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BV GLAS

Decarbonisation of the German Glass Industry

ECEEE's Zero Carbon Industry 2024,

Antwerpen, Belgium, 30./31. January 2024

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Decarbonisation of the German Society

State of Play

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GHG-Emissions in Germany (2023)

- GHG Emissions dropped to 673 Million tons CO_{2eq} , a reduction of 46% compared to 1990 which was below the target set in the German Climate Protection Act.
- Reduction mainly driven by the Energy and Industrial Sector, Housing and Transport with stagnating Emissions
- Key driver had been a change in the European electricity balance and a significant reduction of production in the energy intensive sectors of industry
- Energy efficiency contributed to a smaller extend to the savings, due to significant savings already achieved in the past.

Renewable Energies in Germany (2023)

- Renewable Energies contributed more than 50% to the Gross electricity consumption
- Renewable electricity production increased to 268 TWh, an increase of 13 TWh compared to 2022
- Solar capacity of 14.4 GW and Wind capacity of 2.9 GW was added to the generation portfolio
- About half of the imported electricity was produced by renewables

Energy and Emission Prices

- The average price of for EU ETS Allowances was 83.66 Euro, slightly above the value of 80.32 Euro for 2022 but significantly higher than the 24.61 Euro in 2020
- High prices for fossil energy carriers lead to a reduction of consumption of about 9 %. German industry reduced its gas consumption in 2023 by 18.3 %, mainly due to lower production in the energy intensive sectors of industry.
- The average price level of the day ahead gas prices still significantly higher than before the crisis. 30 Euro/MWh (2024), 41 Euro/MWh (2023), 127 Euro/MWh (2022), around 20 Euro/MWh (before 2020)

Energy Intensive Sectors are Taking Climate Change Serious

Developping Strategies for Decarbonisation

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Paper



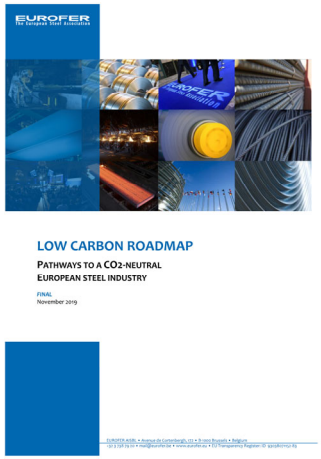
2017:
https://www.cepi.org/wp-content/uploads/2020/11/Roadmap-2050-Final-2017.pdf

Cement



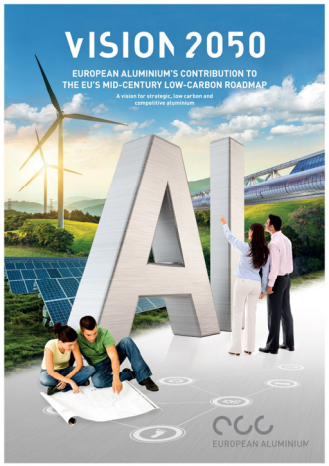
2019:
https://www.vdz-online.de/fileadmin/wissensportal/publikationen/zementindustrie/VDZ-Studie_Dekarbonisierung_von_Zement_und_Beton.pdf

Steel

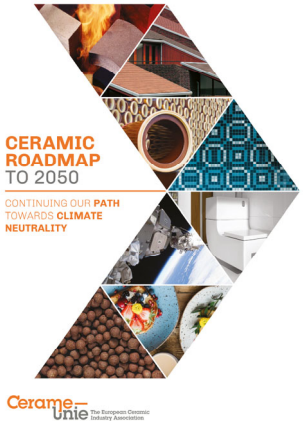


2019:
https://www.eurofer.eu/assets/Uploads/EUROFER-Low-Carbon-Roadmap-Pathways-to-a-CO2-neutral-European-Steel-Industry.pdf

Aluminium



Ceramics



2021
https://www.ceramicroadmap2050.eu/wp-content/uploads/2024/01/ceramic-roadmap-to-2050.pdf

Chemicals



2023
https://www.vci.de/vci/downloads-vci/publikation/broschueren-und-faltblaetter/final-c4c-broschure-langfassung-es.pdf

