



# Introduction to vgbe and the situation of power generation in Germany

*Dr Oliver Then*



IGEF workshop NTPC – vgbe  
Essen, 20 November 2023

# Agenda

- vgbe at a glance
- Power generation in Germany
- The future role of dispatchable generation

# vgbe energy e.V. – Who We Are

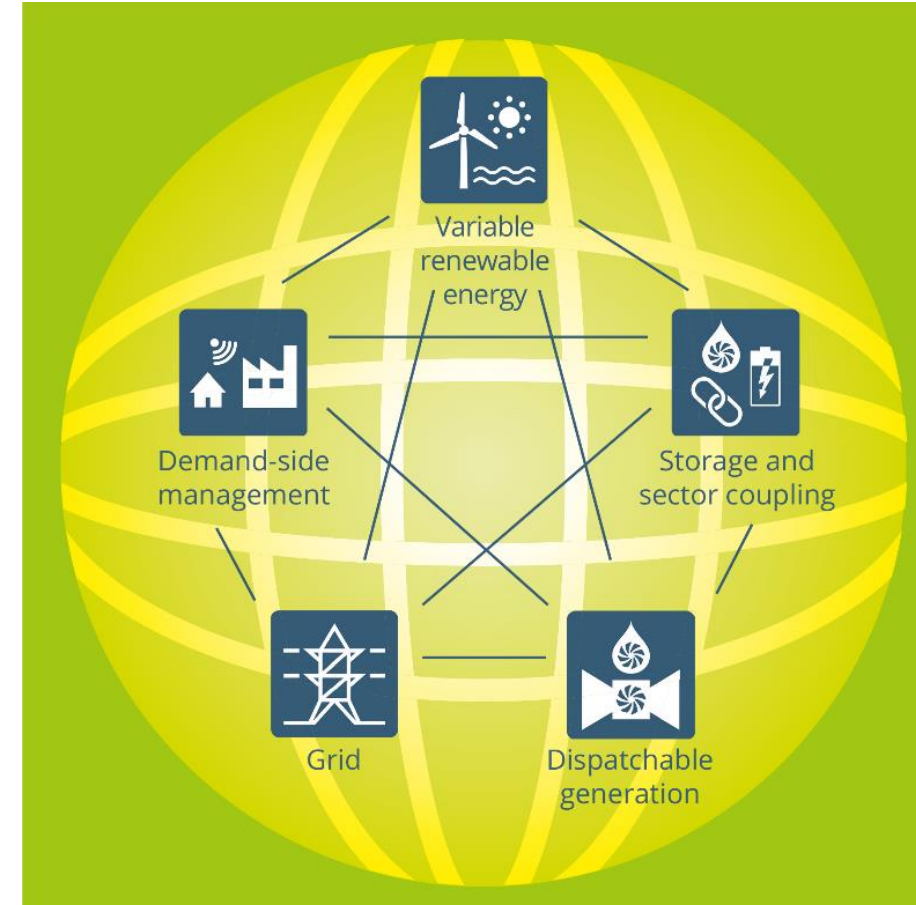
- 437 members in 33 countries around the globe
- Members represent an installed renewable and conventional capacity of 302 GW



vgbe is the International Technical Association of energy plant operators. Founded in 1920, the association covers a wide range of technologies: from renewable and conventional power and heat generation to energy storage and P2X.

# The Future Energy System

- The Future Energy System consists of five technology elements → thereof **variable renewables, dispatchable generation, energy storage** and **sector coupling** are in the focus of vgbe's activities.
- Plant technologies become simpler, whereas the complete system becomes more complex.
- Digitalization is a key enabler for the flexibility of the system.
- Interaction of system elements ensures security of supply as well as compliance to environmental and economic requirements.



vgbe's perspective of the Future Energy System

# Network of Experts



# What We Do – Standards and Position Papers



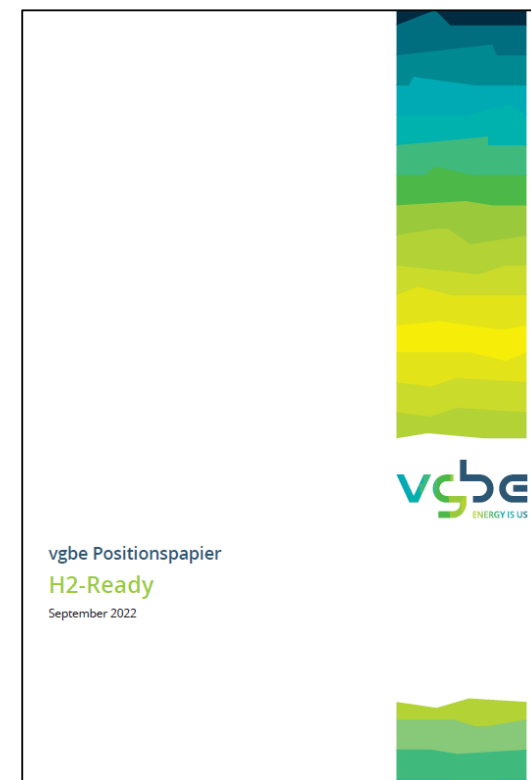
- Provide technical guidance for the energy value chain: from planning and procurement to operation and de-commissioning
- Cover all relevant topics such as engineering, operation, monitoring, health and safety as well as inspection and maintenance
- More than 300 standards available
- vgbe's designation systems KKS (Kraftwerk-Kennzeichenystem) and RDS-PP (Reference Designation System for Power Plants) = the international standard for consistent and uniform labelling of energy plants



## Extract from vgbe's media catalogue

Ref. Ordering Number/ Bestell-Kennz.	Titel/Title
	Titles with "e" or "EN" in the ordering reference number are available in English. Titel mit dem Bestellkennzeichen „e“ oder „EN“ sind in Englisch lieferbar.
VGB-S-008-00-2020-11-DE	Empfehlungen zum Management der funktionalen Sicherheit in Dampfkesselanlagen und Anlagen des Wasser-Dampf-Kreislaufs, 2. Auflage, 164 S., 2021
VGB-S-008-00-2020-11-EN	Recommendations for managing functional safety in steam boiler plants and systems of the water/steam cycle, 2 <sup>nd</sup> revised edition, 164 p., 2021
VGB-S-014-2011-EN	Construction, Operation and Maintenance of Flue Gas Denitrification Systems (DeNO <sub>x</sub> ), 186 p., 2021
VGB-S-017-00-2018-09-EN	Fire Protection in Onshore Wind Turbines, 1 <sup>st</sup> edition, 44 p., 2019
VGB-S-020-00-2017-12-EN	Determination of Measurement Uncertainty upon Acceptance and Control Measurements, 1 <sup>st</sup> edition, 99 p., 2020
VGB-S-033-00-2017-07-LV	Atbilstības novērtējuma un darba aizsardzības prasību savstarpēja iedarbība hidroelektrostacijās (Latvian edition) (Interaction of Conformity Assessment and Industrial Safety in Hydropower Plants, 2 <sup>nd</sup> edition) 104 p., 2021
VGB-S-052-00-2020-06-DE	Leitfaden für die Qualitätssicherung bei der Montage von Flanschverbindungen, 18 S., 2020
VGB-S-103-00-2020-02-DE	Überwachungs-, Begrenzungs- und Schutzeinrichtungen an Dampfturbinenanlagen, 86 S., 2020 (vormals VGB-R 103)
VGB-S-103-00-2020-02-EN	Monitoring, limiting and protection devices on steam turbine plants, 82 S., 2020 (formerly VGB-R 103e)
VGB-S-107-00-2018-03-DE	Bestellung und Ausführung von Armaturen in Wärmekraftwerken, 324 S., 2019 (vormals VGB-R 107)
VGB-S-150-20-2020-08-DE	Einführung und Überblick der VGB-Standards für Abnahmetests und Kontrolluntersuchungen, 12 S., 2021 (Weiterentwicklung der VGB-R 123 Band I.2)
VGB-S-150-22-2020-10-DE	Messstellenliste für Abnahmeuntersuchungen mit Datenerfassungsanlagen, 12 S., 2021 (vormals VGB-R-123 C.2.2, Übersicht s. VGB-S-150-20-2020-08-DE)
VGB-S-150-24-2020-08-DE	Auslegung, Prüfung und Montage von Durchflussmessstrecken mit Drosselgeräten, 30 S., 2021 (vormals VGB-R-123 C.2.4, Übersicht s. VGB-S-150-20-2020-08-DE)
VGB-S-150-26-2022-03-DE	Abnahme- und Kontrolluntersuchungen an Rauchgasreinigungsanlagen, Teil 1: Rauchgasentschwefelung, 36 S., 2022 (vormals VGB-R-123 C.2.6, Übersicht s. VGB-S-150-20-2020-08-DE)

