

The background features a complex, abstract design with concentric circles and a bright blue laser beam. The circles are composed of multiple overlapping layers in various colors, including cyan, blue, green, red, and yellow. A prominent horizontal blue laser beam enters from the left side of the frame, passing through the center of the circular patterns. The overall effect is a sense of depth and dynamic energy, typical of a scientific or technological presentation.

Prof. Dr. Constantin Haefner
BMBF Inertial Fusion Expert-Panel Lead

The German Roadmap on IFE state of the art and prospective

Germany is excited about fusion!

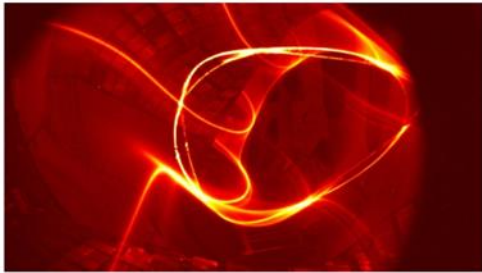
SPIEGEL Wissenschaft

Was der Durchbruch bei der Kernfusion für die Energiegewinnung der Zukunft bedeutet

Zum ersten Mal haben Fachleute bei der Kernfusion mehr Energie gewonnen als eingesteckt wurde. Die Methode könnte die Stromproduktion revolutionieren – doch noch sind viele Fragen offen.

Von Anika Freier
14.12.2022, 18:30 Uhr

Frankfurter Allgemeine



DEBATTE UM KERNFUSION

Irrlichter, keine Leuchtfeuer

Eine Entbürokratisierung soll der Kernfusion laut FDP-Fraktionsvize Christian Dürr Aufwind verleihen. Doch Naturgesetze lassen sich nicht entschlacken.

Hinnerk Feldwisch-Drentrup
18.04.2023, 13:32 Uhr

Die Welt im Fusionsfieber

Als Witz kursiert in der Community, dass die Kernfusion immer 30 sei. Doch es gibt vielversprechende Forschung, gerade in Deu

Ein Bericht von Werner Pluta
6. Mai 2023, 10:00 Uhr

Handelsblatt

ENERGIE

US-Forscher melden Durchbruch bei der Kernfusion

Zum ersten Mal ist es Wissenschaftlern gelungen, eine positive Energiebilanz bei der Kernfusion zu erzeugen. Bis zum ersten Kraftwerk bleibt der Weg aber noch lang.



INNOVATION

USA fördern deutsches Start-up

Der Darmstädter Kernfusionsspezialist Focused Energy steht hoch im Kurs – und das nicht nur in

Kernfusion

ZEIT ONLINE

Fusionsreaktor

Durchbruch in der Kernfusion! Das behaupten US-Forscher. Doch die Sache ist komplizierter. Viel, viel komplizierter. Welche sechs Probleme auf dem Weg zum Kraftwerk noch zu lösen sind.

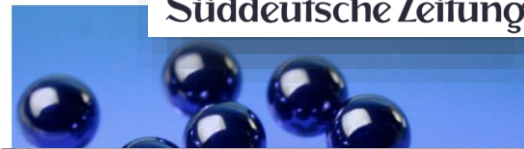
Von Dirk Asendorpf und Ulrich Schnabel

Aktualisiert am 22. Dezember 2022, 5:55 Uhr / 67 Kommentare

Energie

Diamanten made in Freiburg

27. April 2023, 17:30 Uhr | Lesezeit: 5 min



Süddeutsche Zeitung

Lehre

FUSIONSFORSCHUNG

US-Forschende berichten von Durchbruch bei Kernfusion

Eine Kernfusion, bei der mehr Energie freigesetzt als verbraucht wurde: Von diesem wissenschaftlichen Meilenstein berichten Forschende aus den USA.

15.12.2022

Kernfusion

Das Sonnenfeuer auf die Erde bringen - daran arbeitet die Fusionsforschung seit Jahrzehnten. Stehen wir kurz vor dem Zeitalter unbegrenzter Energie?