Energy Intensive Sectors are Taking Climate Change Serious

Developping Strategies for Decarbonisation

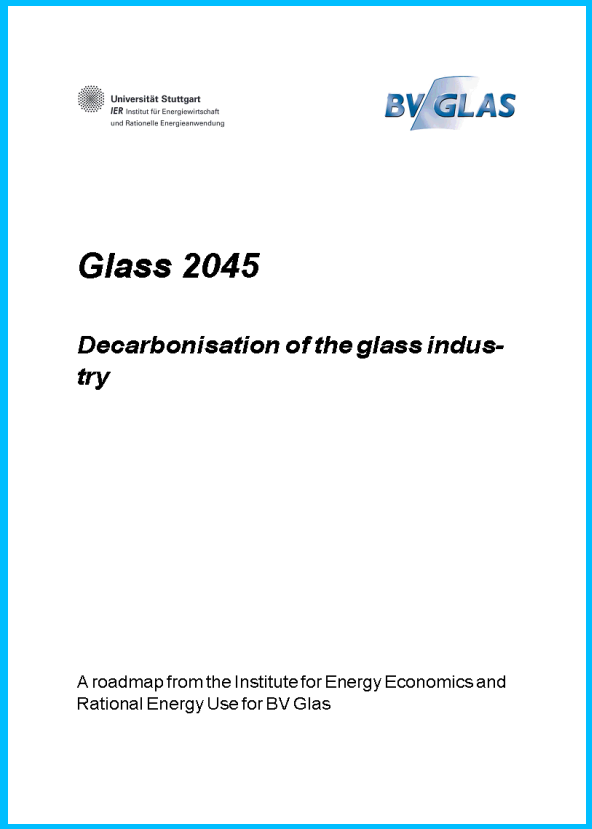
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2017:

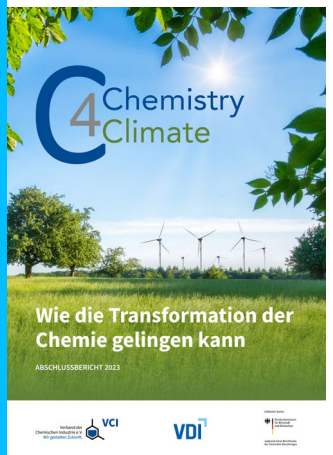
https://www.cepi.org/wp-content/uploads/2020/11/R
p-2050-Final-2017.pdf



2023 Glass

https://www.bvglas.de/index.php?eID=dumpFile&t=f&f=2738&token=d0e5fc3de0c90256568ee3a064ec4d470e41b500

Chemicals



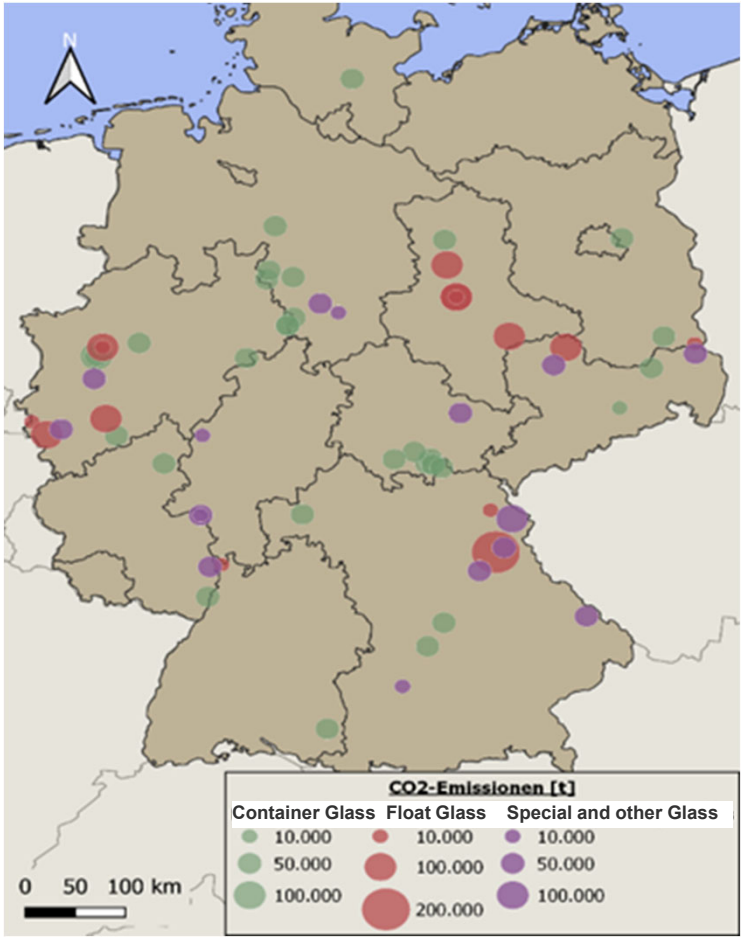
2023

https://www.vci.de/vci/downloads-vci/publikation/broschueren-und-faltblaetter/final-c4c-broschure-langfassung-es.pdf

