Role of Swiss Industries in New Era of Fusion Energy

Viewpoint of

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Disclaimer

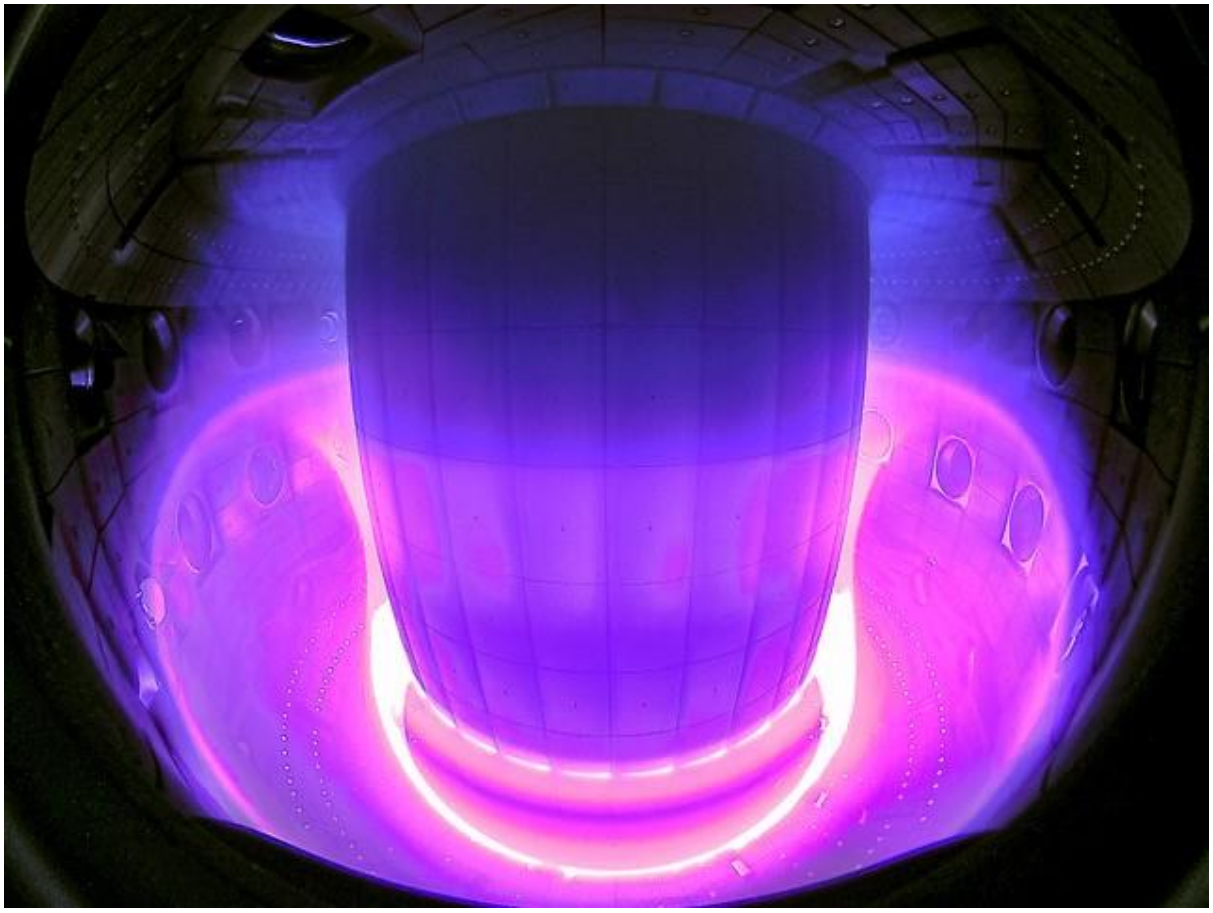
This article is a viewpoint of the author, drawing on insights from a strategic discussion on Switzerland's role in the emerging commercial fusion energy era, convened by the author. The underlying report from the discussion was reviewed and approved by all contributors, who expressed both shared visions and differing perspectives - not necessarily those of the institutions or organizations with which they are affiliated. The discussion was conceived and developed by Science for Sustainable Future (S4SF) and implemented under a mandate from SATW with strong support from SPC.

About author and contributors

Details about author and contributors could be accessed in the flyer to be downloaded here.

Personal note: Motivation behind this work

Twenty years ago, when I was doing my PhD on the Swiss *Tokamak à configuration variable* at the Swiss Plasma Center, EPFL (back then the CRPP), and later while working as the editor of the thousand-page IAEA tutorial on nuclear fusion, fusion was still perceived as a purely academic field. Industry was hardly mentioned. I was - and remain - immensely proud to be part of the fusion community, yet I also felt a strong desire to contribute to greater public understanding and appreciation of fusion, whose societal image was - and remains - far less positive than the technology deserves. The lack of awareness and misperception of fusion was striking: I vividly remember driving to the ITER site for the first time in 2006 and seeing large "NO ITER" letters painted on the rocks along the road to Aix-en-Provence.



