FUSION FOR ENERGY

ROUNDTABLE 2025
Key Takeaways

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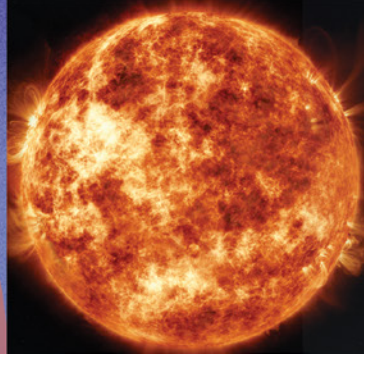
How can Europe harness
the potential of fusion energy?



FUSION FOR ENERGY

ROUNDTABLE 2025

Key Takeaways

Foreword

Energy holds the key to economic prosperity and social well-being. Fusion can help Europe address its energy needs as part of a sustainable future energy mix. The race for commercial fusion is on and the EU is working towards a European fusion strategy, expected by the end of 2025.

At the F4E Roundtable, more than 200 representatives from EU policy, industry, SMEs, start-ups, fusion laboratories and other Big Science projects came to Barcelona on 12-13 June 2025 to take part in the discussions on the future of fusion in Europe. In the format of roundtable discussions, participants expressed their views on topics like the readiness of the European supply chain, the gaps in technology and skills, or the emergence of start-ups in the market. There were many questions on the table, but one can summarise them all: how can Europe lead the way towards commercial fusion power plants?

I also had the opportunity to explain how F4E through ITER, and our engagement with the European supply chain, is ready to support the EU ambitions on fusion.

The aim of this report is to encapsulate the Roundtable recommendations to the ongoing debate on the future of fusion energy in Europe. It constitutes an input to the European Commission's Call for Evidence for a European Fusion Strategy and to all other discussions in this regard.

I would like to thank all Roundtable participants for their active participation in the discussions and for sharing their insights. The feedback we have received has been extremely encouraging and motivates us to work together to make the F4E Roundtable a regular meeting point of the European fusion community.

Marc Lachaise
Director

01

Context

The quest for abundant clean energy

We need secure, sustainable and affordable energy to stimulate our economic growth, enhance our wellbeing in a way that is environmentally friendly and accessible to all. Europe, however, imports 60% of the energy it consumes at a cost of 1 billion EUR per day.

