Preliminary results

Opportunities in the hydrogen value chain

ekinetix
Realizing energy transition

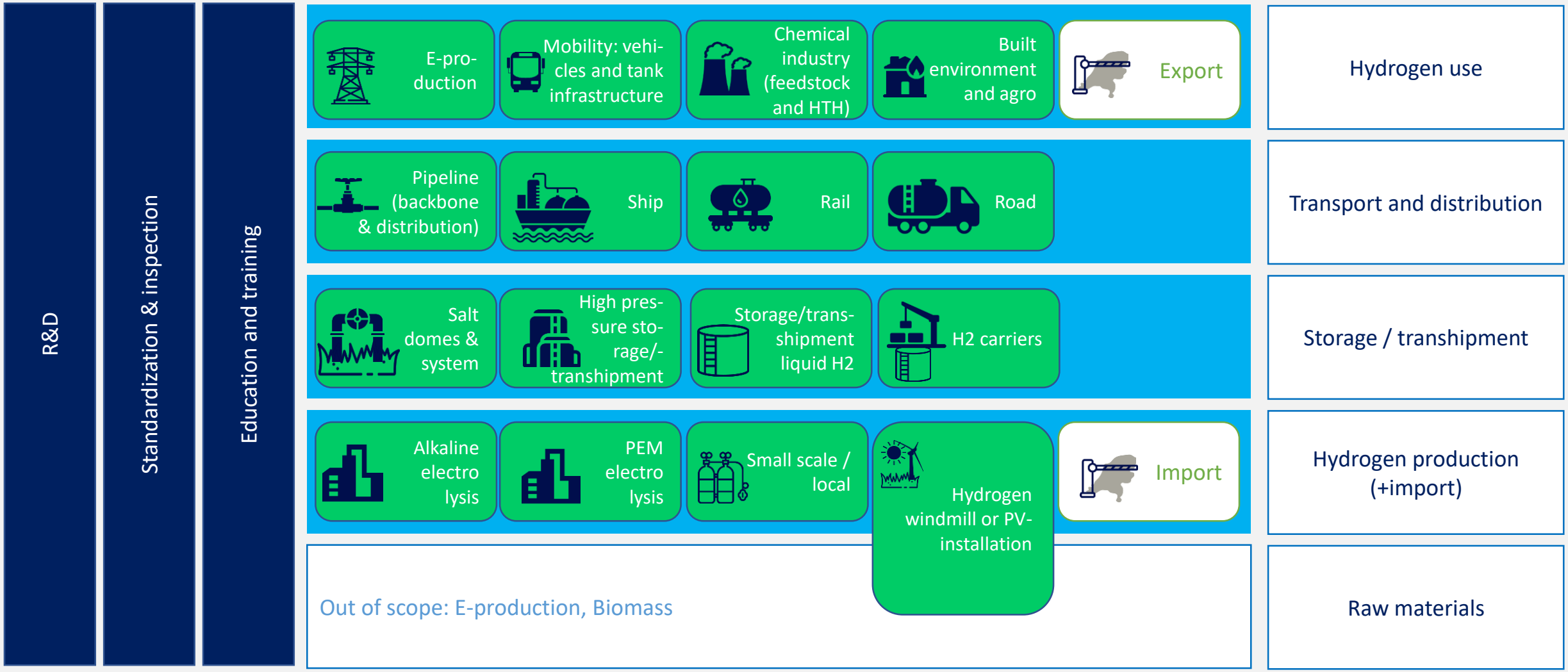
STRATELLIGENCE
decision support

Study goal and definition of supply chain

- What are the most relevant and interesting parts in hydrogen (elektrolyser) supply chain? Where are market opportunities?
- What are existing and potential players?
- What are the challenges of this industry?
- How can RVO together with knowledge institutes support industry?