FOCUS online

% ABO

Politik Finanzen Perspektiven Klima Wissen Gesundheit Unterhaltung Panorama Sp

Nachrichten > Wissen > Technik > US-Wissenschaftler verkünden Durchbruch bei Kernfusion

Schier unerschöpfliche saubere Energiequelle

US-Wissenschaftler feiern Durchbruch bei Kernfusion



ATOMKRAFT IN DEUTSCHLAND

Kernfusion als Königsweg

Die Regierung bereitet einen Plan zur Entwicklung neuer Atomkraftwerke vor. Die Industrie verspricht Unterstützung.

Marcus Theurer
03.06.2023, 09:02 Uhr

German industry sees the merger and the key technologies associated with it as a promising future technology and recognizes its significant market potential.



Development of First IFE-Driver Concepts for Science Applications: High-Energy, Scalable IFE Drive Lasers Installed at ELI Beamlines and HILASE Site

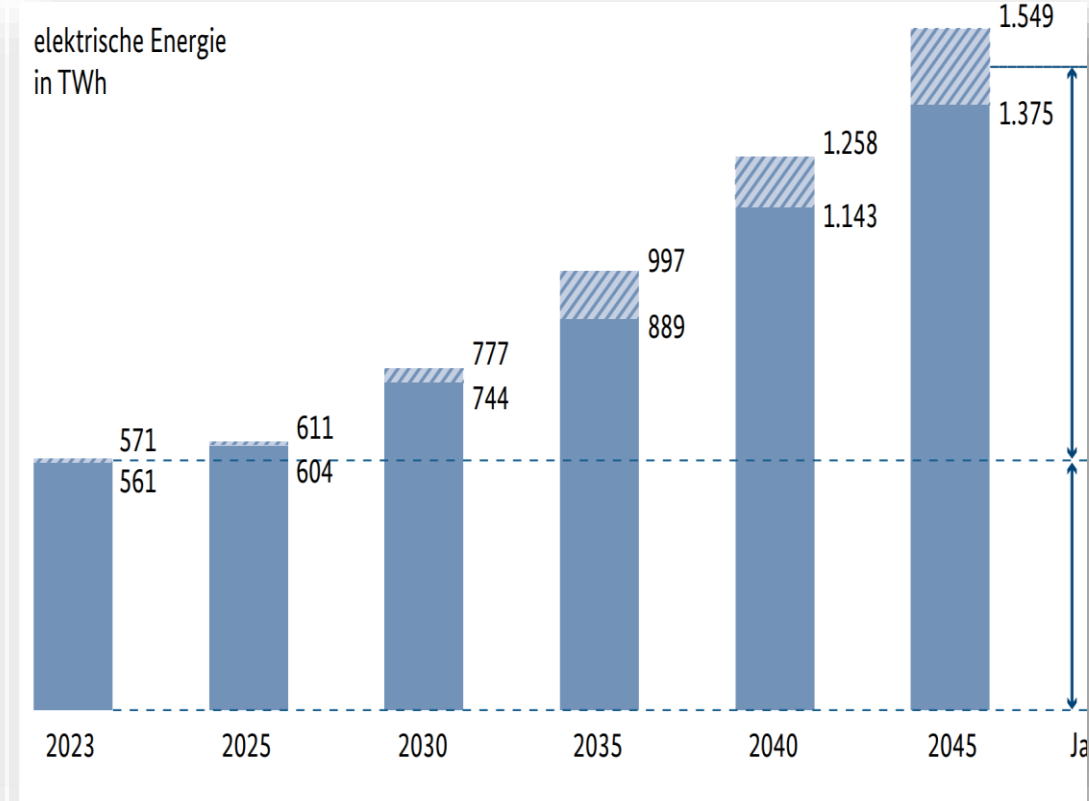
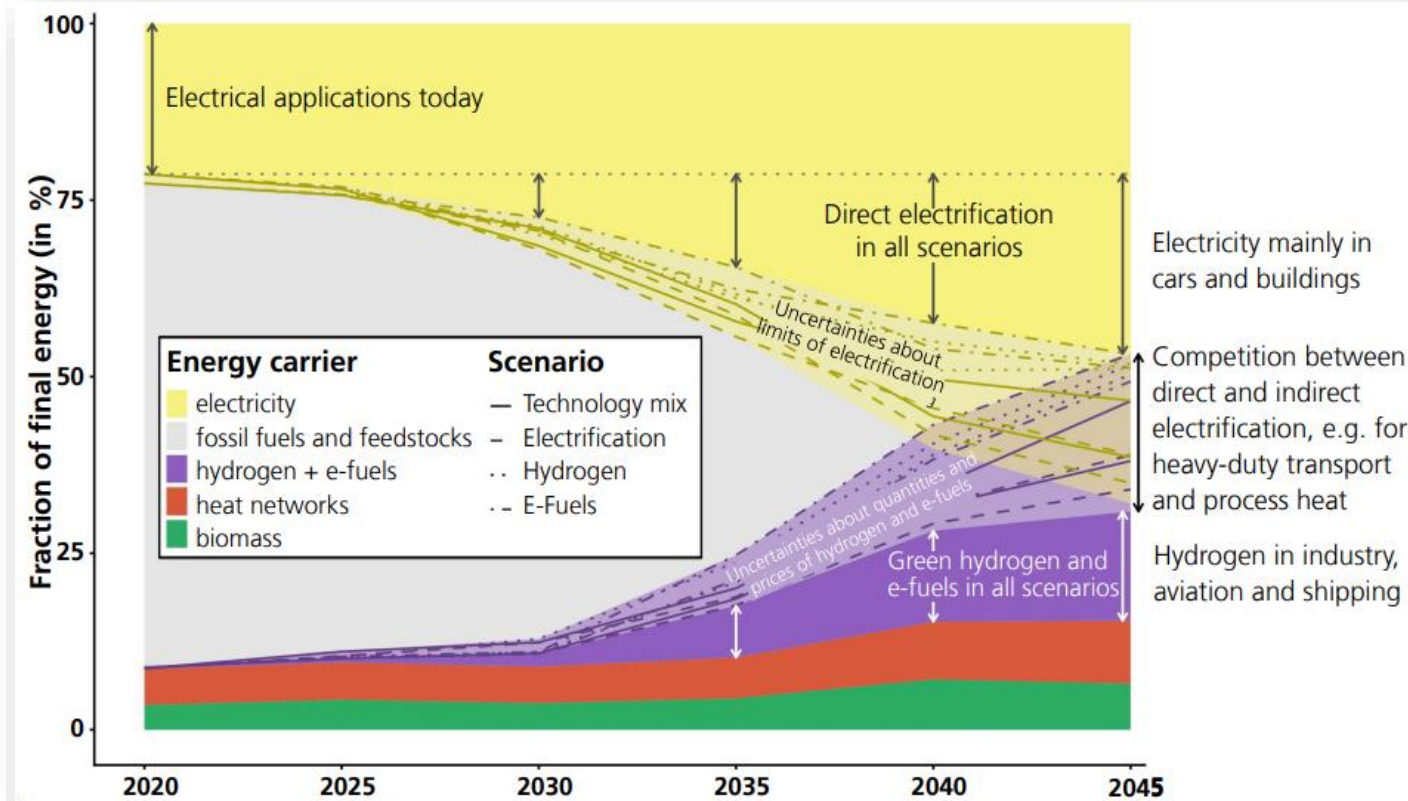
RAL: Diode Pumped Optical Laser for Experiments (2017)