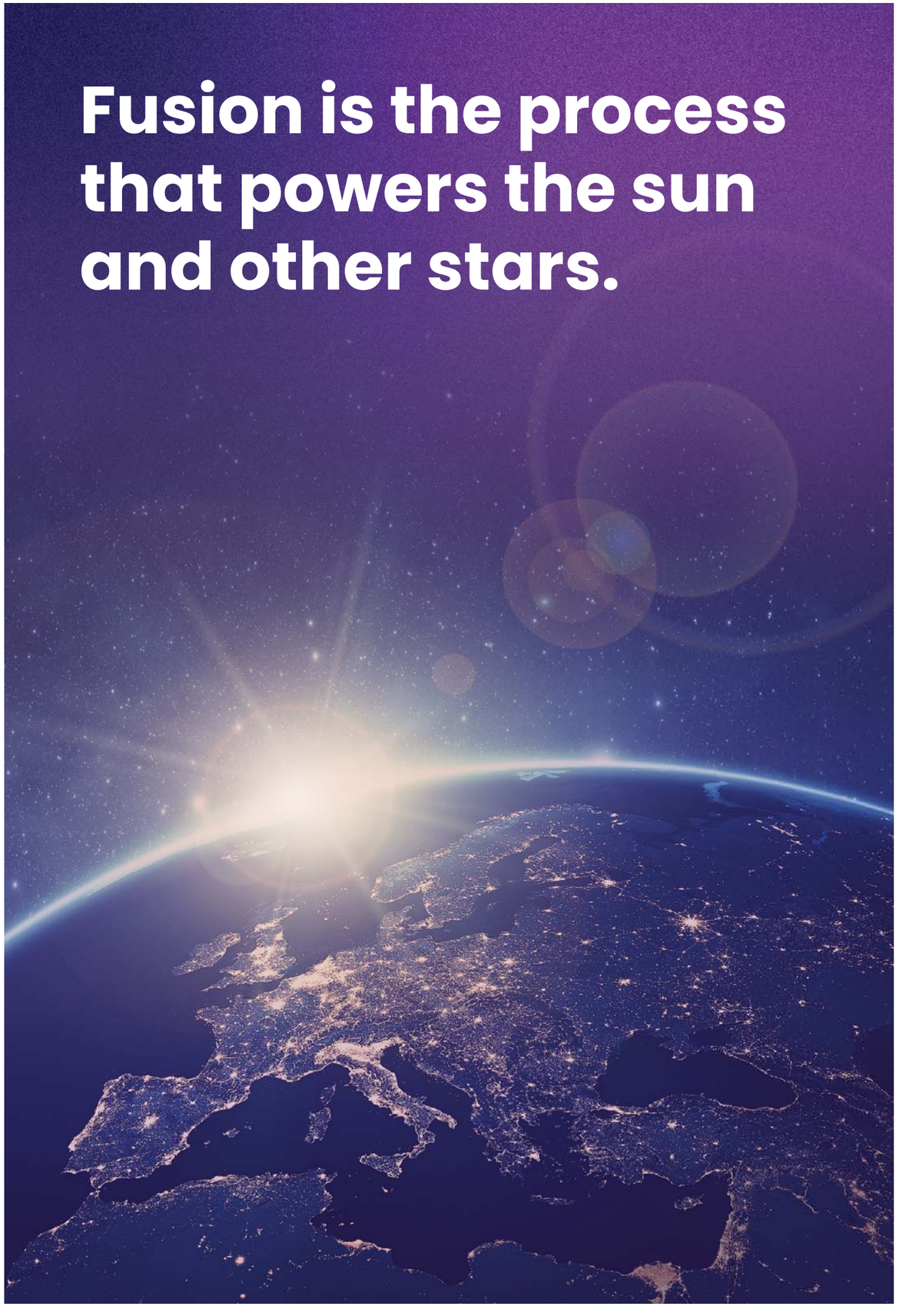
Our continent is vulnerable to geopolitical tensions, facing attacks on its infrastructure, exposing its consumers to market volatility. In parallel, we need to decrease the use of fossil fuels to fight climate change, which is responsible for human and financial losses amounting to 487 billion over the last 40 years in the EU.

Europe is at the forefront of developing fusion—one of the most promising long-term options that could change the future.

Fusion is part of the solution

Europe is at the forefront of developing fusion—one of the most promising long-term options that could change the future. Fusion is the process that powers the sun and other stars. It holds the key to safe, virtually unlimited and clean power supply offering our continent greater autonomy, security, resilience, together with far-reaching benefits:

- The fuels required are virtually abundant, and even in small amounts they can generate plenty of energy. For example, 60 kg of fusion fuel can provide the same amount of energy as 250 000 tonnes of oil.
- No greenhouse gas emissions or long-lasting radioactive waste are produced.
- Fusion power plants will offer steady and reliable energy, providing “baseload” electricity complementing renewables.



Discussing how Europe can lead the way towards fusion commercial power plants.

Developing a European Fusion Strategy

The race for commercial fusion is gaining momentum at global level. Governments and private actors are investing more to harness the potential of this “disruptive technology”, as described in the Draghi report on “The future of European Competitiveness” (September 2024). The economic and geopolitical stakes are high. The EU is working towards its first comprehensive fusion strategy, expected by the end of 2025.

The main objective of the F4E Roundtable was to exchange on Europe’s vision, priorities and capabilities in harnessing this energy source.

The event coincided with the launch of the ‘Call for Evidence’, published on 3 June 2025 by the European Commission, to provide input for the EU’s first-ever Fusion Strategy . Research stakeholders, industry and startups, as well as private investors, were invited to provide input and to identify the most effective actions for the development and deployment of fusion.

