

HIGH LEVEL RECOMMENDATIONS FOR THE EUROPEAN UNION BECOMING ENERGY RESILIENT AND CLIMATE NEUTRAL





#### Foreword

Competitiveness, growth and sustainability will remain the guiding principles of the global economy. The balance between these three factors will make a noticeable difference in achieving the SDGs by 2030, a global agenda! The European Union (EU), the only functioning transnational concept of governance, has to guide by example on a bumpy road and an only very short time period remaining.

Our guiding slogan "technology obliges" has been chosen by our conviction that portrays the potential of our technological capacities in Europe to better solutions for mankind. It is our obligation to provide our economies the best combinations of tech-solutions in the shortest time period possible.

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This makes our approach different and in a certain way turned around to what we have seen in public affairs so far.



**BENEDIKT GRÜTZ** Vice President of European Senate of Economy and Technology That is why the European Senate established its cooperation with EU Tech Chamber (EUTECH) in order to build up a modern and global plattform, also by using the newest technology and social media, where experts can systematically meet and join forces to find the most durable trends for tech-applications and thus for business models in general.

This makes our approach different and in a certain way turned around to what we have seen in public affairs so far. It is not about arguing on how to transform a given economy into a more sustainable system. The intention to make sustainability an accompanying factor of the two established ones, competitiveness and growth, falls much to short. No, sustainability must be placed in the centre of these two others. Sustainability will and must be the source of our future competitiveness and growth. Business models need to be transformed to generate their profitability exactly there, in becoming sustainable not only in their operations but also in their products and services themselves! Only then, we stronly believe, we will be able to make our economies and way of living truly sustainable.

And we do also think that this objective can only be achieved by a very intelligent cooperation between different organisations. With 18 active Alliances, ranging from regional chapters around the world and leading technology fields in Europe to significant sectors of impact, EUTECH provides orientation for businesses. Moreover, through 200+ webinars, networking meetings and theme expos on a yearly basis, EUTECH brought together the tech innovators, industry leaders, policy makers, thought leaders and academician to foster a technology community and an inclusive environment where dialogues are



nurtured, connection can be built, collaboration is valued and the sustainability mission is included in the action plan. In this technology hub, we are jointly exploring the best solution with the right people on the right track. In the process of this exploration of true solutions, there is one more thing that is crucial which would be the voice of this diversed community as well as its positioning in this societal ecosystem – The White Papers.

The European Senate of Economy and Technology, based in Brussels, elaborates position papers based on these white papers and aiming at providing policy makers and governmental institutions a better orientation on how to better frame these developments in businesses of their economies. Position papers somehow will provide a better feeling on where the story is going to. The more longer term perspective in a political world that is driven by short-termism.

The European Technology Chamber as Europe's leading technology organisation, based in Zurich, is the partner institution of the European Senate and unites an enormous know-how potential in Europe according to the motto "Technology Obliges".



FLORIAN VON TUCHER Chairman of European Technology Chamber For political decision makers on the basis of many expertise carriers from economy, science and politics. As a community of values, it does not pursue individual particular interests, but serves the common good.

The European Technology Chamber as Europe's leading technology organisation, based in Zurich, is the partner institution of the European Senate and unites an enormous know-how potential in Europe according to the motto "Technology Obliges". In 15 Commissions entrepreneurs, scientists, politicians and cultural professionals from all over the world develop solutions for the most urgent future challenges of our time, so that the EUTECH has an extremely large experience base. Both organizations take a cross-sector and cross-thematic approach to their papers. The core aim is to help the economy to reposition itself.

The impulses set by the European Senate and EUTECH are thus intended to benefit as many people as possible worldwide and answer important questions about the future in an umbrella context by bringing together different technological approaches from a wide range of sectors.

The European Senate translates the technological know-how of its members into concrete recommendations for action for economic decision-makers and at the same time translates them in such a way that those with political responsibility can also understand them and create appropriate framework conditions for their realization.

The EUTECH serves the transfer of knowledge, the European Senate generates an essence from it, which serves as a support for decision makers in the execution of their highly responsible decisions.

Knowing that both are European organizations and do not belong to any particular nation, it will probably be easier for you as a recipient of this position paper to better interpret the impulses described inside.

We hope you will enjoy reading it!



