



Role of industry in EU fusion research

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Fusion is in a Transition....



Fusion Industry Association survey 2022:

- There is growing excitement about fusion energy as an option to contribute to the world's low-carbon energy supply. Increasing numbers of private companies are aiming to deliver commercial fusion and are producing significant breakthroughs in the science and technology that will lead to a commercial power plant.

Declared Funding

-declared private funding surpasses \$4.7bn, plus an additional \$117 million+ in grants and other funding from governments, taking the total to over \$4.8bn. This is a 139% increase in funding since 2021....

Targeting electricity production in the 2030s

- The survey found that 93%, up from the 83% reported last year, of companies believe that fusion electricity will be on the grid in the 2030s or before, an achievable target for the commercialization of fusion as a clean energy technology.

EUROfusion coordinates the EC funded research along the Roadmap.

The goal is electricity from fusion by 2050.

EUROfusion will see more and more industry involvement and provide increasingly opportunities for industry as fusion energy comes closer.



01	Framework Contracts
02	Non Framework Contracts
03	Lesson learned (ITER, W7X, etc.)
04	Strategy for industry involvement
05	Summary table (for the record)



- FWC foreseen in Euratom Work Programme for the supply of expert industrial competences for the conceptual design activities of DEMO and industry support for the DONES site preparation activities.
- The purpose of the FWC is
 - to provide at short notice the contracting authority with highly qualified industrial expertise;
 - to support the contracting authority in the design, preparation and proper implementation of the work.
- The FWC will provide services based on industry-best practice in the area of:
 - DEMO layout and system architecture;
 - overall plant configuration and system engineering processes, with a focus on plant design and technology options and feasibility;
 - plant manufacturing options;
 - project risk identification, evaluation and mitigation;
 - evaluation of the impact on cost for the suggested solutions.

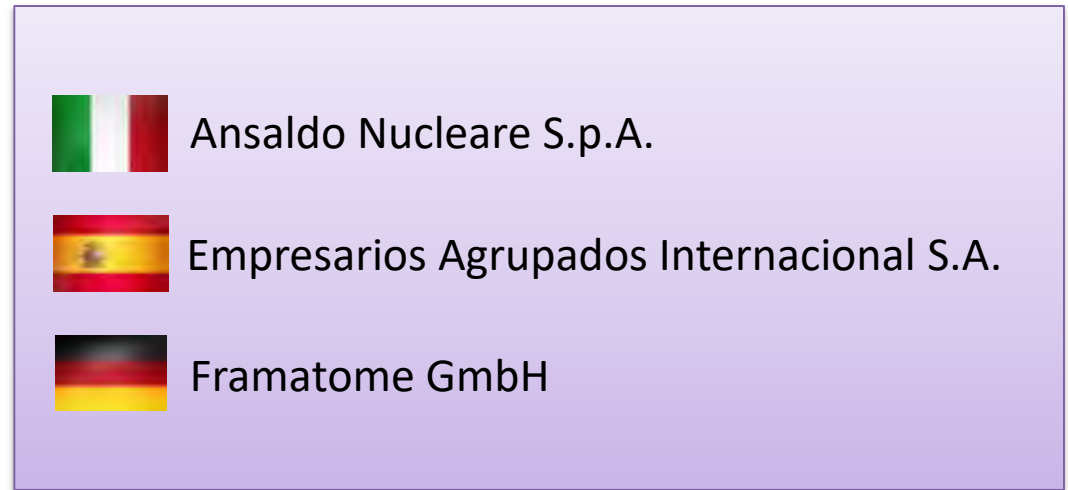
01 Framework Contract (FWC)