*A **supply chain** is the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product, from the delivery of source materials from the supplier to the manufacturer, through to its eventual delivery to the end user.*

Segmentation of supply chain:
1. inventory of system-market-combinations and OEM/manufacturers



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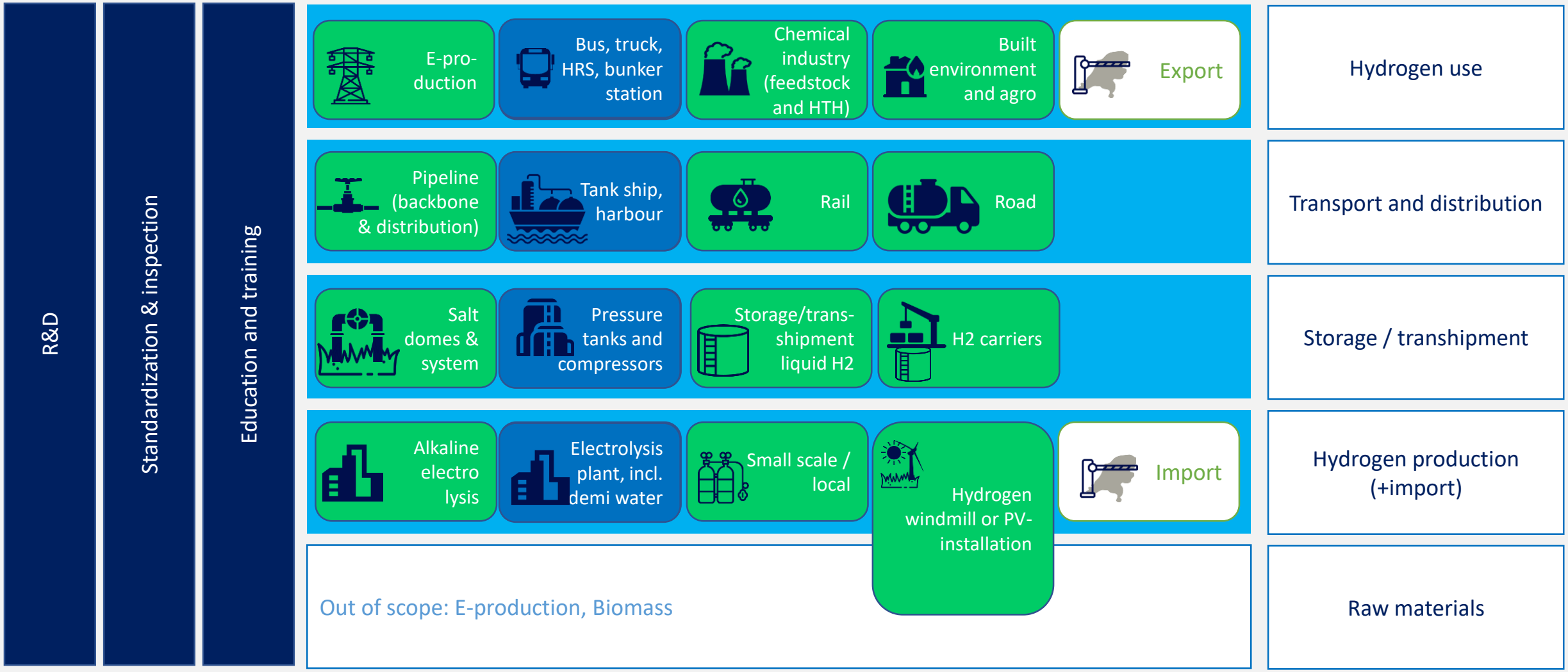