Tokamak a Configuration Variable, SPC, EPFL. Credit: C Wüthrich

Motivated to help strengthen fusion's public profile, I joined CERN with aim to learn from the particle-physics community's remarkable expertise in knowledge transfer, outreach, and science diplomacy. This opened the door to the wider Big Science Business ecosystem and revealed to me the profound synergies between fusion and particle physics - for example, in advancing superconducting magnet technologies that could make future fusion reactors more compact. It was at the FCC feasibility study conference in Paris a few years ago that I first heard about SPARC, and later at a CERN Alumni event that I met colleagues from Proxima Fusion. I have watched with excitement the rise of fusion start-ups over the past decade. It became clear that fusion was entering a new era - the era of genuine commercialisation. Alongside the large international research infrastructures such as ITER and DEMO, a vibrant private sector is now taking shape, working towards building commercially viable fusion energy systems.

This naturally triggered an important question: *What role will Swiss industry play in this new commercial landscape of fusion?* Given Switzerland's longstanding leadership in innovation, and the strength of its physics-based industries - today the second most significant driver of national economic progress after the financial sector- the potential for Swiss actors to assume a leading role in fusion is considerable. I am deeply grateful to the President of SATW and to my former colleagues at the SPC for supporting the idea of convening the strategic discussion to explore the steps needed to build an effective national framework to fully exploit this potential. My sincere thanks also go to all the distinguished speakers for joining this effort and sharing their invaluable insights.

Main stakeholders present at strategic meeting at EPFL, 2nd December 2024. From right: L.Scibile, P.Cordonier, M.Q.Tran, M.Huebner, B.Bruant Gulejova, B.Dubuis, A.Fasoli, F.Bordry, L.Bottura, Y.Martin Others joined online.

Introduction

On 2nd of December 2024, Swiss Academy of Engineering Sciences (SATW), Swiss Plasma Centre (SPC, EPFL) and Science for Sustainable Future (S4SF) co-organised a strategic roundtable discussion at EPFL among the worldwide experts from research & industry active in nuclear fusion and Swiss innovation actors, exploring the potential of Swiss industry to take part in the new era of commercial fusion energy deployment.

The aim of this closed discussion was to bring together key players in fusion energy today, along with representatives from Swiss industries and innovation sectors, to explore Switzerland's potential involvement in the emerging commercial era of fusion energy - beyond the large international ITER research project.

What is the best strategy for Swiss industries and academia to seize the immense opportunities on the horizon, which could significantly enhance the country's innovation leadership and economic progress?

Should Switzerland invest in building its own commercial fusion power plant? Should we join forces with existing international efforts? Or should we focus on becoming a key supplier of components to power plants worldwide?

What are the necessary next steps to secure effective support to establish a robust, comprehensive framework for active industrial involvement in fusion energy?

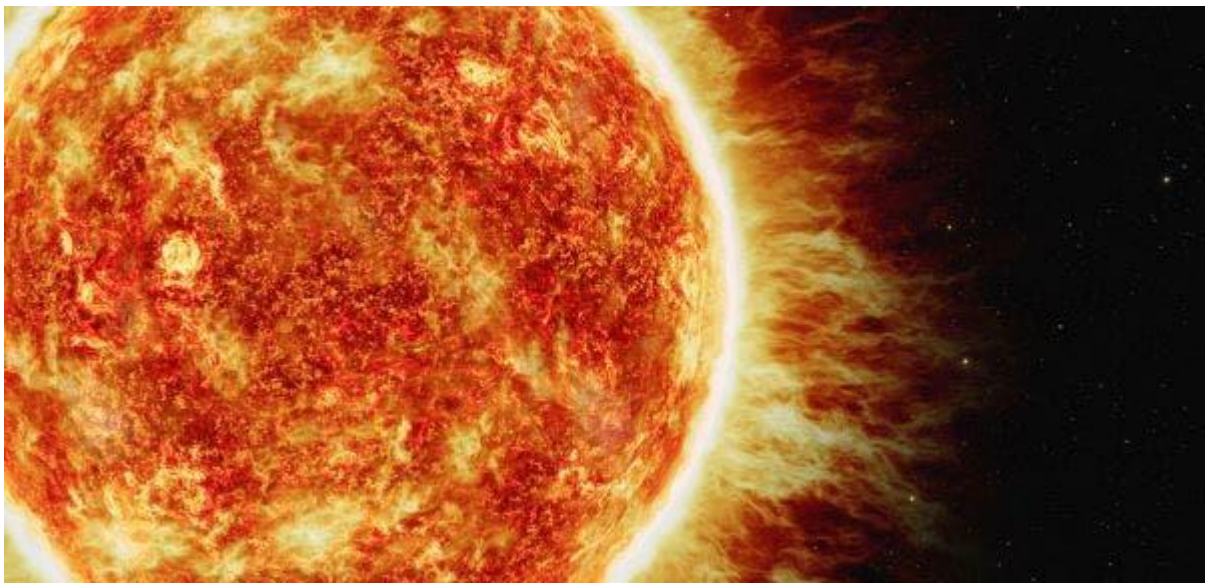
How can we attract a qualified workforce to this rapidly growing field? How can we increase the public awareness, support, and appreciation for fusion within society?