## Cover page of vgbe's H2-Ready position paper



# What We Do – Technical Programmes and R&D Projects



- Address specific and/or overarching topics
- Enable interdisciplinary cooperation and involvement of stakeholders in- and outside vgbe
- Aim at specific targets within a defined timeframe
- Funded by participating institutions and other funding sources, e.g. public funds or vgbe research foundation
- Examples for Technical Programmes:
  - Implementing the EU Taxonomy in the Energy Industry
  - Cost comparison for run-of-river plants
- Examples for R&D projects:
  - Repurposing coal-fired power plants (EU funding)
  - Evaluation of ice detection systems for wind turbines



Technical Programme | Technisches Programm  
 Implementing the EU Taxonomy in the Energy Industry: Part I - the Climate Delegated Act  
 Umsetzung der EU-Taxonomie in der Energie-industrie: Teil 1 – der delegierte Klimarechtsakt

Technisches Programm

XSTAND-H2 – Entwicklung standardisierter Kennzahlen zum datenbankbasierten Benchmarking von Wasserelektrolyseanlagen – Phase 1 von 3: KPI-Metastudie

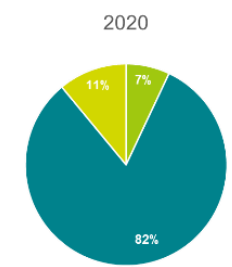
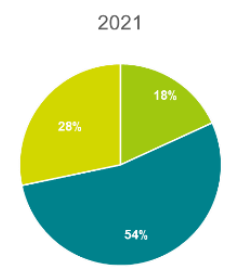
"As policymakers and the private sector hone in on climate finance we need a shared language and set of metrics. This doesn't just apply to green bonds – this market is a litmus test for wider climate finance."

Aldo Romani,  
Deputy head of Euro funding at the European Investment Bank

Research projects started in 2021, compared to 2020

13 projects / 5.57 million €

6 projects / 2.25 million €



■ Operators funds ■ Public funds ■ Other funds

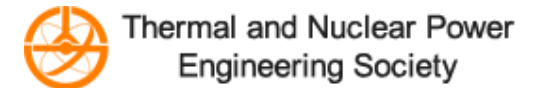
■ Operators funds ■ Public funds ■ Other funds



# International Projects and Cooperation

- Cooperation with various international organizations such as the International Energy Agency, eurelectric and the Japanese Tenpes
- Point of contact to stakeholders worldwide in order provide technical energy expertise
- Active in many bilateral energy partnerships of Germany's Federal Government – with China, India, South Africa and Türkiye
- Consultancy projects with international industry partners, e.g. in India, UAE and Saudi Arabia

**Trustful cooperation based on a neutral, technology driven perspective**





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- The future role of dispatchable generation


# Challenging climate targets in Europe – Germany even more ambitious – coal phase-out seems unavoidable



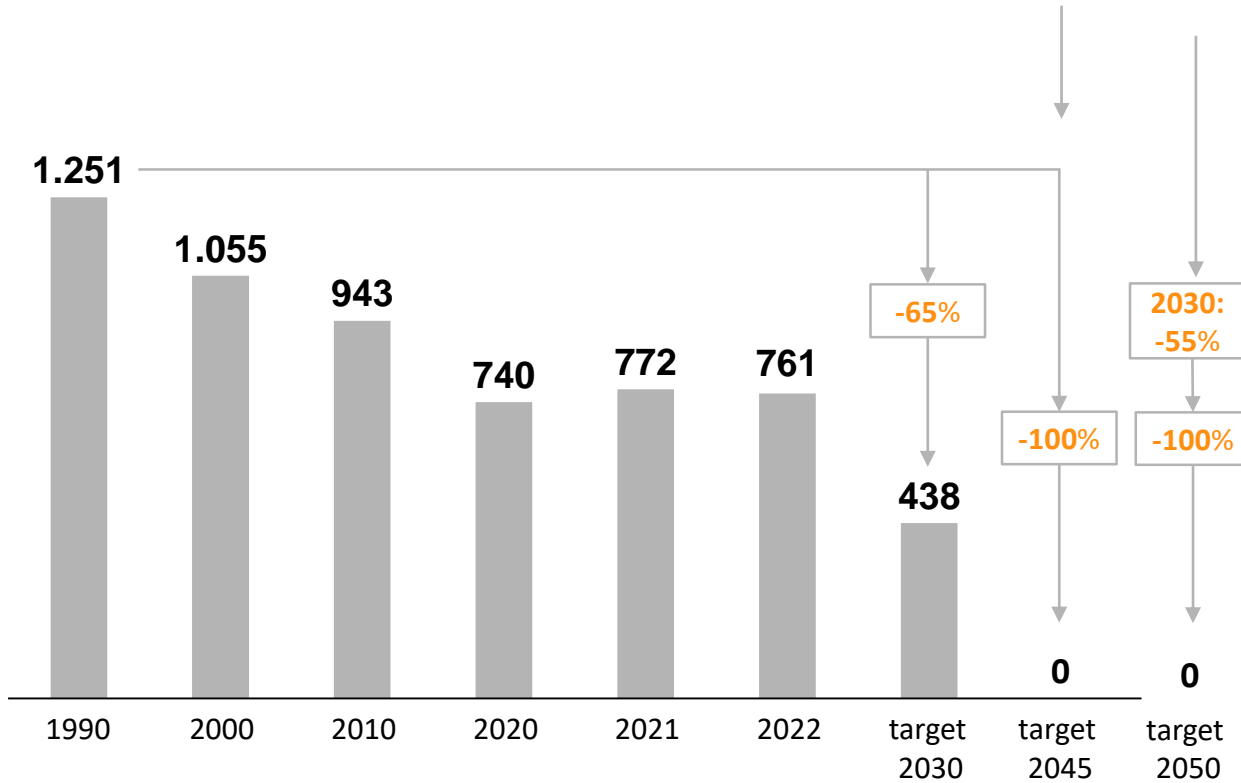
**Targets**  
in Mil. t CO<sub>2</sub>eq.

- Nuclear and coal phase-out laws
- Climate Protection Law

  
2045

  
2050

- Fit for 55
- RePowerEU
- Clean Energy Packages



# Nuclear phase out according to current German nuclear exit law

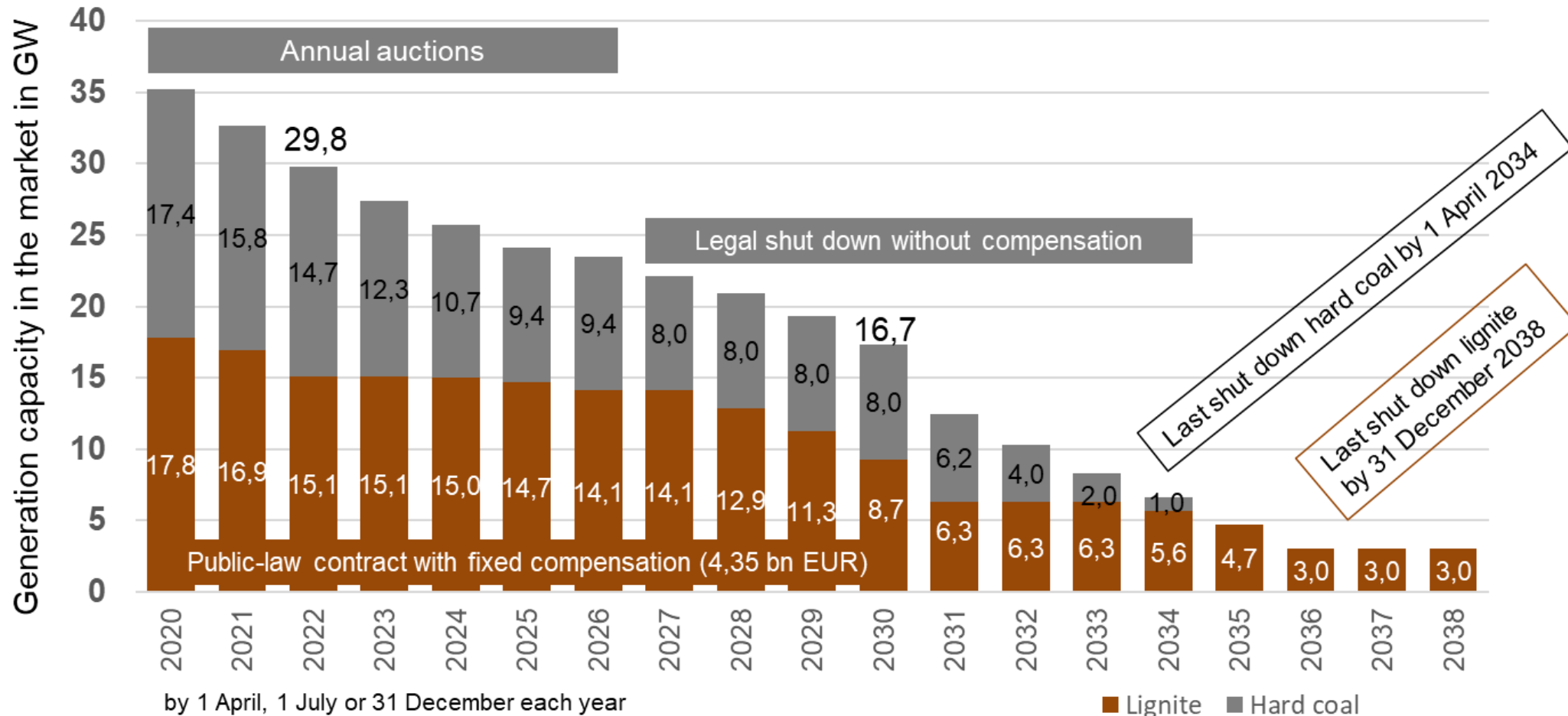
## Location and status of Germany's nuclear power stations and year of (planned) shut down.

