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H₂ Hydrogen Map of Poland

Survey results report



Reliable transmission,
sustainable future.



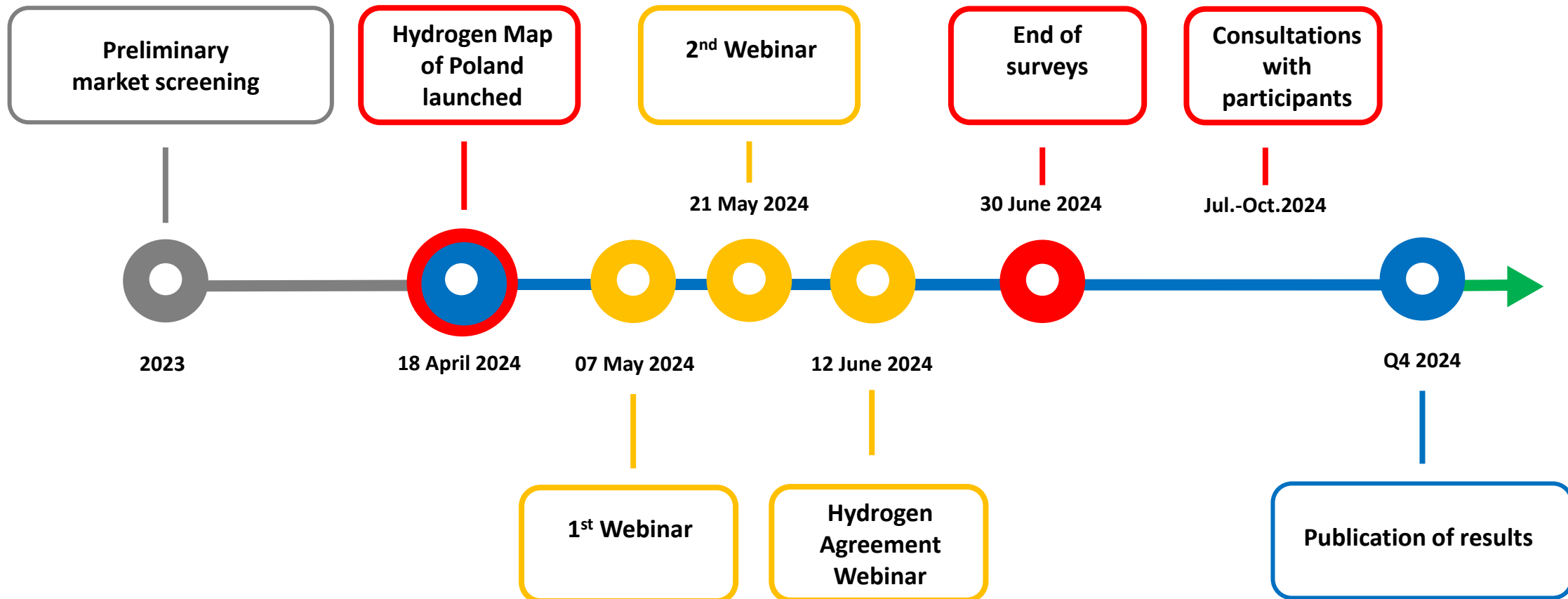
Information about the survey



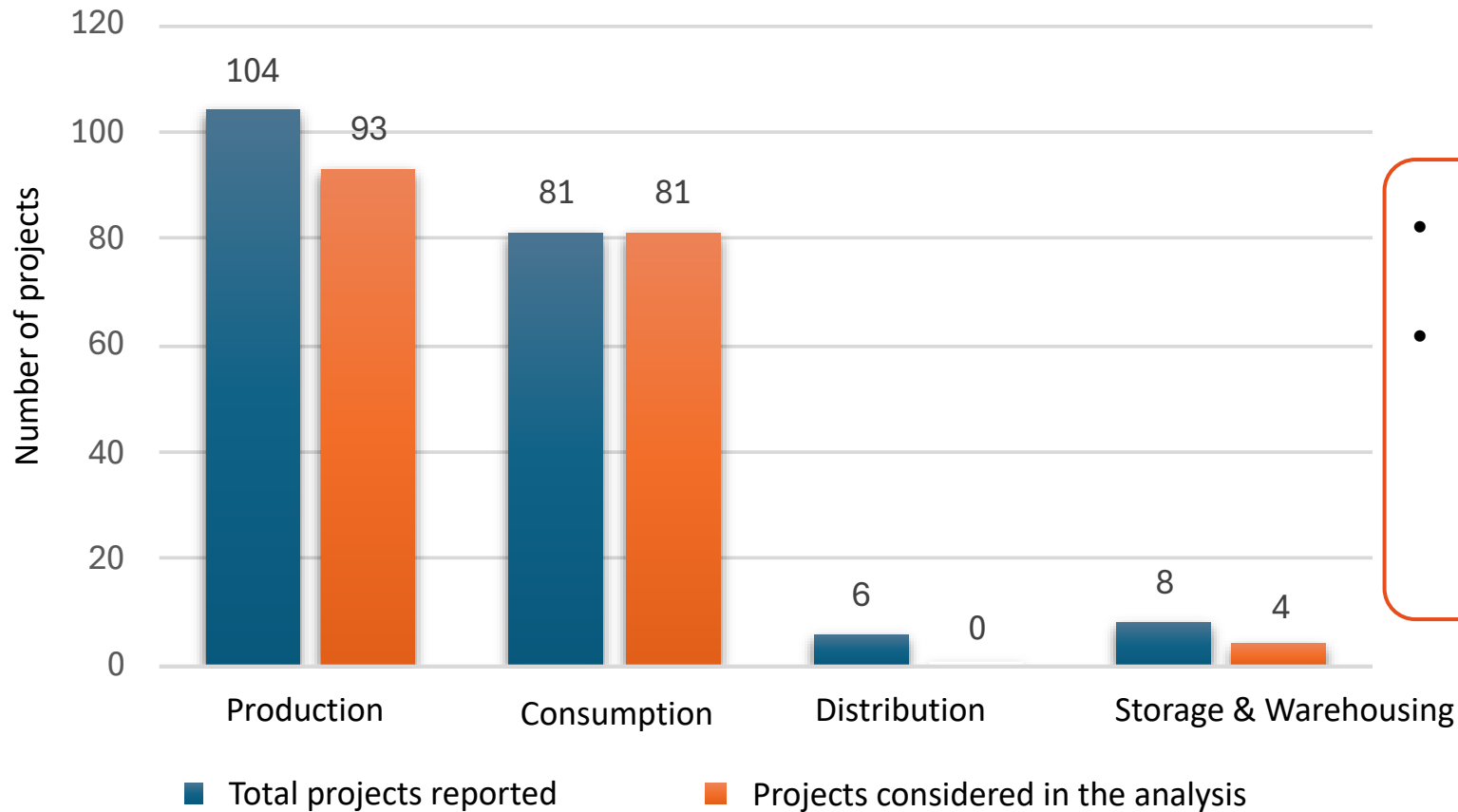
Reliable transmission,
sustainable future.

- The Hydrogen Map of Poland survey was conducted by GAZ-SYSTEM S.A. in Q2 and Q3 2024.
- The results and information contained in this document:
 - were compiled by GAZ-SYSTEM S.A. on the basis of data collected from voluntary responses provided by representatives of companies operating in various sectors of economy,
 - present a quantitative summary of the information received,
 - are indicative only,
 - do not obligate GAZ-SYSTEM S.A. to any acts nor reflect the views of GAZ-SYSTEM S.A. in any way whatsoever, and they should not be regarded as the source of any binding commitment or contractual relationship between GAZ-SYSTEM S.A. and any party concerned.
- Questionnaires returned with incomplete information on the projects were not considered in the survey results.

Schedule



Verified number of projects reported in questionnaires

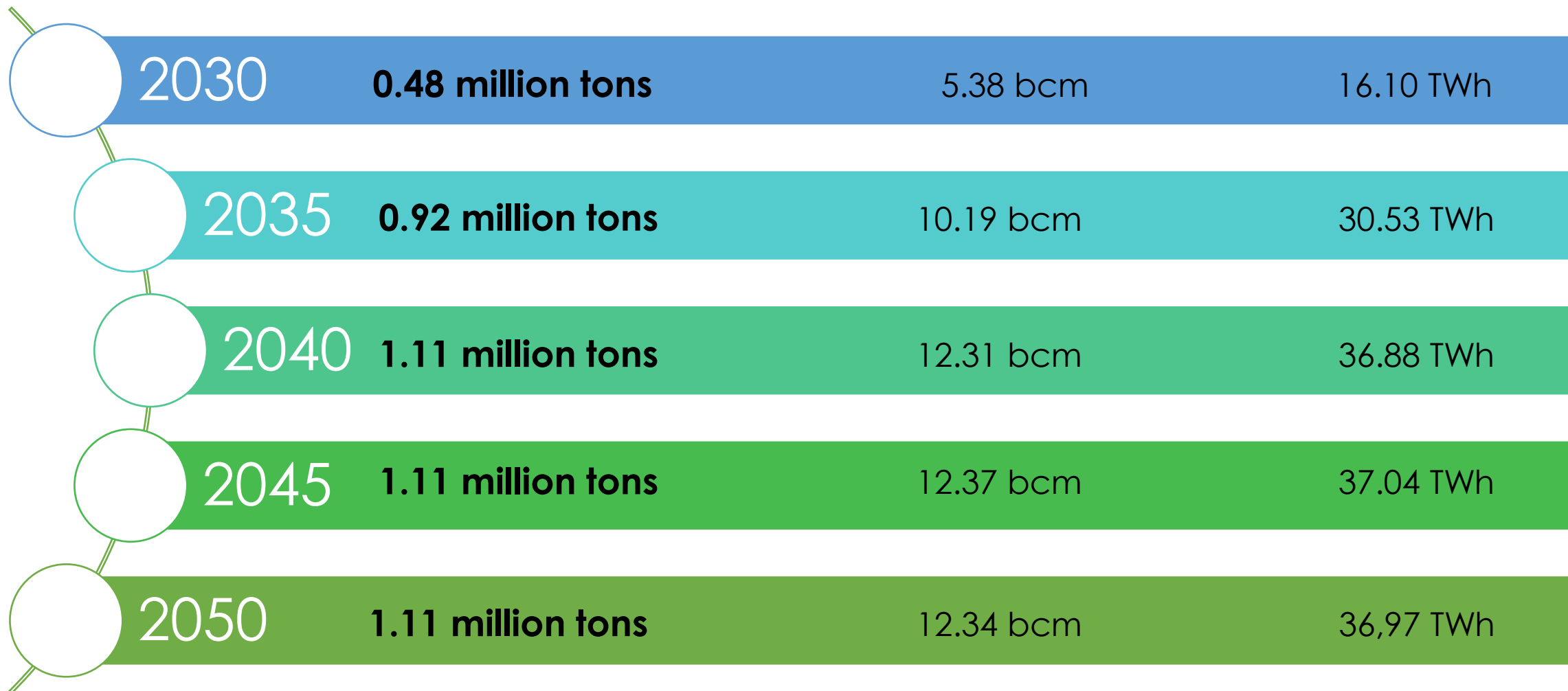


- Number of projects reported - **199**
- The final analysis covers a total of **178 projects** - questionnaires returned with incomplete information on the projects were not considered in the survey results.