LLNL: High Repetition Rate Advanced Petawatt Laser System (2017)



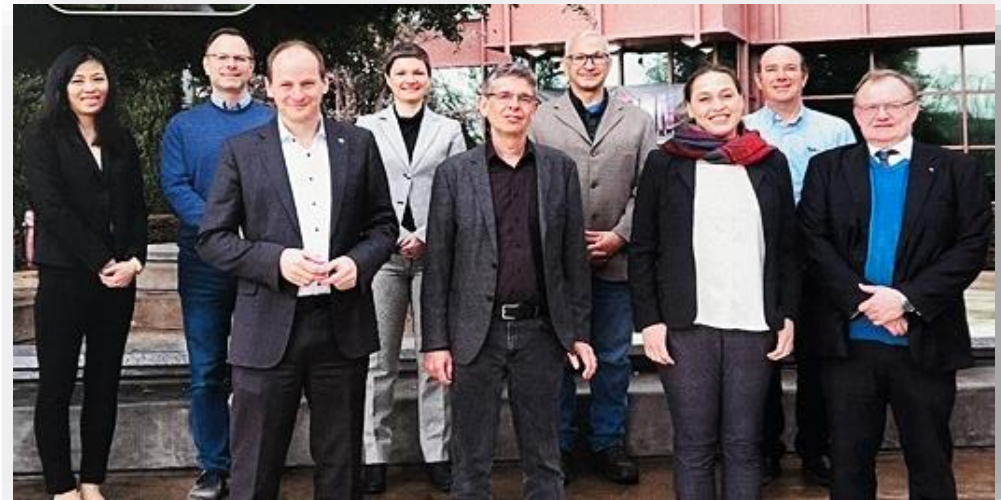
Electricity demand grows up to 300% by 2045, in Germany and worldwide due to electrification and shifts in primary energy use