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	PREAMBLE AND TARGET SCENARIO	WIND ONSHORE AND OFFSHORE Plus P2X conversion			PHOTOVOLTAIC
TIONS	<b>1</b> The EU must develop and operate an integrated energy generation market based on the existing energy transport systems.	1	New wind farms must be set up on the Northern Coasts of the EU on virtual islands and should be equipped with electrolyzers.	1	The EU must become independent of PV panels produced in Asia. The factories in Europe should become operational again as soon as possible. To be able to deploy
RECOMMENDATIONS		2	Windfarms can be extended in cooperation with reliable and stable North African countries. e.g., Negotiations with Morocco must be started now.		the needed PV panels in Europe, we need to invest strongly in the solar panel supply chain (polysilicon, ingot, wafer, cell, panel).
REC	3	3	The disconnected German windfarms in the North Sea must be connected immediately, the "Süd link" should be installed as soon as possible.		
			possible.		



1	The solar thern
	plants must be re Spain. Moreover, i like Spain, Portugo Greece, solar the plants have to capacity is estim- around 60 GW. Italy electrical energy fi power plant in T can be expanded.

SOLAR THERMAL POWER PLANTS

#### GEOTHERMAL POWER PLANTS

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This development should be started as soon as possible as an R&D project in an area where the deep geothermal energy is accessible, a transport system exists and a nearby city can be provided with central heating. Next generation NPPs should be integrated in the EU energy landscape together with a massive expansion of solar, wind, geo thermal and also with an increasing smart grid and software infrastructure and next gen utilities.

**NUCLEAR POWER PLANTS (NPP)** 

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DECENTRALIZED ENERGY SYSTEMS	REQUIREMENTS FOR STORAGE, TRANSPORT, AND Distribution of Hydrogen		
Use the energy and materials near the location which is produced	Therefore, it is now time to set the direction in order to maintain and develop Europe's gas infrastructure which can accelerate the energy transmission with the development of a pan European hydrogen market.		
	2 The MidCat project connecting Spain and France and Mid Europe must be started as soon as possible. Ultimately, to realise the hydrogen pipeline infrastructure required by 2030, action is needed now.		
	<b>3</b> The five supply corridors have the potential to provide Europe with access to abundant and low-cost hydrogen supply by 2030.		



#### **Preamble and Target Scenario:**

The EU must develop and operate an integrated energy generation market based on the existing energy transport systems.

The Energy Trilemma: this conflict-of-interest addresses three fundamental challenges: those emanating from economics (affordability), politics (energy security or security of energy supply) and the environment (including climate change and sustainability). The predicament is the clash between the rising global energy demand and the need to radically reduce CO2 emissions – this has led to increased integration of more sustainable (renewable) energy sources in global energy systems.

A much more detailed overview about the technologies and potentials is given in the white paper:

- Energy Resilience of the EU
- Authors
  - ♦ Andreas Otte (EURECI)
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  - ♦ Oliver Schulte (E:E Consulting)
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  - Thomas Kleefuß (E:E Consulting)
  - Henning vom Stein (Chairman Policy Commission)

The RES based energy generation will utilize the following types of generation:

- Wind onshore and offshore
- Photovoltaic farms
- Solar thermal power plants
- Geothermal power plants
- Nuclear power plants
- Generation, transport, and storage of hydrogen









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#### Wind onshore and offshore plus P2X conversion:

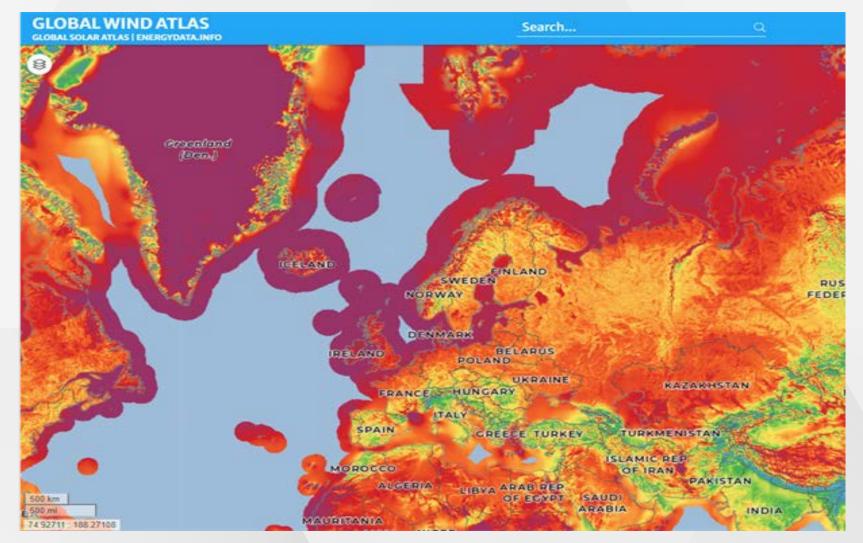
- New wind farms must be set up on the Northern Coasts of the EU on virtual islands and should be equipped with electrolyzers.
- Windfarms can be extended in cooperation with reliable and stable North African countries. e.g., Negotiations with Morocco must be started now.
- The disconnected German windfarms in the North Sea must be connected immediately, the "Süd link" should be installed as soon as possible.