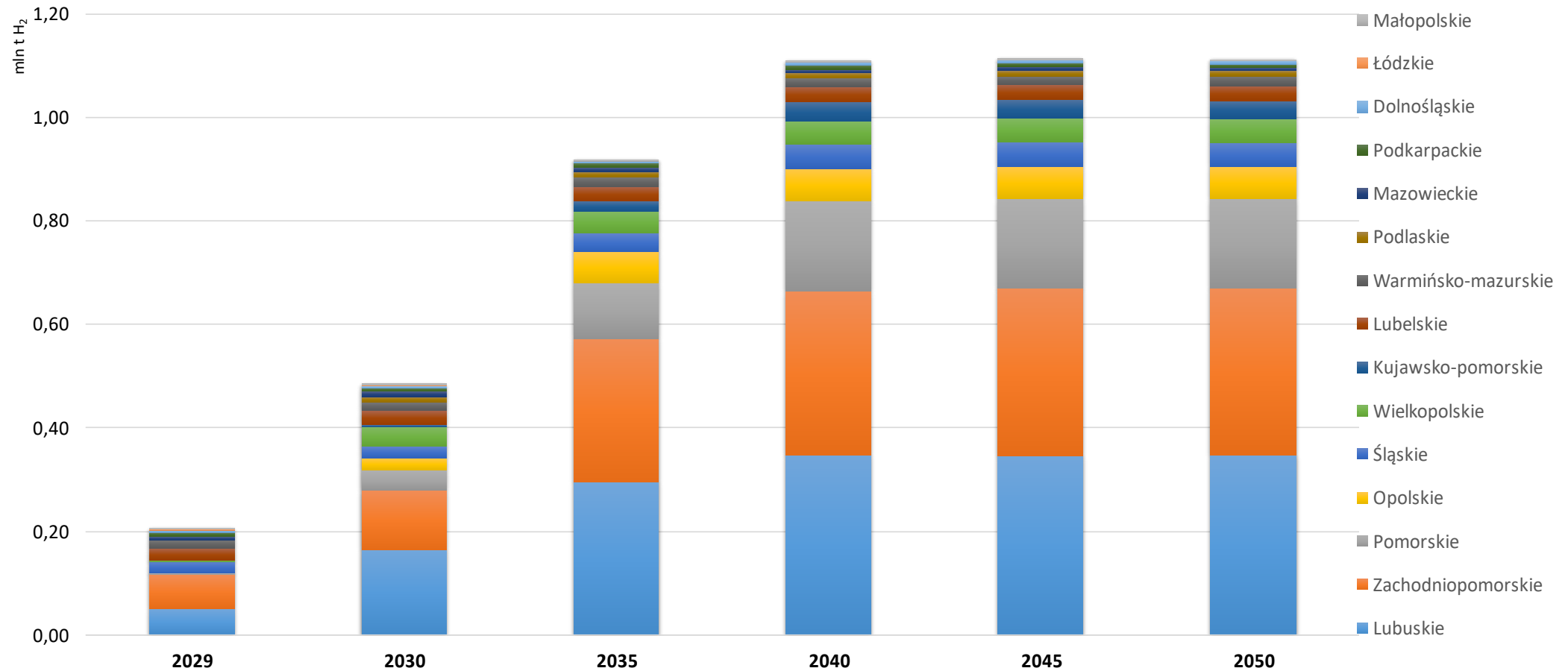
Declared hydrogen production potential



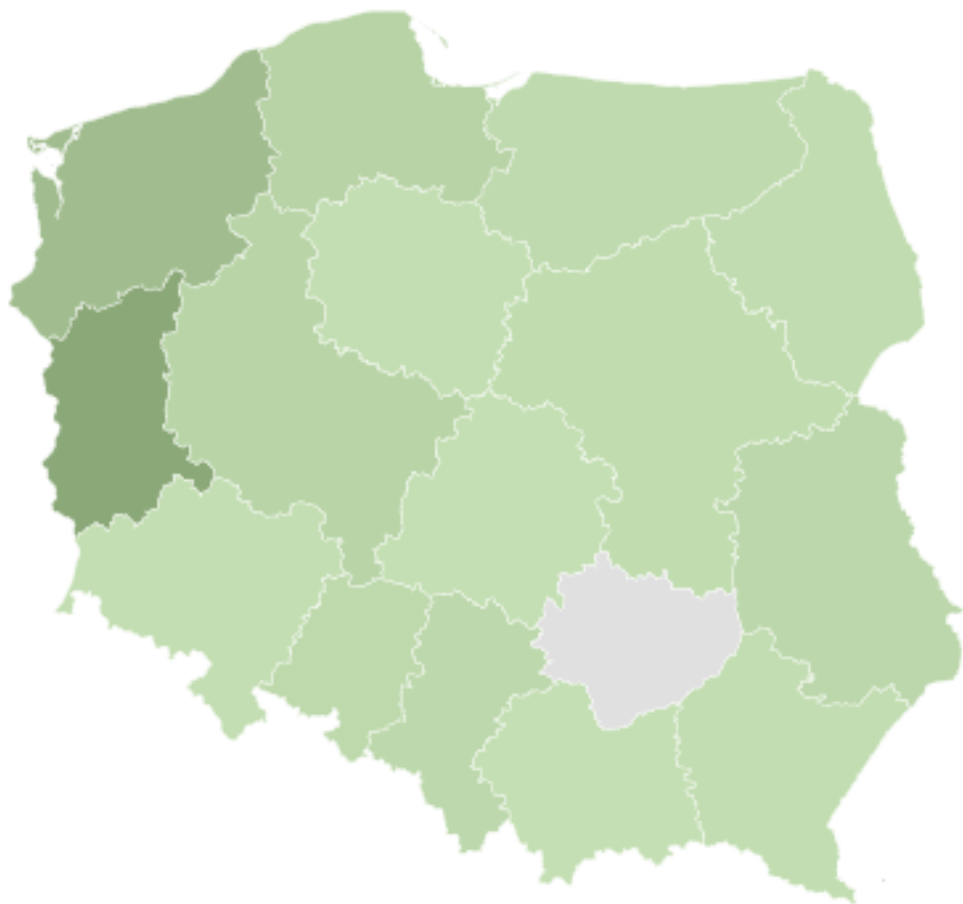
Declared hydrogen production potential



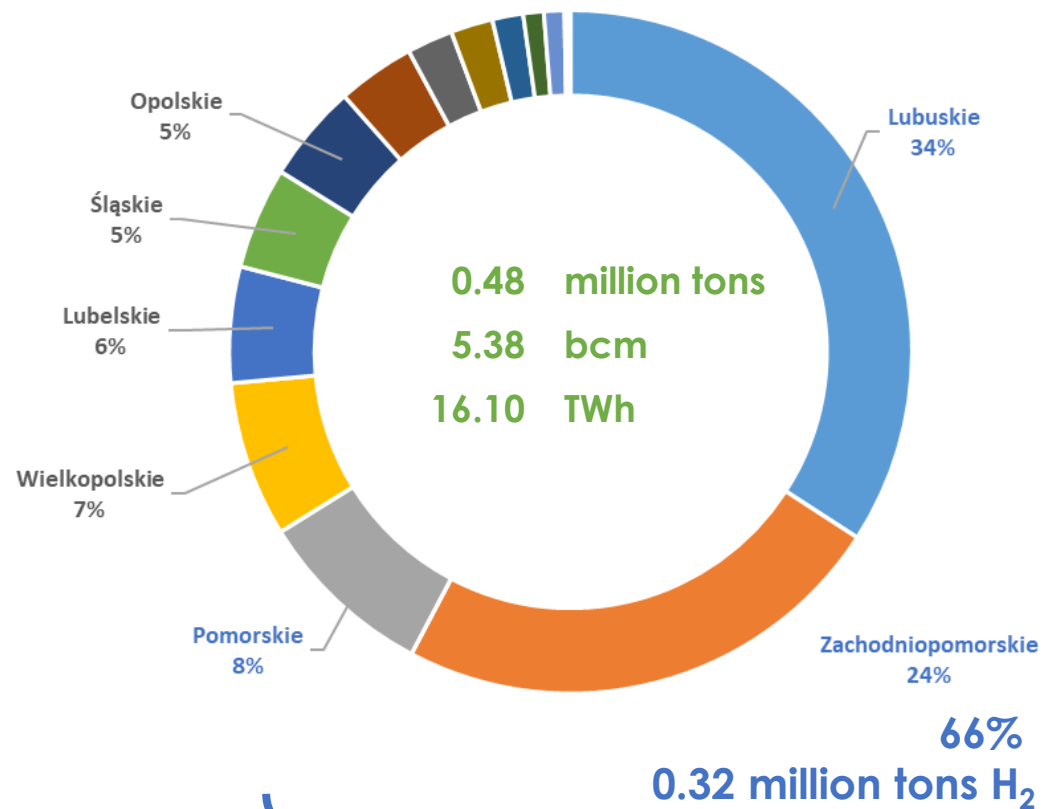
Declared hydrogen production potential - quantitative breakdown by province



