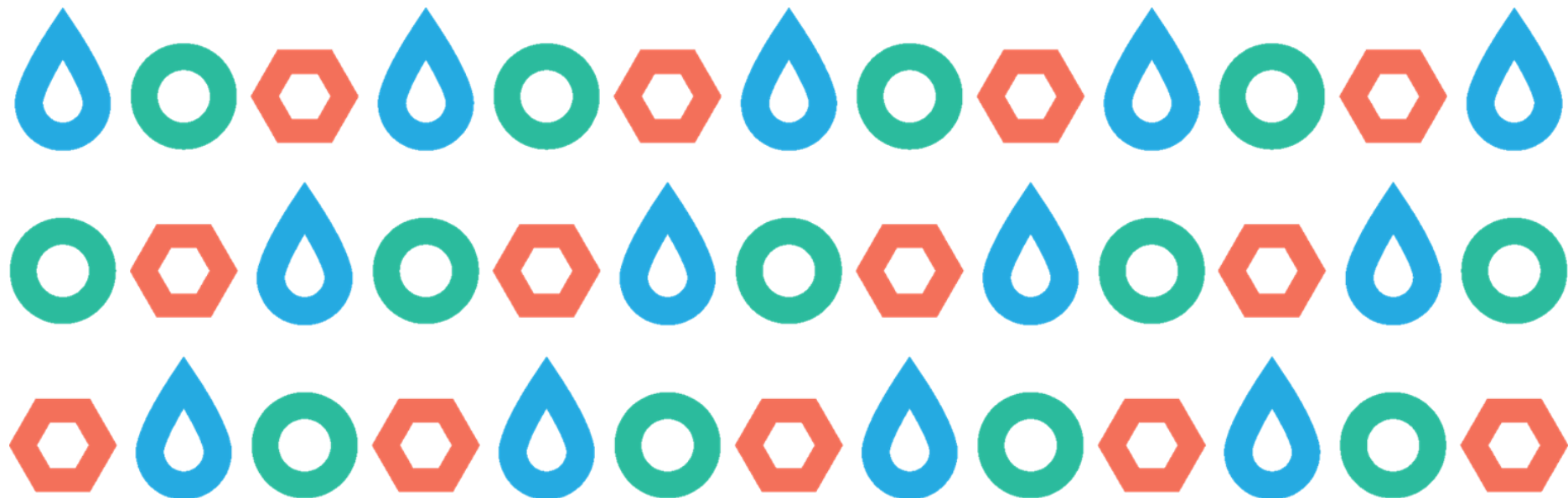


# 3W • WODA • WODŃR • WĘGIEL

**3W Water Hydrogen Carbon: the new sector of the global economy based on life resources, the foundation of the future**



**Opening  
remarks**



Ambassador of the Republic of Poland in Japan  
**Mr Paweł Milewski**



President of the Management Board, BGK  
**Mrs. Beata Daszyńska-Muzyczka**



## The context of 3W initiative



- We're living in a "VUCA reality", facing Volatility, Uncertainty, Complexity and Ambiguity. These are effects of the pandemic, unprecedented inflation and the first full-scale armed conflict in Europe in decades.
- As a development bank, we carefully observe trends, and in a constantly changing reality we look for opportunities that result from global circumstances and the unique potential of Poland on the geopolitical map of Europe and the world.
- We've been looking for **synergies, partnerships, innovations and resources** on which we would build our future security and on which it would be possible to build competitive advantages.
- **Thanks to these observations, we understood that the future is based on 3 life resources: water, hydrogen and carbon, unique for their synergistic potential.**



# Water



Clean water, which we use to drink and for economic activity, is becoming increasingly difficult to access. According to scientists, by 2050, over half of the Earth's inhabitants will already be at risk of a water deficit. The hydrosphere is most affected by climate change resulting in extreme weather phenomena, such as droughts and flash floods. Technologies and solutions in the area of water – innovative retention, usage limitation, desalination and treatment methods will allow us to avoid a water crisis in the future.

- **Water is the biggest challenge (In Poland we have Egypt-level numbers: 1600 m<sup>3</sup>/year/person)**
- **Only 1% of water is drinking water**
- **Water wars – real threat**

# Hydrogen



Hydrogen usage does not result in harmful emissions and that is why it is called the fuel of the future for the automotive industry, as well as the energy and industry sector. The surplus energy produced on sunny and windy days can be used in the electrolysis process to obtain so-called green (i.e. Emission-free) hydrogen. This is a great energy store. Technologies for the production, transport and storage of hydrogen will make it easier for us to move away from fossil fuels and will provide us with access to clean and safe energy, which we need more and more as civilisation develops.

