



# FORESIGHT ON DEMAND

Foresight towards the 2<sup>nd</sup> Strategic Plan  
for Horizon Europe

Deep-Dive: Scenarios of abundant Hydrogen Economy

# TECHNICALITIES

4strat Campus [Icons] [Help] [Profile]

## Workshop 1 - Selection of Key Factors

Personal rooms

Filter users

Mike Parr's personal room

Mike Parr

Rooms

- TK VISITOR
- MK VISITOR
- HL VISITOR
- +2

Breakout 1 - Ulli Lorenz

Breakout 2 - Totti Könnö...

Breakout 3 - Nikolaus S...

Coffee Break

+ Create new room

01\_Plenary

34:48 6

Ulli Lorenz (me)

Harry Lehmann

Totti Könnölä

Martina Kampmann

Monique Baaske

Nikolaus Schall

HL

MK

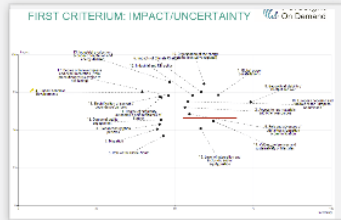
MB

miro

Workshop 1: Selection of Key Factors



Impact / Uncertainty



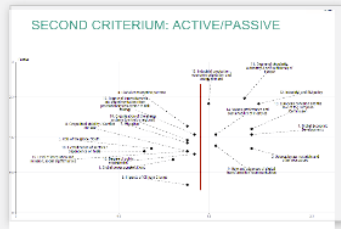
Catalogue of influencing factors



Final list of Key Factors

Group 1	Group 2	Group 3	Final selection	Comments / remarks / additional aspects

Active/Passive



Group 1



Group 2



Group 3



# FORESIGHT FOR THE 2<sup>ND</sup> SP OF HORIZON EUROPE



# SCENARIOS OF ABUNDANT HYDROGEN ECONOMY

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Title of the Scenarios	Hydrogen Economy in Europe 2040
Geographical Scope	Europe 27 - Embedded in a global context
Time Frame	2040
Purpose of the scenarios	<p>The aim is to develop positive Scenarios: How does Europe look like, when there is abundant fuel (H<sub>2</sub>) available?</p> <p>The exercise is exploratory and open; in the first stage.</p> <p>How can and must European R&amp;I policy support the transition? Where are the obstacles, drivers and barriers?</p> <p>Are we in the risk to run in lock-in-effects? How to prepare the context for the energy transition? Which developments support and hinder the transition?</p>
What's in	The socio-economic, socio-technical socio-environmental developments inside and outside Europe that are influenced by a Hydrogen economy and that influence themselves the transition towards the Hydrogen economy.
What's out	<ul style="list-style-type: none"><li>● Technical details of hydrogen technology, including e.g. electrolysers, fuel cells, transport details and alike.</li><li>● Worst case scenarios.</li></ul>

## THE CORE-EXPERTS

- Mike Parr, Independent consultant
- Peter Lund, Aalto University, Finland
- Elisabeth Dütschke, Fraunhofer ISI
- Rainer Quitzow, IASS
- Corina Murafa, Energy & Climate Policy Expert
  
- Totti Könnöla
  
- Nikolaus Schall

## THINKING ABOUT THE FUTURE...

- "I think there is a world market for maybe five computers." -- *Thomas Watson, chairman of IBM, 1943.*
- "It will be years -- not in my time -- before a woman will become Prime Minister." -- *Margaret Thatcher, 1974.*
- "Television won't last because people will soon get tired of staring at a plywood box every night." – *Darryl Zanuck, co-founder of 20th Century Fox, 1946*



## COGNITIVE BIASES

- Confirmation bias: This is favoring information that conforms to your existing beliefs and discounting evidence that does not conform.
- False consensus effect: This is the tendency to overestimate how much other people agree with you.
- Hindsight bias, also known as the knew-it-all-along phenomenon
- Anchoring bias is closely related to the decision-making process, and occurs when we rely too heavily on either pre-existing information or the first piece of information (the anchor) when making a decision.

Trust in the process!



## SCENARIO (ITAL.)

- Scene => comes from theater play,
- Description of what you can see: a complete narrativ of a future state