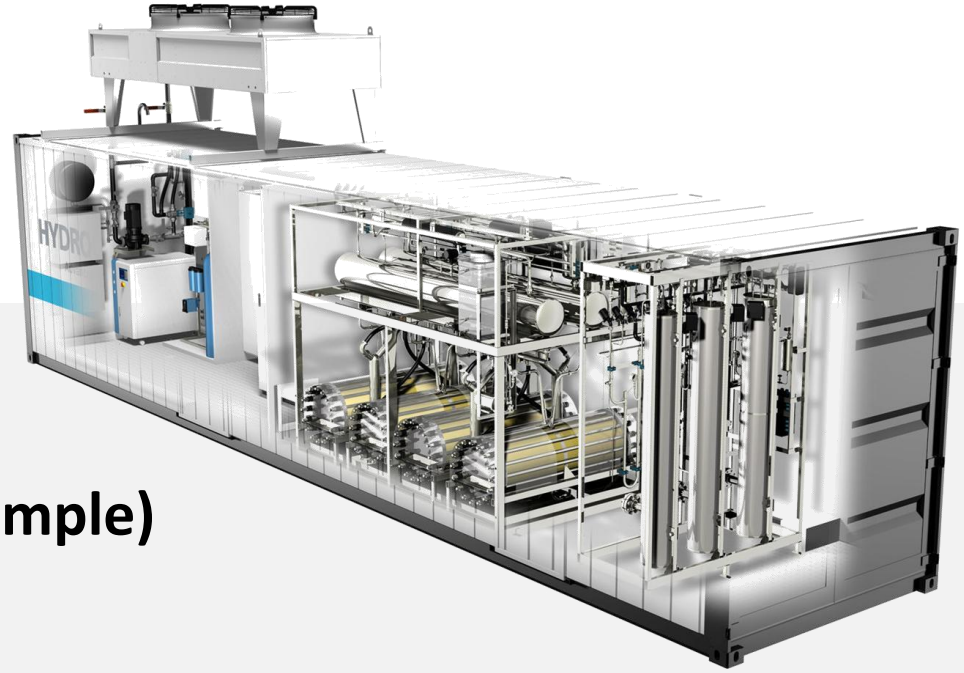
Segmentation of supply chain

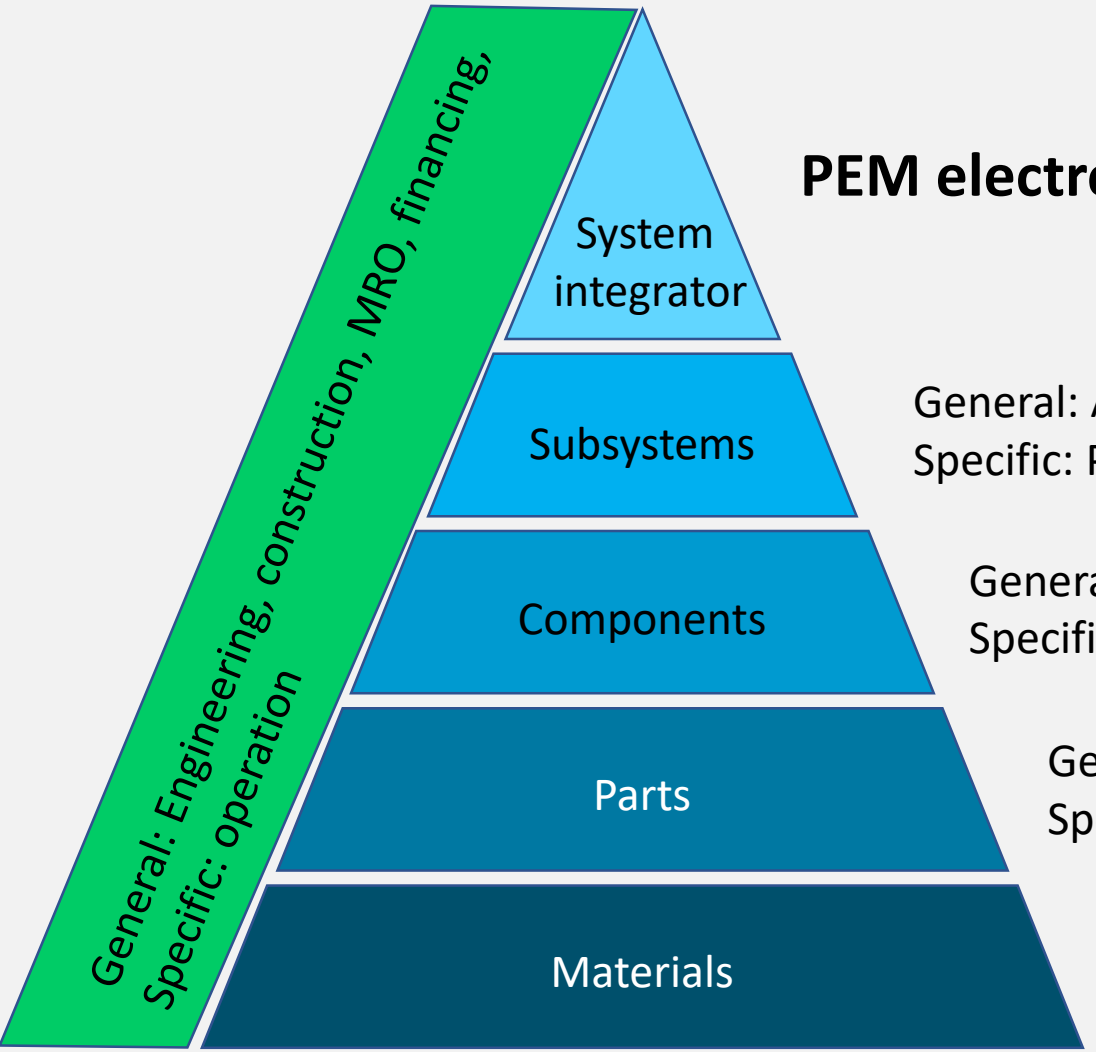
2. Market players for each system and life cycle step