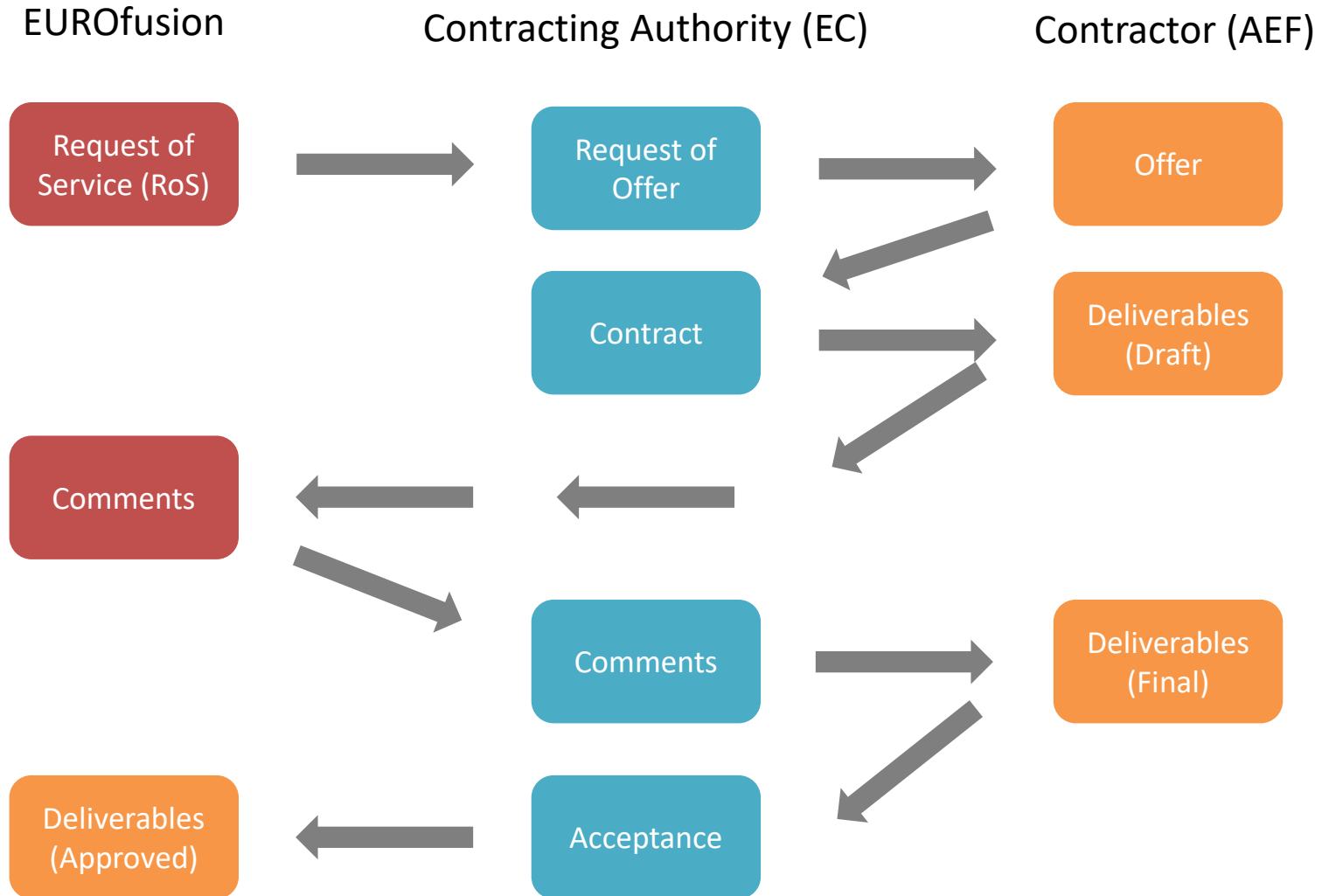
- Contract signed the 04.05.2020 between the European Commission and the Consortium AEF (Ansaldo Nucleare, Empresarios Agrupados Internacional S.A. and Framatome GmbH) for a period of 24 months.
- It is renewed automatically twice for a duration of 12 months each unless one of the parts receive formal notification to the contrary.
- Budget for the whole period: 12 M€ (10 M€ + 20%)