- **Fuel of the future (high efficiency: 141 MJ/kg)**
- **Many non-energy applications (eg. medicine)**
- **Hydrogen is 70% of matter in the universe - it is a challenge to master it**

# Carbon



Carbon is an element of life - all organic chemical compounds contain it. Thanks to its amazing physicochemical properties, it allows scientists to create lighter and more durable engineering materials. It has many forms, of which particularly interesting are its single-atom structures (graphene, fullerenes and nanotubes) as well as activated carbon. Carbon is increasingly used in innovative sectors, including construction, pharmacology, electronics and the space industry.

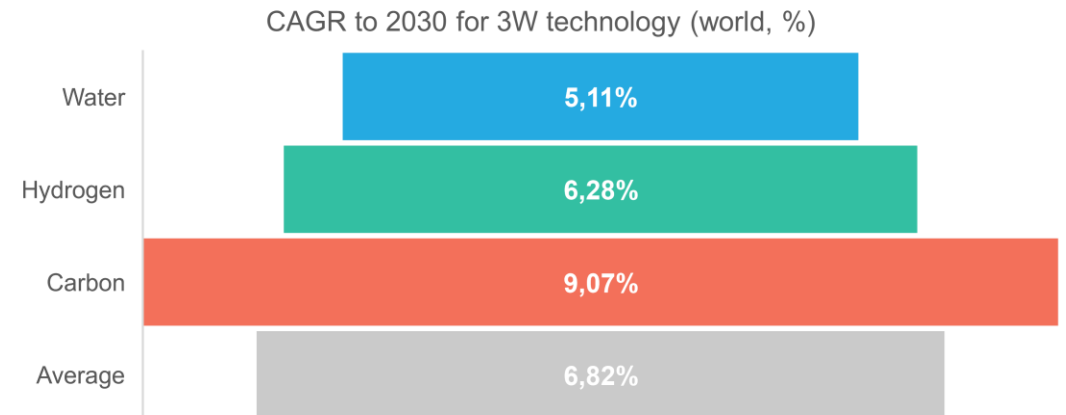
- **Nanotechnology is a next technology breakthrough**
- **Poland is a regional leader in nanotechnology**
- **It will be likely the most significant driver of 3W synergies**



## 3W opportunities



- Water, hydrogen and carbon are the foundations of a sustainable future, and technologies related to these resources **make up a new sector which we call 3W.**
- **The birth and development of this sector is a global opportunity.**
- 3W initiative is a **multi-dimensional space**, where we can bring together science, business and administration from the entire world.
- Poland has a **unique location on the geopolitical map of the world.** We are an exceptional business partner in Central Europe: a place on the globe with outstanding business potential, today and in the future.



## Presentation of 3W Idea



Head of 3W Department, BGK  
**Adam Źelezik**



EU Green Deal Center of Excellence Leader, EY  
**Dariusz Kryczka**



# Why it's a good time for 3W initiative



## EXISTING NEED

The challenges the world is facing

- People want to live in a safe and prosperous world – but development must be sustainable.
- This applies to all aspects of our economic activity: from food production, through housing and transport, to the conquest of space.
- Post-pandemic increased need for security: both physical and security of access to basic resources.

## EXISTING POTENTIAL

Intellectual potential at our disposal

- Technologies in the area of water, hydrogen and coal are being developed all over the world.
- Poland has many talented startups and scientists.
- We have common goals and interests: supporting sustainable development, accelerating the hydrogen economy.

## EMERGING ECOSYSTEM

Project support mechanisms and 3W community we build

- We create a system for supporting innovations, their commercialization and searching for synergies. We implement a holistic approach instead of a silo one.
- The 3W initiative is a platform for combining the potential of the worlds of business, science and administration.
- We are building an international concept that will accelerate development and create new business opportunities.

# Our vision, mission & goals

## The vision

- We create an interdisciplinary international concept in which we facilitate and strengthen cooperation between science, business and administration.
- We take advantage of our **unique location** on the geopolitical map of the world, thanks to which we ensure access to Central European markets.

## The mission

- Help partners around the world to **create and commercialize innovations**.
- Facilitate the exchange of information between scientists from around the world to **add up the efforts of the scientific community**.
- **Unleash business and investment potential** in an extremely attractive region of the world: Central Europe.

## Strategic goals

- Accelerating the processes of commercialization of 3W innovations.
- Accelerating the transformation process towards zero-emission and carbon-neutral economy.
- Developing social awareness of the importance of 3W resources.