Data: BASE 2021.



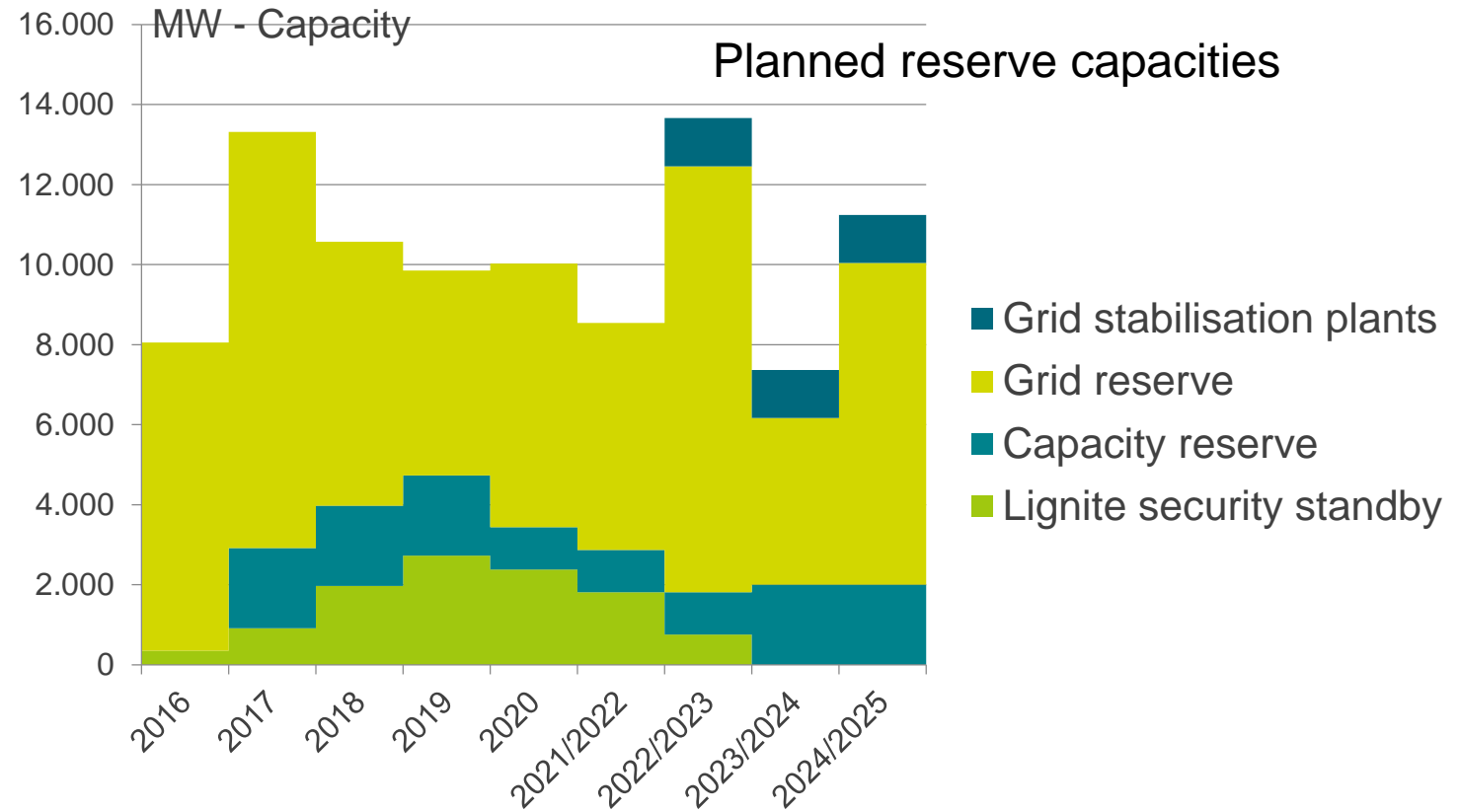
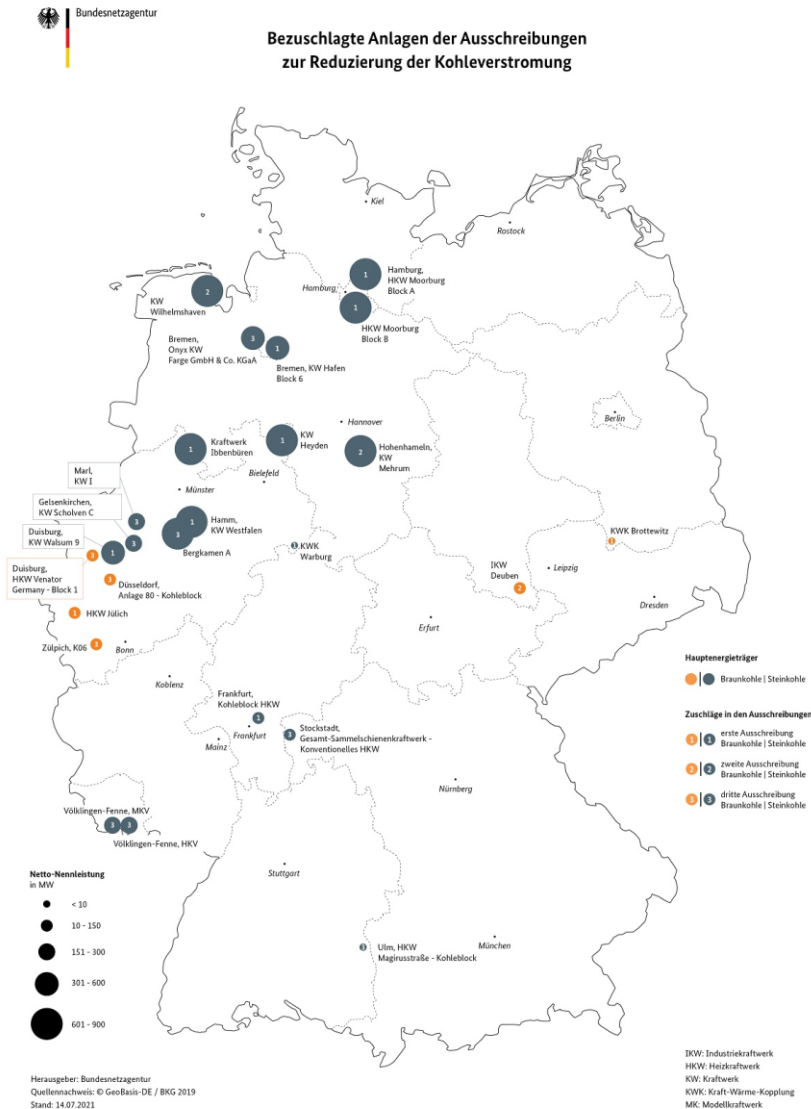
- 3 units in operation until 15.04.2023:
  - Emsland 1.406 MW (all gross)
  - Neckarwestheim II 1.400 MW
  - Isar II 1.485 MW

# Decarbonization in Germany: Coal phase-out underway – but up to now most plants move from market into reserve



RWE's lignite phase out moved to 31.12.2030 – further political acceleration expected

# Status of coal phase-out as of February 2022



## Hard Coal auctions:

- 1<sup>st</sup> 4.788 MW (4 GW planned)
- 2<sup>nd</sup> 1.514 MW (1,5 GW pl.)
- 3<sup>rd</sup> 2.133 MW ( 2,5 GW pl.)
- 3,6 to 875 MW unit size / COD 1966 - 2015

