La Grande
Conversation

Can the Hydrogen IPCEI deliver on Europe's objective to develop a decarbonized hydrogen industry ?

Politics

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The "Important Project of Common European Interest" (IPCEI) launched in July 2020 for the hydrogen sector underlines the ability of the European Union to mobilize around a strategic issue and to overcome its traditional reluctance to provide public support to the industry in the context of international competition, where competitors - especially Asian competitors - have no hesitation in resorting to public subsidies. But it also highlights the difficulties, as Christophe Schramm

points out, to coordinate and ensure the coherence of a truly continent-wide industrial policy.

In December 2020, 22 European Union (EU) countries and Norway signed a manifesto paving the way for a clean hydrogen value chain and committing to launch an « important project of common European interest » (IPCEI) in the hydrogen sector. This followed the adoption of an EU hydrogen strategy in July 2020, which set a target of producing 10 million tons of renewable hydrogen in the EU by 2030[1] through the installation of at least 40GW of renewable hydrogen electrolysers, to be used for hard-to-abate sectors such as ammonia, steel, cement, or chemicals manufacturing[2] and heavy-duty transport[3].

The IPCEI on hydrogen has received quite a bit of attention from both industry players and policy makers. Unprecedented amounts of public funding have been made available, with very high funding rates both for research & development and for industrialisation and so-called « gigafactories ». But there is still limited understanding when it comes to how this new European policy instrument actually works and what its implications are. Moreover, the tool itself is still evolving as the successive IPCEIs across other industry sectors unfold.

Building on the experience from the first wave of this IPCEI, this note takes a closer look at this new, ambitious funding scheme, assesses its strengths and weaknesses to develop the European hydrogen industry, and makes proposals on how to ensure its full success going forward.

An industrial policy revival in a European crisis context : the genesis of the Hydrogen IPCEI

The IPCEI approach was devised in the early 2010s in response to certain Member States' criticism regarding the lack of public support for strategic industries because of the then applicable European rules for State aid. This lack of support put European players at risk against the – overt and covert – subsidies received by those same industries in third countries.

The industry in everybody's mind at that time was the photovoltaïcs industry : Despite ambitious European renewable energy targets, generous feed-in tariffs, and the initial dynamism of European industrial players, virtually all plants and industrial jobs were lost to China, whose companies outcompeted Europe's photovoltaïc cell and module manufacturing industry thanks to an agressive mix of subsidies, loan schemes and other industrial policy tools.

The basic concept of the IPCEI had been promoted for many years by, among others French, industrial policy proponents : The State has a role to play in defining a strategy for core technologies and in furthering the development of their value chains through targeted supply-side investment support, since the market alone will not finance such projects (cf. the French nuclear programme or European high-speed rail programmes) and since demand-side policies (e.g. feed-in tariffs for renewable energy or purchasing subsidies for electric vehicles) are difficult to target at national or European industrial players only and can, on the contrary, in the absence of a level playing field, help to strengthen non-European competitors (as was the case with solar panels and could become the case again for battery-electric vehicles today).

The result was a communication of the European Commission in 2014, which provided the following official *raison d'être* to the IPCEIs : « IPCEIs make it possible to bring together knowledge, expertise, financial resources and economic actors from across the Union, in a bid to address important market or systemic failures or societal challenges that could not otherwise be addressed. They are designed to bring together the public and

private sectors to undertake large-scale projects of significant benefit to the Union and its citizens. »

The initially targeted key enabling technologies included micro-/nanoelectronics, nanotechnology, photonics, advanced materials, industrial biotechnology and advanced manufacturing technologies. In 2022, the European Commission decided to add the implementation of the European Green Deal as one key objective for future IPCEIs.

The first IPCEIs were launched in the field of micro-electronics in 2018 (29 participating companies and R&D organisations from 4 Member States for up to 1.8 billion euros of public funding) and batteries in 2019 and 2021 (59 entities, 12 Member States, up to 6.1 billion euros of funding).