European Commission

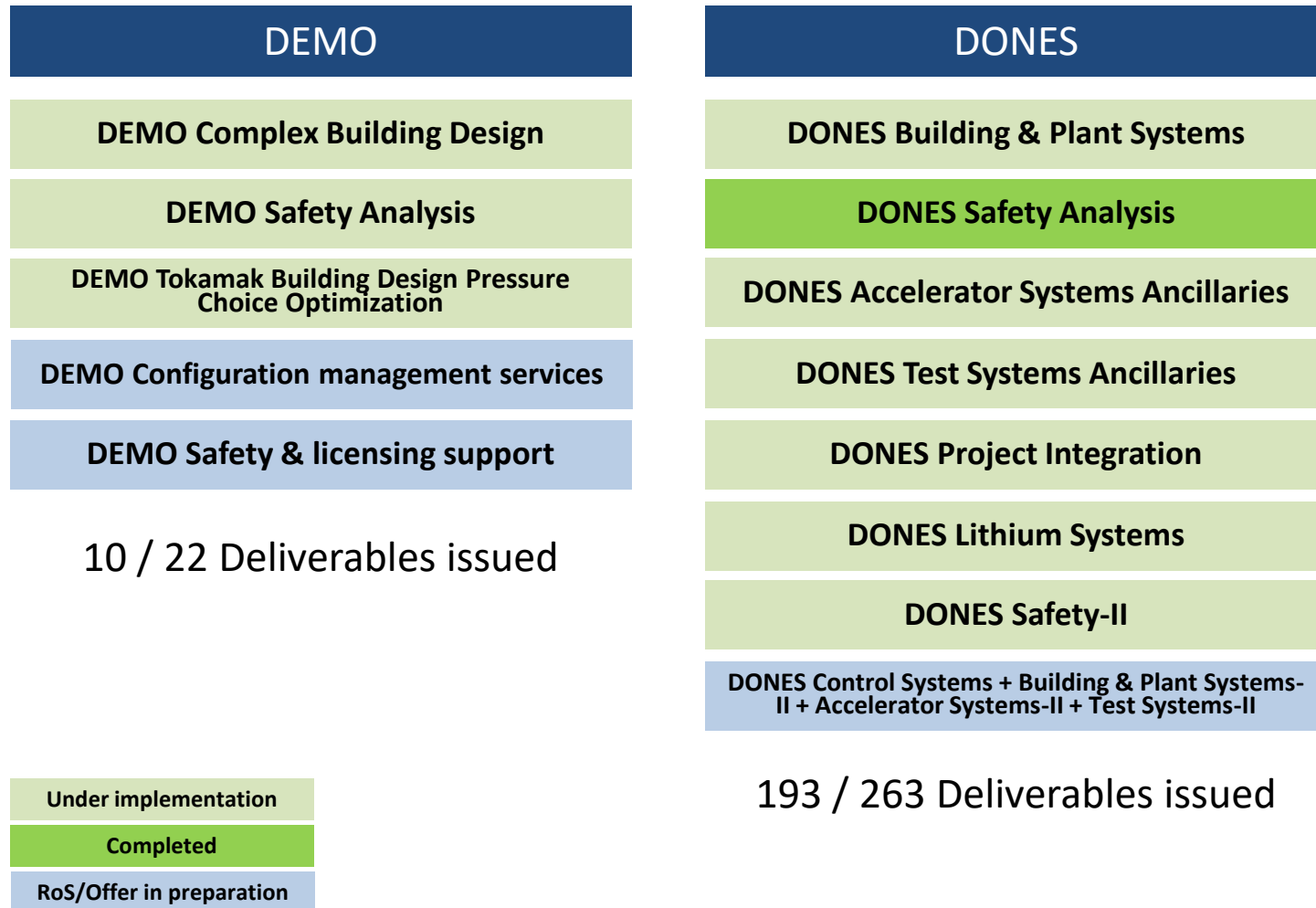


AEF Consortium





Specific Contracts (SC) already defined





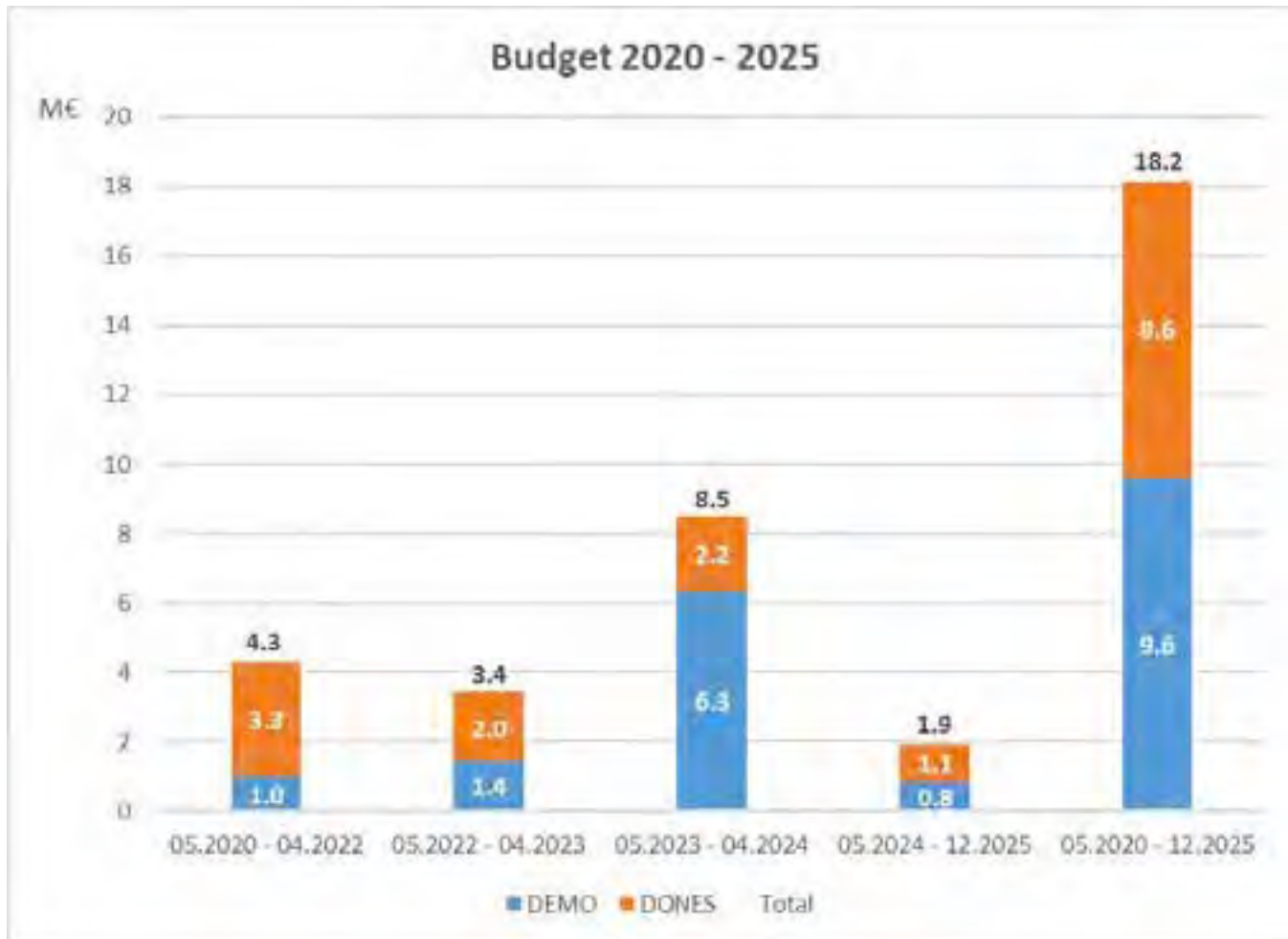
Next Scheduled Specific Contracts

DEMO	
DEMO Cost estimation services-I	Scheduled in Q1 2023
DEMO Maintenance strategy concept	Scheduled in Q1 2023
DEMO System design (cooling water, safety & convent. systems)-I	Scheduled in Q1 2023
DEMO Design office services to support the central team-I	Scheduled in Q2 2023
DEMO Preliminary Design of Safety Mitigation System	Scheduled in Q2 2023
DEMO Cost estimation services-II	Scheduled in Q4 2023
DEMO System design (cooling water, safety & convent. systems)-II	Scheduled in Q4 2023
DEMO Design office services to support the central team-II	Scheduled in Q1 2023
DEMO Configuration management services-II	

DONES	
DONES Safety-III	Scheduled in Q1 2023
DONES Maintenance and RAMI analysis	Scheduled in Q1 2023
DONES Lithium Systems-II	Scheduled in Q2 2023
DONES Control Systems-II + DONES Accelerator Systems-III + DONES Test Systems-III	Scheduled in Q4 2023
DONES Safety-IV	Scheduled in Q3 2024
DONES Lithium Systems-III	Scheduled in Q4 2024