# What does it mean in reality – RES targets in Germany until 2045 (NEP2023)

400-445

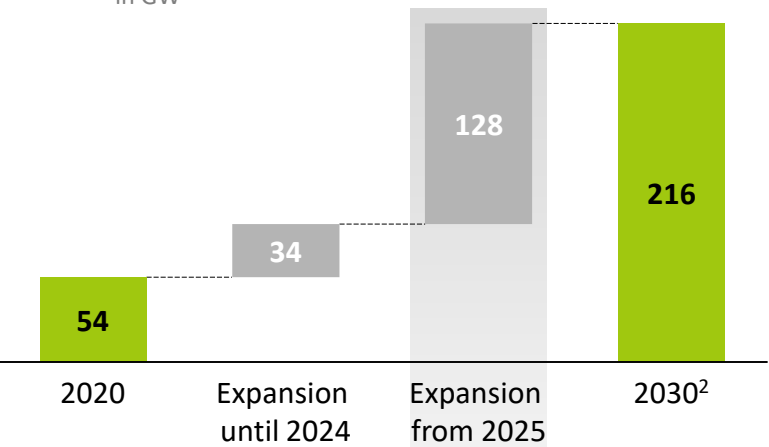
70

160-180



Solar PV – Installed capacity/expansion<sup>1</sup>

in GW



Required expansion each working day (from 2025)<sup>1</sup>

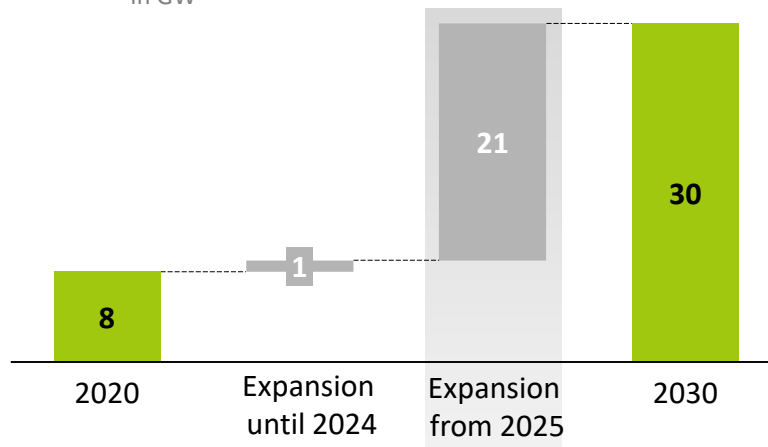
90 MW PV

... approx. ½ capacity of Germany's biggest PV park/day



Wind Offshore – Installed capacity/expansion<sup>1</sup>

in GW



+

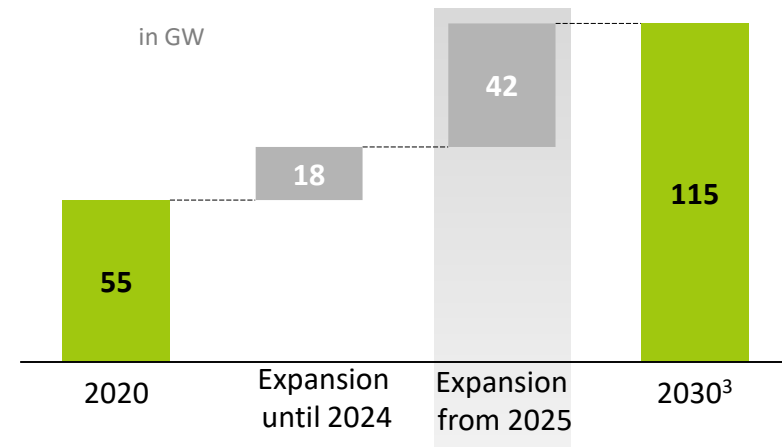
15 MW Offshore

... approx. a large wind farm of 900 MW every 2 month



Wind Onshore – Installed capacity/expansion<sup>1</sup>

in GW



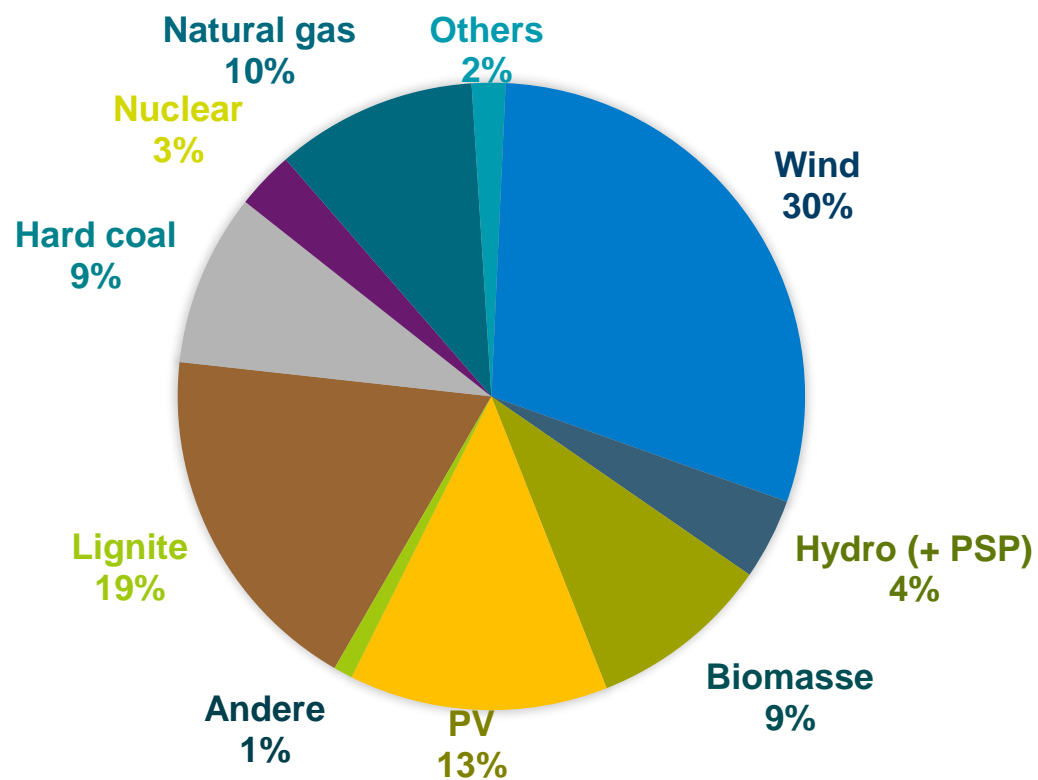
+

30 MW Onshore

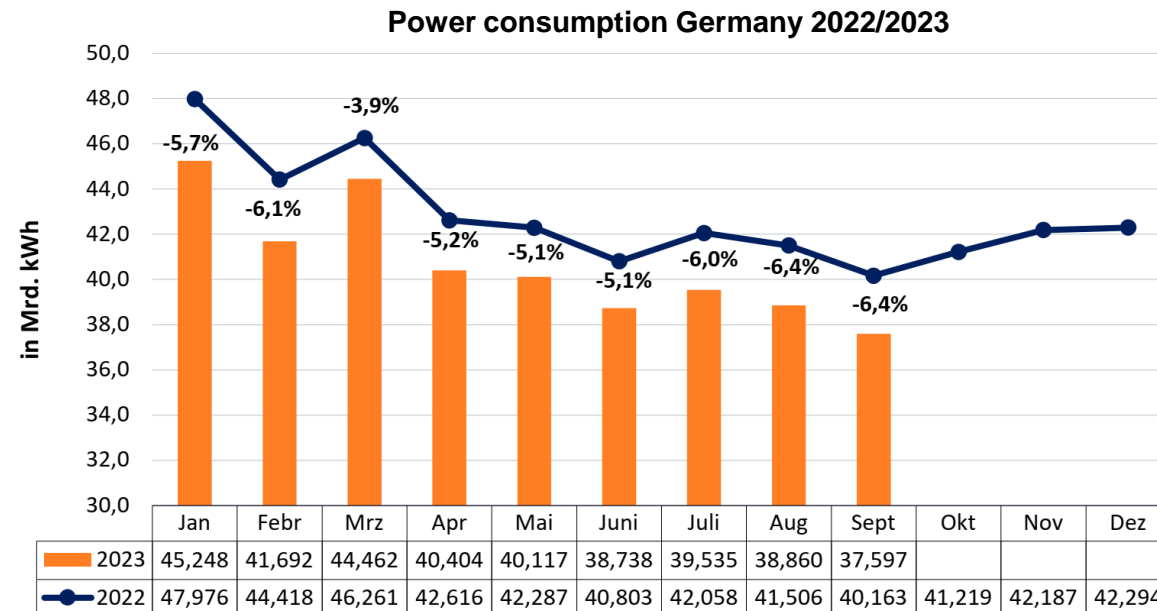
... approx. 7 turbines/day

# Power generation in Germany 1st half 2023

Net generation: 224 TWh – 57 % share of RES  
 Import/Export: 30,6 TWh/32,6 TWh



Source: AG Energiebilanzen



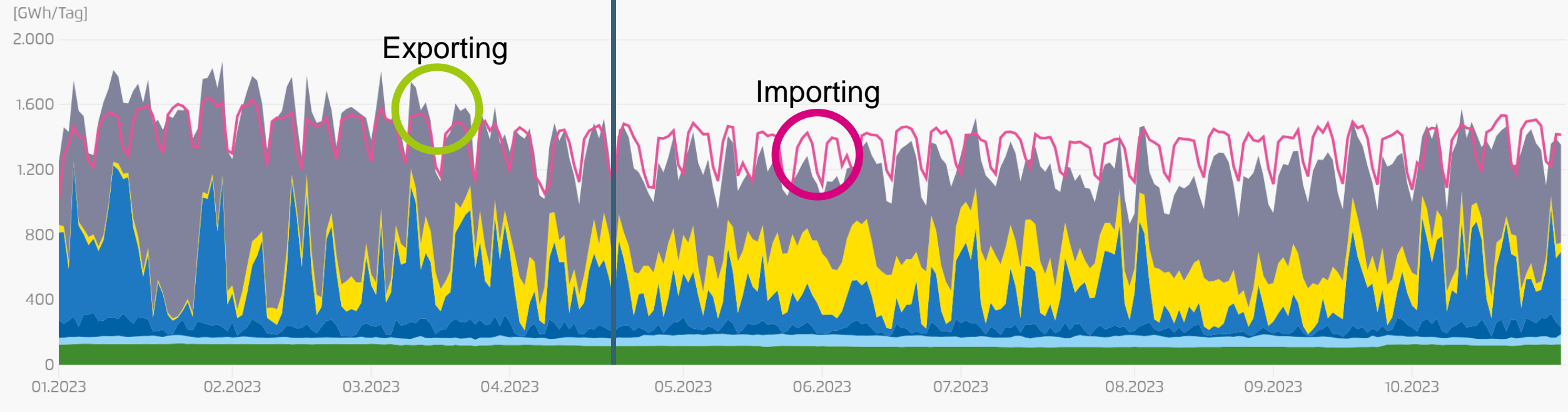
