

From research to deployment: what we learned about scaling clean-energy innovation, from the H2IF project

How early market thinking, clear ownership and practical transition planning can help energy-storage and hydrogen technologies move beyond the laboratory

Europe has a strong record of supporting research and innovation. Yet a promising research result does not automatically become a product, a commercial facility or an operating infrastructure asset. Between a successful pilot and a deployment decision lie questions of ownership, technical maturity, customers, supply chains, permitting, finance and risk. For many innovators, this is where the journey slows down: the “**valley of death**” between research and market uptake.

The **H2IF project was set up to help bridge part of that gap**. Its experience points to a clear lesson: scale-up cannot be improvised at the end of a research project. It needs to be considered from the beginning, developed alongside the technology and translated into a realistic transition plan. The Innovation Fund can be an important route to industrial deployment, but an application is only one step in a much longer journey to market readiness.

What is H2IF?

H2IF “Bridging Horizon 2020 to Innovation Fund” is a EU-funded project focused on strengthening the pathway between research and innovation projects and industrial deployment in the energy-storage and hydrogen sectors. Funded under Horizon Europe, it examines how promising results from earlier EU-funded research can progress towards the higher levels of technical and financial maturity required for deployment, including through the EU Emissions Trading System Innovation Fund.

The project’s work combines two perspectives. It looks upstream at how to **identify research results with credible scale-up potential**, and downstream at **what their owners need to do to prepare for a deployment-oriented funding application**. The aim is not simply to help applicants complete a form. It is to understand the gaps between a research result and an investable industrial project, help innovators address those gaps, and share lessons that can be useful to a wider community.

H2IF focused on three connected objectives: **identifying promising research projects** and **accompanying selected result owners** towards Innovation Fund readiness; **documenting the challenges and practices** encountered along the way; and **developing a practical framework to guide innovators** from research to market deployment. The findings are especially relevant to energy storage and hydrogen, but many of the lessons apply to capital-intensive clean technologies more broadly.

Energy Storage Europe is a full beneficiary of H2IF, in charge of identifying the key takeaways from project activities, defining an overall framework for deployment of energy storage and hydrogen projects, and draft tailored policy recommendations to ease this path and access to funding.

From a broad project pool to tailored support

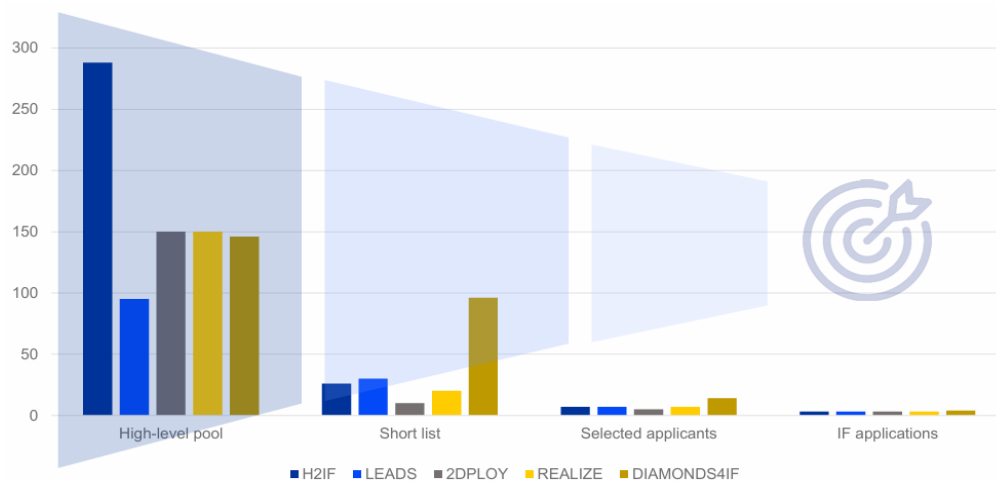
H2IF began by building a wide pool of EU-funded projects in heat, energy storage and hydrogen. Using project databases and a staged screening process, the consortium moved from 288 projects to a shortlist of 26, then to 12 organisations for closer assessment. The screening consid-

ered factors such as **technology maturity, project timing, alignment with Innovation Fund objectives, potential to scale, financial viability and who owned the technology**. However, the process could not rely on public information alone: project descriptions often did not make clear what results had been achieved, how mature they were, who controlled them or whether their owners intended to take them to market. Direct contact with organisations (including questionnaires and interviews) was therefore essential. The overall selection identified three projects for support and a further four as reserves.