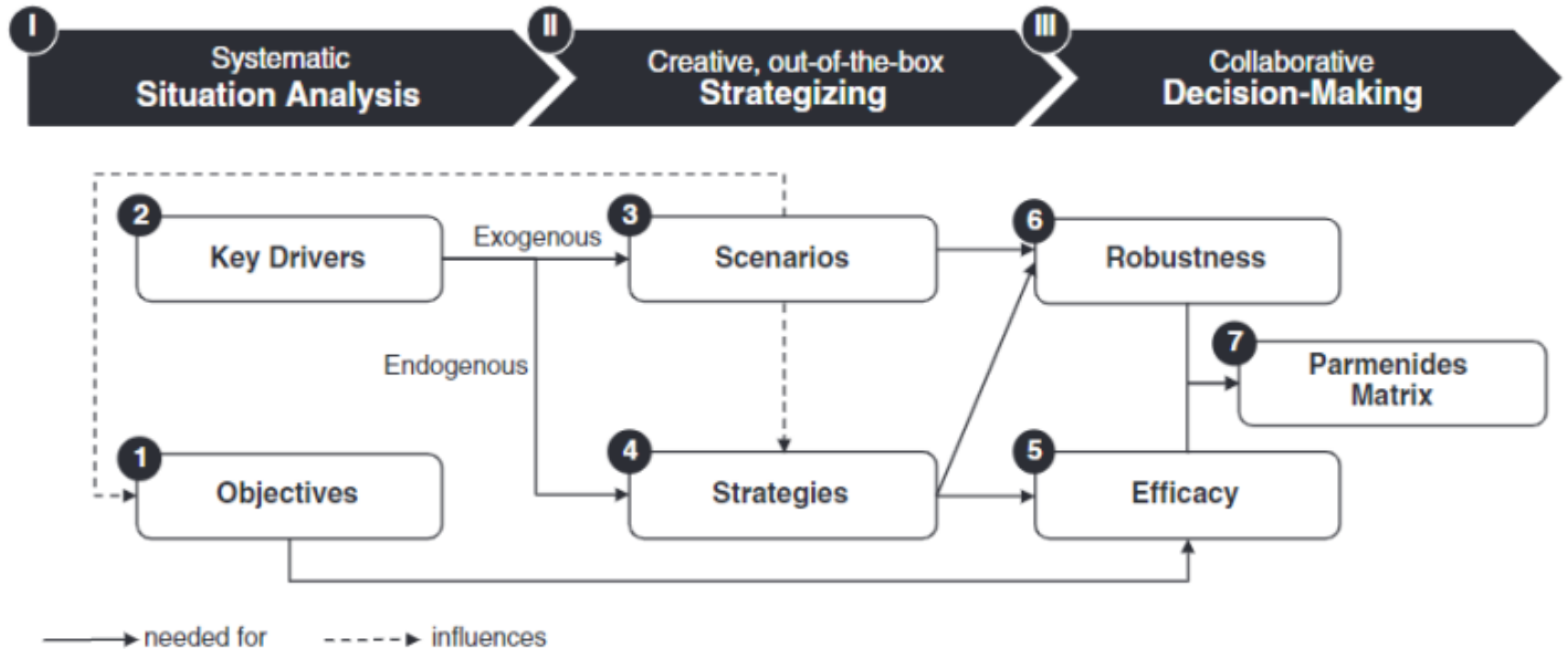


# DEALING WITH TIME – LETS LOOK BACK INTO HISTORY

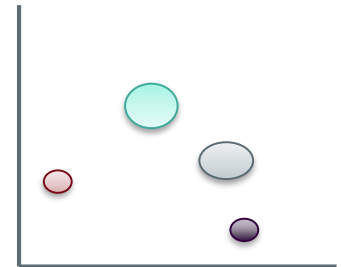
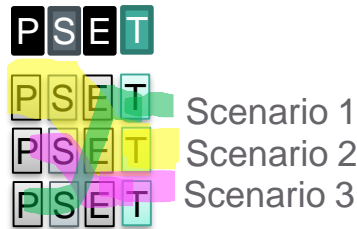
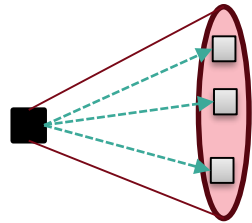
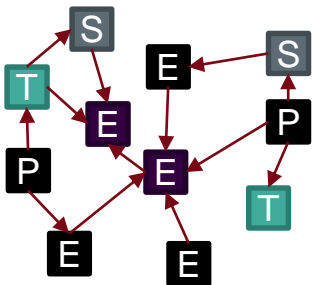
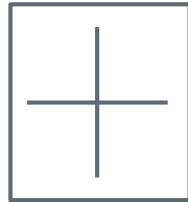
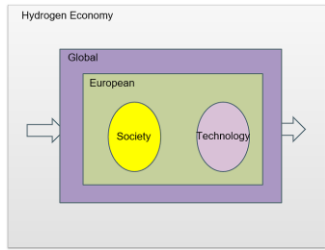
- 1909 – Count Ferdinand Adolf August von Zeppelin made the first long distance flight with the Zeppelin LZ5.
- 1910 – Fritz Haber patented the Haber process.
- 1920 – Hydrocracking, a plant for the commercial hydrogenation of brown coal is commissioned at Leuna in Germany
- 1923 – Steam reforming, the first synthetic methanol is produced by BASF in Leuna
- 1937 – The Zeppelin LZ 129 Hindenburg was destroyed by fire.
- 1938 – The first 240 km hydrogen pipeline Rhine-Ruhr.<sup>[13]</sup>
- 1938 – Igor Sikorsky from Sikorsky Aircraft proposed liquid hydrogen as a fuel.
- 1951 – Underground hydrogen storage
- 1958 – Allis-Chalmers demonstrated the D 12, the first 15 kW fuel cell tractor.
- 1966 – General Motors presents Electrovan, the world's first fuel cell automobile

- 1970 – John Bockris or Lawrence W. Jones coined the term hydrogen economy
- 1990 – The first solar-powered hydrogen production plant Solar-Wasserstoff-Bayern became operational.
- 2001 – The first type IV hydrogen tanks for compressed hydrogen at 700 bar (10000 PSI) were demonstrated.
- 2013 – The first commercial 2 megawatt power to gas installation in Falkenhagen comes online for 360 cubic meters of hydrogen per hour hydrogen storage into the natural gas grid
- 2016 – Toyota releases its first hydrogen fuel cell car, the Mirai
- 2019 – Researchers at the KU Leuven university, Belgium, have developed a solar hydrogen panel that is able to produce 250l of H<sub>2</sub> / d directly from sunlight and water vapor utilizing phytocatalytic water splitting and they are reporting a conversion efficiency of 15%. According to IEEE Spectrum this is a gain of +14,900% from the efficiency figure 10 years back (0.1%)
- 2022 – Researchers in Cambridge develop floating artificial leaves for light-driven hydrogen production.
- 2040 ???