	Design	Build	Finance	Operate	Maintain	Recycle / Dispose
Mobility: vehicles and tank infrastructure	Car manufacturers	Car manufacturers	Lease company, consumer, operator	Bus & transport companies, tank station operators	Car garage	Car demolition company
Built environment and agro	Manufacturer boilers, heating solutions	Manufacturer & installation companies	Consumer, energy provider, housing corporation	Consumer	Installation companies	
Industry	Engineering companies	Project management companies	Industry/-operator	(Petro)chemical industry, basic metal, refineries	MRO-companies	

Products ← → Specific services: software, financing

Segmentation of supply chain:
3. Top-down decomposition





PEM electrolysis system (example)

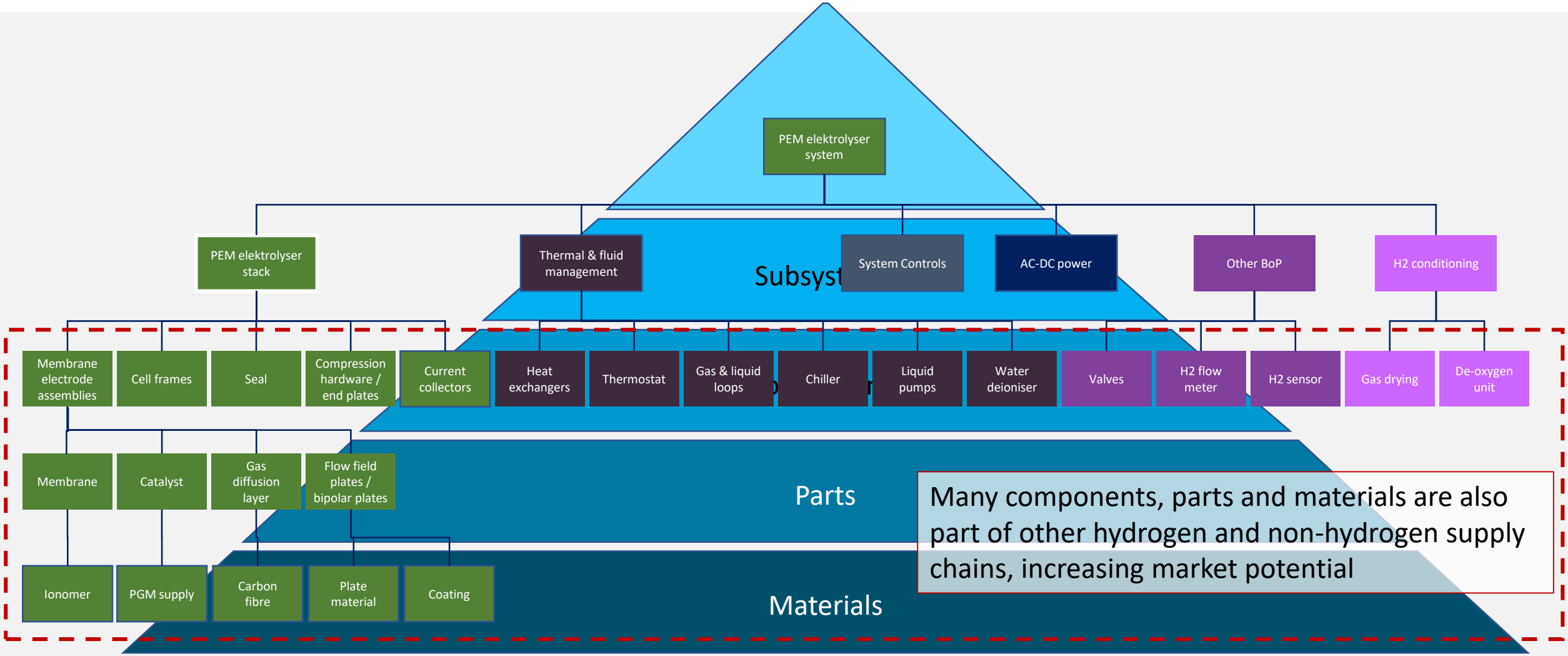
General: AC/DC, thermal & fluid management, water treatment, H2-conditioning.
Specific: PEM electrolysis stack