Declared hydrogen production potential - breakdown by province - 2030

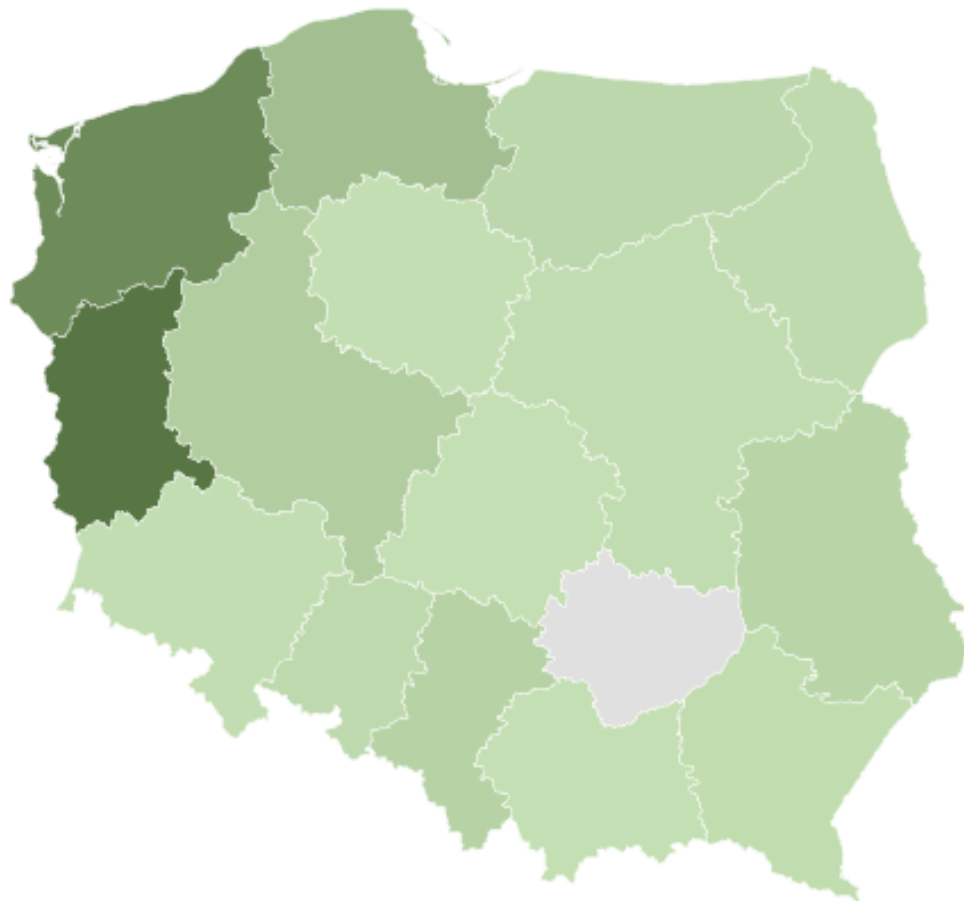


0.45 million T H₂

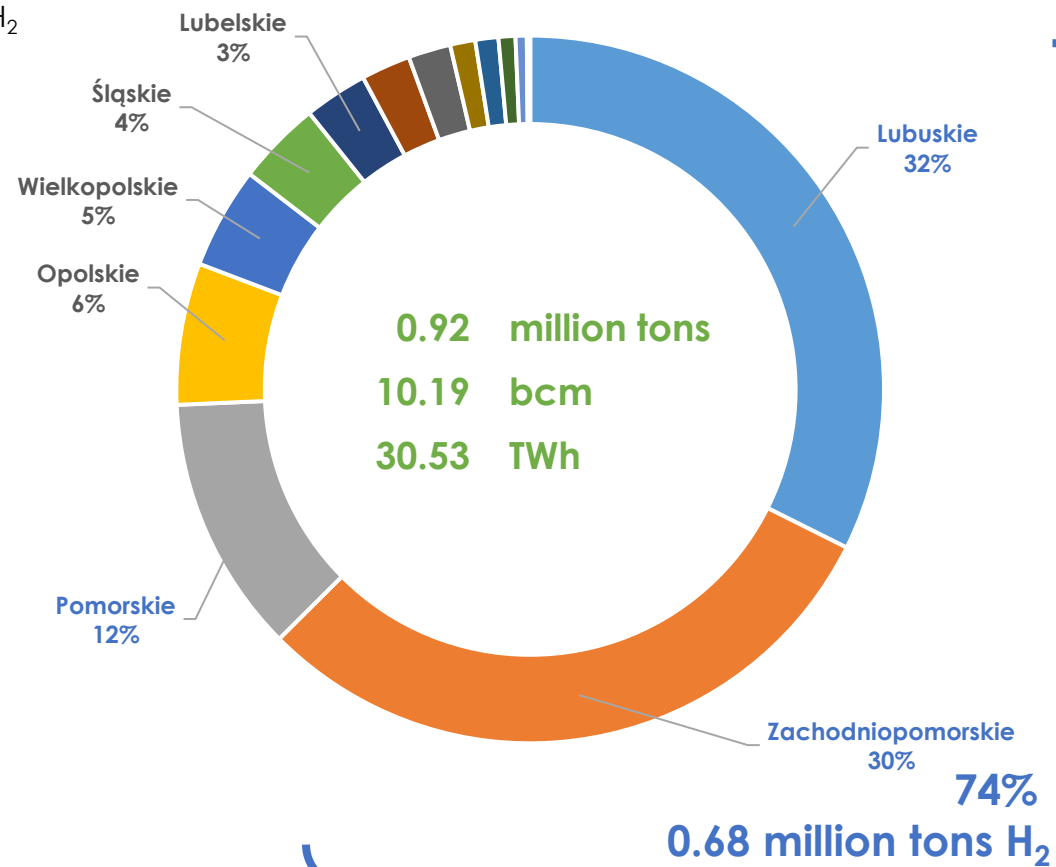


Cumulative for the three provinces declaring the highest hydrogen production potential

Declared hydrogen production potential - breakdown by province - 2035

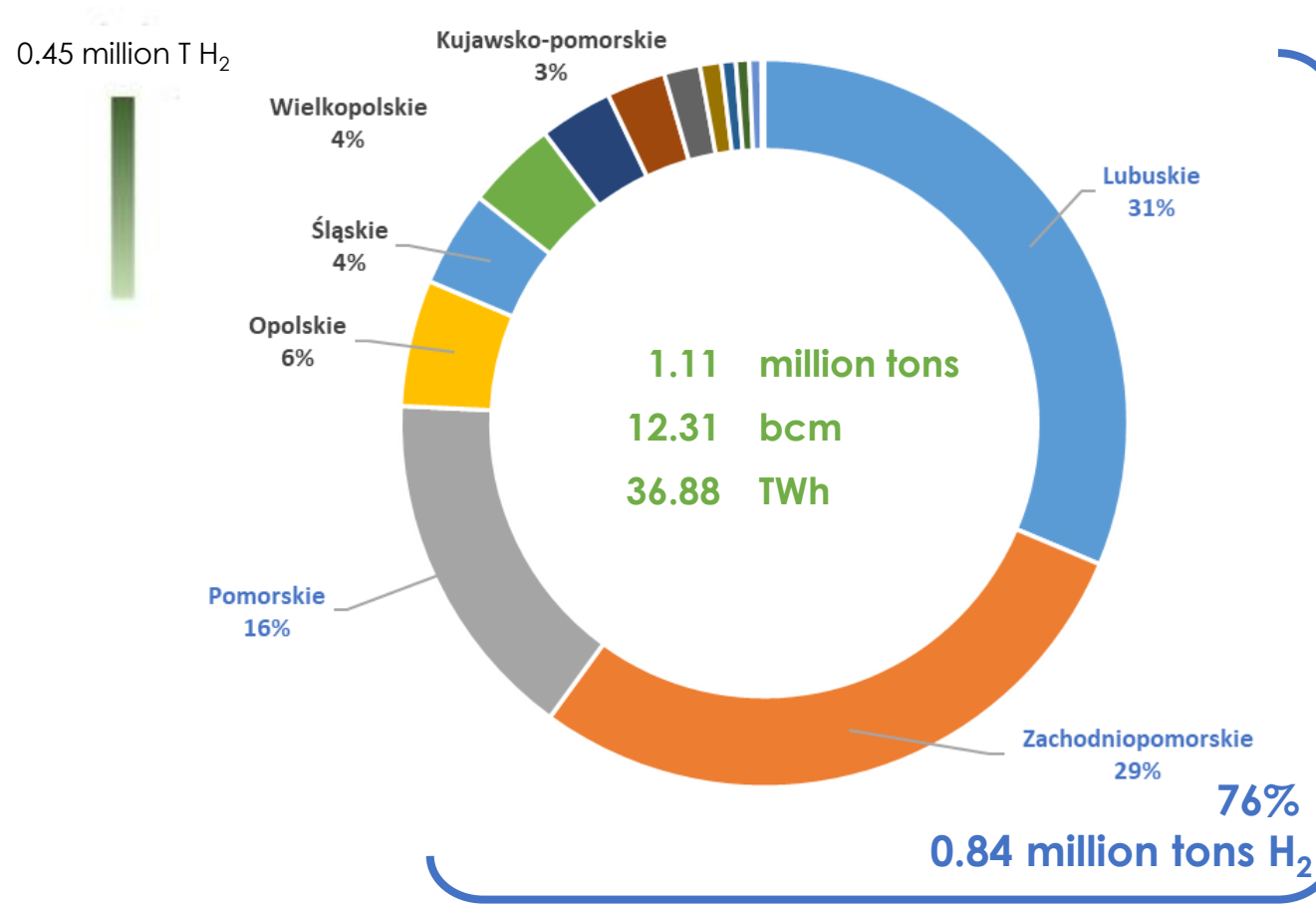
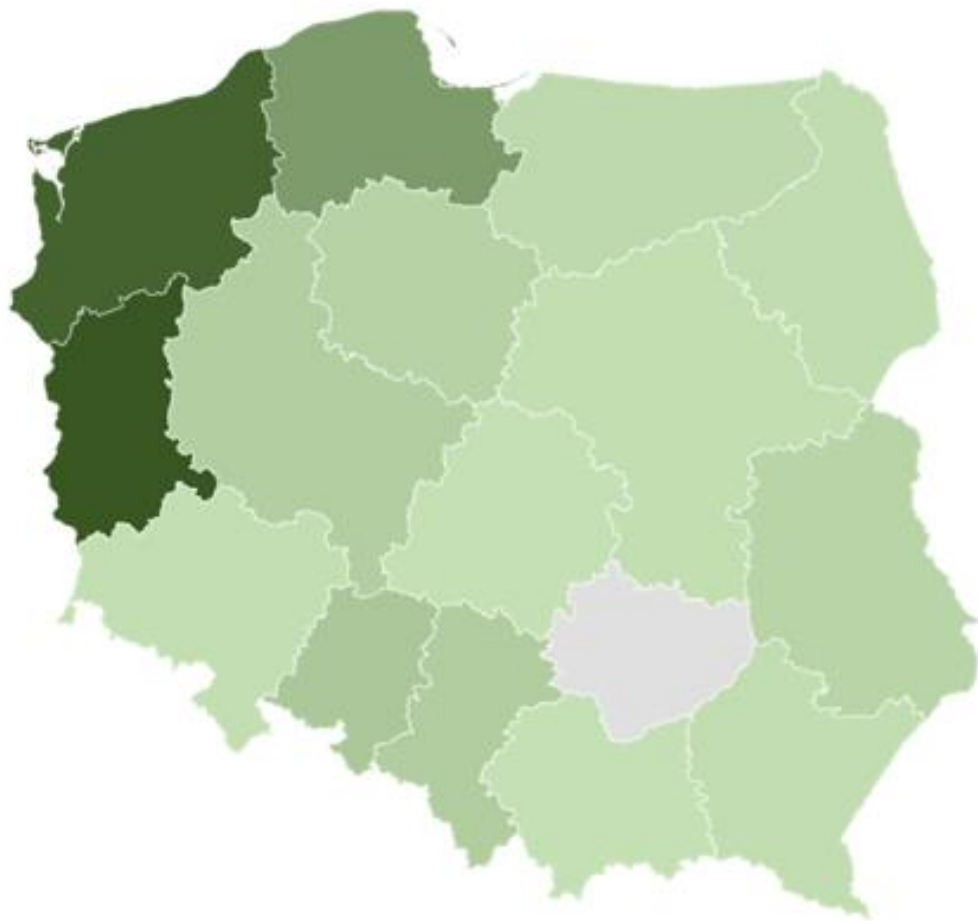


0.45 million T H₂



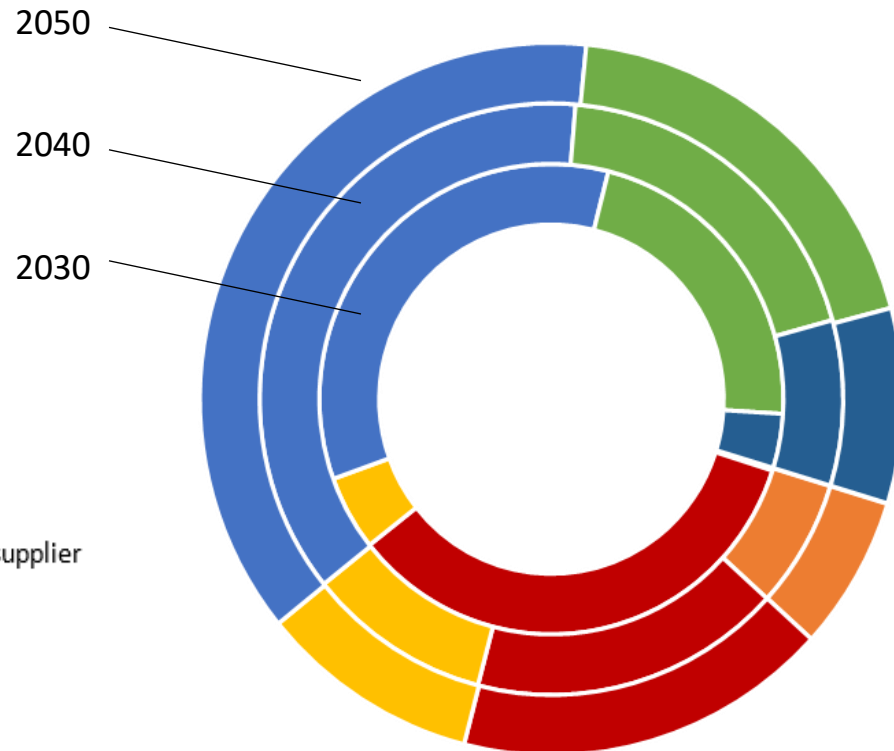
Cumulative for the three provinces declaring the highest hydrogen production potential