The Hydrogen IPCEI was launched in the wake of the European Green Deal. Initiated by the European Commission end 2019, this Deal included the « Fit for 55 » package published mid-2021 that created binding targets to achieve 55% greenhouse gas emission reductions across the EU by 2030 compared to 1990. The IPCEI was meant to accelerate the production of decarbonized hydrogen to address emissions in hard-to-abate industry sectors.

The IPCEI's preparation phase then coincided with two major macro-economic shocks that set free vast amounts of public money to deploy anti-cyclical policies :

- First the Covid-19 crisis : Faced with an unprecedented economic recession, the EU discovered its dependency on international supply chains for basic goods such as face masks or paracetamol. In response, it unleashed an extraordinary 750 billion euro recovery effort in July 2020 (« NextGeneration EU ») with the explicit target to increase its strategic autonomy in core industries.
- Then Russia's attack on Ukraine in February 2022 : The ensuing energy and in particular gas crisis created a

shared sense of urgency to accelerate the deployment of an integrated renewable hydrogen value chain in Europe, as highlighted in the March 2022 « REPowerEU » Communication, in order to reduce the European dependency on Russian gas.

It's this convergence of an ambitious climate agenda, an energy crisis and a « Zeitenwende » in European industrial policy thinking, catalysed by low interest rates that facilitated Keynesian economic policies, that explains why the Hydrogen IPCEI gathered so much political support and hence financial firepower.

About project portfolios, a chapeau document and notifications : how the Hydrogen IPCEI worked (and works)

The first IPCEI proposals (the so-called « project portfolios ») were submitted by project promoters as early as mid-2020, with some Member States taking a headstart in collecting projects thanks to already defined national hydrogen strategies, while others had to wait until early 2022 to engage in the process of identifying and pre-selecting national candidate projects.

By mid-2022, the number of project proposals had grown to over 400, which completely overwhelmed the European Commission in charge of carrying out the due diligence for each project, as well as the German government who had volunteered to coordinate the preparation phase for this IPCEI.

To address the backlog, Member States agreed to release projects in 4 different waves, trying to create coherent

« packages » of projects on equipment for hydrogen production, fuel cells, storage, transportation or distribution (Wave 1 / « Hy2Tech »), on industrial end uses (Wave 2 / « Hy2Use »), on infrastructure (Wave 3 / « Hy2Infra »), and on mobility end uses (Wave 4 / « Hy2Move »).

Following their pre-notification to the European Commission, projects had to go through a parallel process :

- Each project was evaluated individually, first at national level (by the ministry in charge of industry) and then at European level (by the Directorate General in charge of competition) via several rounds of « requests for information », through which the European Commission wanted to ensure that the project was technically sound and financially credible (i.e. not asking for too much funding) and that it was ticking all the boxes in terms of partnerships established between companies and across Member States, sharing of intellectual property, dissemination efforts and other so-called positive « spill over » effects.
- All projects of a same wave also had to contribute collectively to the drafting of a so-called « chapeau document » that summarizes the objectives of that wave and tries to ensure consistency between projects.

The formal approval (« notification ») of the projects for Wave 1 was obtained in July 2022. Then came a period of political validation at national level – and in certain Member States further down-selection due to budgetary constraints or shifting political priorities –, given that the final funding decision for an IPCEI, once the regulatory greenlight given by Brussels, lies with the Member State.

Awarded Wave 1 projects were finally authorised to negotiate and sign funding agreements with the designated national authorities (e.g. the national public investment bank such as BPI

in France). The first public funds were cashed out to projects in the last quarter of 2022.

The 41 projects from 15 Member States collected in Wave 1 (Hy2Tech) have received up to 5.4 billion euros of public funding, among them Symbio's Hymotive fuel cell project for up to 670 million euros. Waves 2 and 3 (Hy2Use in September 2022 and Hy2Infra in February 2024) have added 68 projects eligible to up to 12.1 billion euros in public funding, while a fourth wave (Hy2Move) is still expecting final approval from the European Commission. In total, public funding in excess of 20 billion euros should be made available for this IPCEI, i.e. more than three times the amounts made available for the next-largest IPCEI on batteries.

