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Benchmarking Scenario Comparisons: Key indicators for the clean energy transition

Speakers:

- Wouter Nijs, Researcher – Knowledge for the Energy Union Unit, European Commission JRC
- Nadeem Goussous, Associate Professional – Clean Energy Transition Scenarios and Network, IRENA

TUESDAY, 14 DECEMBER 2021 •

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International Renewable Energy Agency

SPEAKERS

Nadeem Goussous

Clean Energy Transition
Scenarios and Network

IRENA

Wouter Nijs

Knowledge for the
Energy Union Unit

European Commission JRC

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Background

LTES
LONG-TERM ENERGY SCENARIOS

LTES LONG-TERM SCENARIOS FOR THE ENERGY TRANSITION
AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

Country members

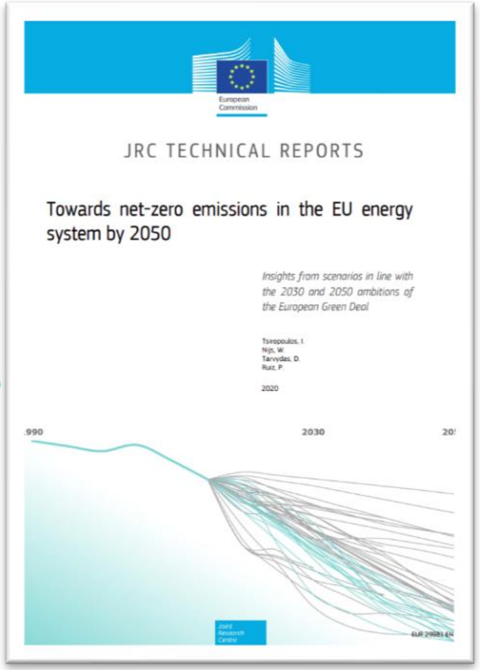
Technical partners

GET.transform
United Nations Climate Change
CNREC China National Renewable Energy Centre
World Resources Institute
JISEA Joint Institute for Strategic Energy Analysis
World Energy Council
iea International Energy Agency
ИНЭИ РАН
国家电网有限公司 State Grid Corporation of China
European Commission
The European Commission's science and knowledge service
Joint Research Centre
RSE Ricerca Sistema Energetico
etsap

European Commission

The European Commission's science and knowledge service

Joint Research Centre


JRC TECHNICAL REPORTS

Towards net-zero emissions in the EU energy system by 2050

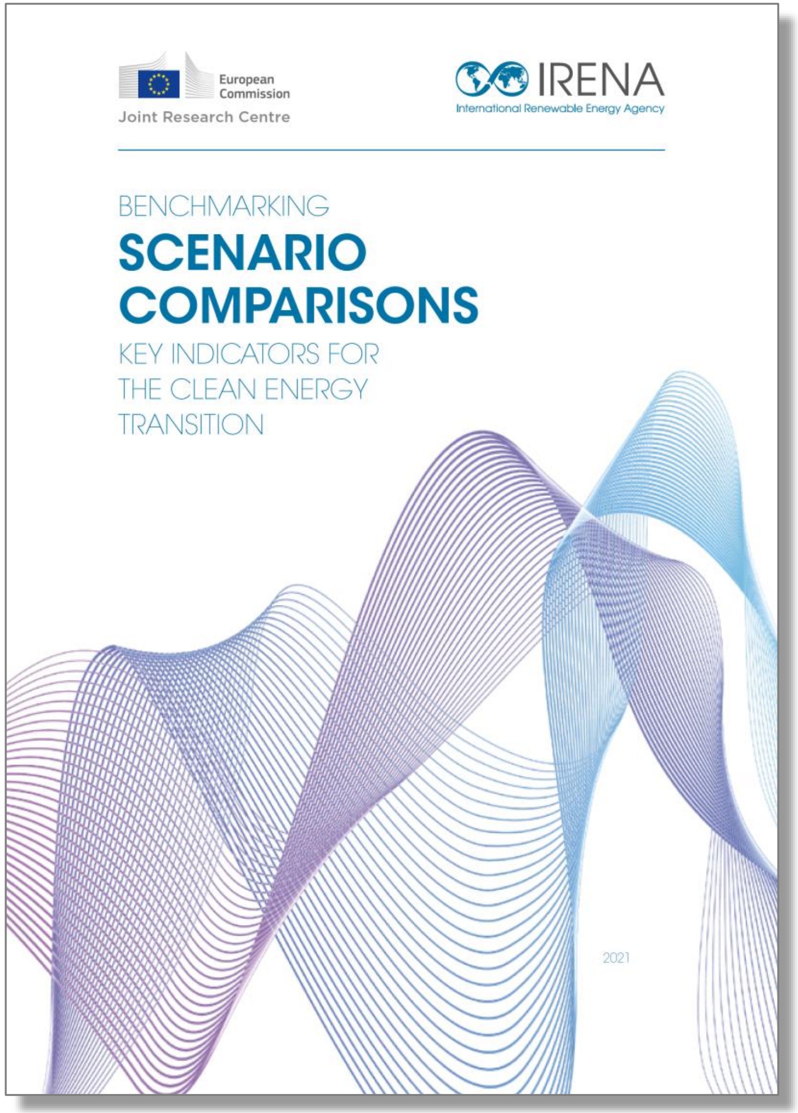
Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal