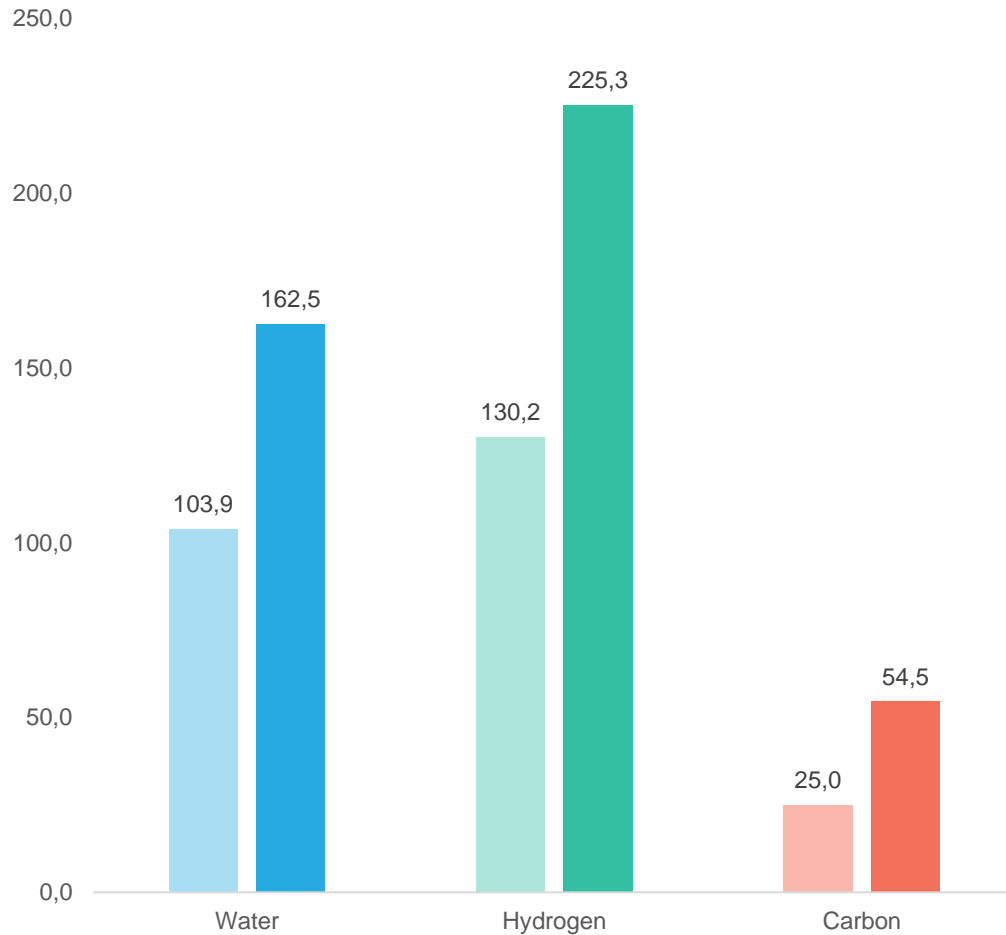




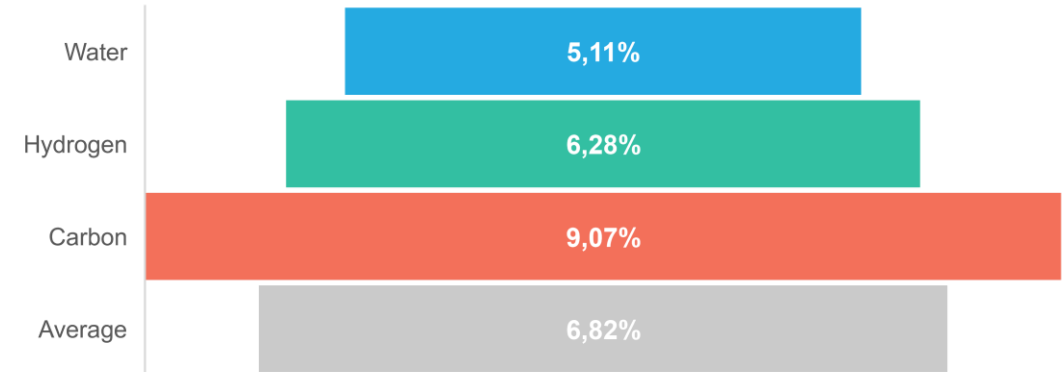
# Key figures on the 3W idea



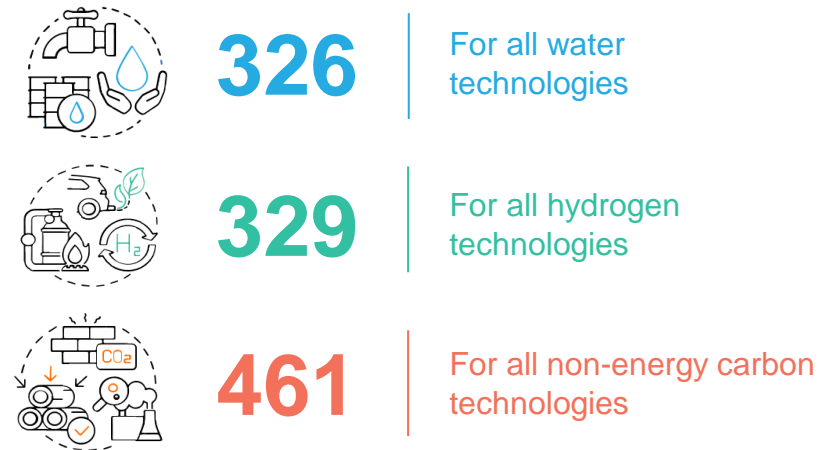
Estimated value of 3W markets in the world 2021 vs 2030 (USD billion)



CAGR to 2030 for 3W technology (world, %)



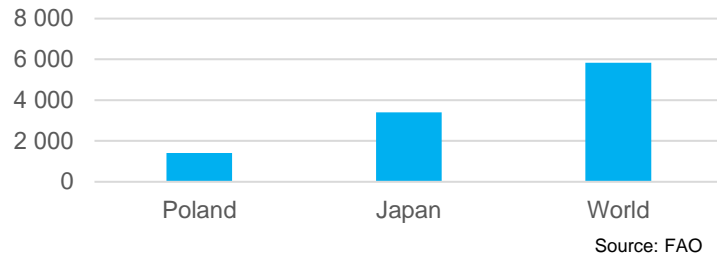
Number of patents in Poland for 3W technology



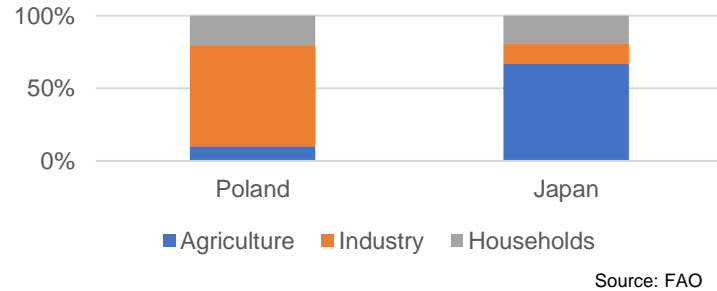
# Water market potential



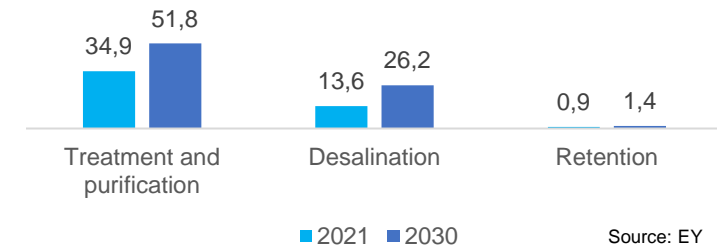
Water resources per capita (m3 per capita)



Structure of water consumption (%)



Global market development potential (\$ billion)



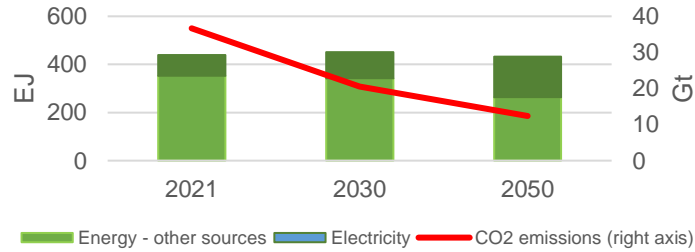
## Comment on value chain:

- **Raw material** - the need to diversify the sources of water used and to adopt an appropriate approach for them
- **Water production** – investment in retention and storage technologies as one of the most pressing needs of the economy
- **Final customer** – increasing water demand from all economic sectors
- **Waste water treatment** - wastewater treatment technologies still in their development stage - constantly being refined and advanced depending on the type of contamination
- **Reuse and conservation of water resources** - technologies key to ensuring sustainable water use, reducing environmental damage and maintaining optimal water retention in nature
- **Smart water monitoring and management services** – application of those technologies as the fastest growing part of the water value chain with a CAGR of 13% for Poland, Europe and the world