Keynote speakers from the European Parliament and the European Commission, exchanged views with high-level experts from industry, laboratories and associations. In four distinct roundtable discussions, participants expressed their views on the strategic importance and relevance of fusion energy, the creation of a robust industrial supply chain, key technologies and skills that need investment, how to assist private sector initiatives in fusion. One could summarise all these topics in one question: how can Europe lead the way towards fusion commercial power plants?

As a follow-up to these discussions, it is crucial to consolidate the various actions and proposals made during these exchanges.

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02

Fusion energy is of strategic importance for Europe

The fusion landscape is changing with countries like the United States, the United Kingdom and China ramping up investments and fusion start-ups emerging in the market. In this context, Europe can build on its formidable scientific legacy and pave the way to commercialisation. Its journey has been marked by pioneering experiments such as JET (1983-2023). Other devices such as JT-60SA - constructed and operated by Europe and Japan - and WEST achieved the record for the world's largest and longest plasma, respectively.

Currently, Europe is the main contributor to the ITER project, providing almost half of the in-kind contributions. ITER is expected to provide a lot of the answers to many of the remaining technical questions in the field. F4E has invested 7 billion EUR to provide the European contribution, delivering complex components like superconducting magnets or a big part of vacuum vessel sectors. Manufacturing these components has given Europe's industry the possibility to grow, acquire new skills and expertise. It is now a challenge for Europe to keep this expertise active and makes sure it does not disappear with time.

The panellists pointed that the EU's future fusion strategy should define all the needs and come up with instruments to tackle them, including public-private partnerships. Ultimately, the next EU Multiannual Financial Framework (2028-2034) will be critical to sustain Europe's potential in the global race.

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ITER will deliver key insights to shape the next generation of fusion reactors.

03

ITER remains central to Europe's fusion efforts

Participants underlined the importance of the ITER project to the European fusion strategy. There is a consensus that ITER is not the endpoint.

On the contrary, it is the point of departure for this exciting technological journey. In fact, we need more European projects and test facilities to run in parallel and keep the supply chain active, to cover technological gaps, for example, in the field of materials or tritium breeding.

This continuity is vital to consolidate a competitive industry and shape a mature fusion market. This would also promote the development of skills using the expertise accumulated, plus the involvement of younger generations of scientists, engineers, and other graduates.

The construction, assembly and operation of ITER are expected to provide valuable information and experience on many technical issues. The lessons learned will feed into the next generation of fusion reactors.

The European Union's participation in ITER has been a catalyst for innovation, competitiveness, and the enhancement of industrial capabilities across the continent. Speakers highlighted that Europe's involvement in fusion R&D is built upon decades of leadership and investment. ITER constitutes a cornerstone of this development, having contributed to a proliferation of know how, and expertise, amongst involved parties and their supply chains.

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04

Building the Fusion Industry of the Future

Recognising fusion as a key technology in a vibrant ecosystem was the starting point of the discussion. F4E has successfully involved in ITER more than 2 700 companies and at least 75 R&D organisations, as part of Europe's contribution. An external study calculated that the contracts awarded by F4E in 2008-2017 resulted into more than 400 new technologies, tools and processes, while generating at least 20 start-ups, and joint ventures (F4E Interim evaluation study and Economic Impact).

This investment is delivering tangible benefits by stimulating innovation, generating technology transfers, and positioning Europe at the forefront with the support of a competitive fusion supply chain. But to keep its lead, Europe must scale up its industrial readiness; otherwise, it risks falling behind. Empowering companies as equal partners, and not just as suppliers, is key to reach a more agile environment that will help them unleash their potential.

A resilient, skilled and diverse workforce holds the key to Europe's success. F4E with its Technology Development Programme – once scaled up substantially - can play a crucial role in addressing technical gaps and building competencies, while promoting closer collaboration with private entities through specific agreements.

The time for public-private partnerships is now! To make, however, a success out of them, there needs to be convergence amongst the different fusion associations, clearer vision, and some creative thinking in addressing intellectual property. Companies requested a long-term strategy offering business continuity, the right regulatory framework and guarantees in terms of investment.