The German Glass Industry

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- Approximately 400 companies
- one of the most important industrial sectors in Germany
- Approximately 56,000 employees.
- Generated turnover just under 10 billion euros (2021)
- Approximately 7.4 million tonnes of glass produced every year of which are
  - Container glass 4.1 million tonnes per year
  - Flat glass industry 2.1 million tonnes per year
  - Special and utility glass 0.3 million tonnes per year, but high importance of the products manufactured and value added.
- Approximately 4 million tonnes of CO_2 per year emitted
- Mainly related to firing furnaces with natural gas but also process-related emissions form the raw material used
- 55 production sites with a total of 122 furnaces for glass production (2021)



Study Approach

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- The German decarbonization target defined in the Climate Protection Act is to be carbon neutral in 2045, therefore the Roadmap for the German Glass Industry is looking forward to 2045 to be inline with the overall goals .
- To use the Roadmap results also during the transformation process, the analysis was based on the detailed plant data of the individual production sites. Their production characteristics such as number of furnaces, furnace type, age, production quantities and energy consumption where the basis for the transformation study.
- Suitable decarbonisation measures had been selected on the following criteria:
  - Availability and suitability of the technology for the glass product to be manufactured
  - Availability of the appropriate (energy) infrastructure for the use of emission-free energy sources
  - Decarbonisation measures already communicated or planned by glass manufacturers

Roadmap Scenarios

Four scenarios with different energy supply focus

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- Reference scenario ("BAU"): no significant changes are assumed compared to the current state of the art in the individual glass plants. This scenario serves as a comparative framework for the analysis of the alternative development paths, Data for energy consumption, CO_2 emissions and costs of the decarbonization scenarios were compared to the reference scenario.
- Electrification Scenario
  (Focus on electrification when technically feasible)
- Hydrogen Scenario
  (Focus on hydrogen when technically feasible)
- Hybrid Scenario
  (No exogenous focus on an energy carrier or a technology was specified, but all decarbonisation measures considered can be applied)

Roadmap Input

Forecasted Development of Annual Production and Energy Prices

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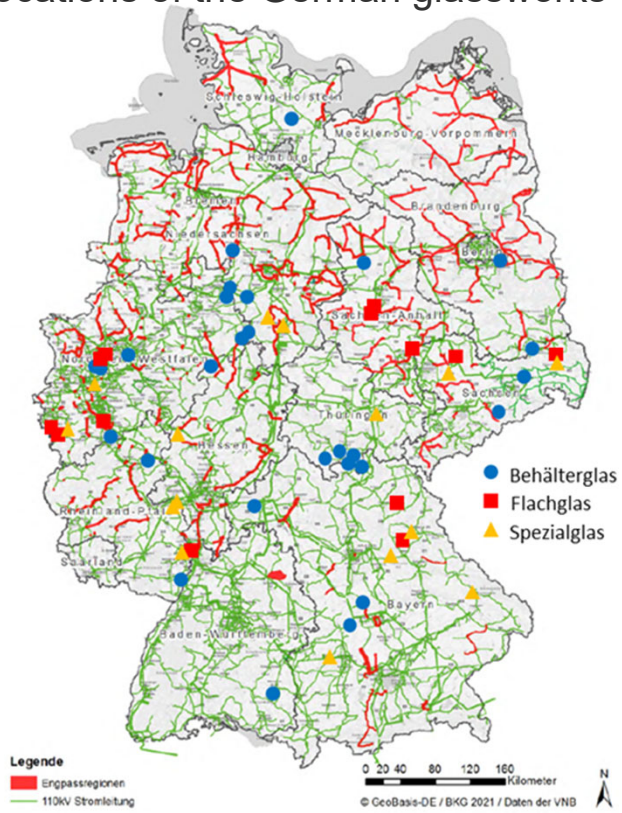
Glass type	2020	2030	2040	2045
Container glass	**4.215.985 t**	*4.426.784 t*	*4.637.583 t*	*4.742.983 t*
Flat glass	**2.456.443 t**	*2.579.265 t*	*2.702.087 t*	*2.763.498 t*
Special glass	**270.680 t**	*278.800 t*	*286.920 t*	*290.981 t*