## Generation capacity

- 242.871 MW installed capacity
  - Thereof 151 GW RES
- 234.062 MW in the market
- 8.808 MW reserve power plants

# Power generation in Germany 2023

Power generation and consumption

15.4. shut-down of final 3 nuclear units



Exporting

Importing

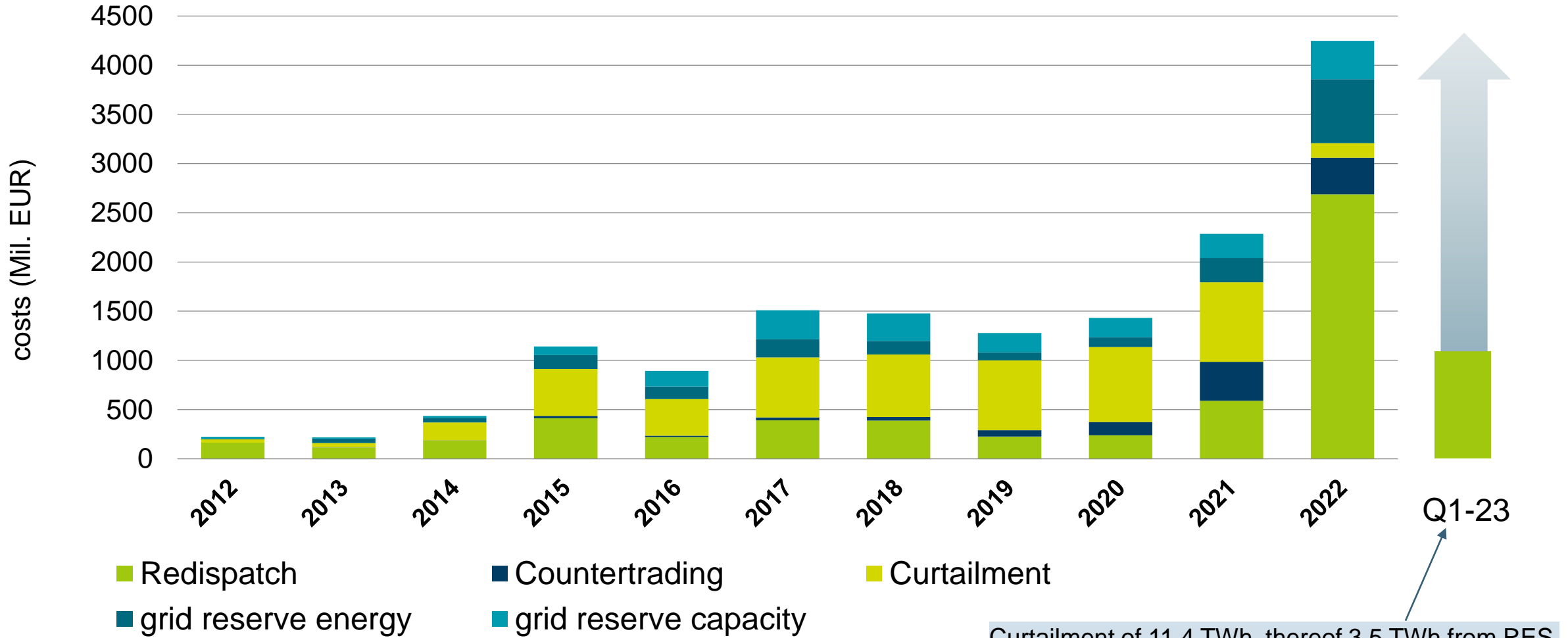
- Stromverbrauch
- Biomasse
- Wasserkraft
- Wind Offshore
- Wind Onshore
- Solar
- Konventioneller Kraftwerke
- Kernkraft
- Braunkohle
- Steinkohle
- Erdgas
- Pumpspeicher
- Andere

- Lower RES (wind) in Q3
- Time limited (4/2024) reactivation of approx. 7,6 GW Coal in 2022/2023

Quelle: Agora Energiewende



# Costs for system and grid stability on the rise



Curtailment of 11,4 TWh, thereof 3,5 TWh from RES (in particular 2,1 TWh Offshore-Wind)

source: German Regulator BNetzA 2023

# Agenda

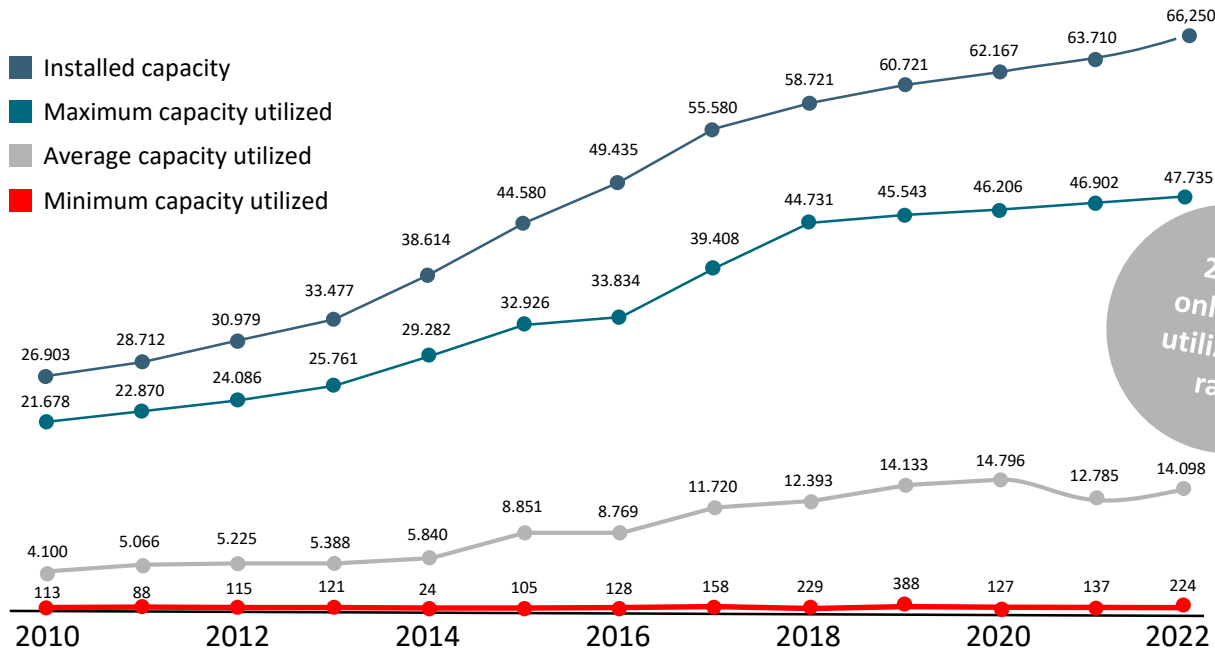
- vgbe at a glance
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# Perspective 1: dispatchable generation and flexibility options