For selected result owners, support started with a **deeper assessment against Innovation Fund expectations**. The consortium explored the project concept, technical maturity, business model, funding needs and long-term strategy, then worked with each organisation to identify gaps and define a technical and financial roadmap. Dedicated workshops introduced the Innovation Fund's objectives, evaluation approach, greenhouse-gas calculations, financial maturity and relevant-cost concepts. Applicants that moved towards submission received more tailored support: milestones and internal deadlines, clear roles and responsibilities, recurring discussions across technical, financial and operational topics, structured collection of evidence, and detailed reviews of application materials.

Alongside this direct work, H2IF prepared **public guidance and self-assessment tools**, engaged with **Innovation Fund-related institutional stakeholders**, and **shared funding updates and lessons** through events, publications, social media and its website. The project therefore treated the pipeline as more than proposal writing: it included applicant preparation, learning from the funding system and communication with the wider clean-technology community.

Very similar activities were also carried out by **H2IF sister projects**, focusing on different sectors: [LEADS](#) (CCU/S), [2DPLOY](#) (Energy Intensive Industries), [REALIZE](#) and [DIAMONDS4IF](#) (Renewable Energy).



The main lessons: readiness is broader than technology

Start the market journey during the research project

One of H2IF's strongest findings is that the transition to market should begin before a research project ends. Some barriers that later appear as “funding problems” have their roots much earlier: no one has been assigned to lead exploitation, potential customers have never been approached, the supply chain is unknown, or the project has not tested whether its result addresses a real market need.

A research project can achieve its technical objectives and still leave the result far from deploy-

ment. A laboratory or small pilot may not yet demonstrate performance at the scale, cost or reliability that industry needs. A promising technology may also require a further pilot or demonstration stage before it is ready for a large commercial investment. Planning for that possibility early gives the project owner time to identify suitable partners and bridge funding rather than discovering the gap after the grant has ended.

Make ownership and decision-making clear

Collaborative research can produce several valuable results, with different owners and access rights. That structure is useful for research, but **it can complicate commercialisation if multiple parties must agree** on how a result is used, who pays for scale-up or who takes responsibility for a deployment project. H2IF found that identifying a result owner and clarifying intellectual-property and exploitation rights are practical preconditions for a company-led scale-up pathway.

The organisation that owns a result also needs a route to make timely decisions. Internal governance, subsidiary structures and competing priorities can delay progress even where the technology itself is promising. Clear responsibilities, active senior-management involvement and an agreed process for go/no-go decisions help keep the pathway moving.

Build an industrial and commercial ecosystem around the innovation

Deployment depends on more than the technology developer. Suppliers, customers and off-takers, investors, infrastructure owners, permitting authorities and other industrial partners may all influence whether a project can be built and operated. **Identifying these actors early (and involving them while the research is still under way)** can help validate technical requirements, expose practical constraints and build relationships that will later support investment and market entry.

For newer technologies, **customer commitment may take time**. Potential buyers may not yet understand the technology, may be uncertain about its performance, or may be unwilling to pay an innovation premium over established alternatives. **Early engagement** gives them time to assess the solution and gives the innovator a chance to test assumptions about demand, value and willingness to pay. It also helps smaller innovators understand the wider value chain and identify the partners they need to reach the market.

Supply-chain readiness matters just as much. Critical components may be unavailable, expensive or sourced from outside Europe; infrastructure may not be accessible; and permitting or regulatory requirements may be uncertain. These factors should be investigated as part of the business case, not left until after the project has been designed.

Treat the business case as a core workflow

Research teams often have strong evidence of technical novelty and performance but less developed evidence on costs, revenues, customers, financing and commercial strategy. H2IF's experience highlights the need to **give business planning the same deliberate attention as technical development**. A credible scale-up case needs to explain how value will be created, who will pay for it, what resources are required, how the project will be financed and how the plan changes under different market conditions.

This is particularly important when the technology and its market are both evolving. Energy prices, raw-material costs, regulation, geopolitical developments and the pace of competing technologies can change the business case. Innovators cannot remove all this uncertainty, but they can identify assumptions, test them with stakeholders, prepare alternative scenarios and show how major risks will be managed.

Choose the right bridge between research and deployment

Not every research result is ready to move directly into a large deployment project. H2IF identified a maturity gap for technologies that have reached a promising pilot or demonstration stage but still need further validation, larger-scale testing or stronger financial and commercial evidence. **In these cases, an intermediate development step may be more appropriate than an immediate Innovation Fund application.**

Finding and financing that bridge can be difficult. The funding landscape is fragmented, and the instrument that supports research may not be the one that supports demonstration or commercial deployment. Innovators therefore need to map possible public and private funding sources, understand the sequencing between them and plan for the time when one funding phase ends and the next has not yet begun.