Wind onshore will provide regional electrical power. For that the power transport system must be upgraded since the major wind parks are typically connected to the high or highest voltage and the energy should be transported to different areas of Europe.

The same requirement to upgrade the transport system has applied to offshore wind parks. These farms are affecting the maritime ecology, thus the solution that has been developed in Denmark can be preferred: artificial islands are used to install wind parks in the sea and there is one major connection to the coast. This could in some areas support the prevention of floods due to the rise of the oceans. Offshore windfarms in the Northern part of Europe should be utilized to generate hydrogen, however, the desalination can be performed by osmose membranes which are already available. The hydrogen will be transported through the upgraded natural gas pipelines.







Picture : Wind atlas of Europe and Northern Africa



#### **Photovoltaic:**

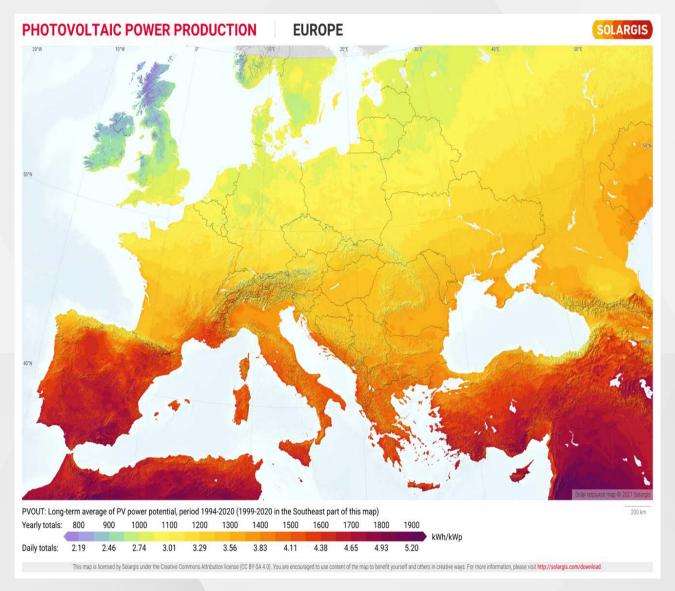
The EU must become independent of PV panels produced in Asia. The factories in Europe should become operational again as soon as possible. To be able to deploy the needed PV panels in Europe, we need to invest strongly in the solar panel supply chain (polysilicon, ingot, wafer, cell, panel).

The average energy cost for solar panels has been dropping drastically since several years. This is due to the fall of the solar PV module prices, which have fallen around 80% since 2009, and with every doubling of installed capacity module costs plunge a further 20% thanks to economies of scale and the types of performance and efficiency improvements currently being seen.

Furthermore, IRENA forecasts 59% Solar PV Price Reduction By 2025, bringing the global average price of electricity even lower. The photovoltaic potential of Northern Europe is far less than Southern Europe and North Africa. Here again a cooperation with reliable and stable North African countries is highly recommended.







Picture : Photovoltaic power potential in Europe and nearby countries



#### **Solar Thermal Power Plants:**

The solar thermal power plants must be re-started in Spain. Moreover, in countries like Spain, Portugal, Italy, and Greece, solar thermal power plants have to setup: the capacity is estimated to be around 60 GW. Italy is receiving electrical energy from a solar power plant in Tunisia: that can be expanded.

Solar thermal power plants are most efficiently located in the South of Europe as the sun is shining 1.5 times brighter than in the North and has a better angle. The solar thermal power plants should be located close to the coast since the heliostats have to be cleaned frequently. To use sweet water for this is not reasonable, a nano technology-based material would make the cleaning redundant.

The solar thermal power plants operate thermal reservoirs: thus, a conversion P2X is not necessary since the power can be generated any time if the thermal reservoir is not depleted. In the meantime, solutions are available which allow to do a precise management of the thermal reservoir and thus produce an electricity generation schedule. In the Southern EU (for example in Spain), solar thermal power plants have been shut off during the finance crisis in 2008.