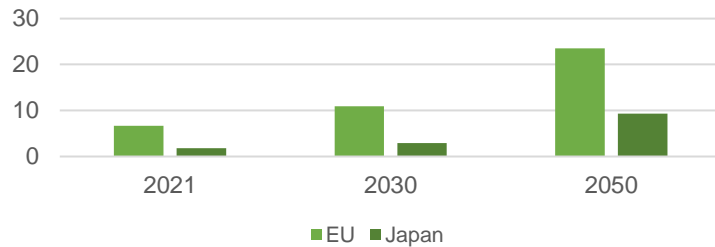
# Hydrogen market potential

### Energy demand



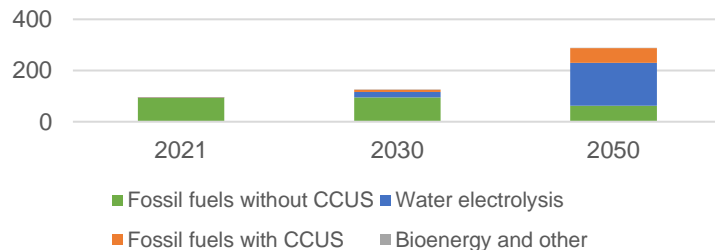
Source: World Energy Outlook 2022

### Hydrogen demand (Mt)

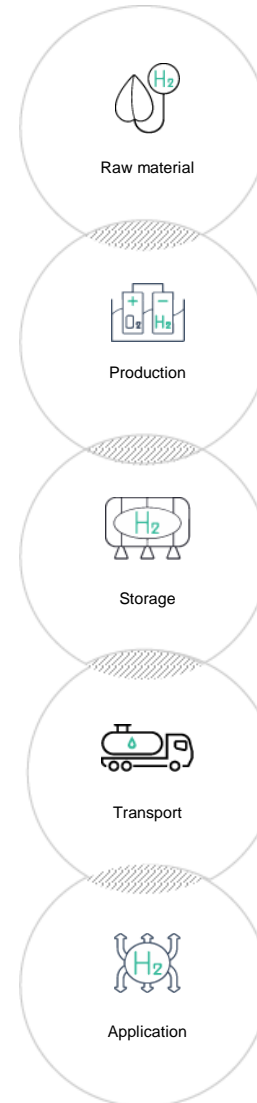


Source: World Energy Outlook 2022

### Hydrogen production by technology (Mt)



Source: World Energy Outlook 2022

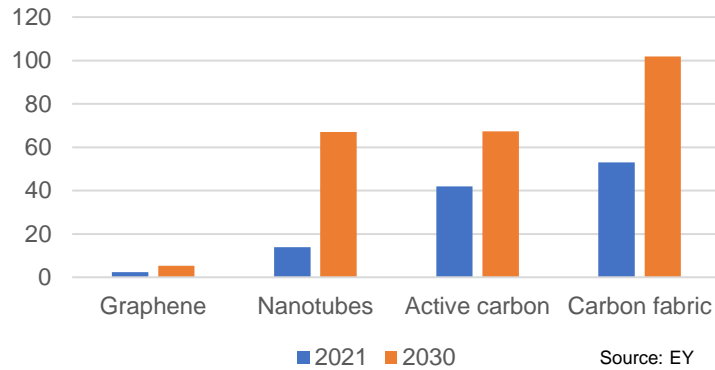


## Comment on value chain:

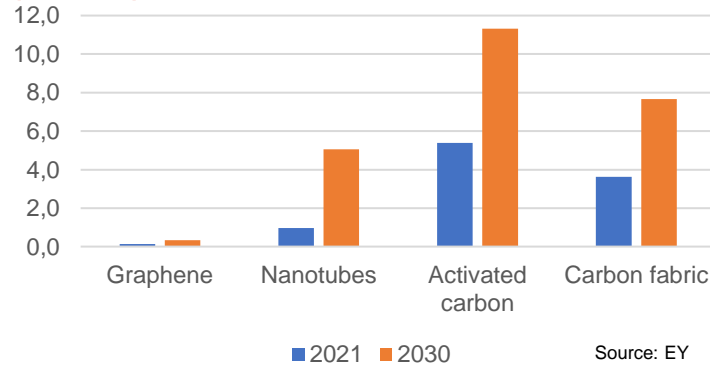
- **Raw material** – globally the leading feedstocks for grey hydrogen production are fossil fuels however the decarbonation trajectory requires a switch to less carbon intensive carriers such as electricity from RES
- **Production** – the EU, including Poland aims to switch from steam methane reforming to electrolysis with RES for renewable hydrogen production
- **Storage** - the leading method of compression, with a significant increase in interest in alternative methods such as storage in ammonia, LOHC or in liquefied form
- **Transport** - early stages of the market will be dominated by road transport (cylinder trucks) as scale increases, pipelines and long-distance sea transport will be implemented
- **Application** – very wide range of hydrogen applications in commercial end-use, hydrogen as an energy carrier in line with Power-to-X concept

# Carbon market potential

Prospects for the development of the Polish market (\$ million)