This strategic discussion also served as a preparation for a strategic plan to guide the creation of the platform bringing together Swiss industries, innovation centres, research groups, and all other stakeholders who could contribute to the development and commercialization of fusion energy.

More details about the event can be found in this webpage.

Commercial fusion: immense opportunities on the horizon

Fusion energy offers immense opportunities that will change the energy ecosystem in Europe and worldwide. Once deployed, this energy is not only clean, but also safe, efficient and economically viable compared to other resources. Many countries and investors are turning eyes towards this promising green electricity source.



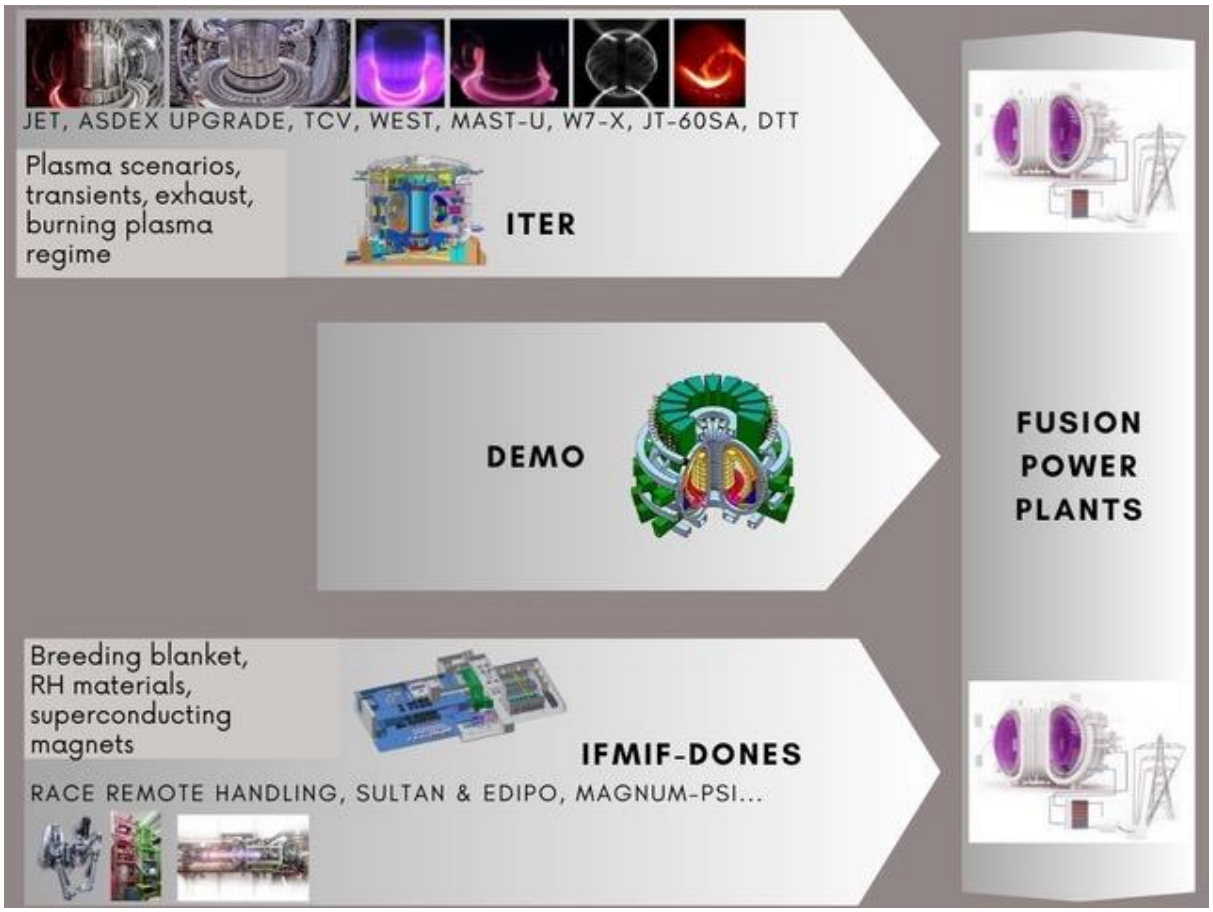
Nuclear fusion: bringing power of stars on the Earth for sustainable energy production

This is not that far in the future anymore, as fusion is now moving to a new commercial era, when in parallel to research at large international experiments, ITER and DEMO, as well as national ones, the commercial fusion power plants will be built by private companies. With decades of tremendous progress in fusion research, we are nearing the point where industry can implement the necessary components to demonstrate net energy gain - reaching engineering breakeven, where more energy is produced than consumed by the entire reactor system. At this stage it is a question of investment to accelerate the entire ecosystem. Fusion is ready to move from the lab, industry is not only a supplier but an actor: commercial fusion power plants producer! Industries must scale-up and make fusion economically feasible. There is a need to have a strong base of suppliers; and subsystem and system integrators. The supply chain of components of power plants will have to change from “order-based” to fluid “factory” production in the post-ITER phase. The cumbersome public procurement process will give way to a more agile, business-like model, ranging from small, fast orders to large-scale contracts placed by major construction companies securing supply chains for geographically and temporally distributed fusion projects. The fastest and most reliable players will harvest the greatest success. The companies able to nimbly provide components will be the most profitable and stable businesses. This

growing momentum is reflected in market dynamics: a 2024 survey by the Fusion Industry Association (FIA) of 22 private fusion companies and 57 fusion suppliers reported a 73% increase in supply chain spending - from around $250 million in 2023 to $434 million in 2024. Projections suggest a further 25% increase in 2025, as fusion gradually transitions from the lab to a commercial energy technology. This sharp rise signals not only a growing confidence in the sector but also the increasing readiness of suppliers to meet industrial-scale demands.