A powerful instrument to deliver on Europe's Green Deal... that suffers from a lack of (European) strategy

It is too early to judge whether the Hydrogen IPCEI as a whole will be a success, given that projects are mostly set to reach the end of their funding period between 2025 and 2030. But the experience gained over the past 4 years allows already to draw certain conclusions.

Let's highlight that the IPCEI certainly is among the most powerful European industrial policy instruments that has been put to work in recent decades, and all those having contributed to its creation and implementation should be commended for this achievement.

When it comes to hydrogen, the IPCEI has tried to take a holistic approach to developing a fully-fledged European value chain, from production to transportation, storage, and usage in

industry and mobility, with a focus on promoting home-grown technology companies and creating solid eco-systems across the continent. The amounts made available are considerable and place Europe at the forefront of hydrogen developments in comparison to other major markets such as North America and China.

With regard to process, it is obvious that it has just taken too much time to instruct and launch the IPCEI projects, leading to large discrepancies in project execution between waves and within a same wave :

- Today, almost 4 years after the first project proposals were submitted, the European Commission is still evaluating a certain number of projects part of the fourth Hy2Move wave, while the projects of the first Hy2Tech wave have already gone through an initial intermediary evaluation presented during the 1st IPCEI Hydrogen Conference in December 2023.
- In this first wave, about 1/3 of the projects have not started yet while the fastest projects had kicked off their activities in September 2021 (date of the first pre-notifications).
- Without having access to detailed data for each of the first 3 waves, we estimate that out of the 17.5 billion euros made available for close to 110 projects in 3 waves since July 2022, about 2-3 billion euros have been disbursed to date.

With regard to outcomes, our preliminary assessment of the four waves reveals three main shortcomings.

First, the IPCEI has suffered from a lack of strategic planning and insight gathered during the preparation phase in order for the massive funds to be spent in the most effective way.

For the hydrogen economy to take off, it is vital that 4 key technologies are developed, industrialised and deployed at scale :

- production technologies, be they water electrolysis with renewable or nuclear energy, steam methane reforming with carbon capture or other zero-emission solutions ;
- transport and storage technologies, be they for liquid or gaseous hydrogen and through storage tanks or pipelines ;
- distribution infrastructure, in particular hydrogen recharging stations for mobility applications ;
- hydrogen use technologies, as they already exist for industry applications (ammonia, steel, chemicals production) or are being developed for mobility applications (fuel cells or hydrogen combustion engines).

Yet, the order in which these technologies are deployed matters. Only if fuel cells and storage solutions are available at the right level of industrial maturity, can vehicle manufacturers develop large programmes of fuel cell electric vehicles. Only if hydrogen recharging stations exist at the right place with the right availability for the targeted use cases (urban and peri-urbain delivery, regional logistics, long-distance trucking etc.), will customers feel confident to buy those vehicles. And only if decarbonized hydrogen is made available at the pump at an acceptable cost, will fuel cell mobility be rolled out at scale to complement other solutions such as battery electric vehicles.

The preparation for the Hydrogen IPCEI was insufficient in this respect :

- When the IPCEI was initiated, neither the European Commission nor the Member States had a clear and shared view of how the value chain should develop over the coming 5-10 years. Those who had a view did not

agree on such fundamental assumptions as « where will the hydrogen come from ? » : France advocated a local production model based on renewables and its nuclear fleet, while Germany called for supply of green hydrogen from sun- and wind-rich third countries (ideally produced using electrolysers made in Germany). As a result, the 4 waves of projects were conceived without sufficiently taking into account technological readiness of the different solutions, detailed development needs in terms of industrialisation to achieve mass roll-out in line and in time with EU objectives, investment timing and sequencing, normalisation and standardisation, and finally realistic lead times for product and project development. Instead, the 4 waves were launched as a function of the level of readiness of those projects that showed up first. Certain projects in a given wave had much more to share with projects from another wave, but ended up in the wave they are in today simply because of the constraints of the evaluation process.