Prospects for the development of the global market (\$ billion)



## Comment on value chain:

- **Raw material** - by choosing a more sustainable raw material (waste, grass, crop residues), we can cut the costs and at the same time contribute to emission reductions.
- **Production** - most of developed production technologies are highly energy-intensive. We should both, working on developing more sustainable technologies and developing green energy sources.
- **Product / semi-finished product** - for now the more advanced and thus more expensive the production process is, the better the technical parameters of the material obtained are. We should focus on R&D to reduce the costs.
- **Application** – carbon fiber has a potential to replace steel in future application. Carbon fiber & carbon nanotubes may replace silicon in electronics.
- **Disposal** – technology of recycling might limit the cost of production. We should focus on R&D to reduce the costs & emissions of recycling technologies.



# Water, hydrogen and carbon synergy for a better working world

## Sources of synergy:

- New business models
- New products
- New services

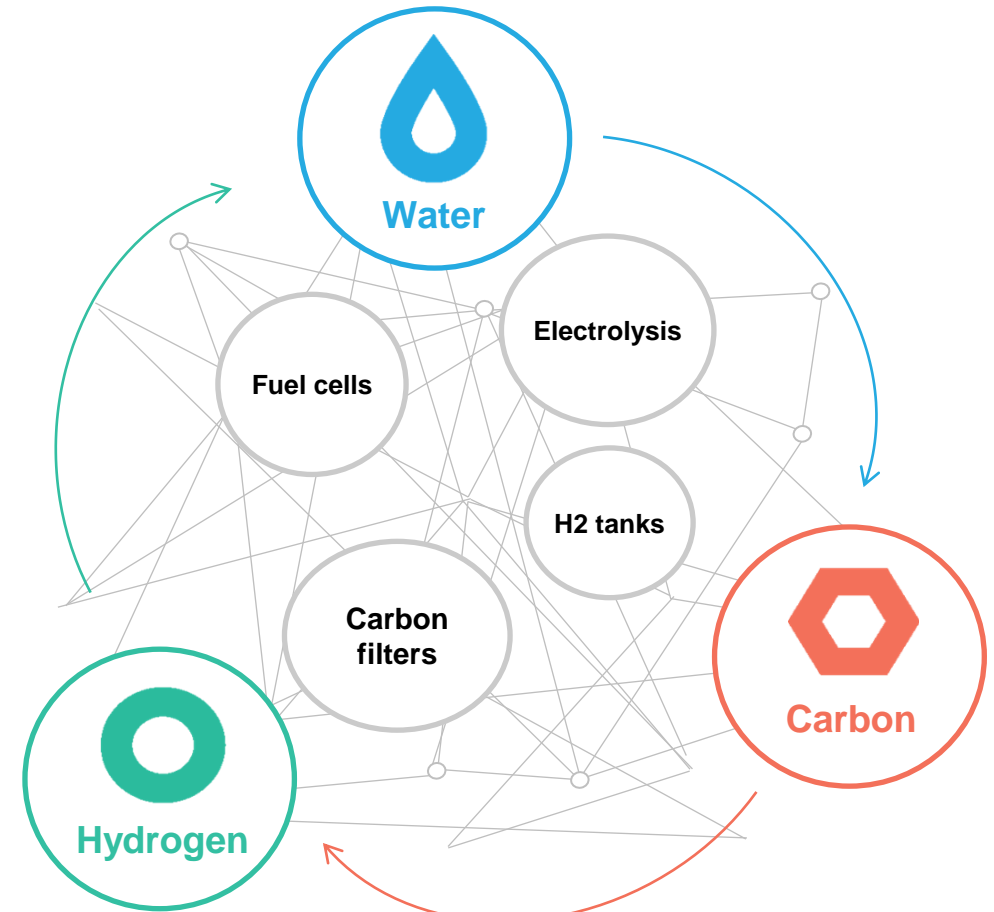


Cumulative value increase of 3W markets thanks to synergy (up to 2030)