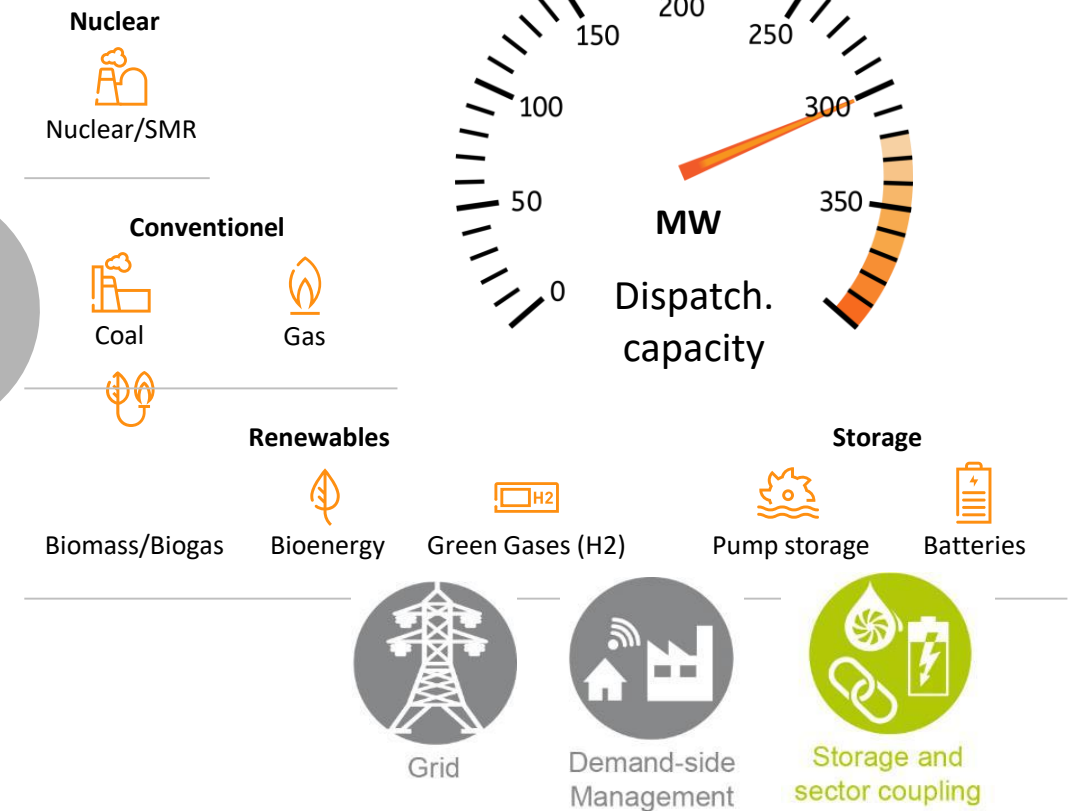
## Demand grows with increasing RES in the system

### Wind generation in Germany from 2010 until 2022

in MW

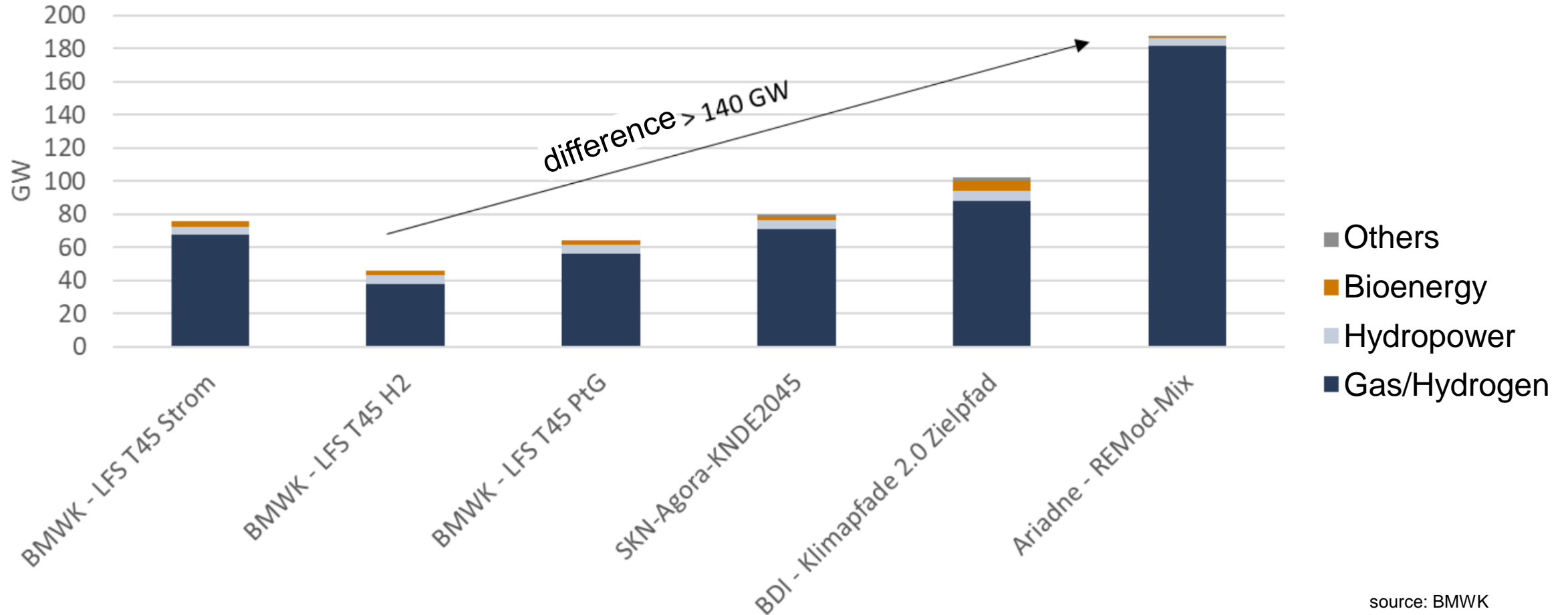


### Options for dispatchable power generation and flexibility



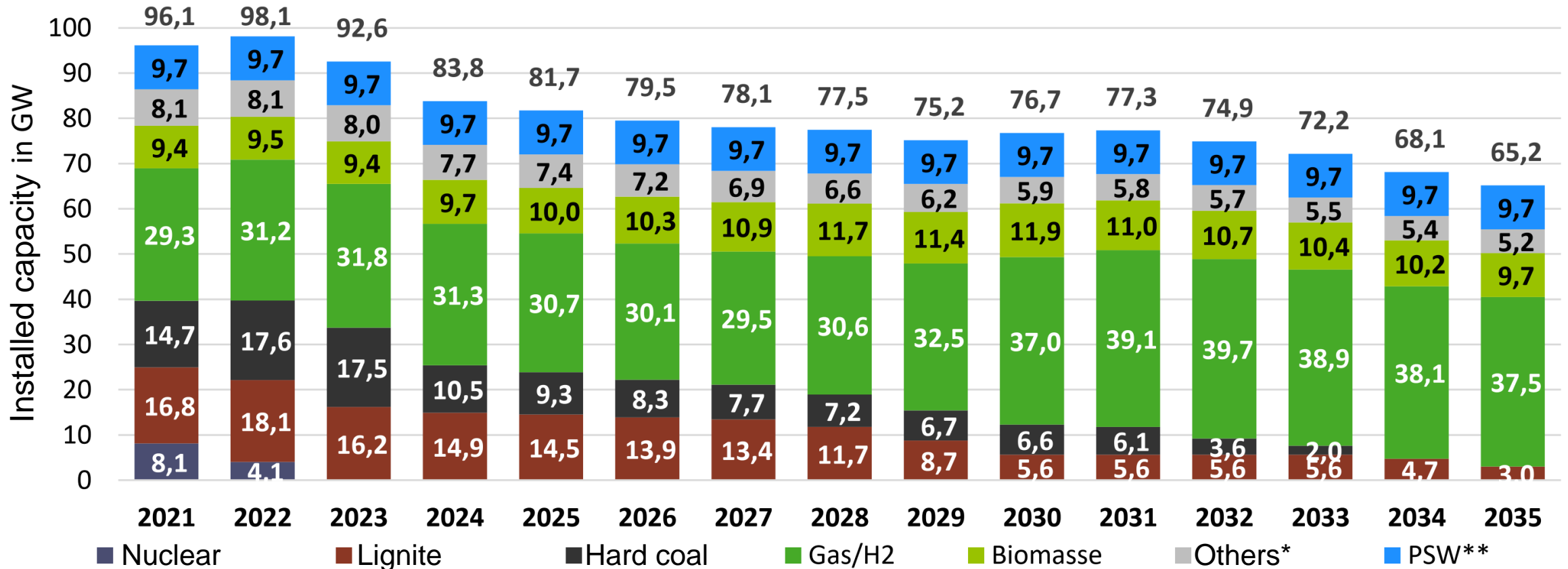
# Dispatchable generation is needed in the long run – but volume depending on various influences