Tsiropoulos, I.
Nijs, W.
Tarvydas, D.
Ruiz, P.

2020

Comparison of 16 decarbonization scenarios

What made us write this report



Expert insights

William Zimmern
bp

Christoph Jugel
German Energy Agency (dena)

Seb Henbest
BloombergNEF (BNEF)

Sheila Samsatli
University of Bath (UoB)

Trieu Mai
National Renewable Energy Laboratory (NREL)

Anahi Molar-Cruz
Technical University of Munich (TUM)

Christof van Agt
International Energy Forum (IEF)

James Newcomb
Rocky Mountain Institute (RMI)

Daniel Raimi
Resources for the Future (RFF)

Jürgen Kropp
Potsdam Institute for Climate Impact Research (PIK)

Edward Byers
Institute for International Applied Systems Analysis (IIASA)

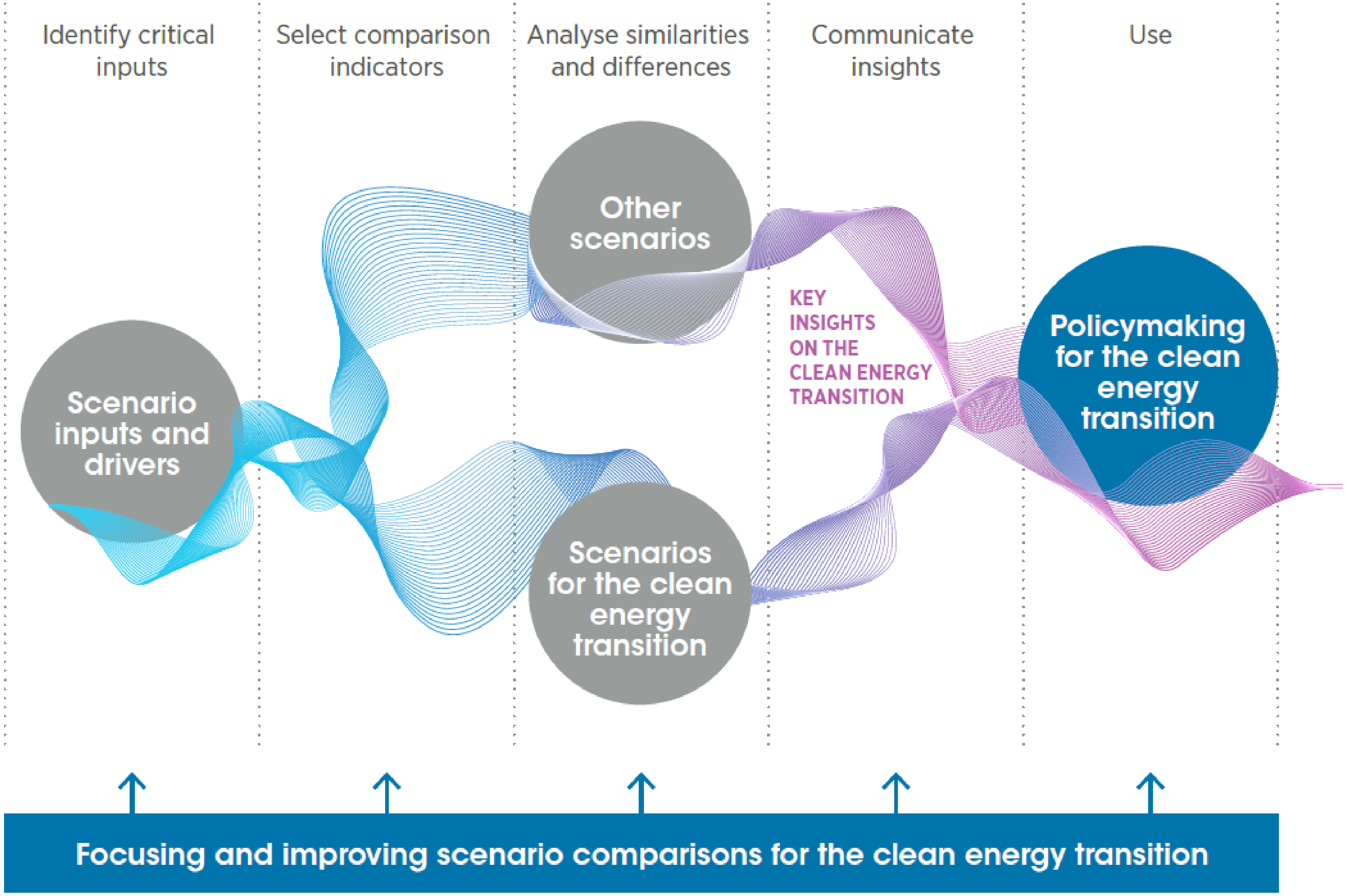
Andries Hof
Netherlands Environmental Assessment Agency (PBL)