Declared hydrogen production potential - breakdown by province - 2040



Cumulative for the three provinces declaring the highest hydrogen production potential

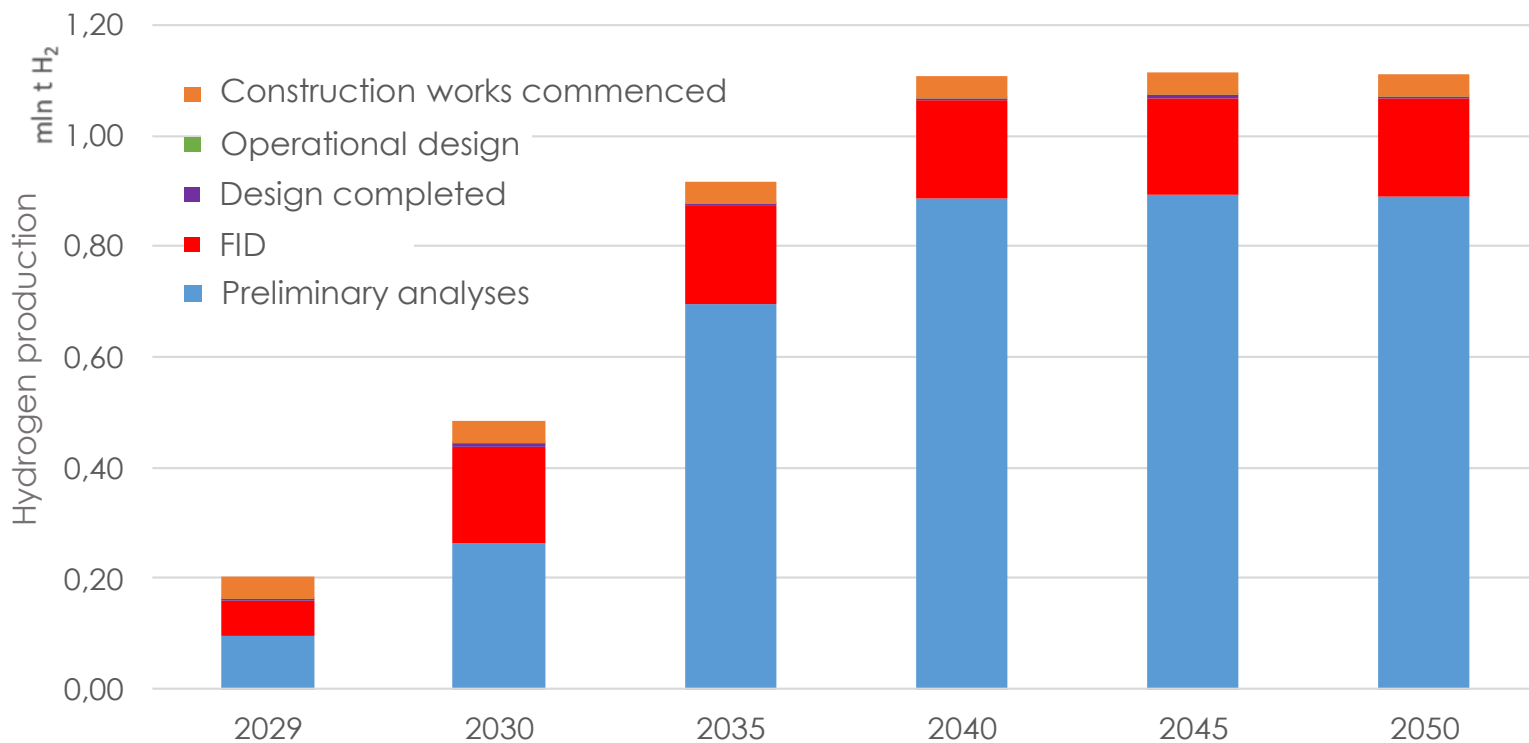
Declared hydrogen production potential in 2030 - breakdown by business area



- Energy trader and supplier
- Industry
- Manufacturing
- Other
- Power plant
- Combined Heat and Power Plant
- Consulting

- The business areas of companies declaring the highest interest in hydrogen generation include:
 - **Production - renewable energy sector for hydrogen production**
 - **CHP Power plants - electricity sector with planned hydrogen generation systems**
 - **Industry - industrial plants planning hydrogen generation capacity development**
- It is worth noting that the breakdown remains virtually stable throughout all reported years.
- Other business areas:
 - Energy traders and suppliers
 - Combined Heat & Power plant
 - Consulting
 - Other

Declared hydrogen production potential - investment readiness level

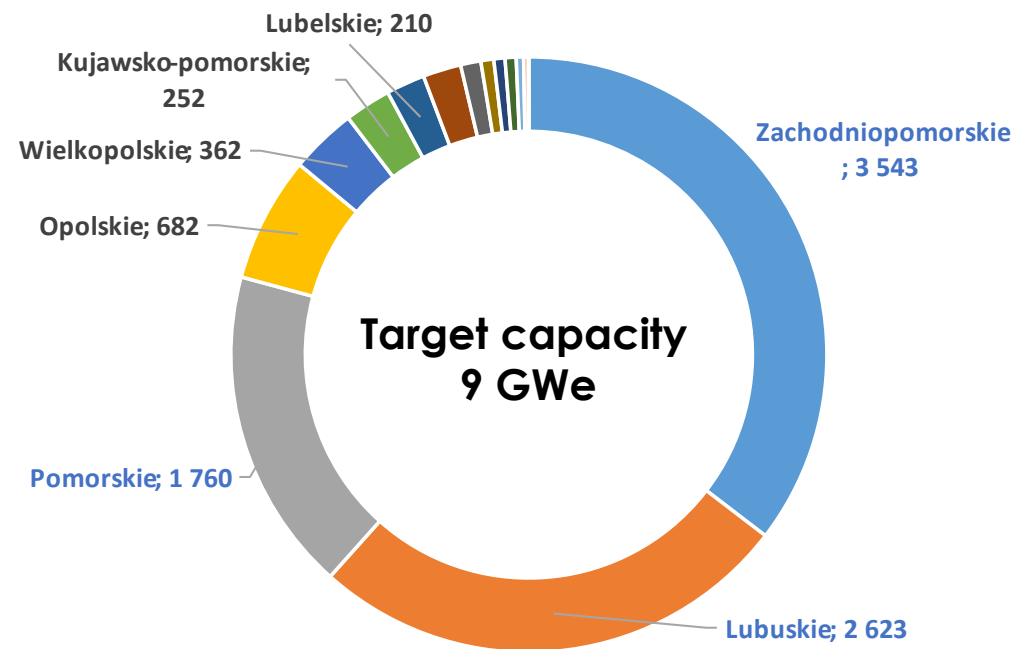
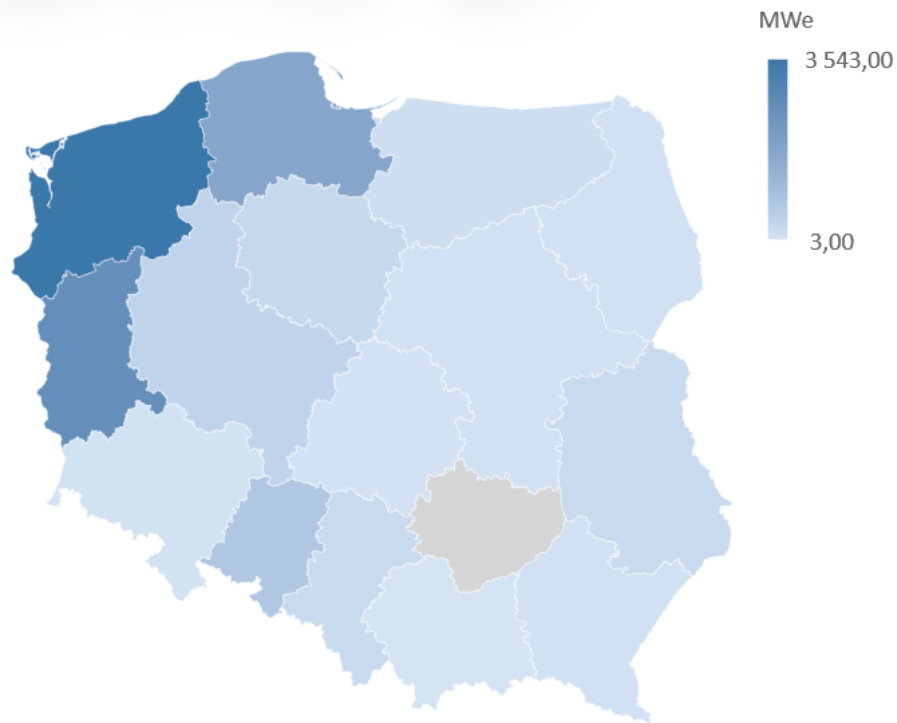


PROJECTS IN TOTAL	2029	2030	2035	2040	2045	2050
	52	83	88	93	93	91

A vast majority of hydrogen production projects reported in the survey are at the stage of preliminary analysis, which is due to the high investment uncertainty and insufficient maturity of the hydrogen market in Poland, including the absence of transmission infrastructure.

The development of hydrogen transmission network requires determination of particular implementation stages of each of the reported projects, starting from the FID until project commissioning.