Different scenarios on dispatchable generation 2045



source: BMWK

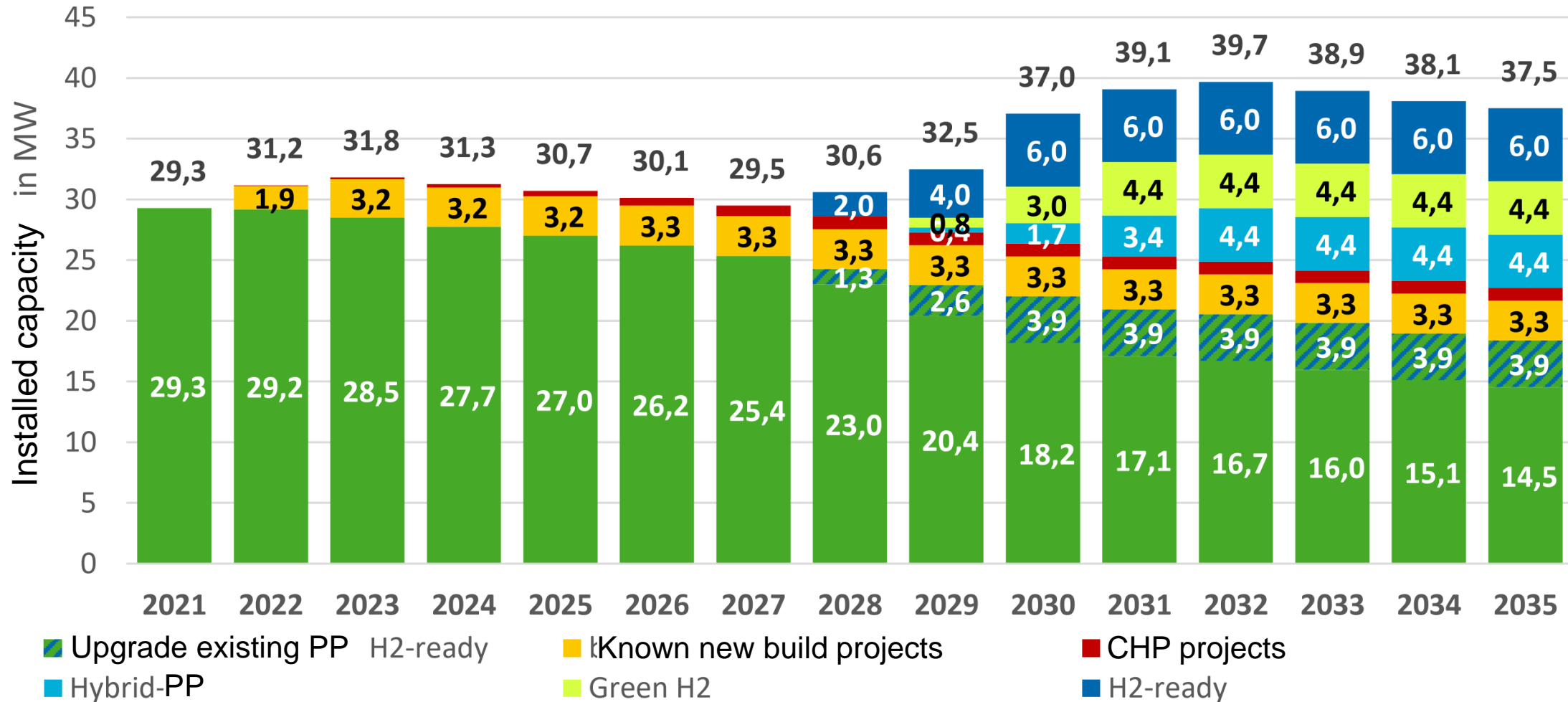
# Expected development of dispatchable generation capacity in Germany until 2035



Quelle: BDEW (eigene Berechnung) \*Mineralöl, Abfall, Grubengas, Sonstige Gase \*\* inkl. der direkt an dt. Regelzonen angeschlossenen PSW in AT und LU  
 2023: Anpassung §50j EnWG noch nicht berücksichtigt

As of 31.12.; inkl. coal exit according to existing law, all known new build projects, all expected auctions

# Expected development of gas-fired units in Germany until 2025



Quelle: BDEW (eigene Berechnung auf Basis öffentlich bekannter Angaben (BNetzA, MaStR, Ökoinstitut, eigene Recherche))

As of 31.12.; inkl. all known new build projects, all expected auctions

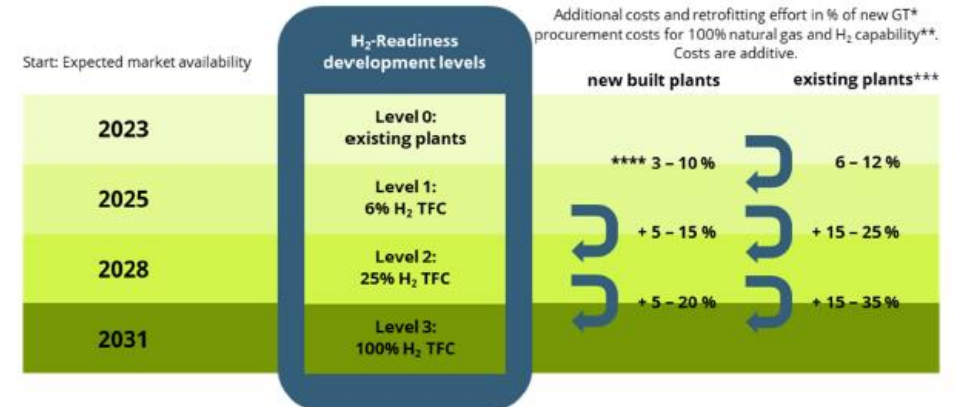
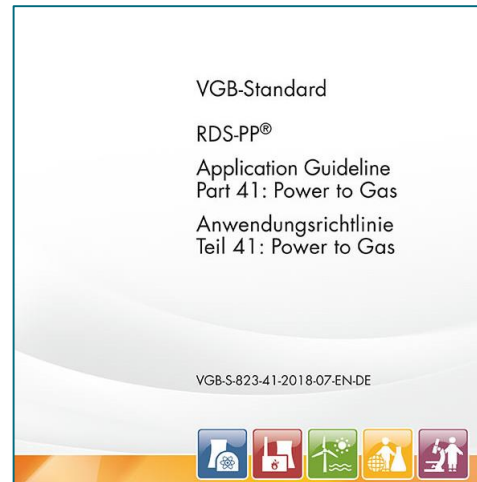


# Perspective 2: Hydrogen H<sub>2</sub>-Readiness is key for sustainable fuel-switch in the future

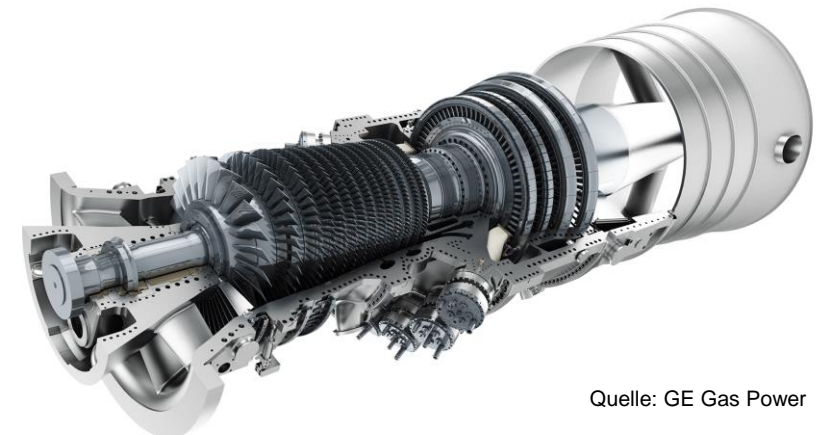
- H<sub>2</sub>-ready means that a plant can be operated with 100 % H<sub>2</sub> in its lifetime.
- Use of H<sub>2</sub> is possible in gas turbines, engines, industry furnaces and fuel cells. At present, no economic viability is presentable.
- Burning H<sub>2</sub> leads to higher NO<sub>x</sub>-emissions compared to natural gas.
- Emission limits and material standards need to be adopted in regulation on European and national levels.



vgbe position paper  
H<sub>2</sub>-ready  
September 2022



\* The scope of retrofitting refers to the retrofitting of all components necessary for operation, but the cost reference is the gas turbine as core component  
 \*\* A pre-planned modular design of the ancillary systems can significantly reduce retrofitting costs for new plants (H<sub>2</sub> capability)  
 \*\*\* In many cases, retrofitting existing systems can make much more economic sense, even if measures to extend the service life, etc. still have to be carried out on the GTP  
 \*\*\*\* Additional costs for H<sub>2</sub> capability



Quelle: GE Gas Power

# Hydrogen as main fuel for dispatchable generation in the future: vgbe is paving the way

GER/ENG



vgbe Positionspapier  
**H2-Ready**  
September 2022



GER/ENG



vgbe Positionspapier  
**Factsheet**  
**H2-Readiness für Gasturbinenanlagen**  
Januar 2023



GER only



Berlin, 4. August 2023

**Diskussionspapier**

**H2-Prozessleitfaden:  
Strom- und Wärmeerzeugung  
auf der Basis von erneuer-  
baren und dekarbonisierten  
Gasen**



Energie. Wasser. Leben.