Energy source	Unit	2020	2025	2030	2035	2040	2045
Natural gas	€/GJ	**8.0**	6.1	6.2	6.2	6.3	6.3
Natural gas (incl. CO_2 cost)	€/GJ	**9.5**	9.1	10.4	11.9	13.3	14.7
Hydrogen	€/GJ	**130**	115	101	81.0	64.0	60
Electricity	€/GJ	**24.4**	26.1	30.4	32.4	33.8	30.0
CO certificates$_2$	€/t_{CO2}	**26.6**	51.3	75.9	100.6	125.0	150.0

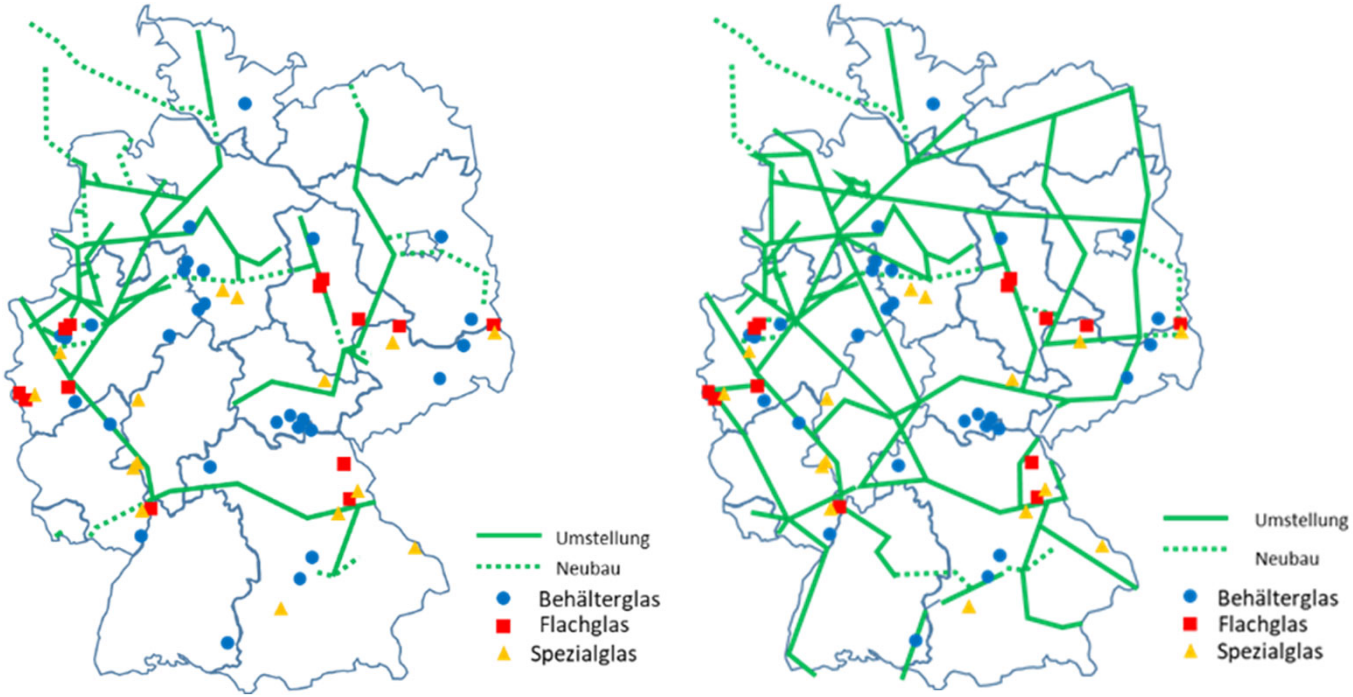
Energy Infrastructure Requirements

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High-voltage grid (110kV) in Germany and locations of the German glassworks



Planned hydrogen network in Germany 2030 2050.