Prepare for the demands and limits of the Innovation Fund

The Innovation Fund asks applicants to make a deployment case, not simply to describe a research achievement. Its application requires a **multidisciplinary effort** spanning engineering, finance, market analysis and project management, supported by detailed documentation and evidence. Applicants need to understand the Fund's specific methodologies and demonstrate a credible business case, project maturity, emissions impact and financing structure. H2IF found that early onboarding, external expertise where needed, a defined team and a realistic schedule can make this work more manageable.

The Fund is not a universal fit for every innovation or every stage of development. Applicants need to assess whether the project's scale, maturity, funding needs and evidence align with the instrument, and account for the time between application, evaluation, grant preparation and disbursement. That timeline can create a cash-flow gap. In energy storage and hydrogen, applicants may also face sector-specific difficulties, including uncertain markets, international cost competition, regulatory dependence and evaluation approaches that may not fully capture some system benefits. A sound application can improve how a project is presented, but it cannot by itself resolve structural market or policy barriers.

A five-stage framework for moving from R&I to scale-up

Energy Storage Europe translated H2IF findings into a **framework that begins at the design of a research project and continues through preparation for deployment**. The stages are sequential in emphasis, but several activities overlap and should be revisited as the technology and market evolve.

1. Strategic positioning at project set-up: Before a research proposal is written, test whether there is a genuine ambition to bring the innovation to market. Identify likely exploitable results and potential owners, consider whether consortium partners' interests are compatible, involve industrial and value-chain actors, and clarify governance. Design the project to create the conditions for scale-up as well as to deliver research outputs.

2. Ownership and exploitation during implementation: As results take shape, confirm who will lead their exploitation and review the ownership and use of key results. Keep market and industrial actors engaged, map the stakeholders needed for deployment, and strengthen the role of industrial partners in steering work towards real needs. This stage shifts the focus from a consortium's collection of results to a responsible organisation with the capacity to make commercial decisions.

3. Pre-market readiness assessment: In the later part of the research project, assess technolo-

gy maturity honestly and identify any further validation or demonstration required. Resolve intellectual-property questions, test market demand and customer willingness, map supply-chain risks, and develop an initial business case and deployment roadmap. Use Innovation Fund criteria as a reference point for identifying gaps, even if an application is not yet planned.

4. Transition planning: Before the research project ends, make a timely go/no-go decision about deployment and a possible Innovation Fund application. Build a roadmap that sets out remaining technical, financial, regulatory and operational tasks, dependencies and milestones. Decide whether an intermediate step is needed, identify bridge-funding options and plan for the funding and timing gap between research and deployment.

5. Application preparation and readiness consolidation: If the Innovation Fund is a suitable route, assemble a team with technical, financial, market and project-management expertise, bringing in external support where needed. Start early, assign responsibilities, collect and cross-check evidence, and develop a clear business case alongside the technical case. Identify methodological or sector-specific limitations and address them transparently, while preparing for investor scrutiny and market uncertainty.

Together, the stages turn scale-up from a late exploitation-plan task into a series of decisions and actions that can be revisited throughout a project's life. They are a guide rather than a universal recipe: the right pathway depends on the technology, its owners, its market and the maturity it has reached.

What this means for Europe's clean-technology pipeline

H2IF's findings show that Europe's challenge is not only to generate more research results, but to connect those results to organisations and markets capable of deploying them. **Technical excellence matters, but it needs to be joined by clear ownership, industrial commitment, market evidence, financial planning and a credible route through the steps between demonstration and investment.**

Many of these conditions can be improved by innovators themselves, especially when they act early. But not every barrier is within an applicant's control. Market uncertainty, fragmented regulation, permitting delays, infrastructure gaps, international competition and the way funding criteria recognise sector-specific benefits can require action from a wider ecosystem of public authorities, investors, industry and funding bodies.

The practical message is straightforward: **begin with the end in mind, keep the market in view while the research is being done, and decide early what must happen next.** When these elements are built into the innovation pathway, public research investment has a stronger chance of leading to industrial deployment and lasting value for Europe's clean-energy transition.

This article synthesises the main findings of H2IF deliverable D6.2, "Innovation pipeline: from R&I to deployment", that will be published on H2IF website. It reflects the project's analysis and does not replace official Innovation Fund call documents or guidance.