

ERCST hydrogen paper in preparation for the “Fit for 55”: Identifying key issues and questions

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1. Introduction

The European Green Deal is entering a crucial phase where there is an evident change from exploration and preparation to delivery in which substantial issues of the various legislative and non-legislative developments are being exposed. The “Fit for 55” package will undoubtedly shed some light on some of these issues, setting the course for future developments.

This paper will:

- Provide a high level summary of the current policy framework on hydrogen.
- Analyze key issues and identify key questions based on the lessons learnt from ERCST webinars, before the publication of the “Fit-for 55 package”.
- Point out convergence of views between different stakeholders on key issues.
- A prospective exercise about where (in what pieces of legislation) key issues identified will be addressed.

2. High level policy summary:

2.1. European Commission Strategy

On July 8th 2020 the European Commission adopted its hydrogen strategy. The aim of the strategy is to create an enabling framework to scale up renewable hydrogen supply and demand in line with the EU climate neutrality objective, recognizing a role for low-carbon hydrogen in the short and medium term. The strategy outlines a gradual development for this technology in three phases with the focus set on the hard to abate sectors, including a target for 2030 of at least 40 gigawatts of renewable hydrogen electrolyzers.

2.2. European Council Conclusions

Heated discussions took place in Council on the role of low-carbon hydrogen, where Eastern European countries and France were pushing, respectively, to produce hydrogen through the reforming of natural gas with carbon capture and hydrogen produced by using electricity from nuclear power. In the end, the Council adopted conclusions in December 2020, with a focus on renewable hydrogen for decarbonization, recovery and competitiveness.

Although hydrogen produced by electricity from nuclear power and natural gas with CCS are not specifically named, the conclusions recognize that there are different safe and sustainable low-carbon technologies for the production of hydrogen that contribute to the rapid decarbonization. Regarding infrastructure, the Council acknowledges the opportunities for the repurposing of existing interconnected European natural gas networks and storage infrastructure.

2.3. European Parliament Resolution

ITRE, the leading committee responsible for the EUP’s “Own Initiative” on hydrogen, approved its Report in March, which was subsequently passed in plenary on May 19th.

The report highlights the need to timely foster the deployment of hydrogen relying on low-carbon hydrogen for its production during a transition phase, until enough additional renewable capacity is ready, allowing the switch to renewable hydrogen. It also points out that hydrogen is not the silver bullet for decarbonization, but it is a solution to decarbonize the hard to abate sectors having a huge potential to reduce emissions in the industry.

When it comes to infrastructure, the EU Parliament highlights the timely need to develop a hydrogen infrastructure while also pointing out that when public resources are invested in new pipelines, the risk of stranded assets should be avoided.

3. Key issues identified by ERCST

3.1. Demand

Market Economy v. Regulation

One issue identified was the role that markets and regulation would have to play in shaping the hydrogen economy. In this context the question is then why such a robust regulatory framework is expected by some and put forward in the upcoming legislative review.

It must be recalled that the EU-ETS already provides a price signal that should play the role of promoting the deployment of less emitting technologies without the need to depend so intensely on regulation. It is however also true that the current carbon price is not enough to guarantee the switch to renewable and low-carbon hydrogen. In this logic the discussion then would have to be not how are we going to foster the deployment of decarbonized hydrogen through regulation, but how can we strengthen the carbon price, and under what conditions.

Today just 4% of hydrogen produced in the EU comes from renewable energy, the rest being produced with the use of fossil fuels, releasing 70-100 million tonnes of CO₂ annually.¹ Moreover, renewable hydrogen is today not cost competitive neither with fossil-fuel hydrogen nor with low carbon hydrogen.² It is therefore important to pursue ways to decarbonize the current hydrogen production, and markets not regulation should be the first. However regulation should not be discarded as a mix of regulation and markets is always necessary with each playing a role where they are most effective.