**15%**

## Examples of synergy technologies:

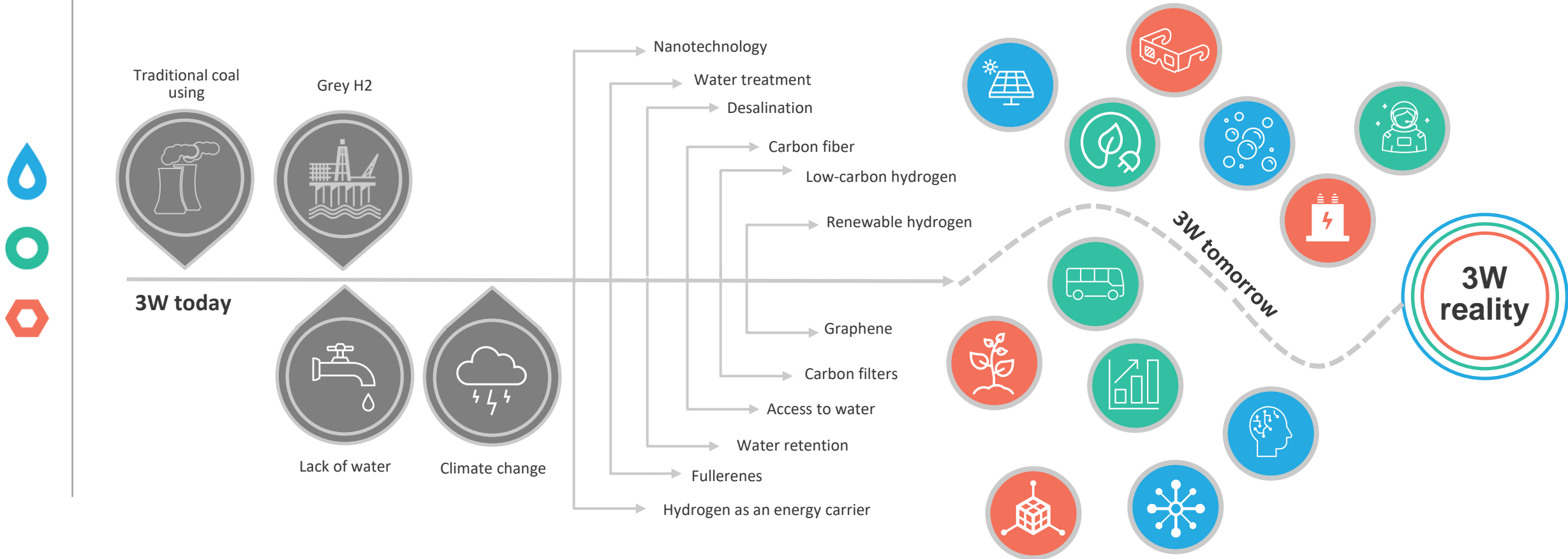
- |                |                  |
|----------------|------------------|
| • Electrolysis | • Carbon filters |
| • Fuel cells   | • H2 tanks       |



# How do we get to the reality of 3W?

Today's climate and environmental challenges can be solved ...

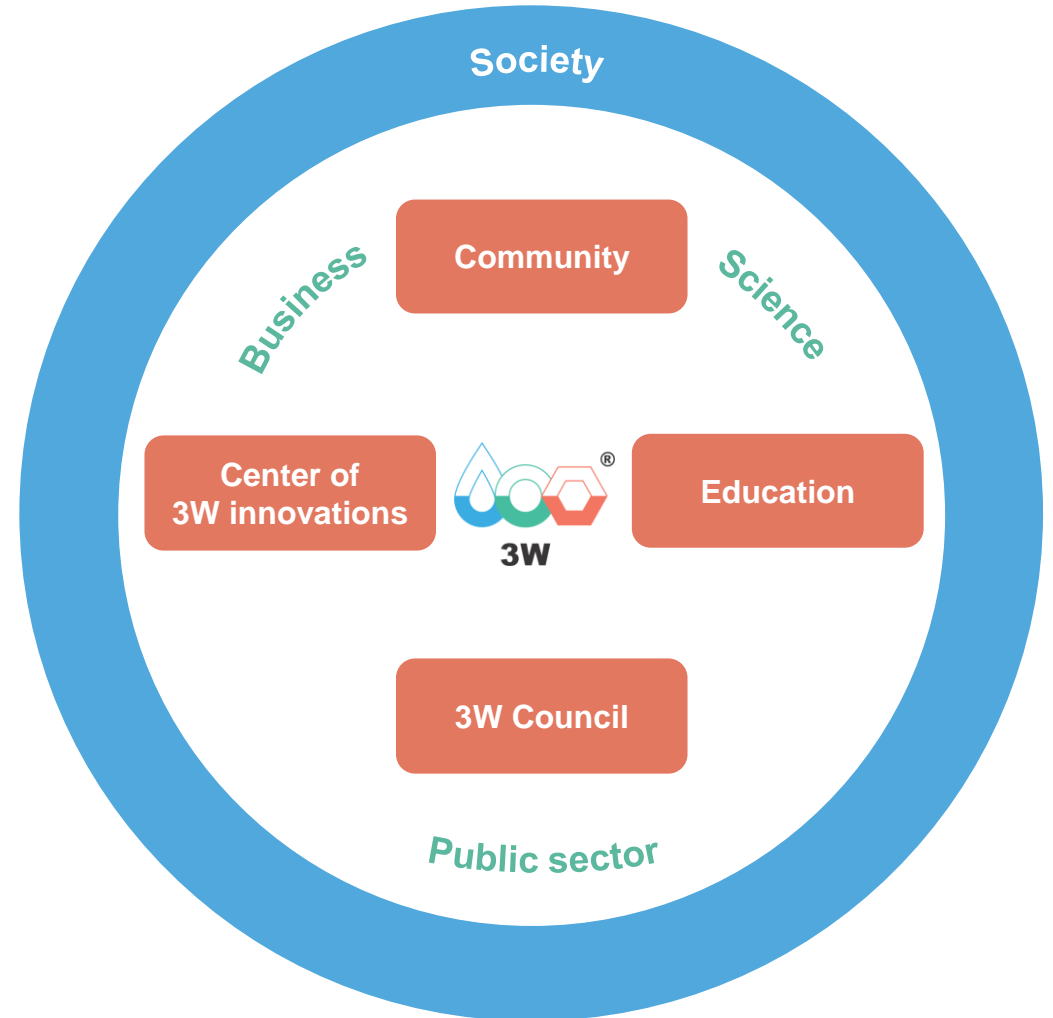
... by making sustainable and full use of the potential of 3W technology