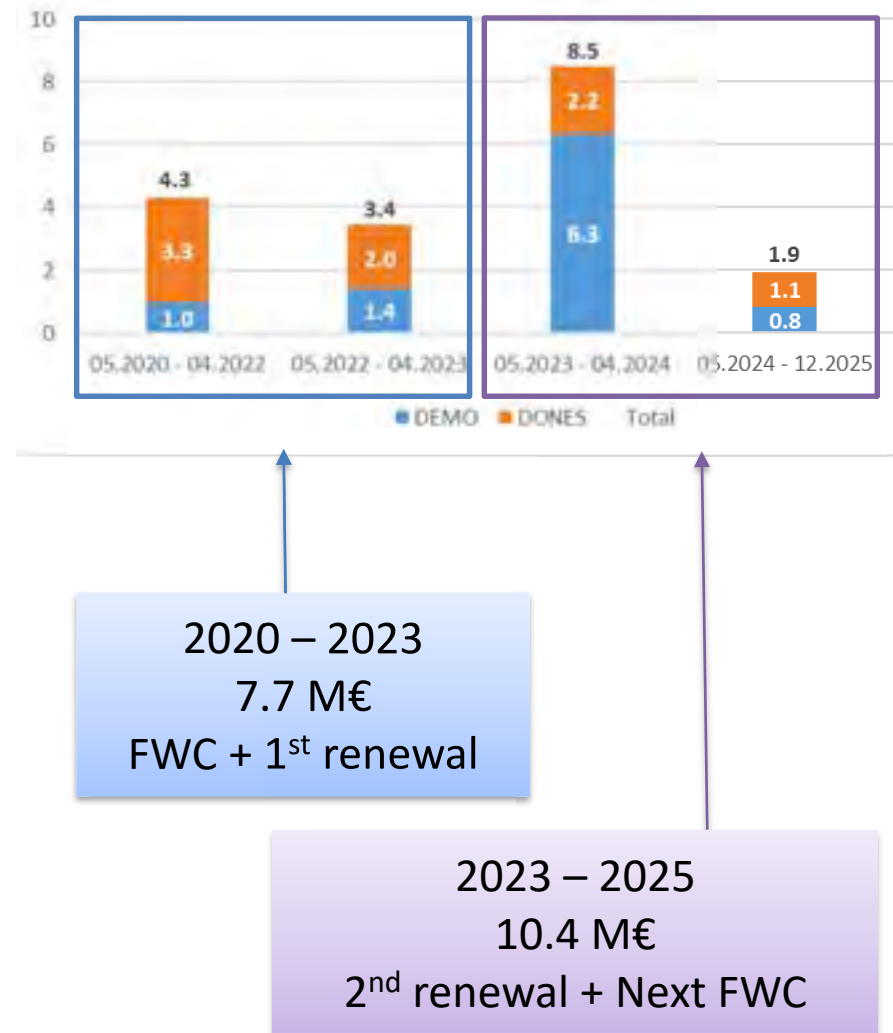
FWC Budget (2020 – 2025)