Anastasia Belostotskaya
World Energy Council (WEC)

Wouter Nijs
Joint Research Centre (JRC)

Asami Miketa
International Renewable Energy Agency (IRENA)

Comparing LTES for the clean energy transition



Source: JRC and IRENA

Christof van Agt

International Energy Forum (IEF)

"Comparing scenarios is not about creating consensus, but making sure there is a valid and good intercomparison of different viewpoints."

Trieu Mai

National Renewable Energy Laboratory (NREL)

"There is an underestimate of change in the business-as-usual scenarios and perhaps an over-optimism of technology success in the policy-driven scenarios."

Assumptions and indicators that need more focus

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Assumptions and indicators that need more focus

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

● Quantitative comparison
◐ Qualitative comparison or based on only one range
○ Not compared

Source: JRC and IRENA

Seb Henbest

BloombergNEF (BNEF)

"Scenarios differ in their assumption of what is impossible. Trading off renewable energy production against other land uses will have to become mainstream."

Assumptions and indicators that need more focus

Assumptions	Limits of what is possible	• How fast sectors can grow • How much can be electrified • How easily 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 may have • What are the limits of financing
	Technology trade-offs	• Electrification versus the use of green hydrogen or derived fuels • Natural gas with carbon capture and storage (CCS) versus upscaling renewables and electricity storage • Public transport versus private electric vehicles

Source: JRC and IRENA

Jürgen Kropp

Potsdam Institute for Climate Impact Research (PIK)

"When it comes to energy scenarios, we can make a lot of choices in various sectors, but it is important to focus on the co-benefits and trade-offs involved."

Assumptions and indicators that need more focus

Indicators	Supply	• Biofuel feedstock • Power-to-X capacity • Material flow needs
	Demand	• Zero-emission vehicles • Electrification of final energy • Heating systems in buildings • Consumer behaviour
	Cost and emissions	• CO_2 reuse or sequestration • Afforestation or other natural carbon sinks • Investment cost and finance gaps

Source: JRC and IRENA

Christoph Jugel

German Energy Agency (dena)

"Building renovation rates are around 1%, but more interestingly they have been around 1% for three decades now while during the same period, studies have been saying that they have to go up to 2%."