Engaging with companies within the fusion ecosystem is important to co-share the technological and commercial risk. Industry and SMEs are also at the heart of the supply chain, making it necessary to involve them at an early stage and ensuring a return of investment. When addressing the international competition Europe faces from other countries, some experts underlined that it would come down to who will deliver first and not necessarily best.

To keep its lead, Europe must scale up its industrial readiness; otherwise, it risks falling behind.

05

Investing in Key Technologies and Skills

The delivery of fusion energy is a multi-generational endeavour requiring from those involved today, to attract tomorrow's talent, and offe meaningful career paths. Europe is well-positioned because it masters knowledge and counts several centres that could provide training. The best way to achieve this objective is to *"align, act, and accelerate"*.

Education and training initiatives like Erasmus Mundus, or mobility schemes between academia and industry, were also suggested to attract new talent. In parallel, universities and companies need to build a strong reputation for the fusion ecosystem, making room for diverse careers such as engineering, project management, procurement, legal, business, marketing, communication, etc.

Young generations interested in fusion energy will need to be reassured that jobs will be there and that those opportunities will be real. Otherwise, they might consider other more stable and consolidated domains in terms of jobs and careers. Upskilling and reskilling of workforces will also be fundamental to cover the job market and the technology needs

To compensate for the low levels of readiness of some key technologies, new facilities must be created that are representative of operational conditions. In turn, they can become technology hubs offering hands-on experience to tomorrow's workforce. A question remains open on the need to propose additional machines to facilitate the integration of all operating systems into working and efficient devices. Such prospect was considered of critical importance.

The development of a skilled workforce is paramount. The fusion industry will require a diversity of talents from engineers and physicists to project managers and policy experts, as well as technicians with different backgrounds. Investing in education, training programmes, and promoting careers in fusion, will be necessary to pave the way for the next generation of professionals.

Stronger collaboration between different stakeholders, and better governance will help Europe capitalise on talent, manage resources efficiently, and deliver in line with the priorities of an EU strategy.

06

Regulation, Investment Perspectives, Public Acceptance

Regulatory frameworks must also be adapted to support the unique challenges and opportunities presented by fusion energy. This includes establishing clear and consistent safety standards, facilitating the licensing of fusion facilities, and ensuring that regulatory processes are efficient and supportive of innovation.

Economic considerations are another crucial aspect. The long-term viability of the fusion industry will depend on its ability to attract investment and demonstrate economic competitiveness. This requires not only reducing the costs of fusion technologies but also highlighting the broader economic benefits, such as job creation, regional development, and the potential for new markets.

Public acceptance and engagement are equally important. Building trust, and understanding the merits of fusion energy, will be essential for its successful deployment. Transparent communication, community involvement, and addressing public concerns are all necessary for a positive public perception of fusion.

The future of fusion energy in Europe requires coordinated efforts across multiple fronts. By fostering public-private partnerships, investing in people, adapting regulatory frameworks, ensuring economic competitiveness, and engaging with the public, Europe can position itself as a global leader in the field.

The long-term viability of the fusion industry will depend on its ability to attract investment and demonstrate economic competitiveness.

07

Empowering the private sector and attracting investment

According to the F4E Fusion Observatory Report, global investment in the private sector has surged in the last years, up to close to 10 billion EUR at present. However, Europe receives only 5% of the total, compared to the 60% for the US (home of most companies). The panellists, including start-ups and investors, considered this gap a concern despite Europe's scientific strength, and highlighted concrete actions to de-risk and empower private initiatives.

The centre of gravity in fusion is shifting from the sphere of science to commercial delivery. Startups are moving fast, driven by private capital, industrial urgency, and growing confidence that fusion is no longer confined to distant timelines. Several speakers highlighted that Europe has the ingredients for success—leading research labs, a skilled supply chain, and growing entrepreneurial interest—but lacks an EU-level framework that unifies funding, regulation, and deployment objectives.