Declared hydrogen production potential - electrolyser capacity targets in 2050



79%
7 926 MWe

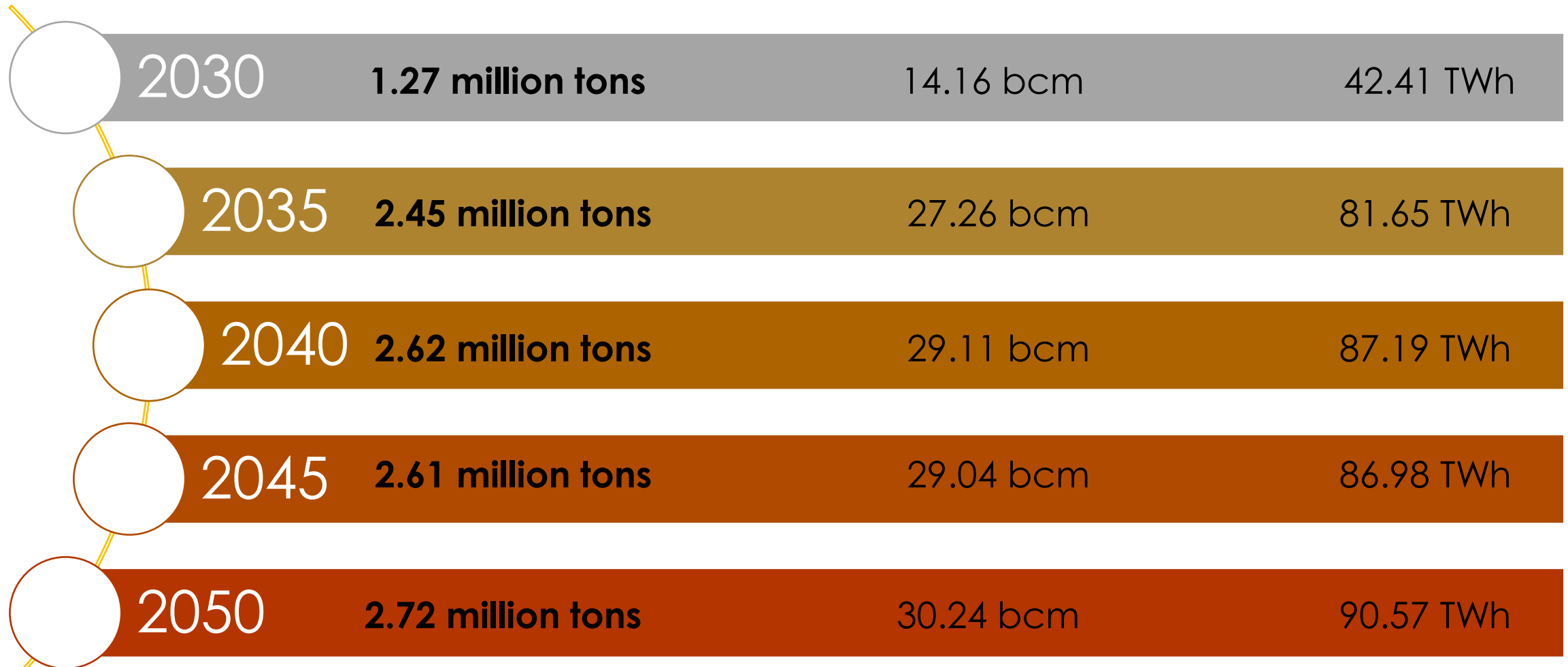
Cumulative for the three provinces declaring the highest electrolyser capacity potential

According to the data provided in the survey, planned electrolyser capacity is to reach 5.6 GWe in 2030. The Polish Hydrogen Strategy provides for 2 GWe of projected electrolyser capacity to be installed by 2030.

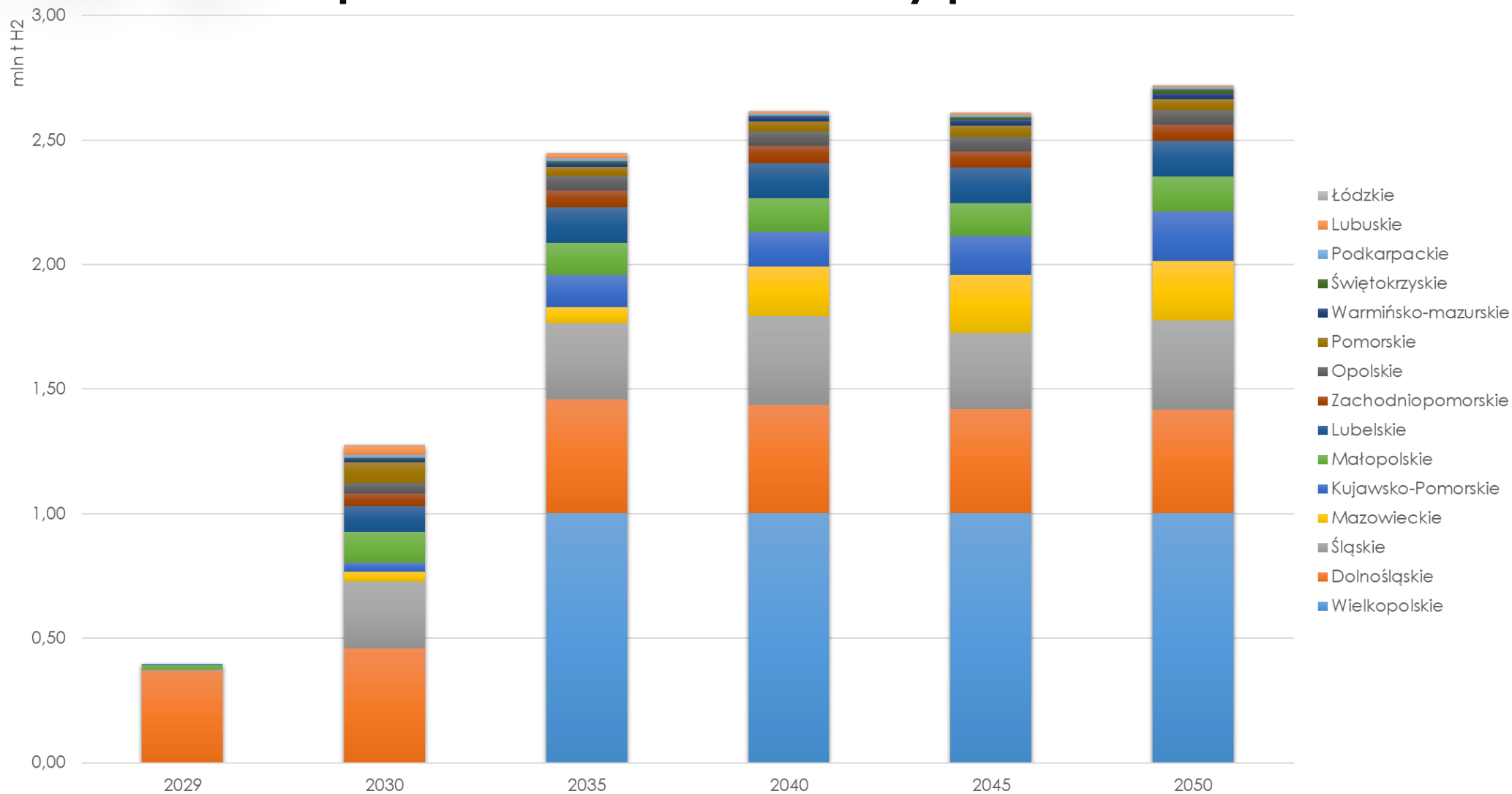
Declared hydrogen consumption potential



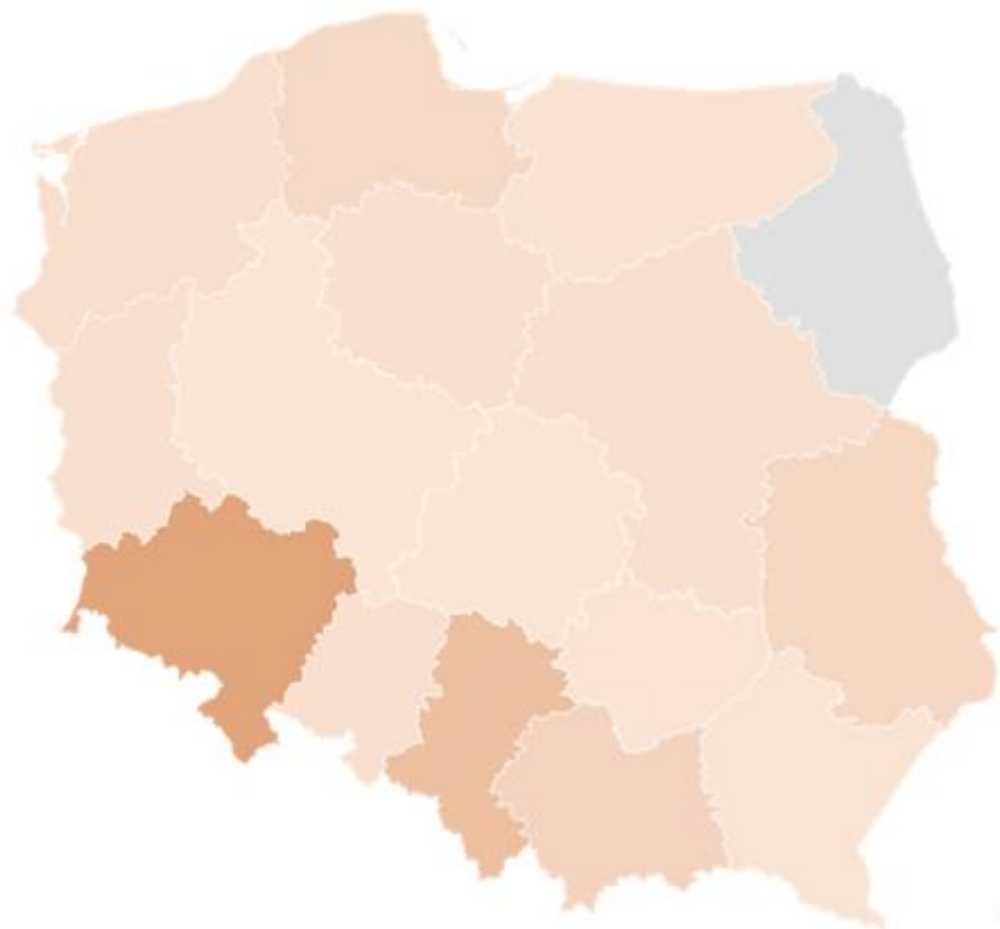
Declared hydrogen consumption potential



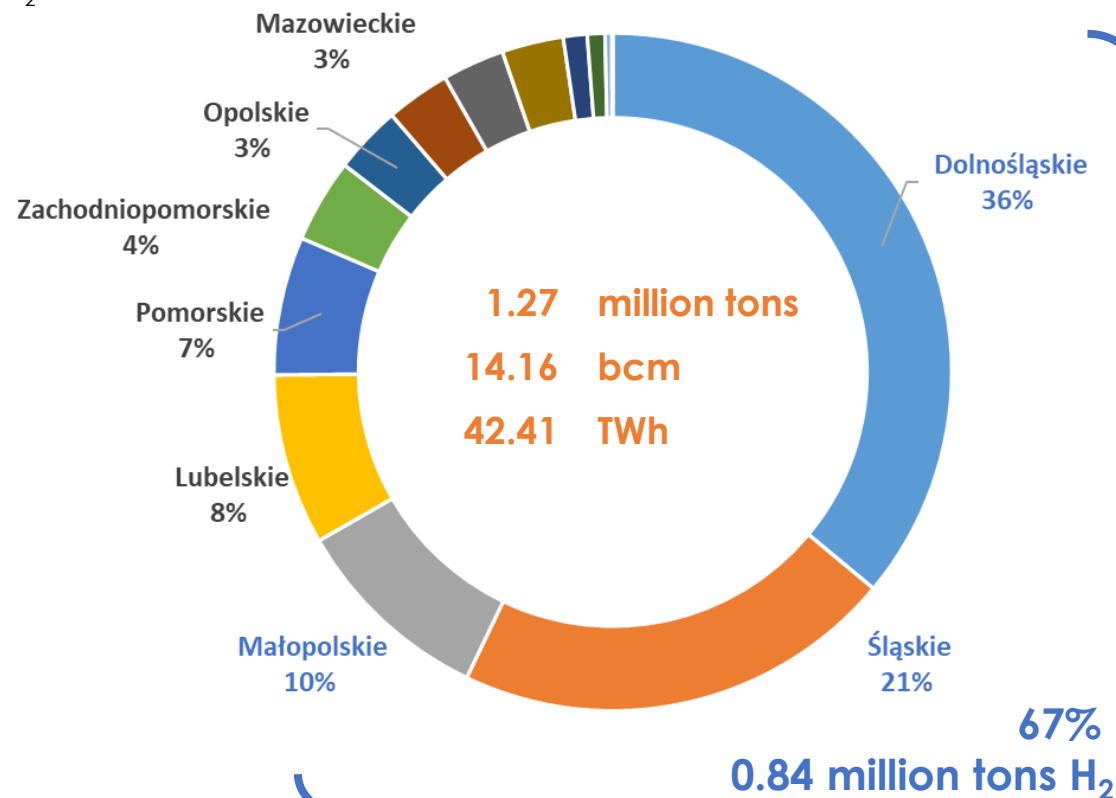
Declared hydrogen consumption potential – quantitative breakdown by province