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# Perspective 3: Repurposing of Coal Plant sides

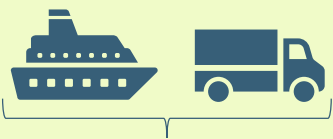
## Multiple benefits in technological, commercial and social dimensions

### Well developed infrastructure

External – access to:



Grid



Transport: harbour, roads and railway



Gas network



Water



District heating

### Miscellanea



Highly qualified personnel



Availability of space



Existing permits



Saving decommissioning cost

### Well developed infrastructure

Internal



Digitalized site



Cooling systems



Water treatment



Heating systems



Steam systems

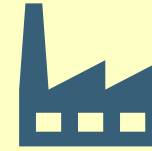
### Consumption near-by



Households and offices



Business and agriculture



Industry

# Joint activities – Individual benefits

**be energised**

**be inspired**

**be connected**

**be informed**

## Your contact

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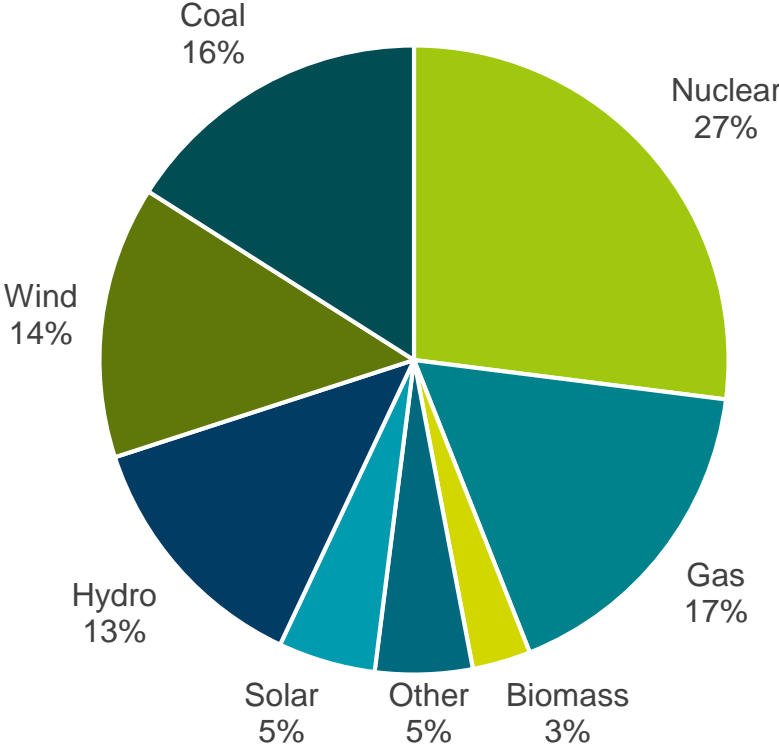
M +49 160 8444 450

I [www.vgbe.energy](http://www.vgbe.energy)

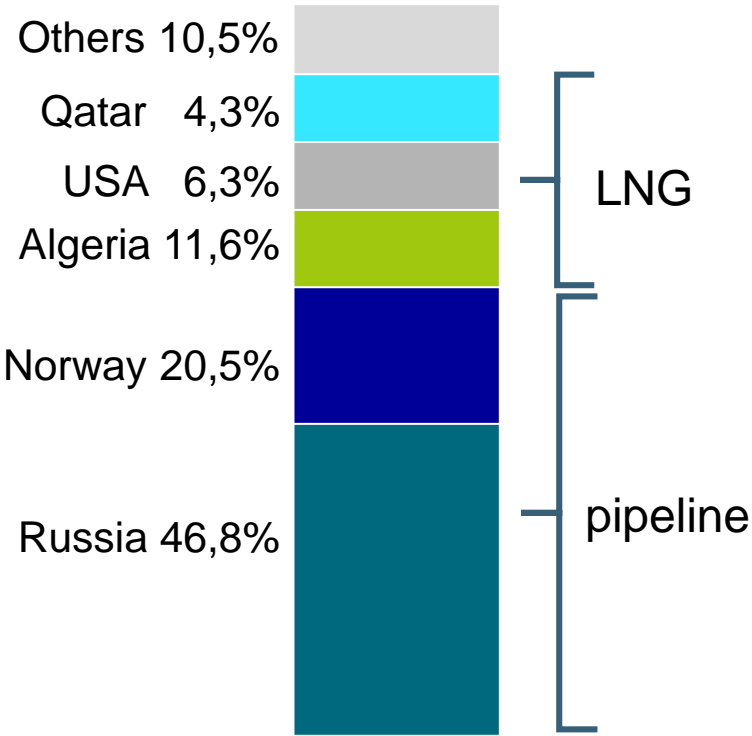


In 2021 EU has imported 83 % of natural gas -  
 Russia was by far the biggest supplier for natural gas  
 Power sector used 30%

**Annual electricity generation 2021**



In average approx. 47% of EU's gas imports came from Russia in 2021

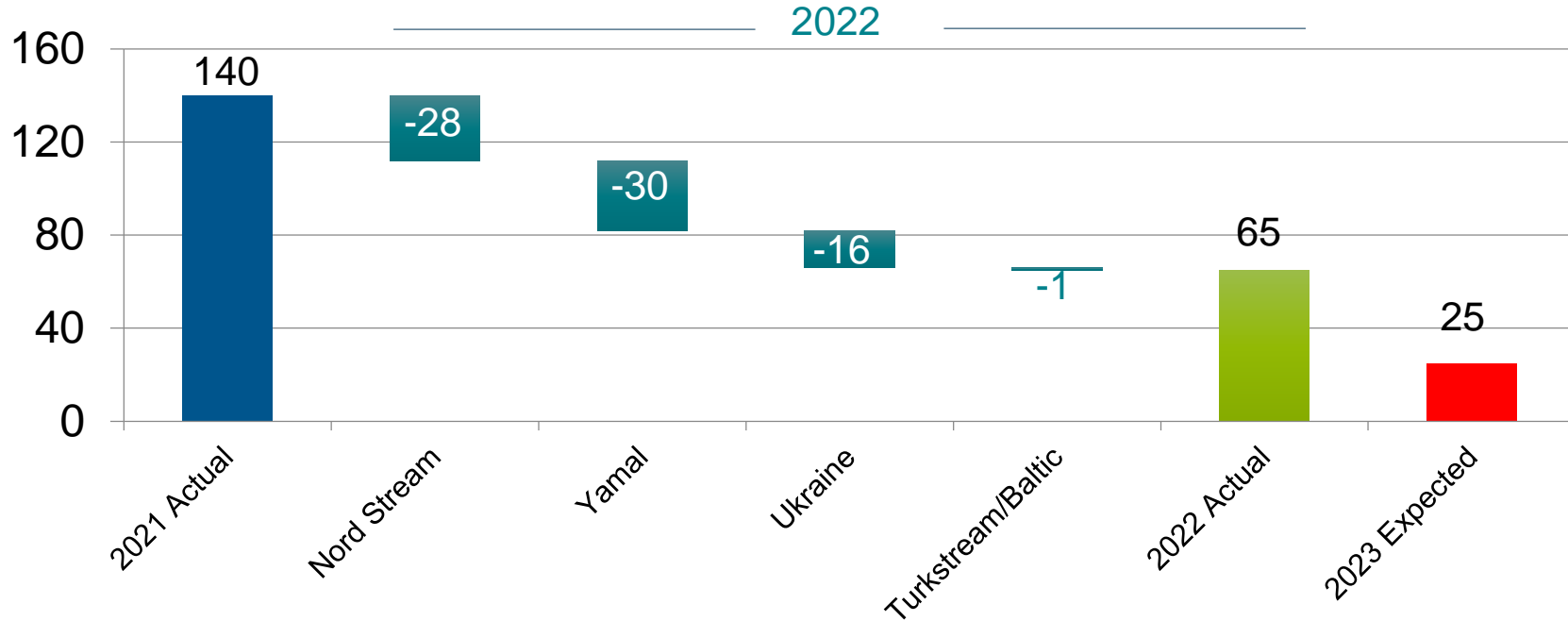


**2021**

# In 2022 Russia gradually stopped gas supplies via Jamal and North Stream 1 pipelines

European gas imports from Russia

in million cubic meter



**-84%**  
(cto 2021)

Germany had to replace Russian gas imports in a few month time:

- increasing **LNG imports** (via Netherlands, Belgium and France)
- slightly higher **pipeline supplies** from Norway