Source: Own extensions to baseic maps of:
Federal Network Agency (2021): Bericht zum Zustand und Ausbau der Verteilnetze 2020.
Association of Transmission System Operators for Gas e.V. (2021): Netzentwicklungsplan Gas 2020-2030

Key Results of the Scenarios for 2045
for the Glass Industry in Germany

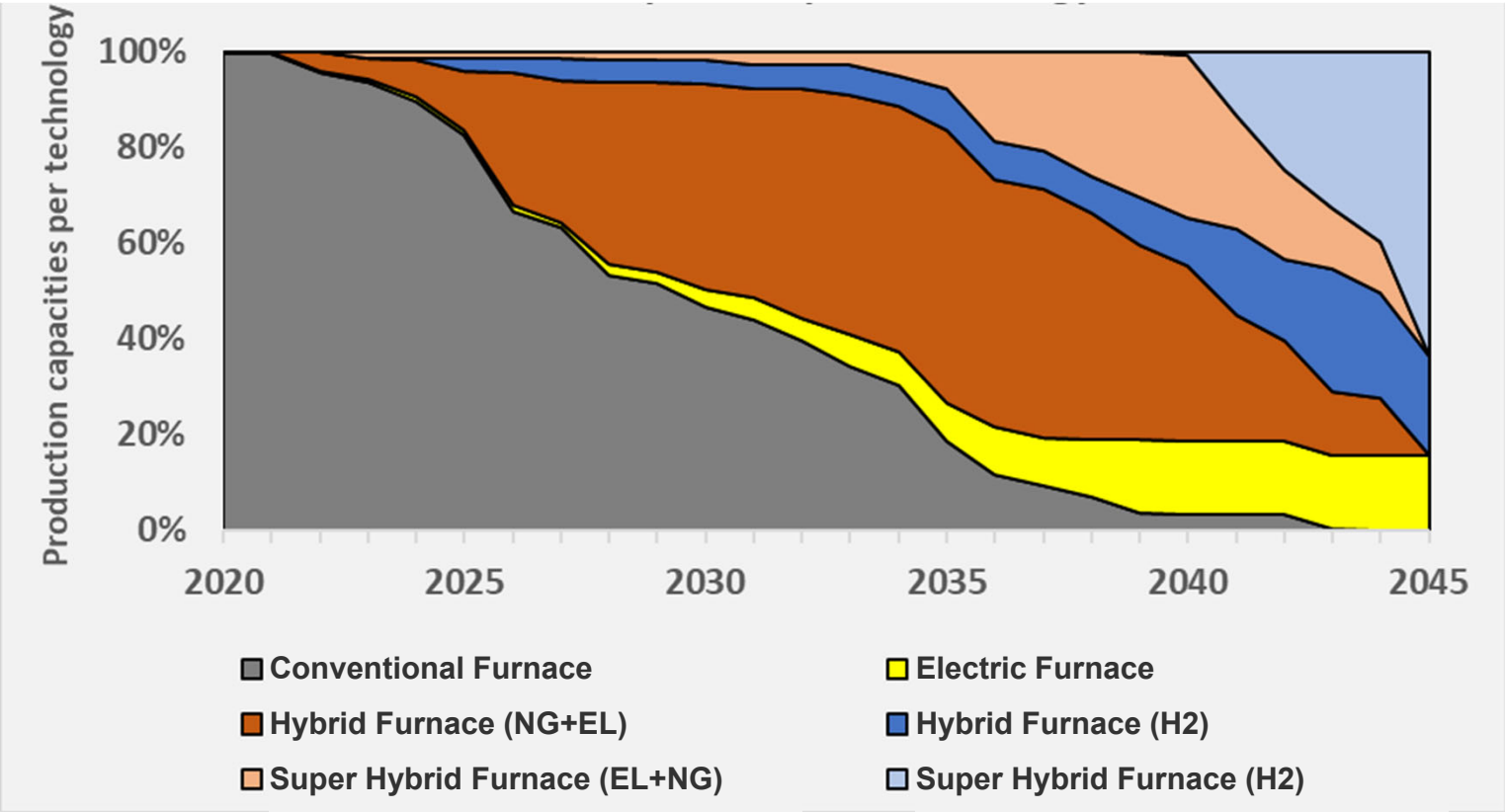
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Transformation Path		BAU	Electrification	Hydrogen	Hybrid
Number of Glass Furnaces	Conventional	115	0	0	0
	Electric	7	108	21	36
	Hybrid (H_2)	0	1	96	7
	Super Hybrid (H_2)	0	13	5	79
Energy Consumption [PJ/a]	Natural gas	43.3	0.0	0.0	0.0
	Hydrogen	0.0	2.8	28.4	8.7
	Electricity	7.0	31.3	15.5	30.0
	Total	50.3	34.1	43.9	38.7
CO_2 Emissions [million t/a]	Energy-related	2.4	0.0	0.0	0.0
	Process-related	0.8	0.8	0.8	0.8
Accumulated Investment [billion Euro]		1.6	5.6	3.2	4.9