- **Key questions:**
 - Is regulation the right instrument to foster the deployment of a hydrogen economy, what should be the role of the EU ETS and market forces?

Hydrogen scarcity and differing demand forecasts

There is a great uncertainty today, regarding what the future hydrogen demand will be. Demand forecasts for 2050 vary considerably (from 270 Twh³ to 2080 Twh⁴) mainly because, on the one side, we do not know yet the supply, which seems to be largely driven by how extensive or limited the incentives framework will be, and also because it is unknown what the hydrogen end uses will be. Moreover, a political willingness to reduce current large imports from energy has bestowed hydrogen with a greater relevance in some Member States, than should be given from an economical and technical point of view. Regarding the different hydrogen end uses, some Member States are considering the use of hydrogen in other subsectors of the economy than the hard-to-abate, in which the role of hydrogen is being contested by some, such as for example: high temperature industrial heat, road transport or heating.

The issue of hydrogen scarcity becomes more relevant when referring to the short and medium term and when considering only the supply of hydrogen from renewable energy. For illustration purposes, for

¹ European Commission (2020), European hydrogen strategy. ([See more](#))

² IEA (2019) the future of hydrogen, keeping an eye on costs. ([See more](#))

³ Agora Energiewende, No-regret hydrogen, 2021, <https://www.agora-energiewende.de/en/publications/no-regret-hydrogen/>

⁴ Bruegel, Navigating through hydrogen 2021, <https://www.bruegel.org/2021/04/navigating-through-hydrogen/>

the decarbonization of just one steel production facility in Duisburg (Germany), 100 kt/a of hydrogen will be required by 2025 which equals approx. 10% of the 2024 EC target for renewable hydrogen. In other words, the decarbonization of just one steel production facility in Germany using renewable hydrogen, will require 10% of the total EU renewable hydrogen target by that date.

- **Key questions:**
 - Are sectorial quotas for hydrogen the right answer to hydrogen scarcity? If yes, in what sectors? For what types of production processes? What are the criteria and why?
 - Is there going to be scarcity for green hydrogen? Is regulation responsible for this scarcity?
 - Is hydrogen a solution to decarbonize other sectors in addition to the hard to abate sectors? Is this something that regulators or markets need to decide?

Technology neutrality principle

On the demand side, the application of the technology neutrality principle reaches greater importance when talking about incentives. As mentioned, the demand side sees hydrogen as a low-carbon feedstock, with costs, incentives, hydrogen purity, security and reliability of supply as the key criteria.

In other words, the demand side cares much less if hydrogen is blue or green, but about the decarbonization, reliability and profitability of their production process. That's why the application of a technology neutral approach on incentives will define to a great extent the success or lack of success of the different hydrogen production processes and the success of hydrogen as a driver for the future economy.

- **Key questions:** Are incentives on the demand side going to be technology neutral? If not why not?

3.2. Production

Classification of the different production processes and the technology neutrality principle

So far, there is no binding or legal classification for the different hydrogen production processes. According to the latest information, it is very likely that there will be a definition for renewable hydrogen in the delegated acts accompanying the revision of the Renewable Energy Directive, however fundamental issues affecting this definition such as the additionality principle, or the criteria on biomass should be clarified. Moreover it is unclear, where, (in what piece of legislation) a definition for low-carbon hydrogen (as opposed to green hydrogen) will be found, and where low-carbon hydrogen will be regulated.

Again, this classification has relevance when it comes to incentives, as it is not clear yet which sort of hydrogen production processes will get public support. One key issue under discussion is if the classification will be based on production technologies or GHG life cycle emissions, in other words, if the classification for the different production processes will be technology neutral.

The closest to a definition in a legislative document, was provided by the climate delegated act⁵ within the framework of the EU Taxonomy. According to the delegated act, producing hydrogen is sustainable as long as the activity complies with the life-cycle GHG emissions savings of 73.4% (resulting in life-cycle GHG emissions lower than 3tCO₂e/tH₂) relative to a fossil fuel comparator of 94g CO₂e/MJ and the production process complies with the DNSH principle.