# 3W Ecosystem



- **Integration:** 3W community - a space for collaboration between business, science, administration and society.
- **Coordination** (umbrella approach): harmonized support provided in collaboration with leading public business environment institutions and our financial partners worldwide.
- **Multilayer support:** dedicated tools and programs (project development services).
- **Knowledge** gathering and sharing.
- **Education:** personnel for 3W industry and dissemination of 3W Idea in society.



# 3W Ecosystem – rapidly growing community





**3W Idea  
in practice - case  
studies and  
opportunities**




Head of 3W Department, BGK  
**Adam Železík**




# Most interesting examples (details available in supplementary handouts)


## Glassy carbon 3D printing technology



Sygnis is a Polish company from the Deloitte Technology Fast 50 Central Europe Programme.



Sygnis develops glassy carbon 3D printing technology which allows for the development of three key applications:

- 
- Bipolar plates for hydrogen fuel cells
  - EDM electrodes (ElectroDischarge Machining)
  - Biomaterials and biocompatible electrodes

## Hybrid nanostructures based on MoS<sub>2</sub> and carbon nanomaterials



A team of scientists at Warsaw University of Technology research simpler and more effective methods of producing green hydrogen

They used carbon technologies to **replace expensive platinum in electrolyzers**

MoS<sub>2</sub> deposited on carbon nanomaterials with the addition of photocatalytic nanoparticles is a promising catalyst for hydrogen evolution reaction from a (photo) electrochemical process of water splitting

This method is **easily scalable, much cheaper** and can produce nanoparticles with **reproducible properties**.

## Aquaponics - the future of food production



Food4Future Technologies is a Polish-Norwegian start-up specializing in modern food production which stays in line with the **circular economy** philosophy.

The company produces fresh and healthy food in **aquaponics farms**:

- full control of the process,
- environmentally friendly food production,
- low water consumption, **up to 90%**
- natural fertilizers,
- local production - low carbon footprint,
- production independent from the seasons.

**How Japanese  
firms can participate  
In 3W opportunity:  
investors, companies,  
technological  
partners**



**Member of Management Board, BGK  
Radosław Kwiecień**

# How can our Japanese partners take advantage of the potential of 3W?

- BGK is a place within the ecosystem that ensures we can unlock the potential of water, hydrogen and carbon technologies, by creating **favorable conditions in Poland for international cooperation**.
- We ensure a stable legal environment and a good flow of information between the worlds of **science, business, administration and society, throughout the entire Central Europe**, including **Three Seas initiative**.
- **We invite you to contact us with any other ideas and inquiries about how you can participate in 3W initiatives at:**

**3W@BGK.pl**



## Financial investors

- BGK can be an advisor in investments in the 3W sector,
- We can guide investors through legal and other aspects of investment in 3W in Poland and region,
- We can facilitate international projects,
- We can set up funds which, along with BGK's VC Vinci fund, can participate in equity investments,
- Joint project financing, trade and export finance, mitigation of key risks, coverage of a possible financing gap, financial structuring of projects



## Technology partners

- Through our Innovation Centre we can match companies with research teams and tech start-ups,
- We can identify needs and market niches in the region,
- We can facilitate the technological assessment of our partners.



## Industry investors

- Through our Innovation Centre we can match companies with tech startups.
- We can advise on market opportunities.

**Q&A session**



## Concluding remarks



President of the Management Board of BGK  
**Mrs. Beata Daszyńska-Muzyczka**

## Contact

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