A consistent message emerged: fusion commercialisation must be driven by industry, not just supported by it. Building Europe's first commercial fusion power plant must be treated as an industrial mission—integrating design, regulation, financing, and utility engagement from the outset. This requires a shift in mindset and policy: from contracting suppliers to empowering co-developers. Public programmes must create space for private initiatives, and fusion startups — together with utilities and supply chain partners — to be able to shape, not just follow, fusion deployment.

In terms of access to capital, speakers agreed that funding mechanisms like those of the European Innovation Council can be scaled up and made more flexible and responsive. The importance of public private partnerships was also highlighted and that they need clear rules around intellectual property that favour ownership by companies with commercial potential, while ensuring fair access and knowledge transfer.

Aside from the risks, and long-term perspective required for private investment in fusion, regulatory uncertainty was identified as a major barrier - a lack of consistent frameworks across Europe leads to hesitation among both entrepreneurs and investors, who seek predictability and transparency when engaging in high-risk, long-term innovation. Nevertheless, it was noted that investment opportunities exist across the enabling technologies that fusion will require.

Finally, many participants underlined the value of the Roundtable itself as a model for future engagement. The gathering enabled frank, forward-looking dialogue between sectors that often operate in silos. One idea is to establish a more permanent European platform for fusion commercialisation — bringing together developers, utilities, financiers, public institutions, and regulators to align priorities, reduce fragmentation, and accelerate progress. Such a platform could help Europe ambition to deliver with greater coherence, visibility and speed.

08

Conclusion

The successful advancement of fusion energy in Europe hinges on several key elements that must be addressed with urgency and precision. A clear vision is imperative to guide the collective efforts of all stakeholders involved in the fusion ecosystem. This vision must be underpinned by a concrete plan that outlines the strategic priorities, milestones, and actions required to achieve the ambitious goals for fusion energy, and assigning each European player - as part of that strategy - a concrete role and action commensurate to its strengths and capacities.

Equally important is the delineation of clear roles for all key players, including policymakers, industry leaders, researchers, and educators. Each of them must understand their responsibilities and contribution to ensure a cohesive and coordinated approach. A well-defined timeline with specific targets will help maintain momentum and track progress, while adequate resources must be allocated to support the various initiatives and projects essential for the growth of the fusion sector.

By addressing these critical components, Europe can create a robust framework that not only fosters innovation and investment but also establishes our continent as a global leader in fusion energy.

Concerted efforts and unwavering commitment are required to pave the way forward. The potential rewards in terms of energy security, economic growth, and environmental sustainability make it a pursuit well worth undertaking.

We hope that this report will provide an overview of the main recommendations and will make a meaningful contribution to Europe's fusion strategy.

Key Messages from the F4E Roundtable discussions

01. Fusion is of strategic importance for Europe's energy autonomy, geopolitical role and industrial competitiveness.

02. European leadership in fusion is threatened by strong competition from other parts of the world with higher private or public investment.

03. Europe must act in unison - fragmentation across national programmes slows down progress and undermines Europe's global competitiveness.

04. A European fusion strategy is urgently needed to maintain the European leadership and match our industrial ambitions and role in the world.

05. The global efforts that Europe invests in the development of fusion energy should be massively scaled up to remain in the competition with US, China and UK.

06. A European fusion strategy needs to attract public and private funds.

07. ITER remains at the heart of the European fusion efforts - it has been a catalyst for innovation, competitiveness, and the enhancement of our industrial capabilities.

08. The EU investment in the fusion industry is delivering tangible benefits by stimulating innovation, generating technology transfers, and positioning Europe at the forefront with the support of a competitive fusion supply chain.

09. F4E has a key role to play building on its experience from ITER, acting as a hub of technical expertise, procurement, IP and technology transfers.

10. A proper mapping of key fusion enabling technologies is critical to put the R&D focus on those showstoppers and to decrease any dependence from non-European countries.

11. The delivery of fusion energy is a multi-generational endeavour that requires attracting new talent and offering meaningful career paths.