⁵ European Commission (2021), climate delegated acts. [\(See more\)](#)

This definition gains greater relevance in the absence of a specific definition and regulation for low-carbon hydrogen. The compliance with low-carbon hydrogen definition, especially blue hydrogen, will pretty much depend on the emission accounting method used. The overall emissions reached during the production process are different when taking scope 1 or scope 2 and/or 3 emissions into account. In this regard, the delegated act refers to art 28 (5) of the RED II which in turns, refers to a Delegated act to be adopted by December 2021.

- **Key questions:** Where (in which pieces of legislation) are we going to see a definition for the different production processes? Where are we going to find the regulation for low-carbon hydrogen?

EU hydrogen Imports vs. EU own production

The European Commission hydrogen strategy shows how the EU will partly rely on hydrogen to meet its decarbonization objectives. Two scenarios are currently being discussed: one where the EU produces all the hydrogen needed and; a second one where the EU relies to a greater or lesser extent on imports.

The choice of one of these two scenarios will depend on choices made on some of the key issues previously mentioned, such as incentives for the production and demand of hydrogen, and the application of the technology neutrality principle on both the demand and the production side.

This will also depend on the regional approach taken by Member States, as the industrial landscape across Europe varies significantly from country to country.

- **Key questions:**
 - Is the EU going to become a net importer of hydrogen? Which type of hydrogen could be imported (renewable only?, low carbon?).
 - Is there going to be an European approach or are Member States going to define national strategies?

Additionality principle for renewable H2

A possible scenario under consideration by the European Commission, is to only allow hydrogen produced by newly-build, additional renewables. That could mean the production of hydrogen by electrolyzers that are temporally and geographically connected to a renewable plant, built for the specific purpose of hydrogen production⁶.

This measure is intended to ensure that renewable electricity is not taken from the grid, which could otherwise be used for the decarbonisation of other sectors.

What is needed is to debate and better understand why such concept is considered and needed, the rationale behind this approach: this seems like heavy state intervention in asset allocation.

- **Key questions:**
 - Is the additionality principle justified in a market economy and in presence of an electricity market?
 - Will the additionality principle act as a bottle neck for the development of a hydrogen economy?
 - Are there going to be temporal exemptions to this principle?

⁶ Aurora Energy Research (2021), enabling the European hydrogen economy. [\(See more\)](#)

3.3. Transportation

Pace for infrastructure development

An alternative approach between the EC strategy and the ITRE report has been identified. While the EC Foresees different paces for infrastructure development along the 3 phases envisaged in the strategy, the ITRE report emphasizes the timely need to develop infrastructure for hydrogen production, storage and transport to incentivize adequate capacity building.

- **Key questions:** Should the development of infrastructure follow or foster demand?

Blending

The Blending of natural gas and hydrogen is one of the most controversial and discussed issues from both, a regulatory and a technical point of view. From a technical point of view, current gas pipelines are just able to cope with a reduced share of blended hydrogen and some end applications such as those in the chemical industry, require pure hydrogen for their industrial processes. Some Member States argue that the support of a blending phase can lead to the creation of stranded assets, others argue that a blending phase could help to recover investments in current natural gas infrastructure and contribute to the development of a hydrogen infrastructure.

- **Key questions:** Do we need a blending phase? Could it create stranded assets?

Repurposing

Most of natural gas pipelines are not technically ready to transport hydrogen, due to, among others, the difference in energy density between both molecules, that can cause serious damages in the existing natural gas pipelines. The repurposing of natural gas infrastructure is one of the options on the table to develop a European hydrogen backbone.⁷

- **Key question:** Is a regional approach to repurposing needed?