# THE SCENARIO PROCESS



# HOW TO (SYSTEMATICALLY) THINK ABOUT THE FUTURE? BASIC STEPS OF DEVELOPING SCENARIOS.



Step 1: System analysis

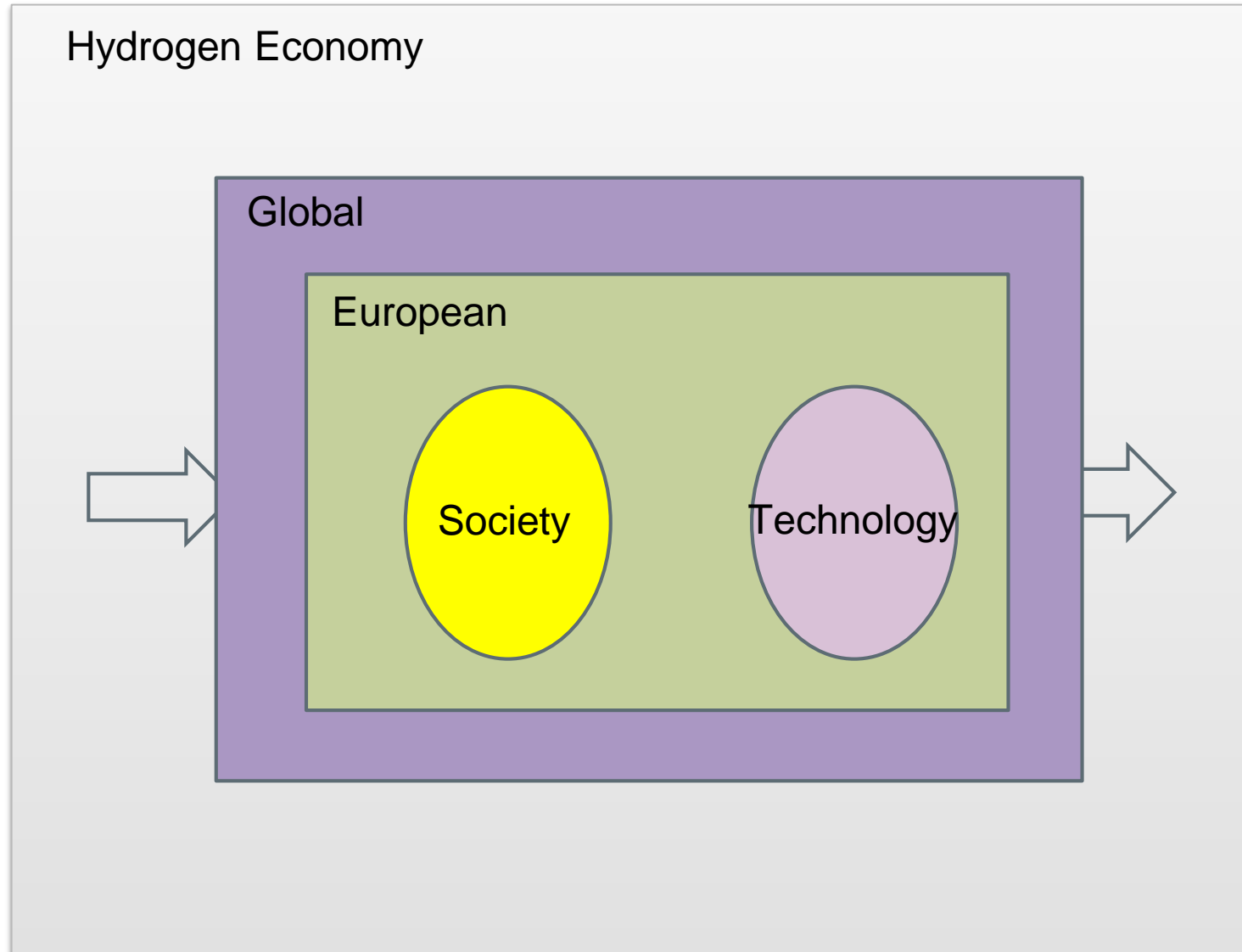
Step 2:  
Alternative projections into the future

Step 3:  
Combination of consistent sets of projections

Step 4:  
Definition of scenarios

Step 5:  
Assessments/  
Evaluations

# SYSTEM ANALYSIS – SELECTION OF KEYFACTORS



# INFLUENCING FACTORS

Global	European	Society	Technology (without Hydrogen)
<ol style="list-style-type: none"><li>1. Goba power constellations</li><li>2. Access to raw materials / resources</li><li>3. Global consumption patterns</li><li>4. Global economic developments</li><li>5. Role of the Global South</li><li>6. Impact of Climate Change</li><li>7. Migration</li><li>8. Geopolitical stability</li><li>9. Role &amp; advances of digital transformation</li></ol>	<ol style="list-style-type: none"><li>10. European cohesion &amp; the role of the</li><li>11. European Commission Degree of circularity, autonomy &amp;</li><li>12. self-sufficiency of Europe</li><li>13. Industrial and R&amp;I policy</li><li>14. Industrial production, economic</li><li>15. orientation &amp; energy demand</li></ol>	<ol style="list-style-type: none"><li>14. Values, preferences &amp; sustainability</li><li>15. of lifestyles including mobility</li><li>16. Level of integration &amp; inclusion;</li><li>17. social equity / justice</li><li>18. Degree of public engagement</li></ol>	<ol style="list-style-type: none"><li>17. Degree of innovativeness &amp; experimentation (from precautionary risk averse to risk taking)</li><li>18. Electrification of sectors / dependence on fuels</li><li>19. Organisation of energy systems (central vs. regional)</li></ol>



## 1 Global power constellations

- Internal and interrelated developments in China and Russia could create new tensions, slow down global economy and accelerate resilience as well as regionalization strategies in Europe.
- Certain raw materials need to be imported to the EU.
- Conflict and war can shift / alter priorities on international agendas.
- There might be place-holder conflicts (e.g. war in Vietnam, Syria, Afghanistan, etc.).



## 2 Access to raw materials / resources

- Trade with China, Latinamerica, and Africa.
- New technologies will demand critical materials: resources for renewable energy, and hydrogen technology.
- Water scarcity is likely to affect the feasibility of H2 production.
- Raw material scarcity can become a bottle neck for renewable energy, electrolysers, batteries, and catalysts.
- Precious and rare earth metals pile up in stocks in renewable energy facilities; delays until they are available for secondary use.



## 3 Global consumption patterns

- Development of consumption patterns in developing, emerging and industrial countries.
- This includes the degree of consumption growth and the prioritisation of sustainability.
- To what degree will countries be leap-frogging?
- What will be the role and the influence of new global middle classes?





## 4 Global economic developments

- Global economic output has increased roughly 35-fold since the start of the 20th century. The OECD projects will double again by 2050.
- This explosion of economic activity has brought with it massive increases in resource use, harmful emissions, and biodiversity loss. Increasingly there are growing concerns about access and affordability of essential resources (food, water, critical raw material, energy etc.), potentially giving rise to crises and conflict.
- Economic shocks (financial crisis, COVID, war, climate...) cause widespread hardship, often impacting the weakest most severely.



## 5 Role of the Global South

- Some member states (e.g. NL, IT, FR) cooperate with Africa building on their colonial history.
- Though, there are little changes in power structures and the benefits often stay among the elite. Europe will deal with Africa more in the future, voluntarily or not.
- Some African countries might create more added value in their nation or do trade / cooperation within Africa.



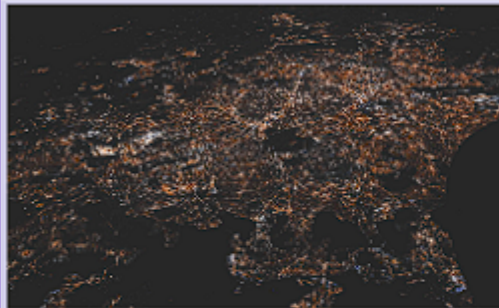
## 6 Impacts of Climate Change

- Water scarcity for producing H<sub>2</sub>.
- More focus on virtual / embedded water and translocation of water.
- Changing precipitation and clouds => changing potentials for wind and solar energy.
- Changing role of water power due to changing water regimes.