Declared hydrogen consumption potential - breakdown by province - 2030

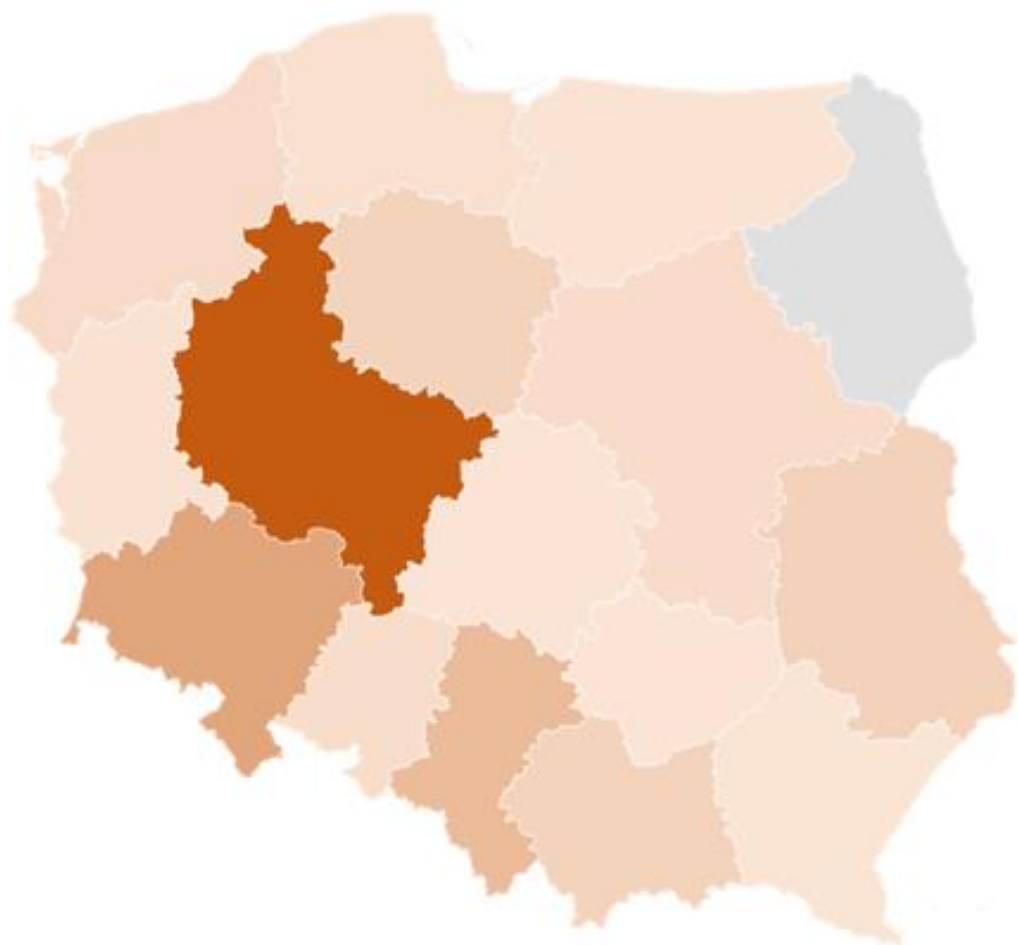


1.0 million T H₂

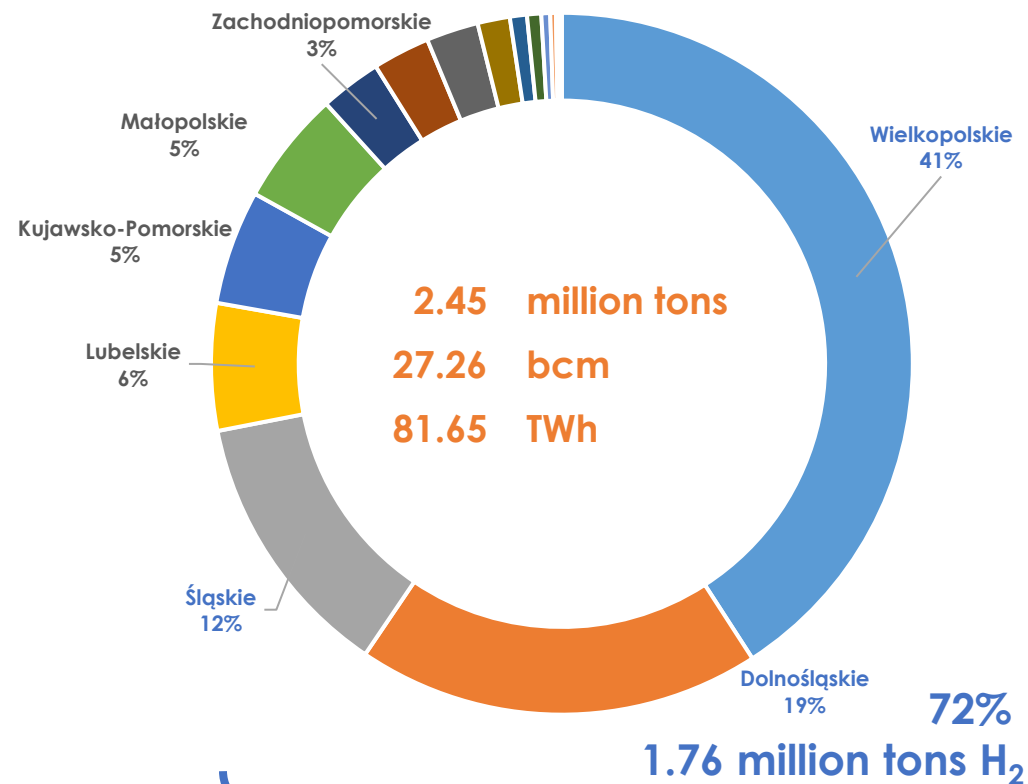


Cumulative for the three provinces declaring the highest hydrogen consumption potential

Declared hydrogen consumption potential - breakdown by province - 2035

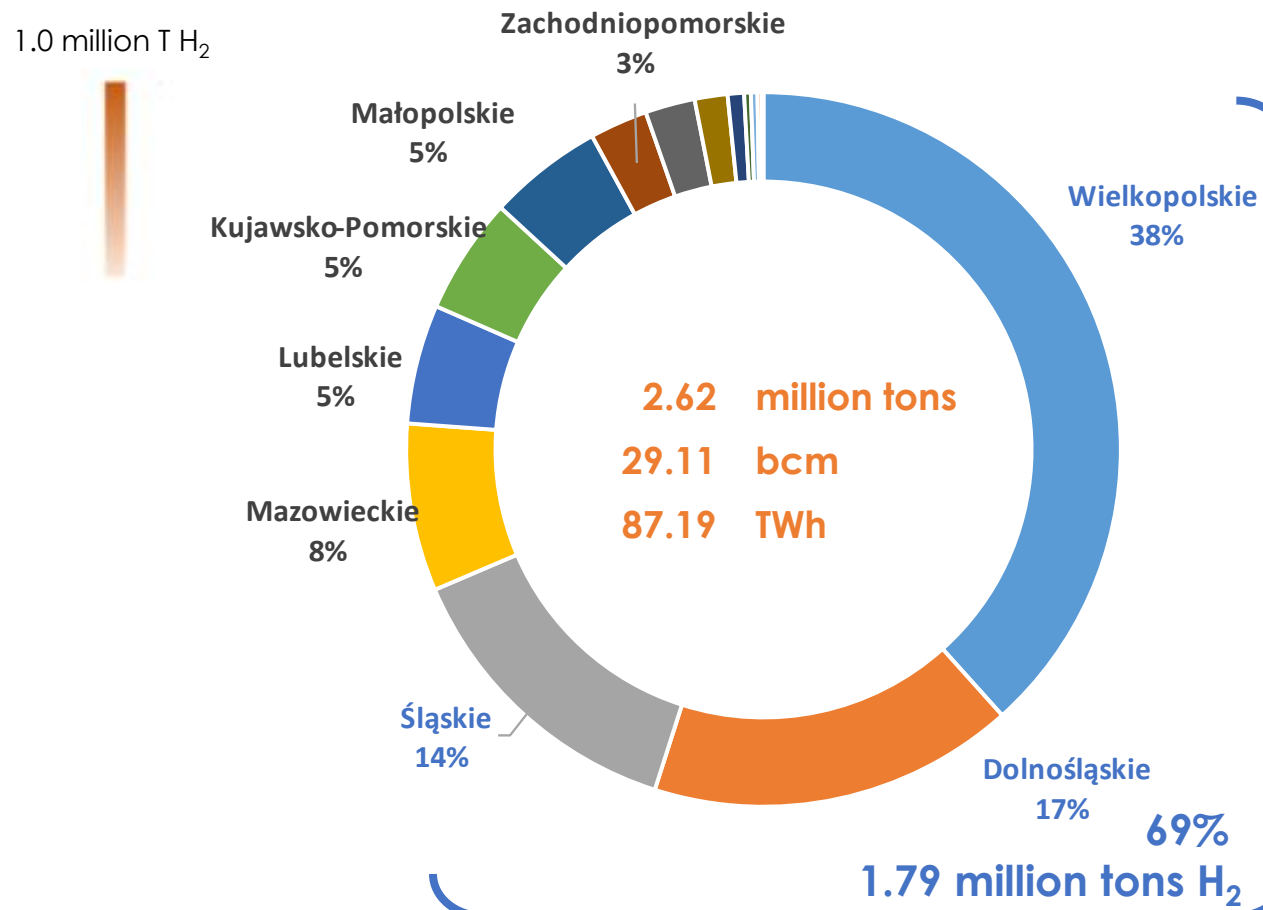
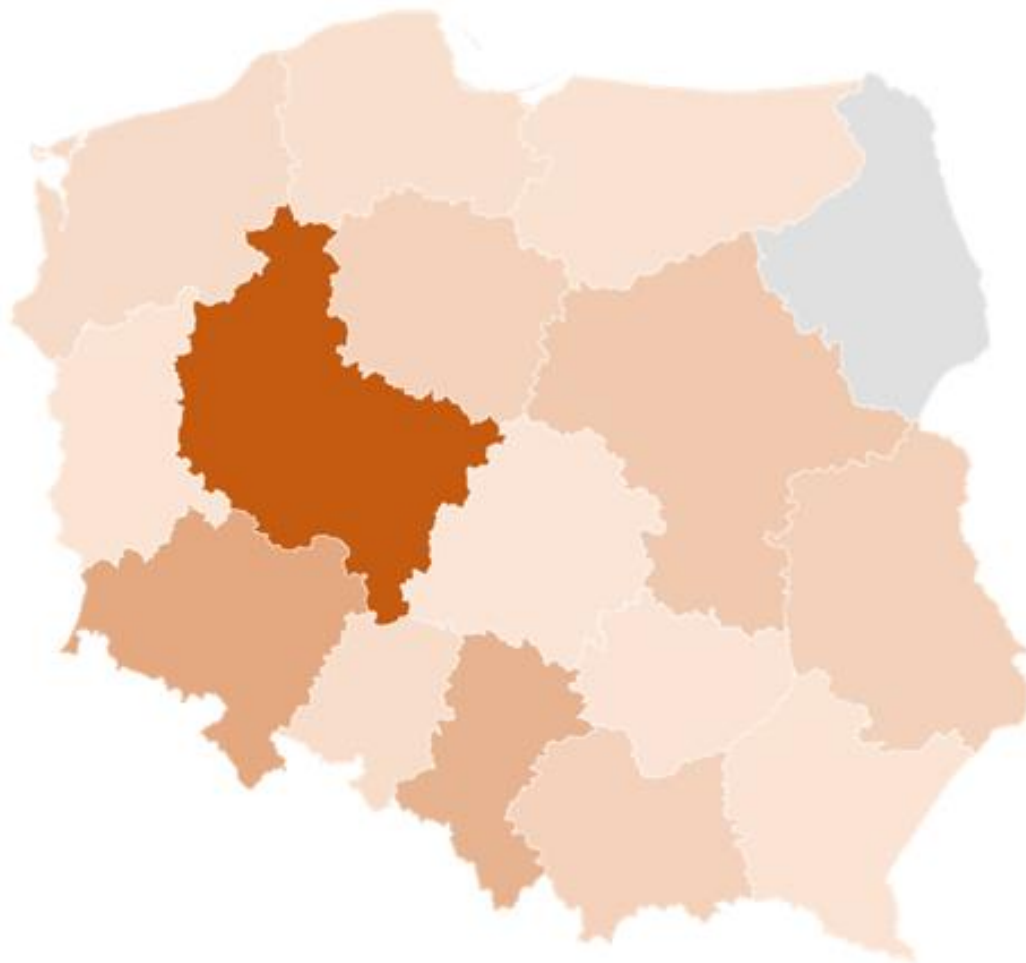