General: housing, cooling, piping
Specific: Gas-drying, reverse osmose, de-Oxo, H_2 flowmeters, sensors, valves

General: fixtures
Specific: gas diffusion layer, membrane and gaskets etc.

General: composites, RVS, aluminum
Specific: coatings, alloys, fibers.

Detailed built-up for PEM elektrolyser system



Many components, parts and materials are also part of other hydrogen and non-hydrogen supply chains, increasing market potential

Search criteria for opportunities and promising segments

- Growth markets with innovation challenge and/or few existing players, preferably with export potential
- Products and services are considered promising when existing companies have a strong position and/or competitive advantage:
  - In relevant markets (share, added value, cluster, assets), such as gas market
  - In relevant knowledge and technology fields
  - In relevant products and services

Hydrogen characteristics:

- Not perceptible with human senses → Sensors
- Small molecule → High-quality materials (alloys), liners, coatings, sealing techniques
- Low density → High pressure, cryogenic, high-tech materials
- Fuel cells → high purity; filtering and separation techniques

SWOT for the Netherlands (preliminary)

OPPORTUNITIES

- Large amounts of North sea wind and spilled renewables offer chance of low-cost low carbon hydrogen
- Green chemicals and refinery may offer large new market
- Many larger OEM's in Europe, with strong local sourcing
- Costs can be brought down through industrialization
- Some components are part of multiple supply chains (hydrogen and non-hydrogen)

STRENGTHS

- Position in several supply chains as subsystem and component manufacturer.
- Knowledge and experience gas and process technology.
- Gas assets and infrastructure
- High tech materials, experience composite materials
- Efficiency, productivity and added value
- Services (optimization & prediction software, financing, testing, logistics)

WEAKNESSES

- Limited number of OEM's in value chain
- Technical and research personnel
- Dependence on fossil fuels
- Small home market
- Research and development
- Access to scarce and high cost materials

THREATS

- Renewable clean hydrogen may not get support to make it competitive.
- Blue and grey hydrogen may have lower costs.
- Insufficient green electricity may be available or at too high costs.
- Industrialization may take place in US or Asia.
- OEM's may build their own capabilities for critical components

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Attack

Focus components and materials, in particular those that appear in multiple chains and some specialized PMC's

Defend

Increase investments in wind energy, develop hydrogen hotspots near landing points, convert gas infrastructure

Strengthen

Seek for cooperation with OEM's, invest in training & education

Withdraw

Develop import and export position in hydrogen

Questions (workshop):

1. Why are costs too high?
   - Number of suppliers
   - Production costs (low automatization, low volume)
   - Logistic costs (worldwide components supply
   - Material costs
   - Technological maturity
   - …..
2. What are opportunities for elektrolyser supply chain in the Netherlands?
3. How can RVO support development of the supply chain?
4. May we contact you?

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