Insights for the clean energy transition - SIMILARITIES

- **Renewable energy** as backbone of the transition
- Massive **electrification** of end uses
- The increasing **complexity** of the energy system
- A rapid **phase-out of fossil fuels** and regulatory response
- An unprecedented **scale-up of electric vehicles, hydrogen and low-carbon heating systems**
- An **integrated planning** approach with room for continuous social dialogue
- **Focus on the near future** up to 2030

Insights for the clean energy transition - DIFFERENCES

- The **extent of energy efficiency improvements** and the reduction of final energy demand
- The roles of **CCUS and natural gas**
- The degree to which **carbon-neutral fuels**, derived from electricity, replace fossil fuels
- The level of emission offsets from **carbon dioxide removal**, linked to the speed of emission mitigation
- The **speed** at which technologies are scaled up
- The role of **small modular nuclear reactors**

Andries Hof
Netherlands Environmental Assessment Agency (PBL)

"Most of the differences identified when comparing scenarios are explained by political choices, not model uncertainties."

14 scenario comparison studies in 1 chapter

1. Towards net-zero emissions in the EU energy system by 2050 – JRC, 2020

- By 2050, climate scenarios project the vehicle stock to be 65-90% zero-emission vehicles and carbon removal

2. Energy Outlook 2020 – bp, 2020

- **Hydrogen in the Net Zero scenario could provide around 15% of total final energy consumption.** It is used in all sectors of the

3. Focusing expertise, shaping policy – energy transition now! Essential findings of the three baseline studies into the feasibility of the energy transition by 2050 in Germany – ESYS, BDI and dena, 2018

SCOPE: Whole energy system – Germany

AIM: To compare three fundamental 2050 studies on the feasibility of the energy transition target in Germany, to learn from differences in assumptions, identify common and robust insights and work out political recommendations from a broad stakeholder basis.

SCENARIOS COMPARED: Three studies from the ESYS initiative, the BDI and dena.

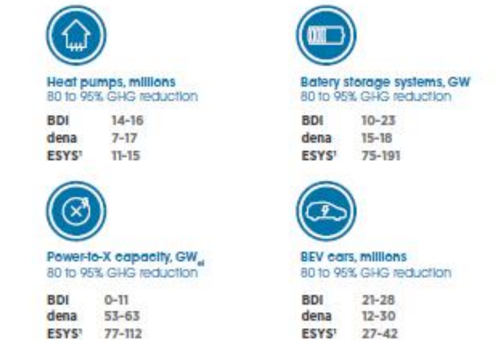
MAIN FINDINGS FOR THE ENERGY TRANSITION:

- **An integrated approach is needed to managing the energy transition to enable investment.** All studies show the necessity for quick political measures to achieve Germany's political goals (80% to 95% GHG reduction). A long-term perspective and a continuous social dialogue will be needed for the great structural changes.

- **Renewable energy supply has to be deployed faster, and German wind and PV capacity growth should increase to at least 6 GW net per year. The government needs to ensure security of supply with demand-side management and back-up power plants.** To optimise sector coupling and flexibility for the various applications in the market, root-and-branch reform needs to be carried out. Grid operators, licensing authorities and policy makers need to collaborate to accelerate the expansion and optimisation of smart control systems and approaches.

- **There is a need to increase the extent and speed of energy refurbishment of buildings. There is an essential role for a new technology mix in the transport sector and power fuels (renewable synthetic fuels) as a missing link for the energy transition.** The projected capacity of key indicators is shown in Figure 12. The number of heat pumps in Germany would reach up to 17 million by 2050. Emissions in the industrial sector can be addressed with energy efficiency, renewable energy and new processes.

FIGURE 12 Comparison of results on electrical storage systems and flexible loads in Germany, 2050



[1] **In the ESYS study:** 85-90% GHG reduction in the energy system
Notes: BEV = battery electric vehicle; GW = gigawatt; GW$_{el}$ = gigawatt electrical.
Source: dena, 2019.