Quelle: Fraunhofer ISE, Kopernikusprojekt Ariadne, www.ariadneprojekt.de

Germany forms an opinion on inertial fusion energy after the NIF breakthrough

- May 22: Federal Ministry of Education (BMBF) invites experts from German Industry, Startups and Public Research Organizations for an Expert Discussion about Fusion Technologies including Laser based Inertial Fusion Energy
- Dec 2022: BMBF charges a group of world-leading experts from ICF and MFE communities to assess Germany's status in IFE R&D and to make recommendations for positioning Germany in the field of IFE



Missing in the picture: Riccardo Betti, Peter Schroth

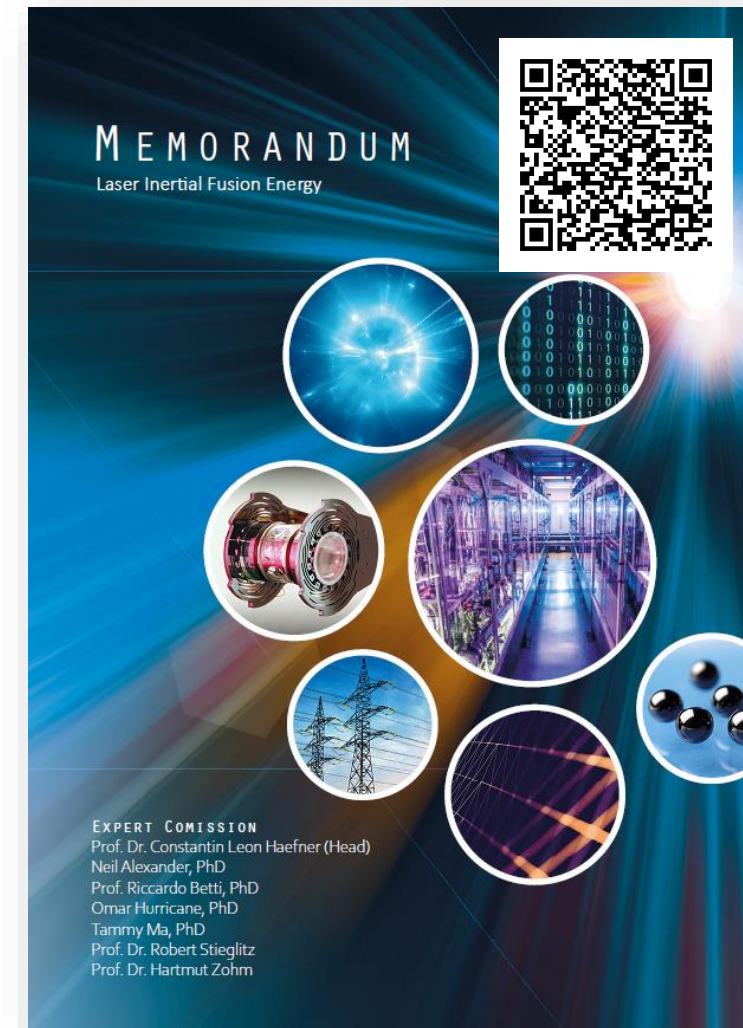
The expert group on fusion energy was formed from world-leading scientists in fusion energy and enabling technologies

Authorizing Individual: Bettina Stark-Watzinger, Federal Minister of Research and Education
rep. Dr. Volkmar Dietz, BMBF