Development of Production Capacities per Technology

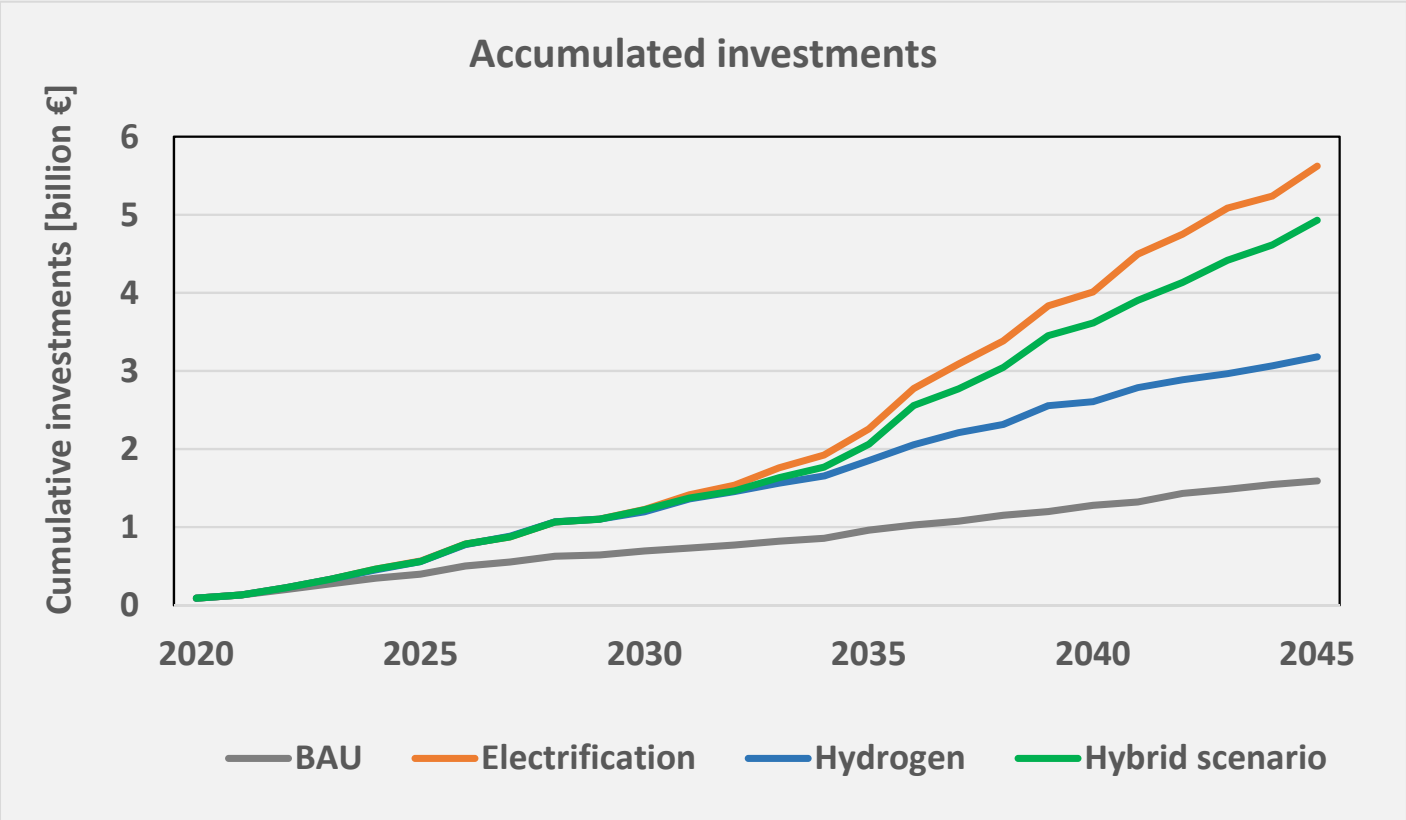
Transformation Pathway in the Hybrid Scenario

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Required Investment depend on the Selected Pathways

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Summary and Conclusion

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- The transformation to carbon neutrality of the German Glass industry is possible but it is not a free lunch
- To enable the start of the transformation, structural, political and financial support is required to maintain the competitiveness of the German Glass industry
- Possible support actions should comprise the following elements
  - Increase production of renewable energies to reduce the costs
  - Expand the energy infrastructures for electricity and green gases
  - Implement Carbon Contracts for Difference (CCfD) to foster transformation
  - Provide investment support for decarbonised glass production

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Thank You!



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