Illustrative image of the commercial fusion energy era.

Many countries, including those within the EU, North America and Asia encourage creation of start-ups and private industries on fusion energy, and such companies are growing around the world (~ 45 as of today). Despite highly competitive expertise in fusion, this is not the case in Switzerland at the moment. However, several European companies (Gauss Fusion, Proxima Renaissance Fusion) with strong links to Swiss research labs, invited to the discussion as inspirational actors, are interested to create their sites in Switzerland. These are all private companies backed by German (Gauss, Proxima) and French (Renaissance) governments (e.g. Germany investing 370 million in fusion in 2024-2028). These and many other companies planning to build the fusion plants, have chosen the stellarator concept, more difficult to build, but easier to operate compared to the tokamak concept. Other companies opt for components manufacturing, entirely (e.g. Kyoto Fusioneering supplying components common to different fusion concepts) or in parallel with system integration (e.g. Renaissance Fusion manufacturing high-temperature superconducting (HTS) components for other industries in fusion and beyond), which is considered a strategic advantage in terms of future supply chain growth, e.g. hundreds of gyrotrons and large quantities of HTS magnets will be needed for one single fusion power plant (FPP).



Fusion R&D landscape

The timescales predictions vary from aggressive schedules of private venture actors, claiming that they will demonstrate the net energy from fusion before 2030, to more careful narrative of public research institutes, 2040-2050. It seems realistic to expect the first commercial fusion power plant construction to start within 15 - 20 years, followed by the deployment of 100–200 fusion power plants (FPPs) across Europe over the course of the century. This, however, requires a shift from the current funding mode - focused on maintenance, such as retraining personnel, recovering lost know-how, and rebuilding supply chains -towards a "cracking the fusion nut" mode that enables solving the real engineering and scientific challenges of building fusion power plants. Fusion has been chronically underfunded for the past 50 years, and unlocking its potential now demands transformative investment in both talent and infrastructure. There is a common perception, that fusion (ITER) is too expensive, which is not the case if compared to large investments of governments to other energy sectors (e.g. 200 billion Euros spent by Germany for yearly gas imports). When looking at private investors, the time scales of fusion are not interesting for classical venture capitalists (VC), who look for the investment return in 5-10 years. However, many other large investors (including VCs), especially in US, simply wish to have a green energy in their portfolio. Interest comes also from the proliferating number of big data centres.

Key Challenges Ahead

Scientific and Technological Challenges

Although fusion is rapidly entering a commercial phase, several fundamental scientific and technological challenges must still be resolved to achieve reliable, grid-scale fusion power. A central difficulty remains plasma confinement and stability, as sustaining plasma at temperatures exceeding 100 million °C without disruptions or intermittent energy losses is extremely demanding. Equally critical is heat exhaust, since the highly localized heat flux onto reactor walls requires advanced thermal management solutions. Tokamak-based concepts must also improve the efficiency and reliability of plasma current drive systems used to maintain the discharge. Progress in material resilience is essential to ensure that divertor and first-wall components can withstand intense neutron bombardment, high particle fluxes, and erosion while having low activation. In addition, commercial fusion will rely on robust remote-handling systems enabling safe, efficient maintenance of in-vessel components. Finally, achieving a fully closed tritium breeding cycle - both safe and efficient - is indispensable for any long-term fusion deployment strategy. These challenges shape the global R&D agenda and frame the industrial opportunities that countries such as Switzerland can seize.

A current view of the ITER Assembly Hall 3 sectors in the tokamak pit, where vacuum vessel sectors and large magnets can be seen in stages of tokamak pre-assembly

Public awareness, appreciation, and workforce pipeline

Beyond the scientific and engineering challenges, fusion must also demonstrate cost-effectiveness, scalability, and long-term reliability, conditions essential for moving from flagship research and pilot projects to commercially viable power plants. Achieving this transition will require not only technological breakthroughs but also strong public acceptance and sustained political and investor