01 Framework Contract (FWC)

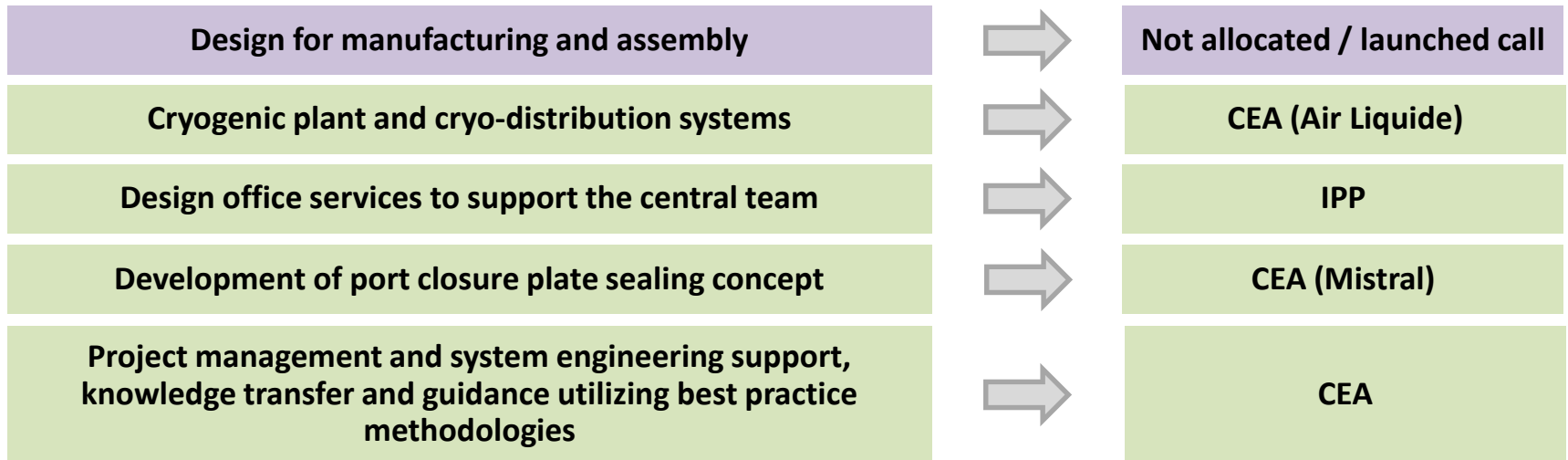


- 12 M€ budget is not enough to implement all the scheduled SCs
- With the actual budget we can cover only the period May 2020 - October 2023 (FWC + first renewal + part of second renewal).
- Discussion started with the European Commission to extend and refinance the existing FWC or to launch a call for another FWC covering the period 2024-2025.





Scheduled Tasks



Total budget: 3.800 k€ for the period 2022-2025



- Activities started in 2022 for the tasks:
 - *Cryogenic plant and cryo-distribution systems* (Technical discussion in progress with Air Liquide)
 - *Development of port closure plate sealing concept* (Technical discussion in progress with Mistral)
- Call launched for the task *Design for manufacturing and assembly*
- Technical specification to be finalized for the task *Project management and system engineering support, knowledge transfer and guidance utilizing best practice methodologies*

03 Lessons learned (ITER, W7X, etc.)



Can take into account manufacturing capabilities, return of experience of similar components, etc.

Frequent changes
High risks
Flexibility to integrated tech. R&D

FOR industry

- Plant detail design when stable and precise functional spec.
- Mech. and component design: best choice

NOT for industry

- Architecting and integration of first of kind

FOR labs and dedicated org.

- Conceptual and basic eng. of first of kind

NOT for labs and dedicated org.

- Details and manufacturing design

Link between tech. R&D & eng.
Find right trade-offs
Complex (unique) integration issue

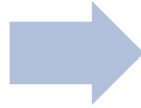
NO BUILT-TO-PRINT by LABs
(manufacturer has to commit)





During conceptual design phase, industry is involved as a partner for

- some technology R&D development in selected areas (e.g. closure plate, complex mechanical structures, etc.);
- as advisor for some engineering tasks (e.g. layout, building design, etc.);
- as consultant to take into account in the conceptual design the constraints coming from the other phases (in particular manufacturing and assembly constraints).



During the basic engineering phase, the role of the industry should cover

- the realization of large prototypes to validate the design manufacturability
- the basic eng. design of plant system



During the detailed design

- industry performs all details and manufacturing design
- partnerships shall be established in order to ensure that the industry that has performed a given manufacturing design commits to manufacture the piece



Project activities	Project Phase			
	Conceptual Design	Basic Eng. Design	Detail & manufacturing design	Construction
Project Sponsor	Dedicated organisation with assistant project sponsor capabilities separated from project management			
Project Management	EUROfusion	DEMO Organization (or equivalent)	DEMO Organization or Industry (to be defined)	DEMO Organization or Industry (to be defined)
Architecting, integration, System Engineering, etc.	EUROfusion	DEMO Organization (or equivalent)	DEMO Organization (or equivalent)	DEMO Organization or Industry (to be defined)
Tech. R&D	EUROfusion	EUROfusion	n/a	n/a
Conceptual design	EUROfusion	DEMO Organization (or equivalent)	n/a	n/a
Basic Eng. Design of fusion systems	n/a	DEMO Organization (or equivalent) * with Industry as advisor	DEMO Organization (or equivalent) (diagnostics, etc.)	n/a
Basic Eng. Design of non fusion systems (utilities, etc.)	n/a	Industry	Industry (nota: the remaining part of basic eng. Design shall be limited as it may poses integration problems)	n/a
Detail and Manufacturing Design	n/a	n/a	Industry	Industry
Construction	n/a	n/a	n/a	Industry

Partnership to ensure that the industry performing the design is also in charge of the construction



Any advices or questions?