BMBF POC: Dr. Peter Schroth, BMBF, /714

Experts:
Neil Alexander, PhD; General Atomics
Prof. Riccardo Betti; University of Rochester
Prof. Dr. Constantin Haefner, Fraunhofer Gesellschaft
Omar Hurricane, PhD; Lawrence Livermore National Lab
Tammy Ma, PhD; Lawrence Livermore National Lab
Prof. Dr. Robert Stieglitz, Institute for Reactor Technology (IFRT), KIT
Prof. Dr. Hartmut Zohm, Max-Planck-Institute for Plasma Physics

Coordination:
Dr. Christian Busch, VDI TZ
Claudia Keibler-Willner, Fraunhofer Gesellschaft



The expert group on fusion energy was formed from world-leading scientists in inertial confinement fusion Research and Development

Charter:

1. Summarize and assess the state of the art of IFE
2. Identify key players and key facilities worldwide in science as well as in technology
3. Evaluate the opportunities for Germany to engage in the field of IFE
4. Identify the research needs in general and recommendations for Germany where to join
5. Identify needs for education and workforce
6. Identify technological unique selling points (USP) of German Research and Industry which can contribute to IFE and could accelerate market access
7. Assess the role of industry



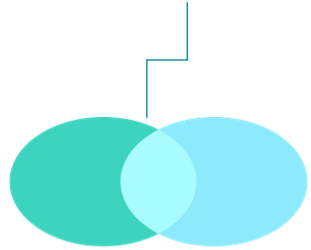
September 2023: BMBF Minister Bettina Stark-Watzinger announces funding for fusion research R&D over EUR 1 Billion for the next 5 years

- May 22: Federal Ministry of Education (BMBF) invites experts from German Industry, Startups and Public Research Organizations for an Expert Discussion about Fusion Technologies including Laser based Inertial Fusion Energy
- Dec 2022: BMBF charges a group of world-leading experts from ICF and MFE communities to assess Germany's status in IFE R&D and to make recommendations for positioning Germany in the field of IFE
- May 2023: Expert group delivers Memorandum on Inertial Fusion Energy
- June 2023: BMBF responds with Position Paper on Fusion Energy (includes MFE and IFE)
- September 2023: BMBF Minister Bettina Stark-Watzinger announces a new Fusion Energy Program that goes beyond institutional funding for fusion.



Germany's Federal Agency for high risk, Leap Innovations "SPRIN-D" promotes disruptive IFE Technologies development in Germany

SPRIN-D



PULSED LIGHT
TECHNOLOGIES

PLT is a 100% SPRIND subsidiary
with the goal to develop infrastructure
to support laser-driven fusion

Since August 2023 PLT finances two laser development projects with **90 Mio. EUR** in total.

Key features of power-plant-ready laser systems will be demonstrated (e.g. rep. rate, efficiency)

The laser systems are developed together with PLT's cooperation partners **Focused Energy** and **Marvel Fusion** and will support their respective fusion approaches.

Memorandum is organized into top level recommendations for a fusion program and recommendations for modular components

Fusion Plasma

High gain mass targets

Fusion vessel

First wall, blanket, fuel cycle

Laser Drivers

Diagnostics

AI & HPC

Fusion Power Plant

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Fusion Power Plant
© GA

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Key findings

- **Fusion Energy is in the National Interest: Pursuing Both an IFE and an MFE Program is Essential:**
 - provide for energy sovereignty,
 - resilience, and contribute to a diverse energy portfolio
 - Both fusion technologies need cutting-edge science and sophisticated engineering and as such will spur innovation, attract talent, strengthen international competitiveness, contribute to a modern society and foster economic growth
- **The international race to fusion energy drives urgency to act**
 - IFE is a burgeoning field, has enormous potential, and is essential to a future diversified energy portfolio.
 - promotes high-tech innovations in areas in which Germany has unique competencies
 - World moves now to claim the intellectual property essential to serving the growing global energy market.
- **Building Trust for Fusion Energy**
 - Societal acceptance of fusion (vs fission) is needed – and requires support and commitment from policy leaders.
 - The timeline for achieving fusion energy depends on the level of investment, commitment, and determination