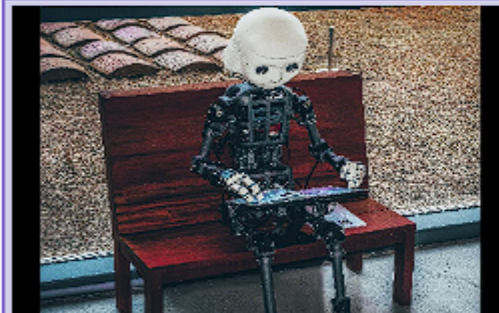
## 7 Migration

- Migration flows towards Europe due to conflict and catastrophes.
- Role of boarder control (Frontex etc.).
- Brain drain (emigration from Europe).
- Concentration in camps posing challenge for the facilities.
- Missing workforce / qualifications.



## 8 Geopolitical stability / conflict & war

- Geopolitical stability refers to peace or conflict between states or regions. It also refers to the stability of a political system in the respective state or region. Ideally, there would be a power balance between states on a global scale.
- However, whether they are caused by religious or historically rooted tensions, conflicts over land and local resources by a state and its allies, or aggressive leaders - conflicts have been numerous, deadly, and relentless.
- Weapons and methods quickly evolve (e.g. drones)
- Terrorism / criminality, and cyber-warfare (e.g. interference in elections, news, public debate, state ownership of big data),
- Human rights.



## 9 Role & advances of digital transformation / communication

- Digital transformation changes the way people participate (e.g. clicktivism on Facebook, crowdfunding) and focus their capacities and resources.
- Development of both global patterns of communication and interaction as well as patterns of mobility and the interactions between the two in developing, emerging and industrial countries.
- Role of Artificial Intelligence.
- Cyber frauds / cyber attacks, digital participation also comes along with risks and dangers like oppression, echo chamber effect or trolls.
- New technologies and communication channels, the diversity and usage intensity of different digital communication formats also compared to non-digital communication formats as well as travel patterns, (new) means of transport, mobility systems and providers.



## 10 European cohesion & the role of the European Commission

- Role of nationalistic tendencies - single countries within the EU have / had strong nationalistic tendencies, partly blocking decisions of the EU.
- From authoritarian states to full representative and participatory democracies.
- Trust in (European) institutions, administrative burdens, speed of making decisions and their enforcement.
- Role of subsidiary principle.
- Economic strength of single member countries.
- Tendency towards United States of Europe vs. loose cooperation of European independent nations.



## 11 Degree of circularity, autonomy & self-sufficiency of Europe

- Level of energy autarky in and self-sufficiency of Europe; outside Europe.
- What goods / resources are imported / exported? Energy? Electricity? Fuels?
- Where are dependencies for raw materials / energy / energy carriers / high technologies.
- Circularity can lead to material and energy efficiency.
- New materials coming; might conflict with recycling.
- Recycling, reuse and other "R-concepts" will play a major role.
- Part of energy use and potentially environmental effects will be translocated to EU (e.g. mining).



## 12 Industrial and R&I policy

- The role of policy providing direction and framework for transition and intermediating between economic and societal actors.
- Development of cogen solutions and community schemes.
- Subsidies to consumers or industry, public investments show direction, private sector investments scale up.
- Emission trading mechanisms and boarder control mechanisms: Carbon border adjustment mechanism and the impact on prices, import and export of fuel.
- Role of multinational mega-companies.
- Form of public / private cooperation (partnerships, missions etc.).



## 13 Industrial production, economic orientation & energy demand

- The increase / decrease of energy demand: role of industry, transport, services, ICT, virtuality and AI in Europe.
- Global recession and its impact on Europe.
- Orientation towards growth or reorientation towards "degrowth movement" => degrowth / growth.
- Circular regional frugal vs. centralised economies.
- Role of circular economy.



## 14 Values, preferences & sustainability of lifestyles including mobility

- Encompasses values, attitudes and lifestyles in Europe with respect to sustainability and its different components.
- Wealth and buying power of society, housing and living infrastructure, hydrogen technology.
- Willingness of people to invest in private facilities (gas heater, heat pump, fuel cell [very expensive], hydrogen cars, etc.); car-sharing and role of public transport; status of long-distance travel; role of air travel.
- From frugality to overconsumption: are all consumers ready / willing to turn to prosumers, energy agents?
- Which role will consumption play with regards to portraying societal status?
- Blending of natural gas for heating is already available and can contribute to reducing prices.



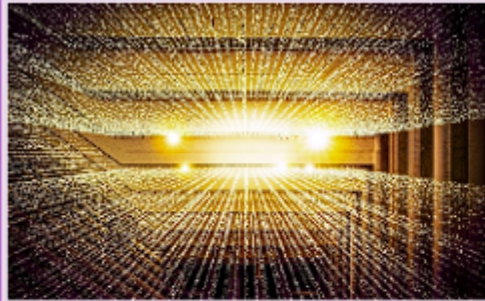
## 15 Level of integration & inclusion; social equity / justice

- Development of civic engagement, participation and contribution including the rate of intensity, the formats of participation and engagement, and the organisational structures.
- Stakeholder engagement.
- Role of nations, regions and sub regional structures.
- Building community culture around energy solutions; people's preference for self-sustaining solutions / dependence on trade / import.
- Social unrest.



## 16 Degree of public engagement

- Citizens' participation in strategic choices (e.g. citizens' climate convention).
- Ability of third sector organisations to participate (effectively).
- Voter turnout.
- Stakeholder engagement in developing regulations.
- The idea of commons plays a growing role in civic engagement.
- Social and political commitment stems less from early age and is subject to change over a lifetime. People are less drawn to a specific membership or organisation.
- Digital transformation changes the way people participate (e.g. clicktivism on Facebook, crowdfunding) and focus their capacities and resources. The latter is evident in the so-called "affective altruism movement". Digital participation also comes along with risks and dangers like oppression, echo chamber effect or trolls.



## 17 Degree of innovativeness & experimentation (from precautionary risk averse to risk taking)

- The role of technology is to enable maximum efficiency of the use of energy in mining, production and the use of resources, while minimising their environmental impact.
- Technology efficiency can be defined through - i.e. smart algorithms that control processes or technologies that in themselves are highly efficient in terms of input / output ratio.
- Technological innovations strive toward simple benign designs and functionality (i.e. mechanical, bioengineering, digitalisation etc.) in order to achieve reliable and low maintenance solutions that ultimately increase efficiency.
- Frugality vs high tech.