4. Incentives

Quotas & Demand Mandates

Under the recast RED II directive, mandates are laid out for the use of renewable fuels. Hydrogen and hydrogen-derived synthetic fuels therefore count towards the minimum targets laid out in the Directive, provided that GHG emissions are lower than 70% of fossil fuels and produced using additional renewable electricity. The introduction of quotas and demand mandates in a number of sectors are being currently discussed as part of the Fit for 55 package, without clarity when it comes to first, sectors and second, if quotas will be set just for renewable or also for low-carbon hydrogen.

CfD and CCfD

CfD can be considered as the closest relative to CCfD. CfD have its origin in the financial sector helping to hedge against volatile prices. CfD have been used as an efficient solution to address the uncertainty of revenues in the renewables sector, being broadly used, as an example, in the UK since 2014. One of the main differences between CfD and CCfD is that in the case of RES, CfD cover all the revenue stream of the investment, while CCfD only address the carbon revenue stream. In this sense, CCfD offsets the difference between the market price for emissions allowances and the carbon avoidance costs. CCfD works as follows:

⁷ Gas for Climate (2021), a european hydrogen Backbone. [\(See more\)](#)

- If the market price for emission allowances is lower than the carbon avoidance costs, the State pays the difference.
- If the market price for emissions allowances is higher than the carbon avoidance costs, the company pays the difference.

The question of CCfD is strictly related with state aid, as the difference between the market price for emissions allowances and the carbon avoidance costs will be payed by Member States. The revision of the Climate, Energy and Environmental State aid Guidelines will broad the scope of the current guidelines and and very possibly cover CCfD. Several Member States are calling for an European approach to CCfD, which according to the renewed industrial strategy will be presented together with the revision of the ETS Directive as part of the Fit for 55 package.

Tax rebates

Tax rebates can be also used to incentivize the production of hydrogen and granted by Member States. As an example, the german hydrogen strategy considers the option of exempting the electricity used for electrolysis from taxes, surcharges and levies.

Funding Mechanisms

There are several funding mechanisms at an EU level from which funding for hydrogen and complementary technologies will flow. For example: ETS Innovation Fund, ETS Modernization Fund, Horizon Europe, Just Transition Fund, Recovery and Resilience Facility, Invest EU, European Investment Bank financing or the CEF.

State Aid

State aid has been definded by several member states such as Germany or the Netherlands as a key instrument for the development of a hydrogen economy. They argue that State Aid will be needed, at least during a transition period, to cover the funding and technological gap between green and low-carbon hydrogen and other more polluting contestants such as hydrogen produced by fossil fuels. However some Member States, for instance in the south of Europe, argue that if public money in certain countries with an stronger financial capacity starts to flow towards their hydrogen ecosystems, the competitive level playing field could be distorted. The revision of the Climate, Energy and Environmental State aid guidelines or “CEEAG” is currently under consultation. The main driver of the revision is an enlargement of the scope of the Guidelines to new areas and all technologies that can deliver the Green Deal such as renewable hydrogen or the CCS / CCU technology.

Sustainable Finance

As previously mentioned, the EU Taxonomy Delegated acts on Climate, state that producing hydrogen is sustainable as long as emissions are under 3 tons of CO₂ per ton of hydrogen and complies with the DNSH principle. Depending on how emissions will be calculated, these requirements make production processes other than from renewables hardly compliant. This represent an strong incentive as the taxonomy will chanel sustainable investments towards the production of renewable hydrogen with of course, the limitations the regulation will impose e.g. additionality principle. When it comes to infrastructure, conversion/repurposing of existing natural gas networks to hydrogen, 100% substantially contributes to climate change mitigation.

Carbon pricing and ETS extensions

One could argue that the increase in carbon prices will foster the switch towards less polluting production process in some parts of the industry such as the steel or chemicals. However, the current

ETS price is not high enough as to guarantee this change today. A recent study published by Agora Energiewende and Guidehouse highlights that even if the EU's carbon price rises to €100 to 200/tonne by 2030, it won't be enough to sufficiently incentivise renewable hydrogen. The extension of ETS or the introduction of a carbon price in other sectors such as road transport or heating may also lead to reduce the funding gap between decarbonized hydrogen and other more polluting solutions.