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#### **Geothermal Power Plants**

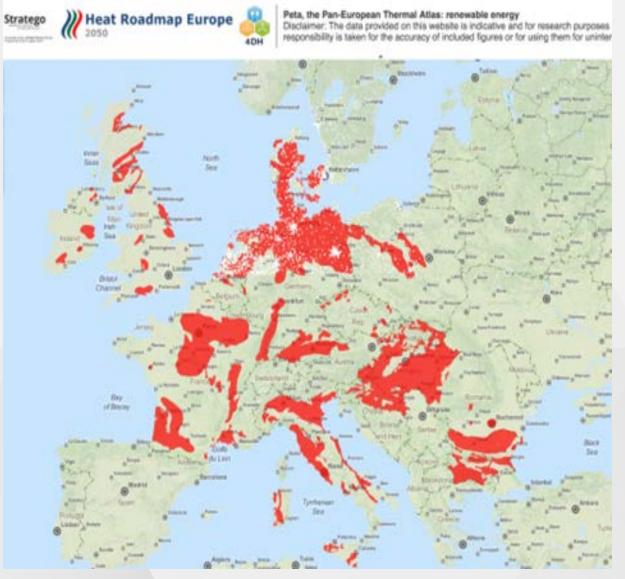
This development should be started as soon as possible as an R&D project in an area where the deep geothermal energy is accessible, a transport system exists and a nearby city can be provided with central heating.

Deep drilling: the temperature rises around 30 degrees with every kilometer going down into the earth shell. The earth shell is approximately 30 km thick.

It can be deduced that Bulgaria, Denmark, France, Germany, Italy, Slovakia, and Romania have a high potential of deep geothermal energy. In Germany, this could replace the heating based on coal and lignite, moreover, in France, a lot of electric heating could be replaced. In Italy, the mountain areas could benefit also from geothermal energy. New drilling technologies with sufficient diameter (6-12 m) and depth to bring shafts (vertical tunnels) of more than 16,000m deep to reach the temperature mark of 400 C for sufficient energy supply. The energy is generated by means of a closed adiabatic system and the generation of steam, which drives turbines. This new form of deep geothermal energy can be used after a maximum of 2-3 years of adapting existing technologies through research and development (R&D). A well can be constructed in 18 to 24 months and a complete power plant construction after another 2-3 years. Another advantage of this technology is that existing power plant sites can be reused as part of the structural change.







Picture : Potential for deep geothermal energy in Europe



#### Nuclear Power Plants (NPP):

Next generation NPPs should be integrated in the EU energy landscape together with a massive expansion of solar, wind, geo thermal and also with an increasing smart grid and software infrastructure and next gen utilities.

Nuclear Power Plants are among the safest and cleanest sources of energy production, and are very dependable. The sixremaining functioning NPPs in Germany – three of them have been shut down end of 2021 – had an average availability of around 90% during their whole operation life cycle.

Generation III reactors have improved fuel technology, higher thermal efficiency, significantly enhanced safety systems (including passive nuclear safety), and standardized designs intended to reduce maintenance and capital costs. According to GEN IV International Forum the Generation IV reactors include (relative to Generation II and III reactors):

- Nuclear waste that remains radioactive for 300 500 years instead of several million years.
- 100-300 time energy yield from the same amount of nuclear fuel
- Broader range of fuels, including unencapsulated raw fuels (non-pebble MSR, LFTR).
- Potential to burn existing nuclear waste and produce electricity: a closed fuel cycle.
- Improved safety via features such as ambient pressure operation, automatic passive reactor shutdown, alternate coolants and eliminating the need for external backup power source
- Usage for district heating



NPPs can produce cheap and clean hydrogen in large quantities, can capture CO2 by Direct Air Capture from the air and help not only the survival of the industries in the EU but also boost the clean production of green ammonia, e-methanol, green steel, green aluminium, silicon wafers, glass, cement, and other electricity intensive products.



Picture : 100 MW Last Energy SMR

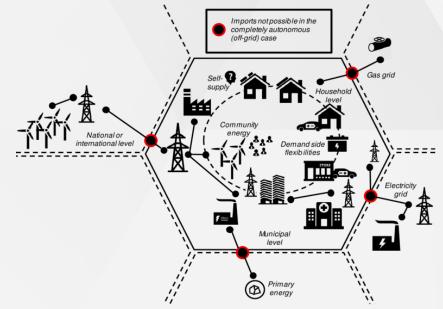


#### **Decentralized Energy Systems:**

Use the energy and materials near the location which is produced.

Benefits of a decentralized energy system:

- Better usage of individual and small clean energy generation and storage capabilities (especially roof-top solar panels and Vehicle to Grid storage)
- Lower capital costs per project
- Planning flexibilities
- · Closer technical relationship between energy retailers and consumers
- More efficient use of combined heat and power systems and water
- Rural and remote electrification
- Quality services resulting from healthy power ecosystem
- Reduction of electricity distribution lines
- Reduction of gas and oil pipelines
- Improvement of resiliency at community and European level
- One of the leading causes of energy losses is using the energy and materials in a far location than it is generated.