## 18 Electrification of sectors / dependence on fuels

- Direct use of electricity is more efficient than any transformation.
- Electrification is prone to cyber-attacks.
- H2 for storing electricity from intermittent sources.
- Buffering and storing systems needed in the GRID.
- Heat pumps are currently more efficient than H2 solutions.
- Synthetic fuels for mobility.



## 19 Organisation of energy systems (central vs. regional)

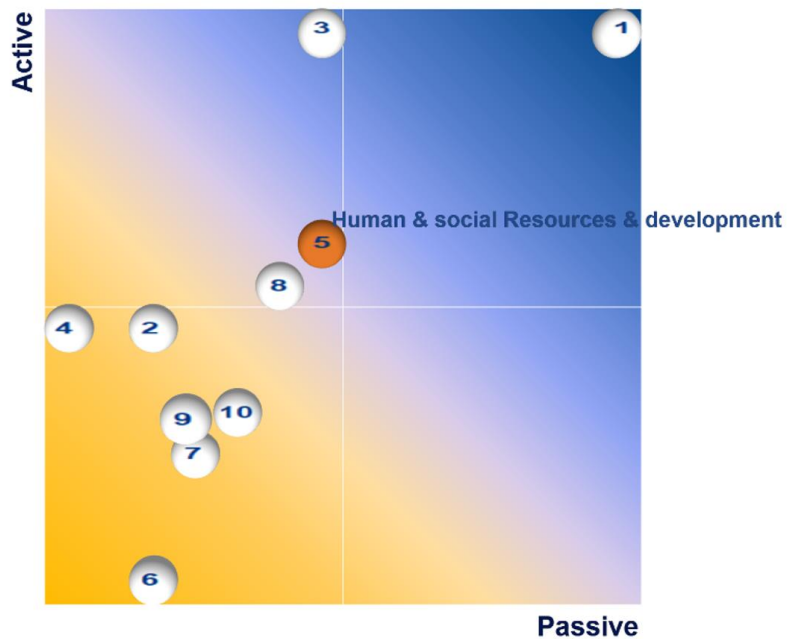
- Small regional power generation and storage vs. large production sites.
- Role of grid, integrated storage systems (e.g. e-mobility, water, hydrogen).
- Question of energy mix, both for industry and private households (heat, power).
- The purpose of the energy system is to maintain a base load of energy production that meets the needs of critical societal and industrial infrastructure.
- Cogen of heat, power and H2 in community energy and agrivoltaics.



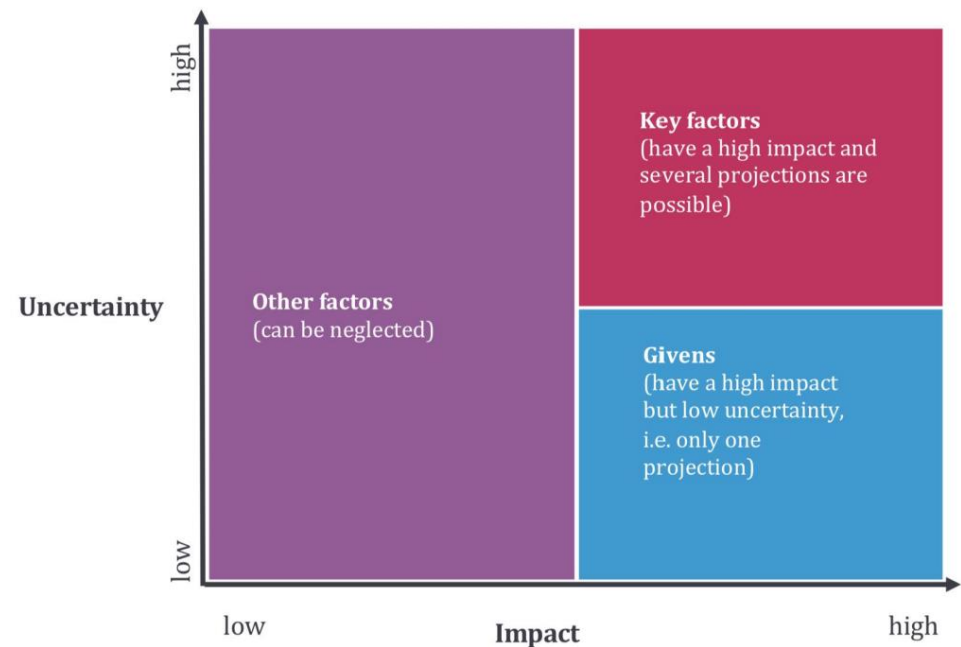
## HOW TO IDENTIFY KEY-FACTORS?

- They have a great variability (uncertainty) for the future
- They have a great impact on the topic of interest or they determine the topic
- They are systemically central (sending and receiving)