The Memorandum provides 16 Overarching Recommendations

Each Technical Chapter provides additional recommendations in the specific field

1 Fusion energy is in the **national interest**: Pursuing both an IFE and an MFE program is essential

2 **Urgency to move now**: Germany needs a robust, aggressive IFE program

3 **Building trust** for fusion energy

4 Need for establishing competency-based **fusion hubs**. Follow **open innovation principles**

5 Focus needed for establishing **successful leadership** in IFE

6 **Evaluating** and **prioritization** of IFE concepts

7 Need to Develop an **Integrated Systems Model** to evaluate risks and tradeoffs

8 Establish **public private partnerships**

9 Establish **international collaborations**

10 Strategize on IFE **implosion facility** to rapidly advance IFE ignition and gain, and technology development

11 **Maintain IFE approaches** until assessment studies are done

12 Assess IFE **programs for accountability** Develop **Metrics** for success and failure

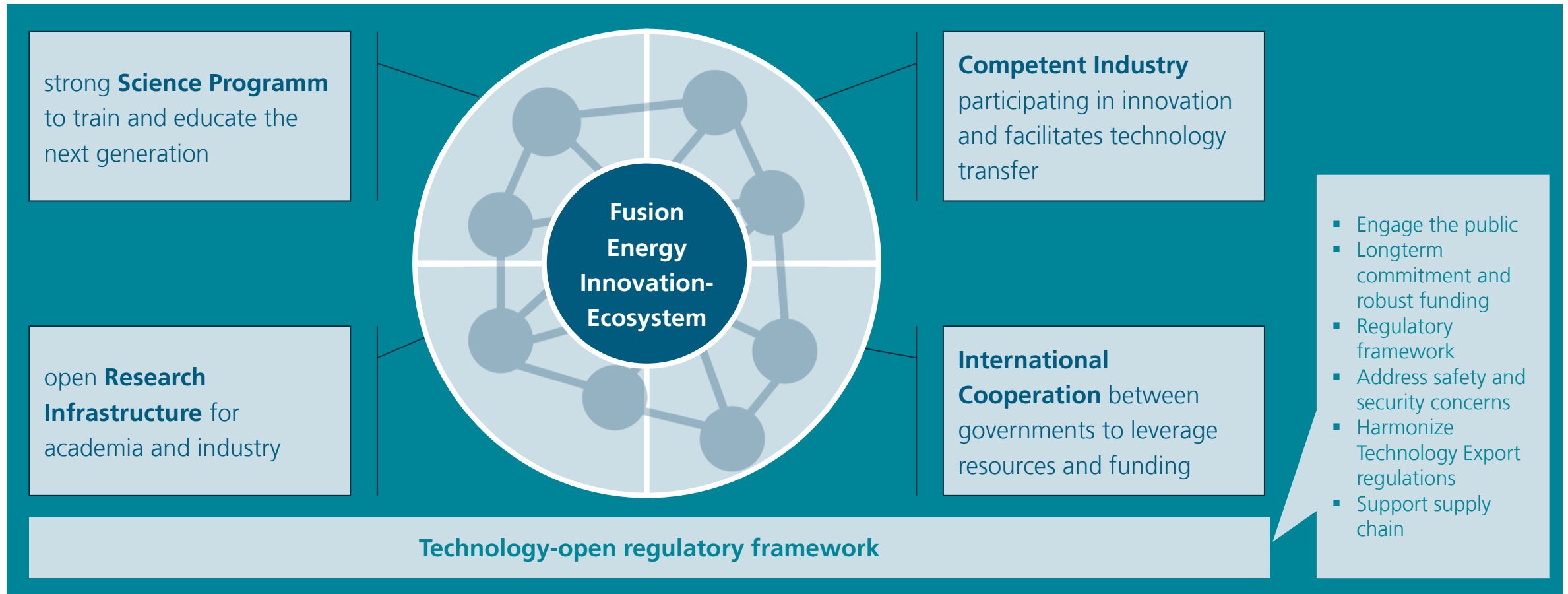
13 Build and maintain **German competencies**