- Beyond the lack of a « target model » for the European hydrogen value chain, there was also a lack of strategic insight about the detailed value chains for the different technologies that make up this industry. In the case of fuel cells, it is of public knowledge that certain key components of the stack are not being produced at all at scale in Europe today, creating a *de facto* dependency for the European eco-system as a whole from non-European suppliers. Taking into account those missing pieces of the puzzle from the outset would have allowed to specifically sollicit projects in those fields and assess projects according to their willingness and technical ability to integrate such core components or develop alternative solutions.

This first problem – lack of strategic planning and insight – is compounded with a second problem : the missing European perspective.

The IPCEI funding is decided by each Member State for its companies, and the logical target each one has as a result of this is to maximize private investment, job creation and value creation in its territory. EU-level decision makers – one would think – should on the contrary target maximised impact at EU level by setting EU-level industrial policy targets – e.g. « we want to have 5 world-class fuel cell / electrolyser / storage companies in the EU by 2030 with production capacity of at least X00 000 systems / year » – and ensuring that only projects able to meet those targets get funded. In practice, this is not what happened.

National ministries did a great job in pursuing the abovementioned national targets. Some of them even served as sounding boards and advisers to secure approval for their projects. But nobody was there to play the European part. DG GROW certainly tried to champion the process, but the ones working on the due diligence of each project were DG COMP project officers, which looked at the projects through the lense of State Aid guidelines (« For the aid to be compatible, the negative effects of the aid measure in terms of distortions of competition and impact on trade between Member States must be limited and outweighed by the positive effects in terms of contribution to the objective of common European interest. »[4]). So the European focus was mostly on the potential negative effects and not at all on the strategic landscape, the potential holes in the upstream component value chains, the coherence and potential synergies of the projects vs. other similar projects, their mid- und long-term viability against global competition etc. While this is not surprising, given how strong the industrial policy scepticism of the European Commission has been in recent history, it nevertheless left the projects with no real promoter at European level, so much so that Member States had to self-organize for the selection process and mobilize national resources to coordinate the chapeau drafting exercise. This lack of European perspective makes it harder to

see the global competitive stakes at play for the European industry as a whole against its non-European competitors.

The third and last shortcoming is an insufficient articulation of the IPCEIs with other European and national policy initiatives. Now that vast amounts of funding have been made available thanks to the IPCEI (even if not necessarily in the right order), European and national policy makers seem hesitant to move forward in line with the EU's objectives and timeline when it comes to create the demand and market conditions that will connect the different hydrogen technologies from the 4 waves and allow them to reach mass market maturity. Arguments you can hear in EU capitals rang from « We are too busy funding fast-charging stations get battery-electric vehicles (BEVs) off the ground, we have no bandwidth (and no funding) left to do the same for fuel-cell electric mobility now — and the technology is not ready anyways ! Let's wait five more years… » to « We have already spent so much public money on the IPCEI, why should we now slash out more to secure hydrogen off-take agreements, enable vehicle purchases or accelerate recharging infrastructure deployment ? »

While the amount of effort already committed by European governments on the hydrogen agenda cannot be underestimated, such questions point to a lack of understanding about the in's and out's of the hydrogen value chain described earlier — and more generally to an insufficient sense of urgency when it comes to develop clean hydrogen technologies.

For the IPCEI projects to fully succeed, more support is essentially needed on two major fronts :

- Mechanisms to reduce the hydrogen price and long-term off-take agreements for energy and industry applications to take initial volume commitments ;

- Support for recharging infrastructure and vehicle purchases to enable the ramp-up of the hydrogen mobility sector that will constitute longer term the biggest hydrogen offtaker.