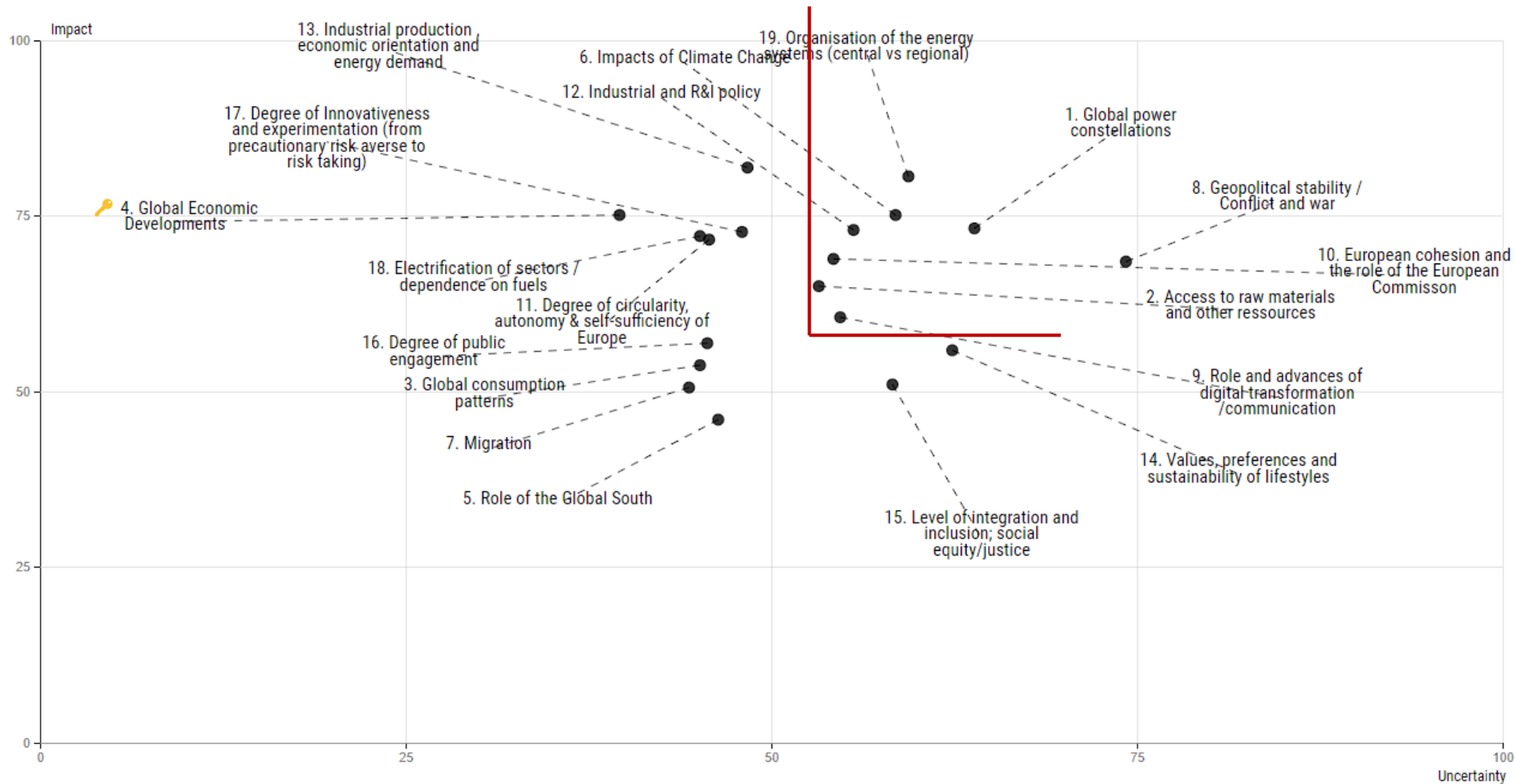
active-passive-matrix



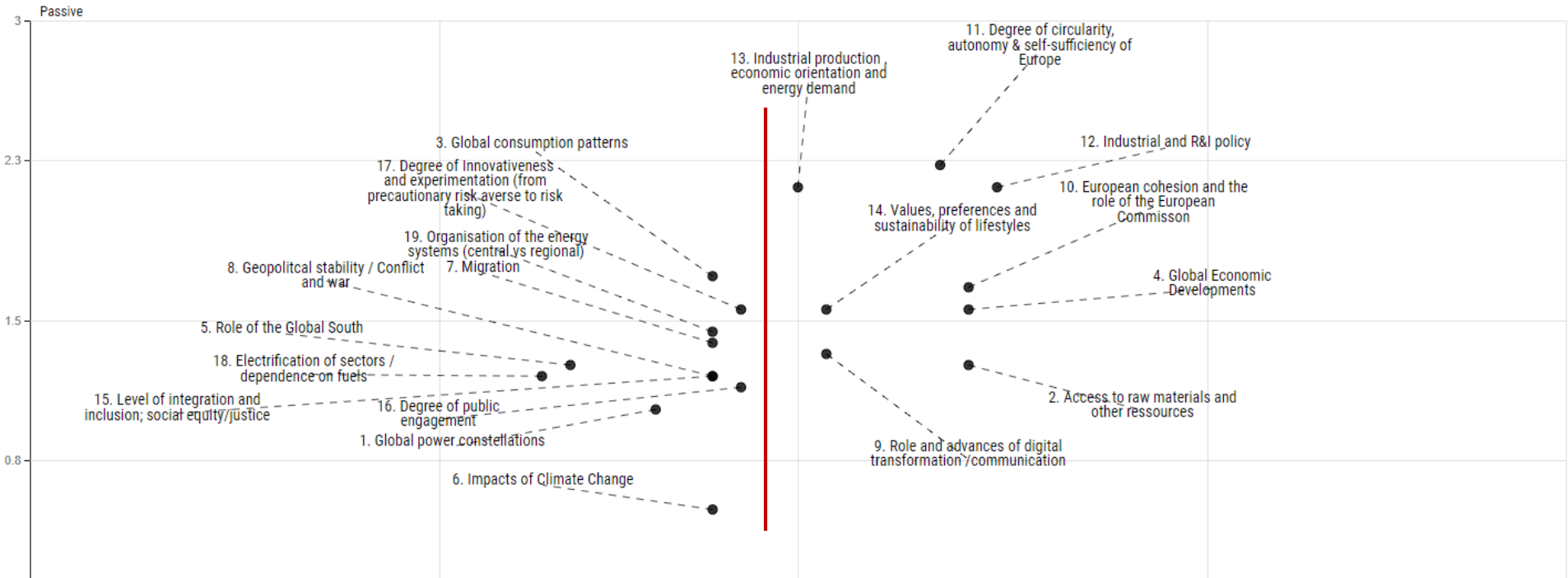
Impact-uncertainty analysis



# FIRST CRITERIUM: IMPACT/UNCERTAINTY



# SECOND CRITERIUM: ACTIVE/PASSIVE



Question: What are the most central factors shaping the future of a Hydrogen Economy?