1.0 million T H₂



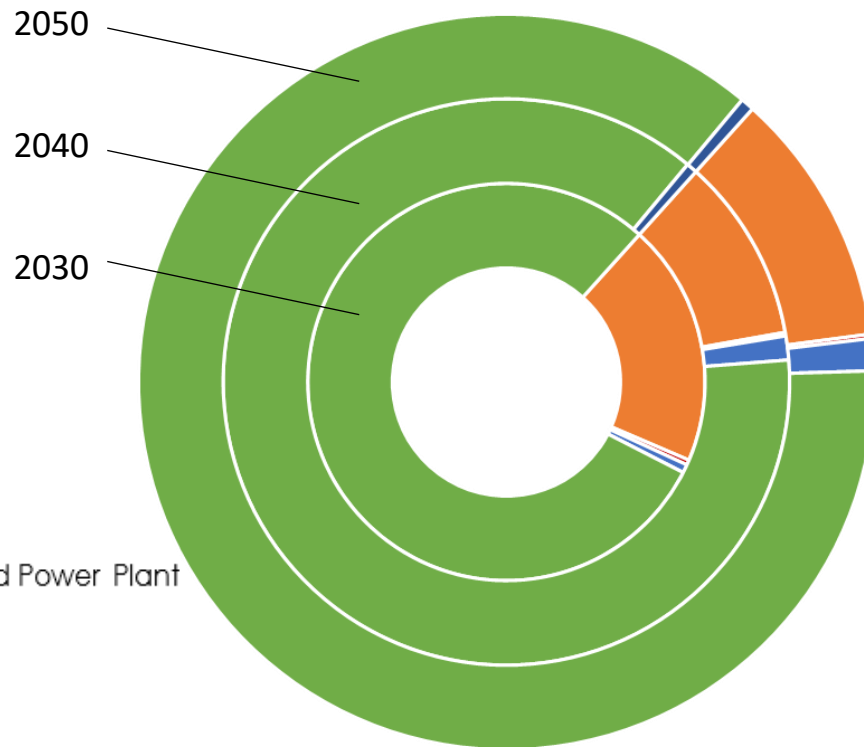
Cumulative for the three provinces declaring the highest hydrogen consumption potential

Declared hydrogen consumption potential - breakdown by province - 2040



Cumulative for the three provinces declaring the highest hydrogen consumption potential

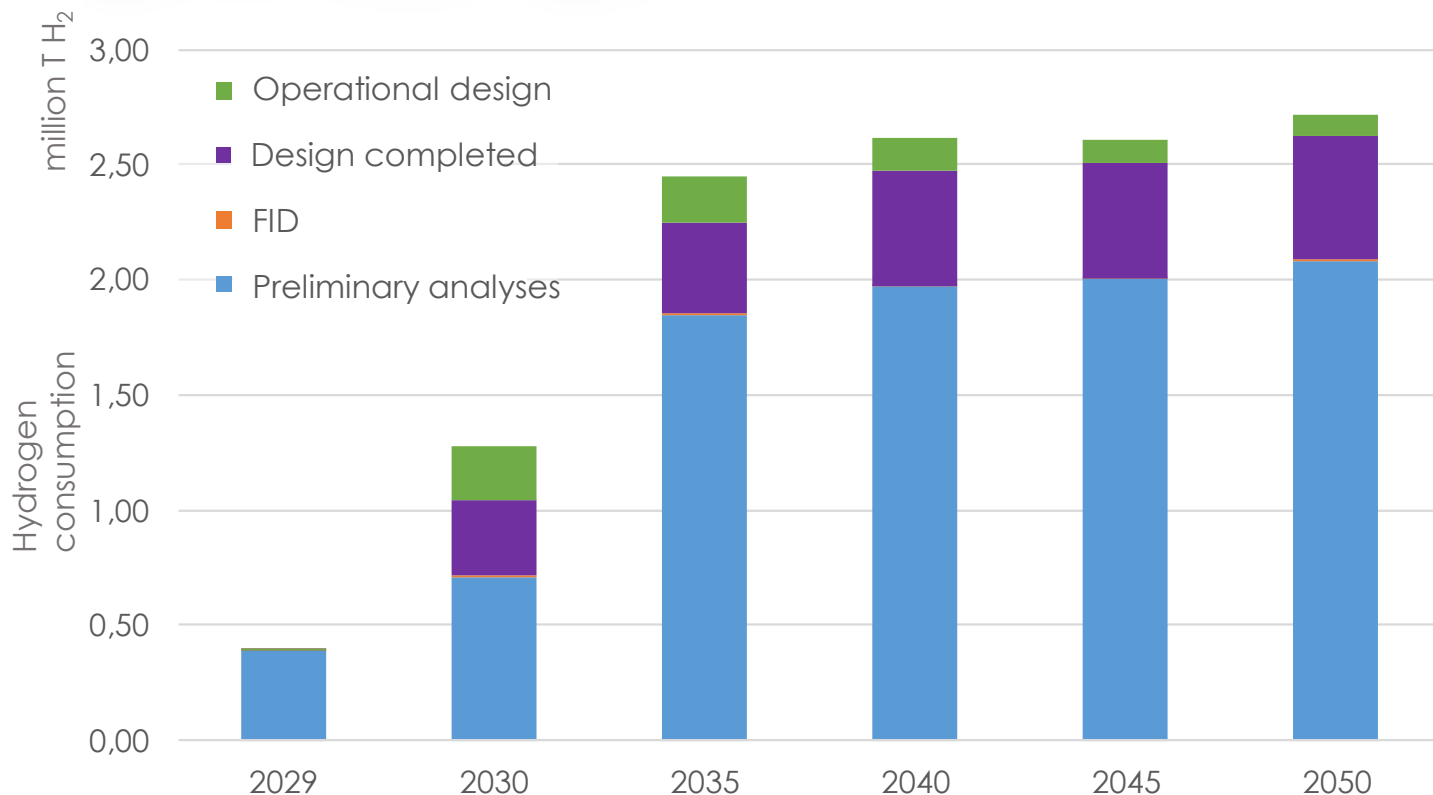
Declared hydrogen consumption potential - breakdown by respondents' defined business area



- Combined Heat and Power Plant
- Power Plant
- Manufacturing
- Industry
- Energy trader and supplier

- The business areas of companies declaring the highest interest in hydrogen consumption include:
 - **Industry - industrial plants using hydrogen in production processes**
 - **Combined Heat & Power plants / Power plants - district heating sector with planned hydrogen fuel systems**
- It is worth noting that the breakdown remains virtually stable throughout all reported years.
- Other business areas:
 - Power Plant
 - Production
 - Energy traders and suppliers

Declared hydrogen consumption potential - investment readiness level



PROJECTS IN TOTAL	2029	2030	2035	2040	2045	2050
	19	52	73	81	78	77

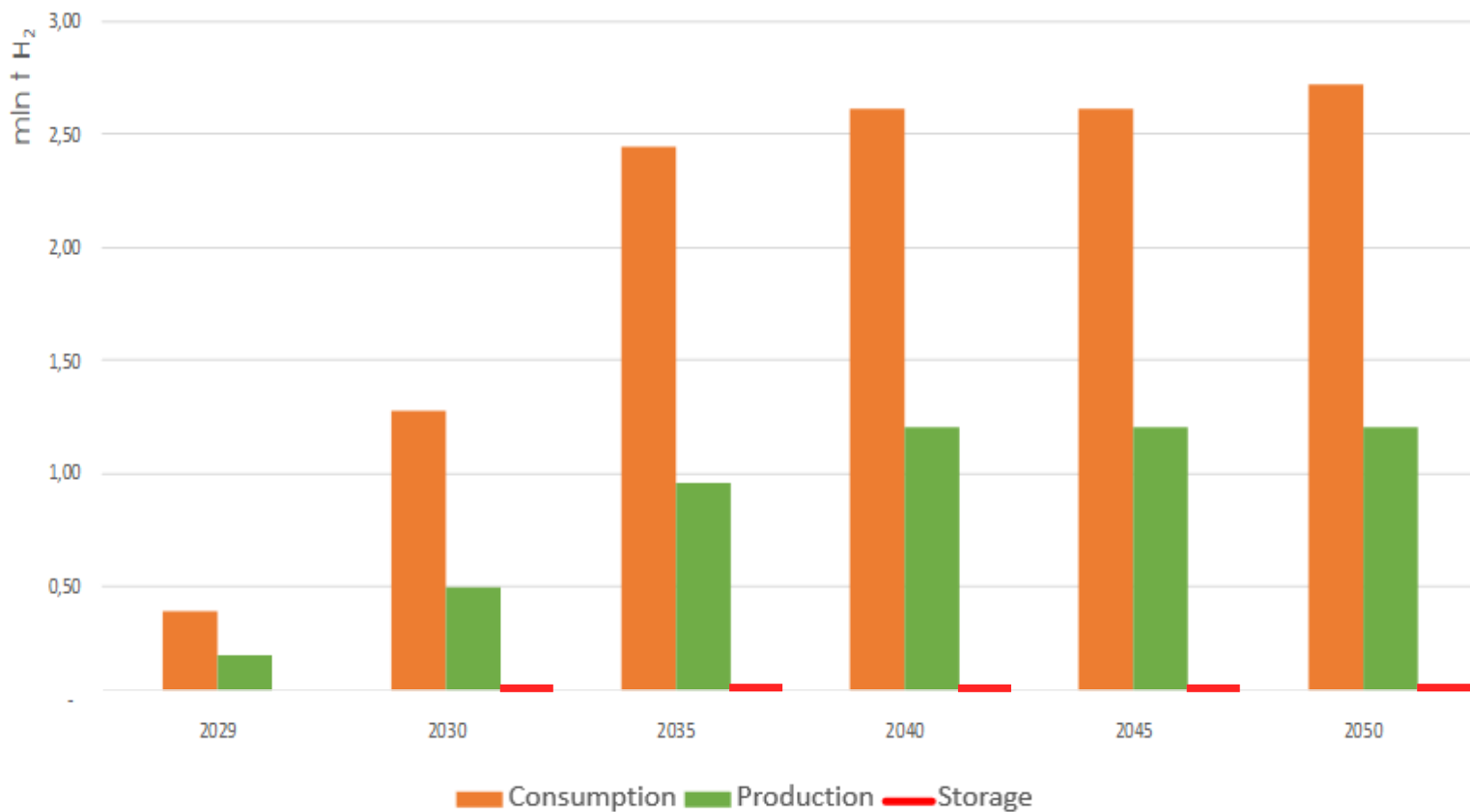
A vast majority of hydrogen consumption projects reported in the survey are at the stage of preliminary analysis, which is due to the high investment uncertainty and insufficient maturity of the hydrogen market in Poland, including the absence of transmission infrastructure.