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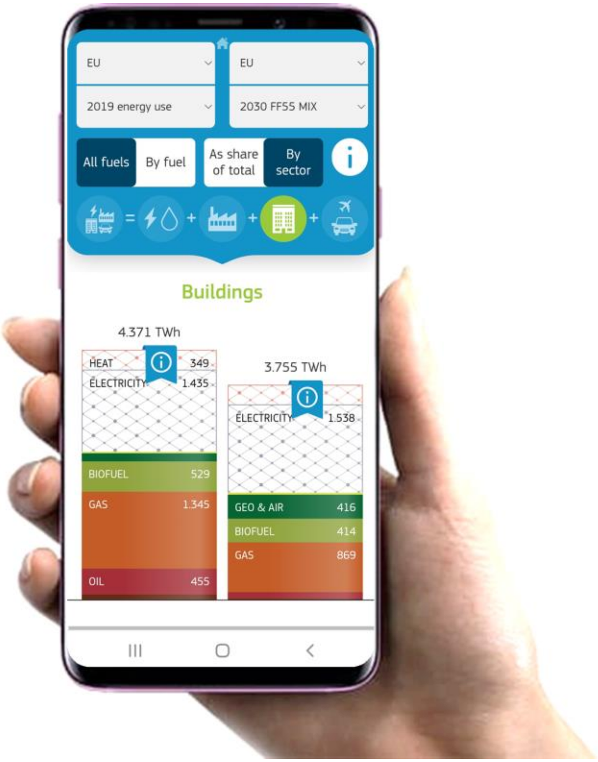
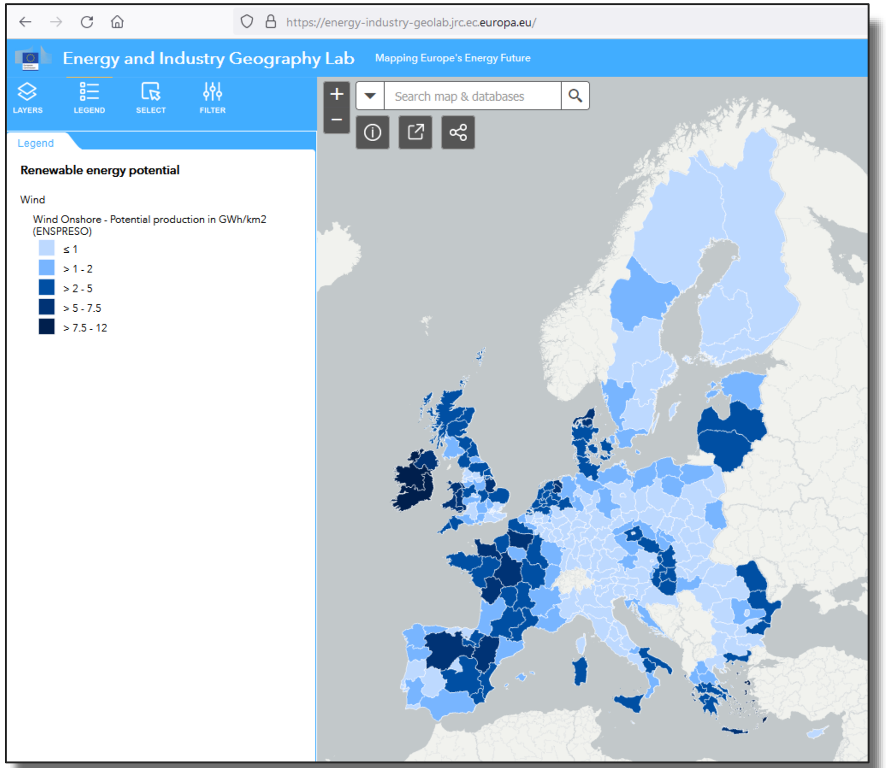


Energy Scenarios Tool



Energy and Industry Geography Lab (EIGL)

Report on buildings released December 15th

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Q & A
10 min

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NEXT WEBINARS

- **TUESDAY, 25 January 2022 • 14:00 – 14:30 CET**
  “Reaching Zero with Renewables: Capturing Carbon”

- **TUESDAY, 8 February 2022 • 14:00 – 14:30 CET**
  “Sector Coupling in Facilitating the Integration of Variable Renewable Energy in Cities”

For more information and to register: https://irena.org/events/2020/Jun/IRENA-Insights

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Edward Byers

Institute for International Applied Systems Analysis (IIASA)

"When comparing scenarios, take time to understand how different baseline assumptions differ, and be careful not to conflate agreement between scenarios with their likelihood."