	Passive	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Active
Active	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1. Degree of innovativeness and experimentation (from precautionary risk averse to risk taking)	1	0	1	2	3	2	2	3	1	2	1	0	2	2	3	0	0	0	2	1	1.3
2. Access to raw materials and other resources	2	0	1	1	1	2	3	2	1	1	1	0	1	2	0	2	0	2	0	2	1.2
3. Global consumption patterns	3	1	1	0	2	2	2	2	1	0	3	3	3	1	2	1	1	0	0	2	1.3
4. Global Economic Developments	4	0	0	3	3	3	3	3	3	0	3	3	3	0	0	2	2	2	0	3	1.8
5. Role of the Global South	5	3	0	3	2	3	3	3	1	3	3	3	3	2	1	0	0	0	0	3	1.8
6. Impacts of Climate Change	6	3	1	2	3	2	1	2	0	1	2	1	0	0	0	0	1	0	0	0	1.1
7. Migration	7	3	0	2	3	3	3	1	1	1	2	2	1	0	0	0	0	0	1	1	1.3
8. Geopolitical stability / Conflict and war	8	3	0	2	3	2	2	3	2	1	0	1	1	1	0	0	0	1	1	0	1.2
9. Role and advances of digital transformation/communication	9	2	1	2	1	2	1	1	1	3	3	3	2	2	3	1	1	1	3	2	1.8
10. European cohesion and the role of the European Commission	10	0	1	1	2	1	2	1	1	3	3	3	3	2	1	3	3	3	1	3	1.9
11. Degree of circularity, autonomy & self-sufficiency of Europe	11	0	1	2	2	2	1	0	0	3	3	3	3	3	2	1	2	2	3	2	1.8
12. Industrial and R&I policy	12	1	0	2	1	1	0	0	0	2	3	3	3	3	2	3	3	3	3	0	1.9
13. Industrial production, economic orientation and energy demand	13	2	0	3	0	1	1	1	0	3	2	3	1	1	0	1	2	1	3	1	1.9
14. Values, preferences and sustainability of lifestyles	14	3	1	0	0	0	0	0	3	1	3	1	3	3	3	1	2	2	3	1	1.3
15. Level of integration and inclusion; social equity/justice	15	0	1	1	1	0	1	0	0	1	3	3	3	0	0	0	3	3	0	0	1
16. Degree of public engagement	16	0	0	2	0	2	0	1	1	2	2	2	2	2	3	2	2	2	2	2	1.8
17. Degree of Innovativeness and experimentation (from precautionary risk averse to risk taking)	17	0	0	2	0	2	1	1	2	2	2	2	3	0	0	3	3	2	2	2	1.3
18. Electrification of sectors / dependence on fuels	18	1	0	1	0	3	1	3	3	3	3	3	3	3	3	3	1	1	2	3	1.4
19. Organisation of the energy systems (central vs regional)	19	0	0	2	2	1	0	0	1	3	3	3	3	1	1	2	3	1	2	3	1.4
Passive sum		1.4	0.8	1.7	1.3	1.8	1.3	1.2	1.1	1.7	2.2	2.3	2.2	1.8	1.2	1.3	1.3	1.4	1.2	1.8	

2.3

Active

## CONVERGING LIST 1 AND 2

<b>Impact / uncertainty</b>	<b>Active / passive</b>
<u>1 Global power constellations</u>	<i>14 Values, preferences and sustainability of lifestyles</i>
<b>2 Access to raw materials and resources</b>	<b>2 Access to raw materials and resources</b>
6 Impacts of Climate change	13 Industrial production, economic orientation
8 Geopolitical stability	4 Global economic developments
<b>9 Role and advance of digital transformation</b>	<b>9 Role and advance of digital transformation</b>
<b>10 European cohesion</b>	<b>10 European cohesion</b>
<b>12 Industrial and R&amp;I policy</b>	<b>12 Industrial and R&amp;I policy</b>
<i>19 Organisation of the energy system</i>	<u>11 Degree of circularity</u>

# PROPOSED KEY FACTORS

- 1 Global power constellations
- 2 Access to raw materials and resources
- 9 Role and advance of digital transformation
- 10 European cohesion
- 11 Degree of circularity
- 12 Industrial and R&I policy
- 14 Values, preferences and sustainability of lifestyles
- 19 Organisation of the energy system

	<h2>1 Global power constellations</h2> <ul style="list-style-type: none"> <li>• Internal and interrelated developments in China and Russia could create new tensions, slow down global economy and accelerate resilience as well as regionalization strategies in Europe.</li> <li>• Certain raw materials need to be imported to the EU.</li> <li>• Conflict and war can shift / alter priorities on international agendas.</li> <li>• There might be place-holder conflicts (e.g. war in Vietnam, Syria, Afghanistan, etc.).</li> </ul>
	<h2>2 Access to raw materials / resources</h2> <ul style="list-style-type: none"> <li>• Trade with China, Latinamerica, and Africa.</li> <li>• New technologies will demand critical materials: resources for renewable energy, and hydrogen technology.</li> <li>• Water scarcity is likely affect the feasibility of H2 production.</li> <li>• Raw material scarcity can become a bottle neck for renewable energy, electrolyzers, batteries, and catalysis.</li> <li>• Precious and rare earth metals pile up in stocks in renewable energy facilities; delays until they are available for secondary use.</li> </ul>
	<h2>9 Role &amp; advances of digital transformation / communication</h2> <ul style="list-style-type: none"> <li>• Digital transformation changes the way people participate (e.g. clickivism on Facebook, crowdfunding) and focus their capacities and resources.</li> <li>• Development of both global patterns of communication and interaction as well as patterns of mobility and the interactions between the two in developing, emerging and industrial countries.</li> <li>• Role of Artificial Intelligence.</li> <li>• Cyber frauds / cyber attacks, digital participation also comes along with risks and dangers like oppression, echo chamber effect or trolls.</li> <li>• New technologies and communication channels, the diversity and usage intensity of different digital communication formats also compared to non-digital communication formats as well as travel patterns, (new) means of transport, mobility systems and providers.</li> </ul>
	<h2>10 European cohesion &amp; the role of the European Commission</h2> <ul style="list-style-type: none"> <li>• Role of nationalistic tendencies - single countries within the EU have / had strong nationalistic tendencies, partly blocking decisions of the EU.</li> <li>• From authoritarian states to full representative and participatory democracies.</li> <li>• Trust in (European) institutions, administrative burdens, speed of making decisions and their enforcement.</li> <li>• Role of subsidiary principle.</li> <li>• Economic strength of single member countries.</li> <li>• Tendency towards United States of Europe vs. loose cooperation of European independent nations.</li> </ul>
	<h2>11 Degree of circularity, autonomy &amp; self-sufficiency of Europe</h2> <ul style="list-style-type: none"> <li>• Level of energy autarky in and self-sufficiency of Europe; outside Europe.</li> <li>• What goods / resources are imported / exported? Energy? Electricity? Fuels?</li> <li>• Where are dependencies for raw materials / energy / energy carriers / high technologies.</li> <li>• Circularity can lead to material and energy efficiency.</li> <li>• New materials coming; might conflict with recycling.</li> <li>• Recycling, reuse and other "R-concepts" will play a major role.</li> <li>• Part of energy use and potentially environmental effects will be translocated to EU (e.g. mining).</li> </ul>
	<h2>12 Industrial and R&amp;I policy</h2> <ul style="list-style-type: none"> <li>• The role of policy providing direction and framework for transition and intermediating between economic and societal actors.</li> <li>• Development of cogen solutions and community schemes.</li> <li>• Subsidies to consumers or industry, public investments show direction, private sector investments scale up.</li> <li>• Emission trading mechanisms and border control mechanisms: Carbon border adjustment mechanism and the impact on prices, import and export of fuel.</li> <li>• Role of multinational mega-companies.</li> <li>• Form of public / private cooperation (partnerships, missions etc.).</li> </ul>
	<h2>14 Values, preferences &amp; sustainability of lifestyles including mobility</h2> <ul style="list-style-type: none"> <li>• Encompasses values, attitudes and lifestyles in Europe with respect to sustainability and its different components.</li> <li>• Wealth and buying power of society, housing and living infrastructure, hydrogen technology.</li> <li>• Willingness of people to invest in private facilities (gas heater, heat pump, fuel cell [very expensive], hydrogen cars, etc.); car-sharing and role of public transport; status of long-distance travel; role of air travel.</li> <li>• From frugality to overconsumption: are all consumers ready / willing to turn to prosumers, energy agents?</li> <li>• Which role will consumption play with regards to portraying societal status?</li> <li>• Blending of natural gas for heating is already available and can contribute to reducing prices.</li> </ul>
	<h2>19 Organisation of energy systems (central vs. regional)</h2> <ul style="list-style-type: none"> <li>• Small regional power generation and storage vs. large production sites.</li> <li>• Role of grid, integrated storage systems (e.g. e-mobility, water, hydrogen).</li> <li>• Question of energy mix, both for industry and private households (heat, power).</li> <li>• The purpose of the energy system is to maintain a base load of energy production that meets the needs of critical societal and industrial infrastructure.</li> <li>• Cogen of heat, power and H2 in community energy and agri-foods.</li> </ul>