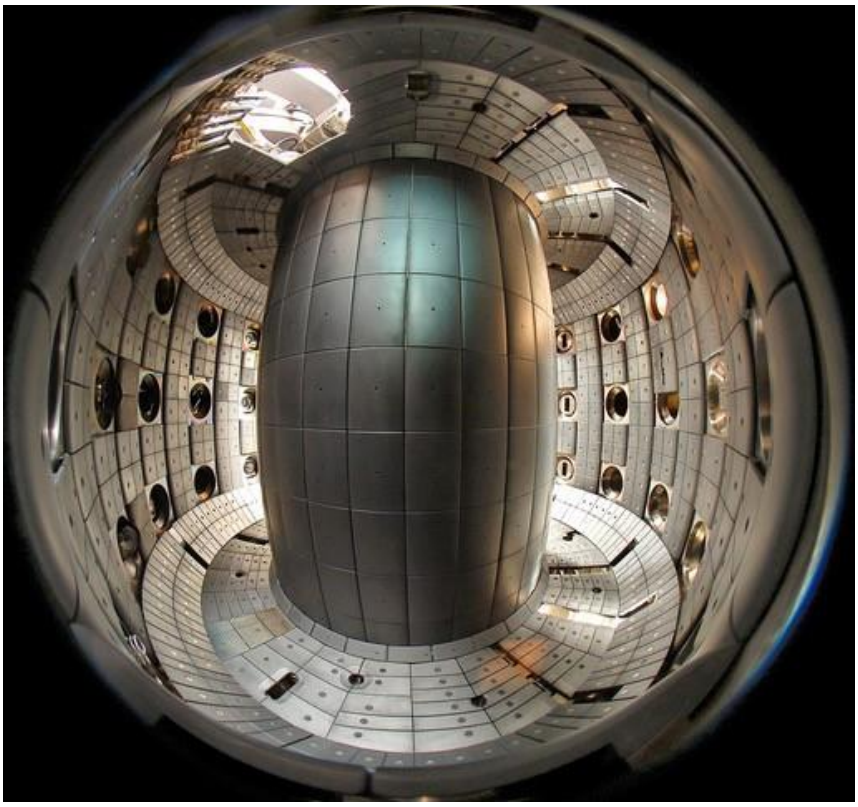
confidence, all of which depend on clear communication of fusion's societal value and realistic timelines.

Demonstration outside of a Nuclear Energy Summit at the Expo in Brussels, Thursday, March 21, 2024. Credit: Geert Vanden Wijngaert/AP

The limited public understanding and appreciation of fusion energy remains a significant challenge: Despite its potential societal benefits, fusion still suffers from negative associations with the word "nuclear," which many people fear more than climate change itself. Efforts in outreach and education are needed to mitigate this misperception driven by fear based on lack of awareness. This also contributes to a weak pipeline of qualified talent entering the field, especially given rapid industrial growth. Acknowledging that awareness of fusion's positive role and long-term societal impact is still insufficient, the Big Science Business community / PERIIA (Pan-European network of Industry Liaison Officers with Large Research Infrastructures) recently recognised the importance of attracting of the new workforce for Big Science Business market, with strong emphasis on fusion, by including the subject to the new network's work plan. While there are a number of emerging outreach activities with schools, these remain fragmented, and fusion - like much of modern science - is still largely absent from high-school curricula. The community therefore recognises the need to strengthen education, outreach, and training efforts using existing academic channels and professional networks, including more coordinated and systematic support for awareness-building, talent development, and engagement with younger generations early enough: already at high school level. Fusion community including industry has large role to play. Unless we do not act as our own ambassadors, who else will do it? The investment in attracting and training qualified future employees in this growing field and fostering early enough - today - the understanding and appreciation of the enormous value of fusion energy for humanity by society, is crucial.

Switzerland's Strategic Position in the Fusion Landscape

Switzerland has been an important player in developments of fusion energy in the past, not only in terms of its own excellence in the research, like at SPC at EPFL (tokamak physics, numerical simulations, gyrotrons, low and high temperature superconductors HTS and semiconductors), PSI (low and high temperature superconducting magnets) and even CERN (magnets, vacuum and many other synergies with fusion), but also in terms of contribution to ITER including important collaborations with Swiss "niche" industries. The interest of Swiss expertise goes beyond the already successful long-term collaboration with Big Science infrastructures. Swiss supply chain has very strong potential offer for fusion and Switzerland has definitely a potential to become a leader in commercial fusion energy phase.