5. Convergence points, lessons from ERCST webinars

- Under the current regulatory framework, there will be a scarcity of renewable hydrogen during the transition.
- There is the risk that a too rigid regulatory framework, in favor of just certain hydrogen production processes, will be put in place.
- The demand side sees hydrogen different from the production side. It mainly sees hydrogen as a low-carbon feedstock, being costs, incentives and hydrogen purity the key enablers. In other words, the demand side cares much less about if the hydrogen obtained is blue or green, but about the decarbonization, reliability and profitability of the production process.
- The technology neutrality principle has not just a vertical applicability but also an horizontal and can be applied not just to the supply but also to incentives, such as CCfD.
- It is unclear, where, in what piece of legislation, a definition for low-carbon hydrogen will be found and where low-carbon hydrogen will be regulated. In absence of an specific definition, the one included in the taxonomy will become the standard.
- It is unclear how much regulatory space will be left for Member States to support low-carbon hydrogen.
- The application of the additionality principle may cause a bottle neck in the development of a hydrogen economy.
- There is a discorvengence of views when it comes to the pace for infrastructure development.

6. Matching the key pieces of legislation with the key issues

This section has been conceived as a guessing exercise in order to provide some guidance on where key issues previously identified will be possibly addressed in the upcoming legislative review. This mapping do not intend to provide detailed information about where exactly in the legislation key issues will be found, pointing out articles or paragraphs, but a rather more general orientation. A more detailed analysis will follow after the publication of the Fit for 55 package. Key pieces of legislation include: The revision of the Renewable Energy Directive, revision of the Energy Efficiency Directive, Revision of the EU-ETS, State Aid (EU-ETS guidelines and CEEAG), RED Delegated act touching upon additionality, CBAM, Energy System Integration Package (Gas Package), TEN-E revision and EU Taxonomy Delegated Acts.

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| Production | <ul style="list-style-type: none"> ❖ Binding classification (production processes) ❖ Additionality criteria for renewable H2. ❖ impots v. exports | <ul style="list-style-type: none"> ❖ RED III for Renewable Hydrogen and Gas Package for low carbon EU Taxonomy ❖ Delegated act on ddditinality ❖ Member States, CBAM. |
| Demand | <ul style="list-style-type: none"> ❖ Hard to abate vs. other sectors ❖ Hydrogen purity ❖ Hydrogen scarcity | <ul style="list-style-type: none"> ❖ RED III, Rev. Energy Efficiency Directive, Rev. ETS Directive ❖ Secondary legislation ❖ Rev. RED III, Rev. Gas Package, Rev. State Aid, EU Taxonomy. |
| Transportation | <ul style="list-style-type: none"> ❖ Pace for infrastructure development ❖ Blending ❖ Repurposing | <ul style="list-style-type: none"> ❖ Rev. TEN-E, Rev. Gas Package, EU Taxonomy ❖ Rev. TEN-E, Rev. Gas Package, Rev. State Aid, EU Taxonomy ❖ Rev. TEN-E, Rev. Gas Package, Rev. State Aid, EU Taxonomy |
| Incentives | <ul style="list-style-type: none"> ❖ CCfD ❖ Demand mandates ❖ Tax rebates ❖ Sustainable Finance ❖ State AID ❖ Funding Mechanisms | <ul style="list-style-type: none"> ❖ MSs Level, ETS Directive ❖ RED III and Rev. Gas Package ❖ MSs Level ❖ EU Taxonomy ❖ Rev. State Aid Guidelines and IPCIs ❖ ETS Modernization & Innovation Fund, RRF, JTF, Horizon Europe, CEF, EIB financing |