14 Workforce Growth and Development of an **IFE curriculum** is needed

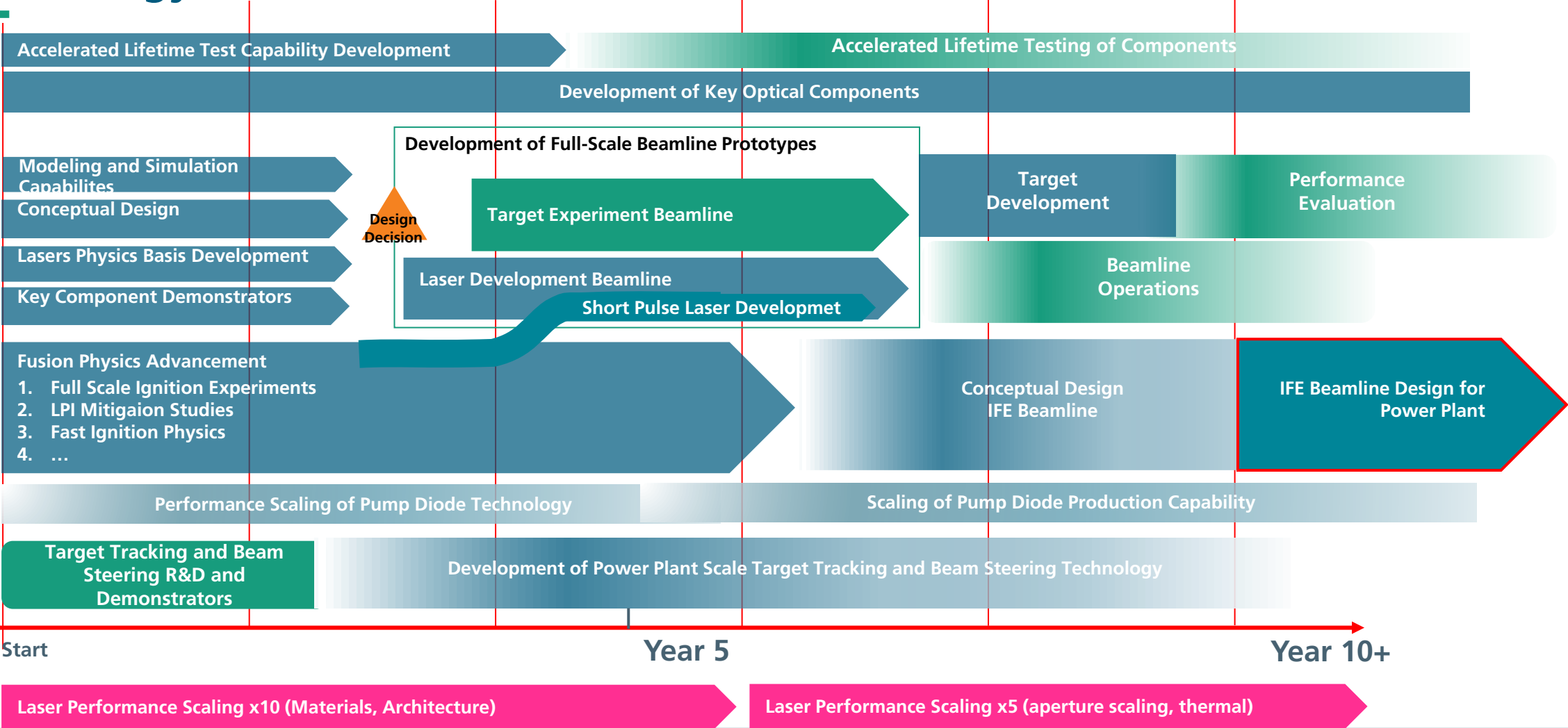
15 Need for a high brilliance, pulsed **fusion neutron source**

16 Support **German industry**

Germany: Establishment of a Fusion Energy Innovation Ecosystem towards delivery of fusion power plant technologies



The Memorandum provides a draft timeline to develop Fusion Drive Technology for a Fusion Power Plant



Fusion 2040 – Research on the way to a power plant

Federal Ministry of Education and Research will start a program for Fusion research in Dez. 2023