On the first front, the European Hydrogen Bank and several national mechanisms are welcome tools to significantly reduce the price of zero-carbon hydrogen. However, with very few green hydrogen project final investment decisions to date, it is becoming apparent that there is still an important gap to fill between the cost of decarbonized hydrogen produced in Europe (4-8 €/kg) and what long-term offtakers in industry and energy are willing to pay (2-3 €/kg delivered), considering the overall hydrogen volumes targeted by the EU (20 million tons/year by 2030).

On the second front, the Alternative Fuel Infrastructure Regulation (AFIR) and certain national subsidy schemes put in place notably at German federal and French regional level, go in the right direction. But 2,000 hydrogen recharging stations are needed by 2030 for heavy-duty mobility alone, against about 650 stations that Member States are tasked to install under AFIR. When adding the specific needs of certain commercial vehicles (such as large delivery vans and light-duty trucks), we believe that Europe needs no less than 3,000 stations by 2030. Investment support is necessary to derisk the installation of such a public network. Besides, current-generation fuel cell electric delivery vans cost around 70,000 euros, to be compared to about 35,000-40,000 euros for their battery electric alternatives (that admittedly offer less range and require longer charging times). As for battery electric vehicles 10 years ago, targeted large-scale support schemes are required to bridge this price gap for the period up to 2030 to allow demand to ramp up from a few thousand vehicles per year now to a few hundreds of thousand vehicles per year by 2030.

Outlook and conclusions : towards a fully embraced European industrial policy on hydrogen

Hydrogen will be part of the solution to meet the EU's net-zero 2050 objectives. Time for action is now. The 4 key hydrogen technologies have to be scaled massively from today's state-of-the-art, whatever their share in the energy and mobility mix in 2030 or 2040, if we are serious about the Paris agreement objectives.

The Hydrogen IPCEI has allowed Europe to position itself at the forefront of the development of a hydrogen economy. The amounts of money put to work are huge compared to anything Europe has done before, and the attempt at coordinating the effort at European level is remarkable, despite its insufficiencies.

But the Union is now at a double cross-roads.

- First on its industrial policy : Does the EU accept its turn towards a more active European industrial policy, with stronger means to be deployed during the development phase of new technologies, in order to shape supply chains and eco-systems that are deep and solid enough to resist international competition – or will it stick to its policing role regarding State aid rules ? To be clear, such a more active European industrial policy is not the return to the French « Plan » from the 1960's at European scale, but it does require resources, both in national capitals and in Brussels, to really think through the value chains that are to be created or repurposed. And going further, is the EU determined enough to pursue such innovation and industrial policies despite the return of budgetary

constraints, and to complement such policies with higher import barriers as long as needed to avoid PV-like scenarios in other industries such as hydrogen technologies ?

- Second on its hydrogen strategy itself : Can the EU quickly put in place the necessary demand side measures to avoid the IPCEI-funded gigafactories being mothballed for lack of sufficient volumes ? Ramping up capacity and reaching threshold volumes is crucial for the companies funded under the IPCEI to develop their high-speed production process know-how, improve the quality of their products and run down the cost curve before massive competition, in particular from China, will arrive in a few years from now (for alkaline electrolysers it is already here).

Contrary to photovoltaïcs and batteries, the race for global industrial leadership in hydrogen and in particular hydrogen mobility technologies is still more open. This offers Europe a chance to maintain a significant industrial footprint in the automotive industry. The importance of this industry for Europe's strategic independence, social fabric, and in the end political stability, cannot be ovestated. The Hydrogen IPCEI has been instrumental in launching the EU's efforts in this space, but policy makers now need to be ready to support the ramp-up of the various hydrogen value chains, above and beyond the IPCEI, including through targeted, time-bound demand-side measures, to really make them viable for the long term.

Notes

① A target of importing an additional 10 million tons of renewable hydrogen from third countries was added later on.

② These industries use hydrogen as a feedstock.

③ Vehicles such as vans, buses and trucks, but also trains, ships and airplanes can use hydrogen via fuel cells to power electric motors or directly as fuel in engines or turbines.

④ Source : Communication from the Commission 2014/C 188/02, paragraph 41