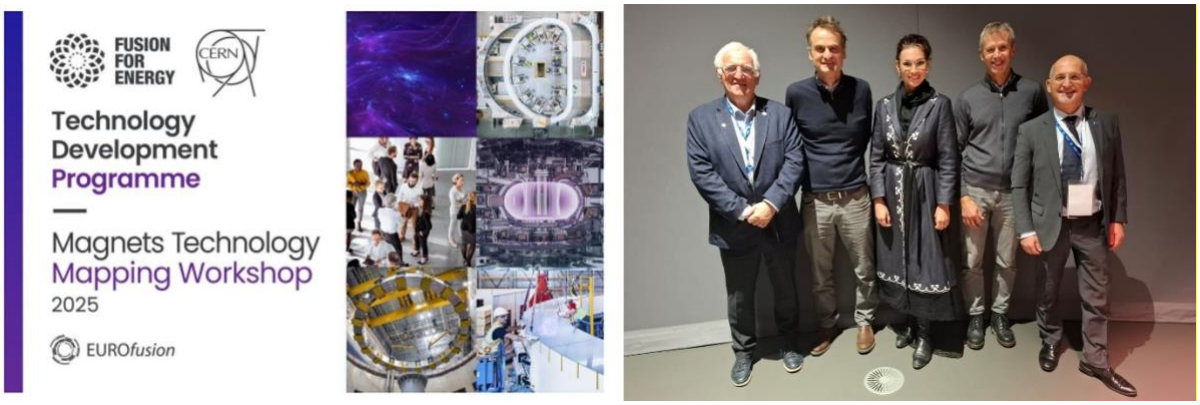
TCV image, Credit:A. Herzog

As the global innovation leader with physics-based industries contributing to economic progress second only to the finance sector, it is not surprising that Switzerland possesses academic and technical capacities with enormous pool of competences of interest for fusion, that not many others can offer (especially in fields like HTS magnets, Electron Cyclotron RF Heating ECRH components, gyrotrons, plasma and particle sources, materials resisting high temperatures and particles fluxes for divertor manufacturing, robotics, precision, AI, big data management, tritium production and handling, etc.). The long-term success tradition of Swiss supplies into the large international research infrastructures supported by Swiss industry liaison office, ensured continuous flow of business for Swiss industry with ITER, CERN etc. even during the times of exclusion of Switzerland from EC activities, including F4E. This was possible in particular thanks to niche technologies, like high precision mechanics, laser tracking, opto- and electro-mechanics, cryogenics, vacuum techniques, sensors, diagnostics. These are mainly the mid-sized family-owned innovative and high-quality oriented companies. Even though such Swiss SMEs landscape offers hidden champions with highest added value for components in future of fusion

and other fields, they do not have the same financial strength as large players in neighbouring countries. Swiss SMEs have difficulties to scale-up financially to deal with the scale of activities intrinsic in large fusion projects. Therefore, one must be careful in addressing the question of private public partnerships PPP, where an important initial push is still required from public funding side. The expertise of Swiss labs (SPC, PSI, and CERN) offers a strong foundation for advancing activities in high-demand fusion fields such as magnets, gyrotrons, plasma diagnostics and transmission lines. Leveraging this know-how through targeted industrial collaboration presents a significant opportunity to enhance Switzerland's role and strategic advantage in the fusion energy market.

Pushed by the strong developments in research, increase in technological readiness level (TRL) and interest in commercial fusion as green investment target during the past few decades, the level of competition of fusion actors has increased in and outside of Europe. As of early 2025, the United States hosts approximately 28 nuclear fusion startups, representing more than half of the global total. To keep Europe strong in the fusion market, the unification of efforts is needed not only on the geographical level, but also among research and industry! Therefore, in 2023 at the request of member states of F4E, EURATOM's agency for ITER and the development of fusion energy, the Industrial Policy of F4E has enlarged the focus from ITER procurement (manufacturing and delivery of components to ITER) to broadening the European industrial base for fusion technologies in the long-term development of fusion as future energy sources to ensure a strong and competitive European industrial participation in the future fusion market. More specifically, in the last 2 years F4E has reoriented some of its industry-collaboration activities along 3 main pillars to ensure the European supply chain readiness beyond ITER. Firstly, the procurement process is more targeted to technologies of importance to future commercial fusion era and SMEs. SMEs of today will be the system integrators of tomorrow. Secondly, a new technology development program (TDP) has been set-up with objective to bridge the gap between research phase and commercial readiness of technologies (moving TLR from 1 to 6). The third pillar is the engagement with private fusion initiatives (supported by channels established with governments), to help them qualify their technologies for the fusion environment and take the ownership of these in terms of IP. In the framework of the new technology transfer joint program of F4E with EUROFusion, calls for European industries have been launched, aiming to increase European competitiveness in the global fusion energy market. This new industrial policy shifts from the most cost-effective delivery and in-kind contributions, to focus on added value and long-term potential beyond the immediate needs, e.g. ITER. EUROFusion recognises that need to move beyond the sequential approach: first ITER, then DEMO, then power plant, which would delay fusion energy production till around 2100. Therefore, the parallelisation supported by private fusion initiatives is inevitable. Lessons learned shared by ITER will advance the knowledge that companies can already use when they are ready to take the risk.

Since the 2021 suspension, Swiss ITER suppliers have struggled to stay active. The confirmed return to full F4E membership in January 2026 brings relief, with pre-procurement access granted for 2025 to ensure a smooth transition. However, providing special supporting measures to make-up for this delay in access of Swiss industries to F4E industrial policy initiatives and crucial information exchange, would be a strategic step to ensure the Swiss competitiveness in the future fusion market. The recognised strength of Switzerland by EUROFusion to be the most agile country in terms of decision making, may play important role in the future of Switzerland's positioning in fusion energy. The launch in January 2025 of the European Commission–funded GO4FUSION initiative - designed to accelerate fusion development through a new public-private partnership - further underscores the importance of ensuring that Swiss actors regain timely access to European industrial policy processes and collaborative frameworks.