12. Europe is well-positioned because it masters knowledge and can count on a strong network of world-class laboratories and research centres in fusion, etc.

13. Upskilling and reskilling of the workforce will also be fundamental to cover the job market and the technological needs.

14. Global investment in the private sector has surged to around 10 billion EUR (June 2025). Europe receives only 5% of the total.

15. Commercialisation must be driven by industry and treated as an industrial mission—not just a scientific project—with clear roles for private developers, utilities, and investors.

16. Public–private partnerships must go beyond procurement and include co-design, shared infrastructure, and joint risk-sharing with clear IP frameworks and delivery-focused governance.

17. Regulation must be an enabling, and not a delaying, factor. Licensing pathways tailored to fusion must be developed in parallel with the progress of technologies.

18. Realism is strength. Europe must commit to achievable timelines, scalable engineering, and commercial integrity from the outset.

19. Dialogue between sectors must be continuous. Regular, structured engagement between industry, finance, utilities, and public bodies is vital.

20. Public acceptance and engagement are important to ensure citizens' trust and understanding of fusion energy in view of its successful deployment.

Key Proposals from the F4E Roundtable discussions

01. Adopt a comprehensive long-term European fusion strategy to ensure European leadership in commercial fusion and to rationalise efforts.

02. Advocate for fusion energy in the European policy and strategic planning – mark fusion as a key industrial technology.

03. Ensure strong fusion governance in Europe with firm political leadership and appropriate roles, for the different parties and stakeholders.

04. Monitor and evaluate progress towards fusion energy goals, and adjust strategies as needed.

05. Develop a robust, agile supply chain and mechanisms to empower industry as equal partners, not just suppliers, to help them unleash their potential.

06. Ensure technology transfers and spin-offs from fusion research benefit broader sectors, from med-tech to aerospace.

07. Support the development of a resilient, scalable, skilled and diverse workforce, as the key to Europe's success. It will allow trained people in fusion to have real job opportunities, ensuring that this talent is not lost.

08. Invest in a set of key technologies identified on the critical path for fusion development.

09. Enhance incentives, regulatory frameworks, and public-private partnerships to unlock private investment in fusion.

10. Support the development of a long-term strategy addressing intellectual property, offering business continuity, the right regulatory framework and guarantees in terms of investment.

11. Share with companies the technological and commercial risks related to the development of key fusion enabling technologies at low technological readiness levels.

12. Invest in education and training initiatives like Erasmus Mundus or mobility schemes between academia and industry for fusion engineers and scientists.

13. Support universities and companies in building a strong reputation for the fusion ecosystem, making room for diverse careers such as engineering, project management, procurement, legal, business, marketing, communication, talent management, etc.

14. Foster collaboration between academia, industry, and government to drive fusion research and development. Promote R&D contracts with favourable IP terms and conditions on key enabling technologies, as it is the case of the F4E Technology Development Programme.

15. Support the development of new facilities, as technology playgrounds offering hands-on experience to tomorrow's workforce.

16. Develop an EU-level fusion commercialisation strategy with clear milestones, regulatory frameworks, and alignment between public and private actors.

17. Establish targeted financial instruments to support private-sector fusion, including co-investment schemes and funding for enabling technologies in the supply chain.

18. Launch fusion-specific regulatory sandboxes to provide clearer licensing pathways and accelerate project timelines.

19. Create a European platform or fusion hub to facilitate ongoing engagement between developers, utilities, investors, and public stakeholders—building on this roundtable format.

20. Clarify intellectual property frameworks to support technology transfer and public–private co-development.

21. Prioritise public–private partnerships as the default mode of delivery for major fusion demonstration initiatives.

22. Provide better access to venture capital for fusion start-ups.

23. Promote transparent communication, community involvement, and address public concerns to foster a positive societal perception of fusion.

24. Create space and opportunities to allow fusion stakeholders to gather, discuss, and establish technological roadmaps, for the different fusion critical technologies, like the F4E Technology Mapping Workshops.

Fusion for Energy
The European Joint Undertaking for ITER
and the Development of Fusion Energy

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