## YOUR TASK IN THE GROUP DISCUSSIONS

After the discussions we aim to have a consolidated and decided list of 8 key factors and added aspects/ideas for the selected KF

- Read and re-familiarise yourself with the selected key factors (read the aspects)
- Still without discussion, add aspects, if something is unclear to you: write down a question...
- Now start the discussions and exchange:
  - What is unclear to you in relation to the factor?
  - Are there missing aspects?
  - Do you agree with all the aspects?
  - Is there another factor you consider to be better suited to be taken on the list? Discuss with the group... you might consider merging factors or aspects from other factors in the list.

Factors not chosen for the elaboration of the scenarios are not lost. They can be used later in the narratives

## ACTIONS – GO INTO A GROUP

The moderators and core experts are set.

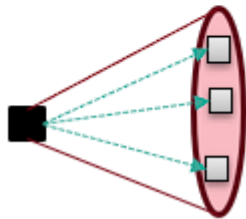
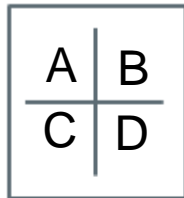
<b>Group 1</b>	<b>Group 2</b>	<b>Group 3</b>
<b>Ulli Lorenz</b>	<b>Totti Könnöla</b>	<b>Nikolaus Schall</b>
Rainer Quitzow	Corina Murafa	Mike Parr
Harry Lehmann	Peter Lund	Elisabeth Dütschke

<b>Time</b>	<b>What</b>
<b>13:00 – 13:15</b>	Quick tour de table: who is in the room
<b>13:15 – 13:45</b>	Presentation by Ulli:
<b>13:45 – 14:00</b>	Immediate Q&A
<b>14:00 – 14:15</b>	Small break
<b>14:15 – 15:15</b>	Discussion in 3 Break-out groups: 1. Ulli 2. Totti 3. Nikolaus
<b>15:15 – 15:45</b>	Plenary: Setting up the final list
<b>15:45 – 16:00</b>	Next steps / Conclusions / open questions

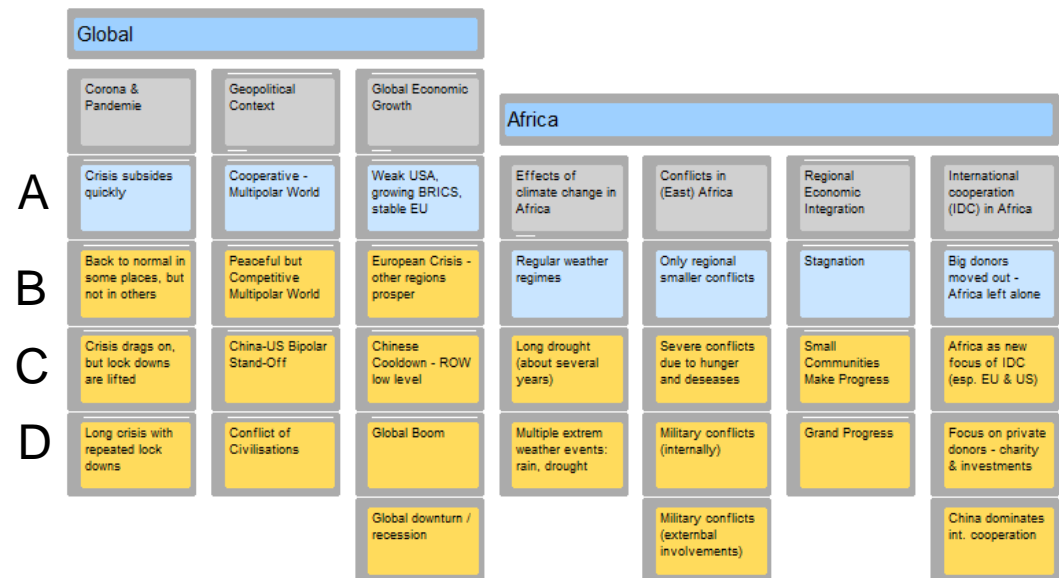
## NEXT STEPS



## 1. Building the projections for each selected key factor



## 2. Building a morphological box



2<sup>nd</sup> Workshop: 14.09.2022, 9:00 – 12:00 CEST

3<sup>rd</sup> Workshop: 26.09, 13:00 – 16:00 CEST