# Requirements for storage, transport, and distribution of hydrogen:

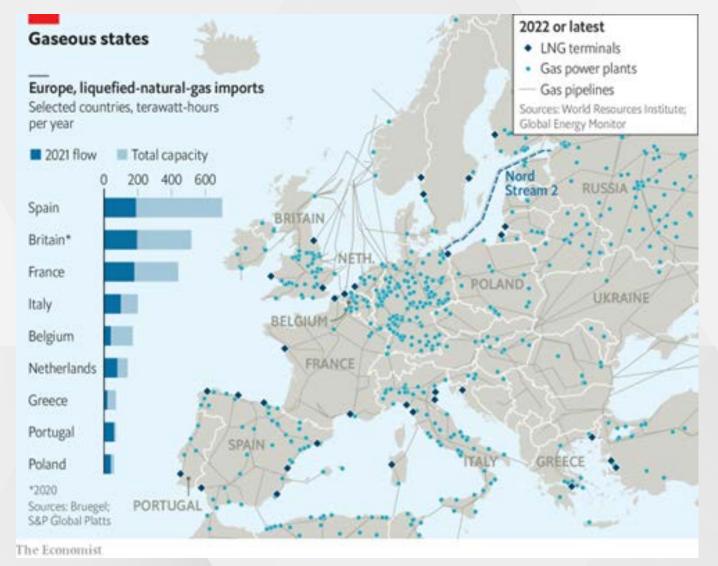
- Therefore, it is now time to set the direction in order to maintain and develop Europe's gas infrastructure which can accelerate the energy transmission with the development of a pan European hydrogen market.
- The MidCat project connecting Spain and France and Mid Europe must be started as soon as possible. Ultimately, to realise the hydrogen pipeline infrastructure required by 2030, action is needed now.
- The five supply corridors have the potential to provide Europe with access to abundant and low-cost hydrogen supply by 2030.

It has already been proved that hydrogen can be transported and distributed via pipelines for natural gas. If the hydrogen content is 100%, an upgrade of the pipelines, especially the necessary facilities like compression, valves and metering must be done.

One example for a missing interconnection of a market with large import capacity is Spain which is lacking export capacities to France. Spain and Portugal have LNG import capacities of approximately 800 TWh/a (appr. 25 % of EU`s total LNG import capacities) and another 220 TWh/a of pipeline gas from Algeria. Thus, Spain's import capacity is three times bigger than the country's annual consumption.







Picture : LNG terminals and natural gas pipelines in Europe





#### SUMMARY

National politics and the EU Commission must ensure in their drafting of regulations and settings of market rules, that the existing gas infrastructure will be considered a backbone for the future sector coupling and the consequences will have significant economic impacts.

If coal and oil shall be displaced sooner, natural gas due to its excellent infrastructure becomes an integral part of Europe's future energy infrastructure. As one of the guiding principles, the climate neutrality must also be financially and socially acceptable.

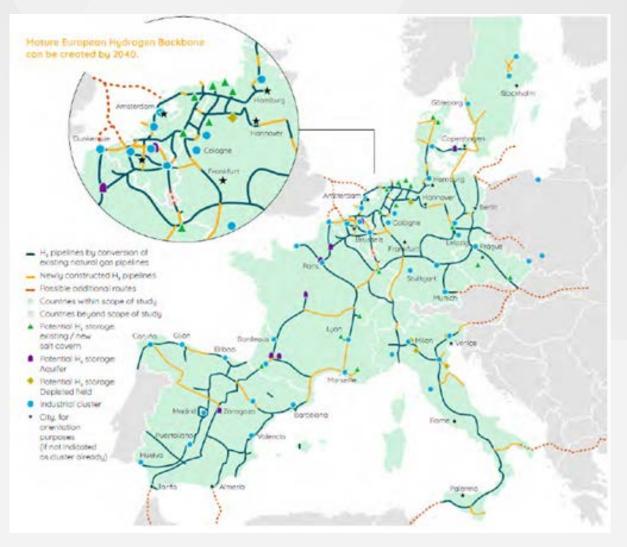
Between 2030 and 2040, the European Hydrogen Backbone will continue to grow, covering more regions and developing new interconnections across Member States. Driven by the ambitious policy environment set in the Green Deal, Fit for 55, and REPowerEU proposals, an increased urgency to meet climate targets, and a rapidly increasing number of projects and initiatives supported by public authorities and industry, the supply corridors will naturally extend into areas where cost-effective pipeline transport of hydrogen is needed to meet market demands.





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Picture : Hydrogen Backbone - dashed lines = under work



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