**Overarching Goal:
Fusion Power Plant**

Funding for MFE and IFE

Duration 01/01/2024 – 31/12/2033

Fields of Action I Scientific and technical issues

- Tritium
- Material development, First Wall and Blanket
- Neutron (sources)
- Plasma confinement
- laser systems
- Targets
- Simulations
- (Design) studies

Fields of Action II ecosystem

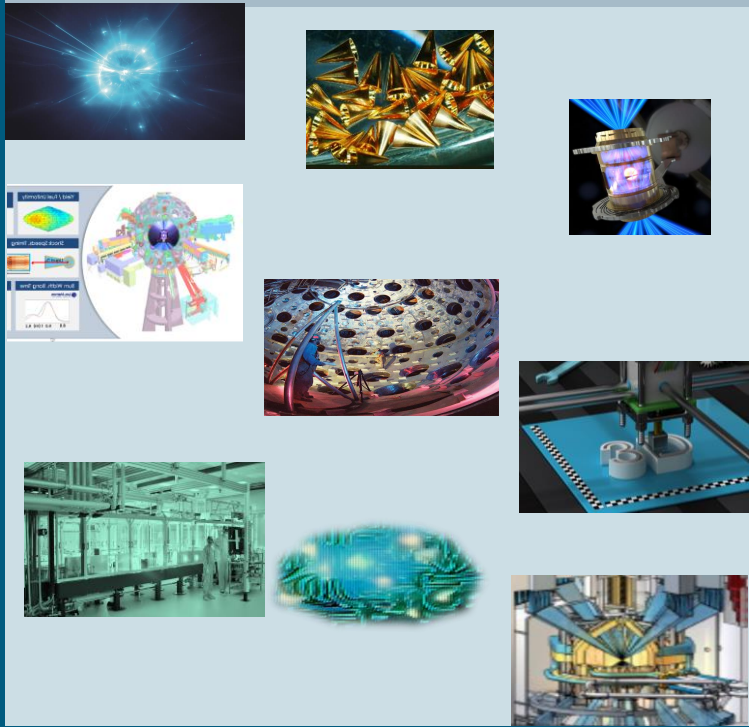
- Infrastructures
- Training and further education of specialists
- Networking (especially research and industry)
- Public dialog & information
- Regulation

Submission of applications in the context of specific announcements

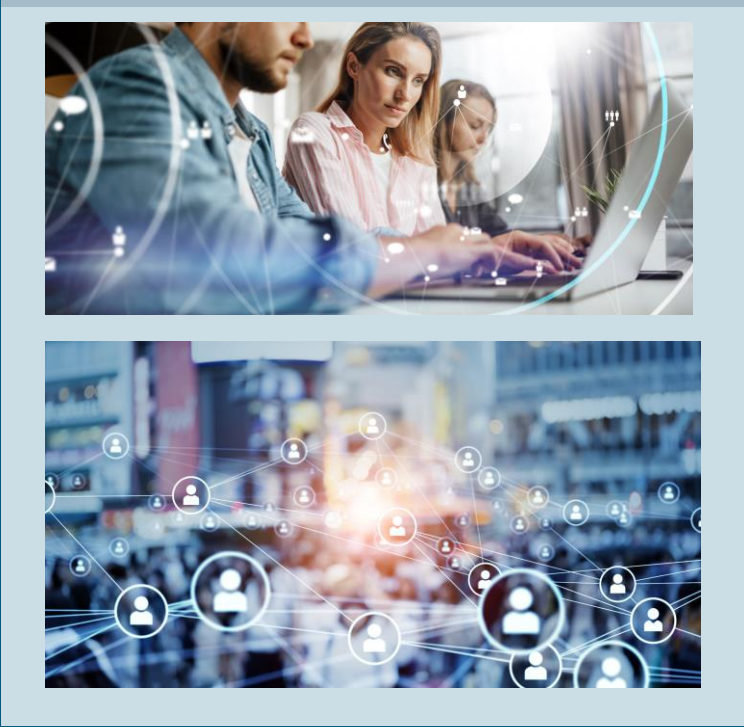
BMBF is planning to launch two calls for fusion energy in spring 2024

Fusion 2024 Research Program

1st Announcement Basic Technologies



2nd Announcement Junior Research Groups



Contact

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Lead BMBF Expert Commission Inertial Fusion Energy

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