The development of hydrogen transmission network requires determination of particular implementation stages of each of the reported projects starting from the FID until project commissioning.



Anticipated balance

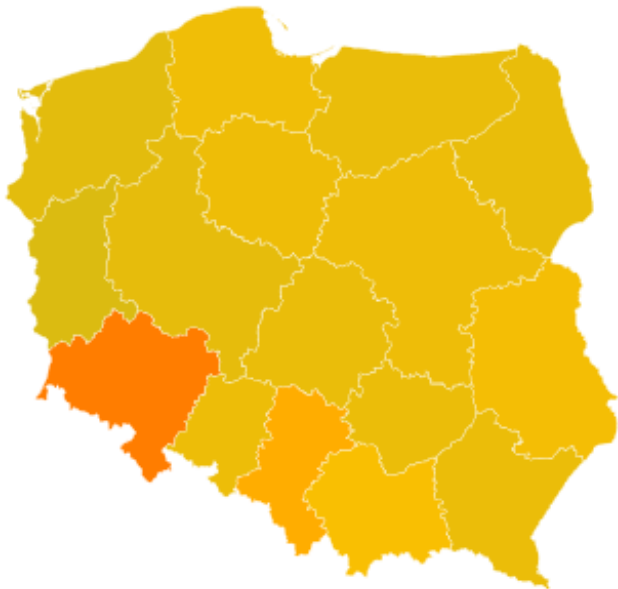
Level of balance and declared storage capacity



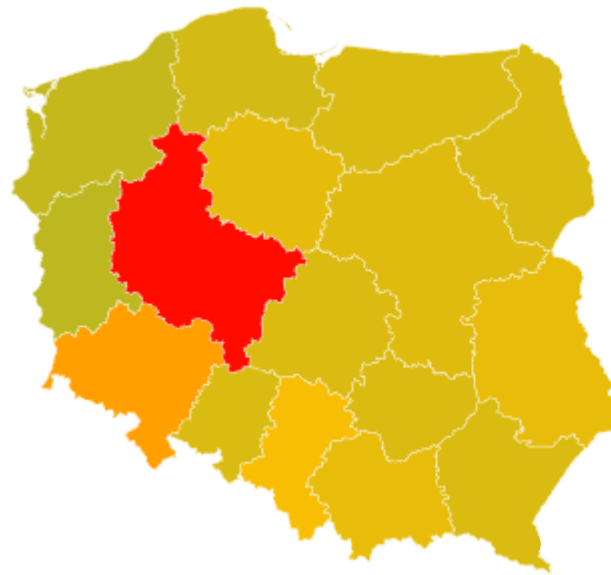
- In Poland, the balance of hydrogen production and consumption is negative.
- From the data declared in the survey it appears that the production capacity of green hydrogen in Poland will not suffice to meet the growing demand.
- Hydrogen storage capacity declared by survey participants totals 0.013 million tons.
- Based on the data declared by respondents it can be concluded that for the proper functioning of the hydrogen market, the increase in the number and capacity of hydrogen storage facilities is pivotal.

Balance in 2030, 2035, and 2040 by province

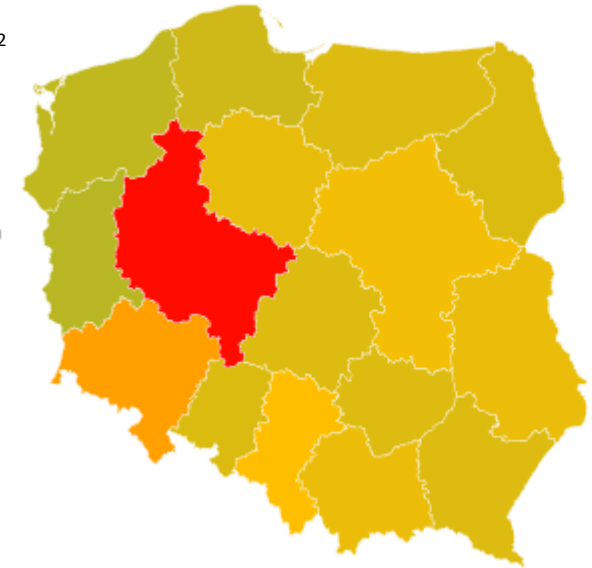
Hydrogen balance in 2030 by province



Hydrogen balance in 2035 by province



Hydrogen balance in 2040 by province



The analysis of the data collected in the survey demonstrates that the greatest undersupply of green hydrogen might occur in **Wielkopolskie, Dolnośląskie, Śląskie and Mazowieckie** provinces.

Year	2030	2035	2040	2045	2050
	million tons H ₂				
Production	0.48	0.92	1.11	1.11	1.11
Consumption	1.27	2.45	2.62	2.61	2.72
Balance	- 0.79	- 1.53	- 1.51	- 1.50	- 1.61

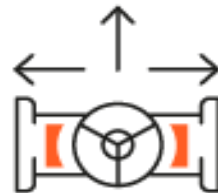
The figures declared by the respondents demonstrate anticipated shortage amounting to almost **0.8 million tons of green hydrogen** in Poland already in 2030.

In the following years, the gap between H₂ production and consumption volume will double, and the discrepancy is expected to reach up to **1.6 million tons** in 2050.

This implies the necessity of further efforts aimed at green hydrogen import infrastructure development or increase in domestic production.

Conclusions

- No response to the Hydrogen Map of Poland survey has been received from entities planning to distribute hydrogen by pipelines.
- Data on demand for hydrogen for vehicle refuelling purposes have been included in the hydrogen consumption section.



- The total declared hydrogen storage capacity amounts to approx. 13,000 tons (432,900 MWh).
- The large-scale hydrogen storage potential is insufficient to meet the demand and to ensure seamless functioning of the hydrogen economy in Poland. It is based solely on the planned three (3) underground hydrogen storage facilities.
- The survey results suggest high interest in hydrogen storage services. The demand for storage services in the future was reported by 28 entities declaring hydrogen production capacity at 0.54 million tons and 6 entities declaring hydrogen consumption at 0.04 million tons.



- The largest number of hydrogen production projects was reported in north-west Poland in Lubuskie, Zachodniopomorskie and Pomorskie provinces. The highest planned hydrogen production capacity (0.84 million tons H₂ in 2040) was reported in the same area, and it is there where the most rapid growth is forecast after 2030 compared to the rest of the country.
- Based on the survey results, hydrogen production volume is expected to surge from 2029 onwards. By 2035, a significant increase in hydrogen production is envisaged, while production volume is to remain stable (at 1.11 million tons H₂) after 2040.
- A vast majority of hydrogen production projects reported in the survey are at the stage of preliminary analysis, which is due to the high investment uncertainty and insufficient maturity of the hydrogen market in Poland, including the absence of transmission infrastructure. The development of hydrogen transmission network requires determination of particular implementation stages of each of the reported projects, starting from the FID until project commissioning.



- In the period from 2029 to 2035, the volume of hydrogen consumption is expected to surge rapidly (2.45 million tons), and afterwards the trend will flatten and record a steady increase (at 2.72 million tons) until 2050.
- The highest demand for hydrogen at 2.13 million tons (2040) is declared in Wielkopolska and the south-west and central parts of Poland: Dolnośląskie, Śląskie, Mazowieckie and Kujawsko-Pomorskie provinces.
- Higher demand for hydrogen is declared mainly by business operating in industrial sector and combined heat and power plants.
- A vast majority of hydrogen consumption projects reported in the survey are at the stage of preliminary analysis, which is due to the high investment uncertainty and insufficient maturity of the hydrogen market in Poland, including the absence of transmission infrastructure. The development of hydrogen transmission network requires determination of particular implementation stages of each of the reported projects, starting from the FID until project commissioning.



Conclusions

- The development of a concept of hydrogen transmission system is essential to enable growth of hydrogen market in Poland, including bridging the supply and demand gap (deficit of domestic production compared to demand) with hydrogen imports.
- The survey respondents declared that their decisions regarding hydrogen projects (both production and consumption) depend on the development and ultimate routing of hydrogen transmission network in Poland.
- Some companies declared interest in targeted hydrogen production, while there are also entities whose decision on hydrogen production depends on the possibility of connecting to the power grid.

- According to the survey results, the entities interested in hydrogen production have not yet established relationships with potential consumers.
- It is therefore fundamental to design the structure of hydrogen market in Poland that will match production capacity with consumption potential.
- Dispersed production facilities located in close proximity to one another can be combined in hydrogen hubs to achieve technical and economic optimisation.

- Given the reported volumes of hydrogen production and consumption, the necessity for hydrogen transmission infrastructure will arise already in the 2030 -2035 period.
- Based on the information collected in the survey, domestic hydrogen production (0.5 million tons) may not suffice to meet the anticipated demand (1.1 million tons) already in 2030. Domestic production (1 million tons) of hydrogen will satisfy only up to 40% of the dynamically increasing demand (estimated at 2.4 million tons) anticipated in 2030 - 2035.
- According to the survey data collected, the only solution to meet the domestic demand for hydrogen will be through imports ranging from 0.8 million tons in 2030 to 1.4 million tons in 2040.
- Based on the information provided by respondents, the planned storage capacity (13,000 tons) corresponds only to 0.5% of hydrogen consumption volume anticipated in 2035.
- Due to the unreliability of RES and the required continuity of hydrogen supply to consumers, the plans for the construction of hydrogen storage facilities need to be thoroughly revised.

Preliminary concept of hydrogen transmission network in Poland based on the results of the Hydrogen Map of Poland survey

Based on the survey results and taking into account other projects implemented by GAZ-SYSTEM, certain areas were selected for which a preliminary concept of hydrogen transmission network will be developed. The ultimate pipeline routes will be defined on the basis of dedicated studies and engineering designs.

Implementation of individual sections will be confirmed following detailed arrangements with entities interested in connecting to the hydrogen transmission network.

The target structure of the hydrogen transmission system in Poland will also take into account the information and data derived from GAZ-SYSTEM's expert knowledge gained through discussions with industry representatives, hard-to-abate sectors, as well as considerations of large urban conurbations.





H₂ Hydrogen Map of Poland



Going forward



Reliable transmission,
sustainable future.

- Discussion on the results and presentation of measures to be taken by GAZ-SYSTEM S.A. will take place during a meeting with all respondents participating in the Hydrogen Map of Poland survey.
- A dialogue with individual survey participants to update the information on the projects reported in questionnaires will continue.
- The measures such as information exchange tool or platform will be undertaken to facilitate mutual identification of entities considering hydrogen production or consumption.
- Further analysis and development of the first National Hydrogen Network concept will follow.
- Activities related to the development of a Feasibility Study for individual components of hydrogen transmission infrastructure, both domestic and cross-border, are to be initiated.





Hydrogen ^{H₂} Map of Poland

Thank you!