Contributors of this paper, at the "Magnet Tehnology Mapping Workshop" hosted by CERN, Fusion for Energy, and EUROfusion, 26 November 2025 at CERN. From left: F.Bordry, M.Huebner, B.Bruant Gulejova, L.Bottura, L.Scibile.

Fusion power deployment requires collective effort beyond any single country or company. To ensure that fusion develops in Europe, maintaining unity is essential. The European Fusion Association, EFA, created in 2023 promotes European industrial revival through fusion and calls for uniting the efforts with European companies and research labs to speak one voice, also in terms of future fusion market regulations. Swiss industries and other players in the innovation ecosystem are encouraged to join these efforts to support pan-European vision. In addition to the EFA, a new member of the European fusion ecosystem Fusion Europe has emerged as an industrial association for most ambitious private organisations working to put fusion energy on the grid (including Proxima Fusion).

Should Switzerland also invest in building its own commercial fusion power plant? Should we join forces with existing international efforts? Or should we focus on becoming a key supplier of components to power plants worldwide?

From Fragmentation to Coordination: Building Swiss Industrial Capacity

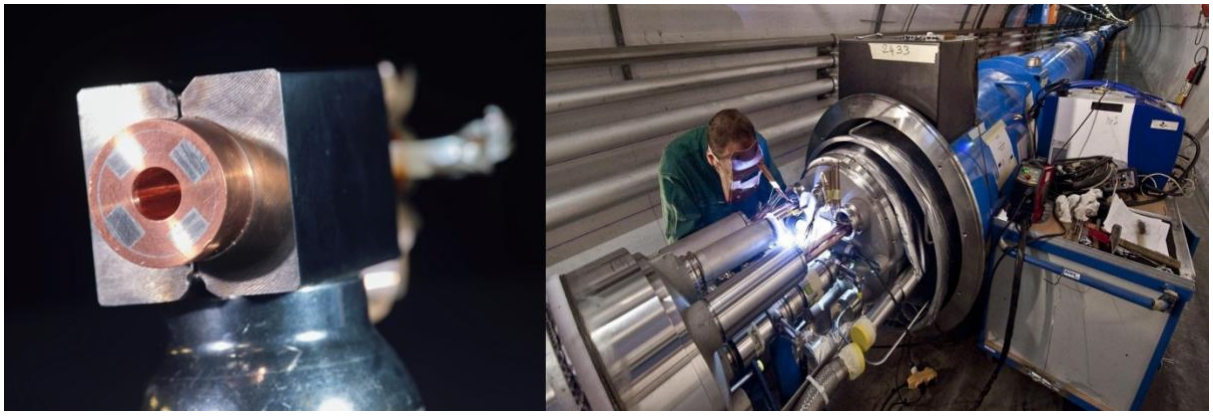
From the discussions it was concluded, that at this stage the biggest strength of Switzerland is a supplier of the components, that is predicted to be the most economically profitable and safe business in future fusion energy supply chains. Today the industrial expertise, readiness and potential of Switzerland is unprecedented in several fields, which will play instrumental role in upcoming years of fusion energy sector developments. On the other hand, however, the companies a miss strategic coordination, infrastructure and ecosystem for supply chain readiness, that would allow them to integrate their efforts in synergetic way, better seize the opportunities to play leading role in future of fusion energy supply.

Building a Swiss consortium of companies active in fusion would enable to elevate the position of Swiss expertise from components supply to the subsystem level. Unlike in other countries (e.g. Germany etc.), the financial tools are not in place in Switzerland to support this transition. To turn a vision into reality, the political support, accompanying measures, active involvement of Swiss innovation and technology actors, and matching funds from industries are needed at least in upcoming 5-10 years.

Swiss Industry Liaison Office booth – ITER Business Forum 2025 - Marseille

Strategic Synergies with Big Science business market and Swiss innovation players

Building on the long tradition of synergies and collaboration between CERN and fusion, the Fusion Technology Coordination Unit FTCU has been recently created at CERN, with aim to identify and foster the commonalities (e.g. magnets, vacuum, cryogenics, material engineering, diagnostics, radiation protection etc.), including industrial partnerships, knowledge transfer, consulting and mentorships. CERN is committed to advance the scientific innovation and sustainable development, while exploring the application of particle accelerator technologies to help address one of society's most pressing challenges that is enabling transition to a low carbon future. Fusion community in Switzerland should further explore synergies with the Big Science Business market (especially CERN) and get inspired in terms of collaboration with industry both in procurement, knowledge & technology transfer and workforce preparation, to attract industry to public-private partnerships by exploring the added value of these synergies.



Left: High-current HTS demonstrator cable at CERN, designed for advanced fusion reactors, carrying up to 60 kA at 20 T when cooled to 20 K. Right: HTW magnets at Large Hadron Collider. Image: CERN

The Swiss innovation ecosystem offers great partners, that can contribute to the effective participation of Swiss industries in the commercial fusion energy. These include the technical industrial association SwissMEM and the Swiss Innovation Agency, Innosuisse, that offer an excellent pool of competent industries and financial tools to support innovation between academia and industry, respectively.

