantitative	Quantitative	Qualitative	Qualitative						Quantitative
Costs															
22 Cost of electricity				Quantitative							Quantitative	Quantitative			
23 System cost		Qualitative	Quantitative		Quantitative										
24 CO2 price					Quantitative							Qualitative			

Legend

Quantitative comparison

Qualitative comparison or based on only one range

EMISSIONS

COST

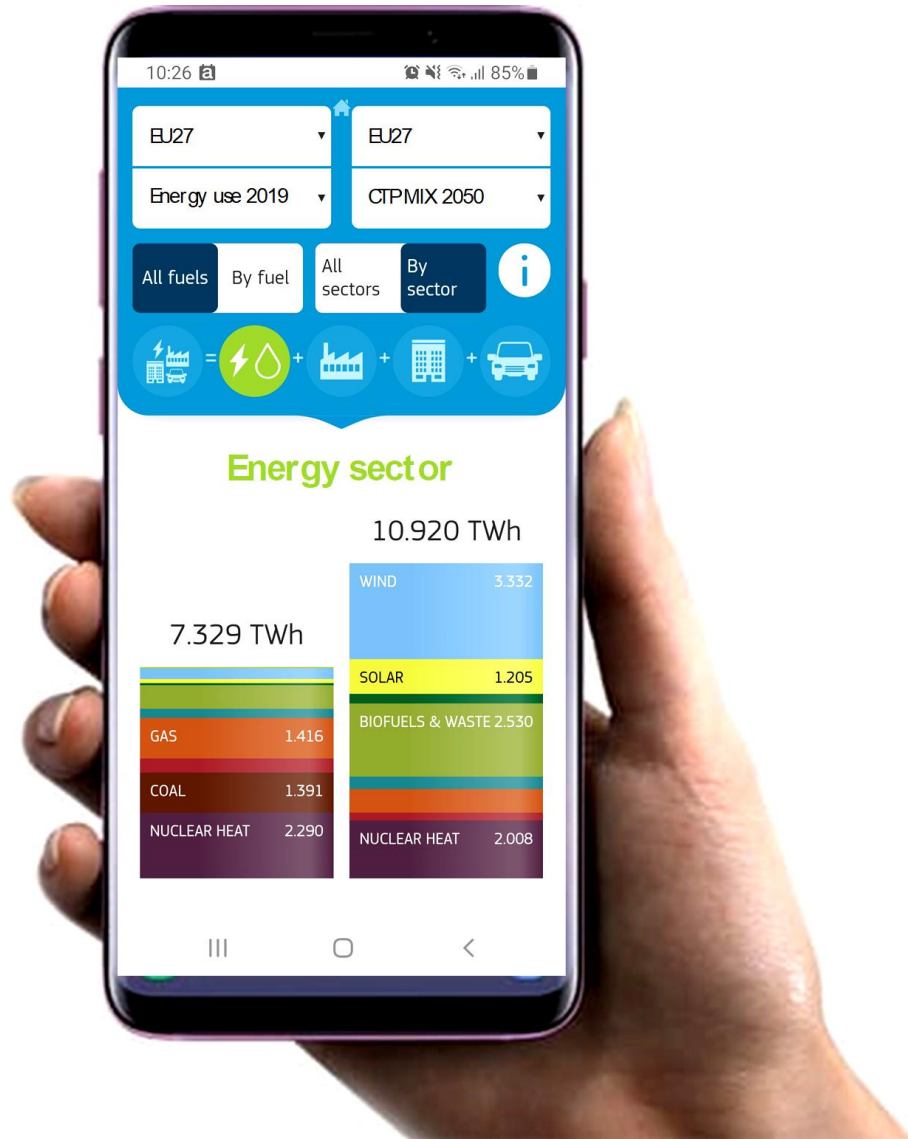
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Q3. Improving scenario development tools

Supply indicators	Demand indicators	Cost and emissions indicators
<ul style="list-style-type: none">• Biofuel feedstock• Power-to-x capacity• Material flow needs	<ul style="list-style-type: none">• Zero-emission vehicles• Electrification of final energy• Heating systems of buildings• Consumer behaviour	<ul style="list-style-type: none">• CO2 reuse or sequestration• Afforestation or other natural carbon sinks• Investment cost and finance gaps
Limits of what is possible		How technology options are traded off against each other
<ul style="list-style-type: none">• How fast sectors can grow ?• How much can be electrified ?• How easy climate-neutral fuels can be supplied ?• What role consumers can play in technology uptake ?• How much natural carbon sinks can contribute and what impact carbon budgets have ?• What are the limits of financing ?		<ul style="list-style-type: none">• Electrification versus the use of green hydrogen or derived fuels• Natural gas with CCS versus upscaling renewables and electricity storage• Public transport versus private electric vehicles

Q3. Improving scenario development tools



- Upcoming JRC interactive tool
- Visualise energy scenarios to create awareness and to inform about the European Green Deal
- Mobile first
- Compare scenarios, countries and changes over time

Keep in touch



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Thank you



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