SwissMEM is a leading association for SMEs and large companies in the Swiss mechanical and electrical engineering (MEM) technology industry. SwissMEM's mission is effective promotion of innovation to contribute to internationally competitive industrial sector, stability and prosperity of Switzerland. Therefore, they also invest heavily in future-oriented education for young people as well as in continuous training. Around 1,400 SwissMEM members, 99% of which are SMEs, rely heavily on exports due to the limited domestic market. Their expertise closely aligns with current and emerging fusion energy needs, positioning them as strong candidates to strengthen Switzerland's role in the global fusion sector. The division of Innovation and Technology of SwissMEM is the right place to start the follow-up discussion on this subject.

Innosuisse is a springboard for Swiss national or international innovation providing public funding to turn innovative ideas between academia and industry into reality, through supporting R&D projects and start-ups to develop promising products and services; building flagship projects including federal level of support; and also collaborating with universities on technology transfer. In 2023, about 492 million of CHF went to the support of such projects. All these options have great potential to be exploited for fusion energy.

Strategic recommendations for Swiss fusion strategy

The main action items identified during the discussion, that aim to enhance the technological roadmap of Switzerland for the commercial era of fusion energy, are the following:

- Consider federating Swiss tech companies in a fusion business hub beyond the current ILO ITER industry network, enabling companies to address the coming fusion market with higher supplier contracting level. Use the impact of earlier references at ITER to develop the marketing visibility of Swiss industry competences facilitating access to the ongoing and forthcoming large international fusion market;
- Explore the creation of a InnoSuisse Fusion Flagship project in collaboration with SERI and explore more public funding schemes for a national fusion roadmap in similarity to other transverse strategic innovation fields (Quantum Computing, Space, Artifical Intelligence...), including national-level support measures through SERI. Anticipate the collaboration with the Swiss Federal Office of Energy (SFOE);
- Consider strengthening collaboration with well-established industry associations (SwissMEM, Nuklearforum Schweiz, Swiss Vacuum, Hydropole) for outreach to a larger industry audience in Switzerland;
- Consolidate the early collaboration of Swiss labs with industry in view of future PPPs (Public Private Partnerships) to be issued from diverse origins (EU, EUROFUSION, neighbour countries national fusion programs);
- Explore the collaboration and synergies of Swiss industries having expertise in fusion-related areas and CERN, especially in terms of industrial partnerships and knowledge transfer in common identified areas;
- Help Swiss industries, research and other innovation stakeholders to be better integrated in the European efforts, e.g. through EFA (European Fusion Association);
- Look for the early involvement of electricity operators and energy stakeholders from both the private sector (AXPO, ALPIC, etc.) and the political sphere;
- Support education, outreach and training activities dedicated to fusion energy, using available channels in academic networks and professional umbrella associations.

Conclusions- Moving Forward: A Call for Collective Action

The strategic discussion on Switzerland's role in the emerging commercial fusion energy era on 2nd of December 2024 served as a first step toward building a shared understanding and identifying opportunities for Swiss industry engagement in the commercial fusion energy ecosystem, including the examples of concrete possible steps listed in the recommendations above. A larger initiative with dedicated support, like creating a platform uniting Swiss industry, innovation centers, research groups, and all relevant stakeholders to collaboratively push forward the development and commercialization of fusion energy, would contribute to shaping a future where Switzerland stands at the forefront of this technological revolution. Positioning Switzerland as a key player in this field would unlock unprecedented economic opportunities, solidify Swiss global leadership in clean energy technologies, and help pave the way toward a sustainable and secure energy future for generations to come.

Raising awareness, improving public understanding, and building a strong talent pipeline for fusion should be considered as an integral component of Switzerland's long-term fusion strategy. This would require sustained, collective action for coordinated education, outreach, and training initiatives that can systematically integrate fusion into public discourse and high-school-level science learning, while improving the attractiveness and clarity of career pathways in this rapidly growing field.

Ensuring continuity of this newly launched process is essential to safeguarding the impact of the initial efforts. This contribution is welcomed as an input to the national reflection on Switzerland's future role in fusion energy, and as the field evolves, SATW will remain committed to fact-based dialogue and to fostering opportunities for collaboration across the Swiss scientific and industrial ecosystems

Youth@STEM4SF Swiss Pilot in High schools, Bern, Zurich, Vaud, Credit: Barbora Bruant Gulejova

Science for Sustainable Future (S4SF) remains open to collaborate with other key stakeholders, with aim to continue contributing to the recommendations outlined above, and carry forward the momentum generated by this first discussion—particularly through its activities in cross-sector dialogue (as in the discussion on 2 December 2025), as well as public awareness and education. By leveraging science diplomacy to foster efficient dialogue between science and current and future societal leaders, this Geneva-based NGO aims to contribute to informed societal reflection on emerging technologies and to inspire the young generation at high-school level. Through the pioneering innovative outreach programme Youth@STEM4SF, developed with the Big Science Business community and piloted in Switzerland under the umbrella of the UNESCO Decade of Sciences for Sustainable Development, S4SF will continue bridging high-school science education with cutting-edge technologies, using fusion as a prime example of science for sustainable future!

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