1. The ITER project & F4E
2. Industrial Involvement
3. Procurement Processes
4. Business Opportunities
5. Securing the Supply Chain
1. The ITER project & F4E
2. Industrial Involvement
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What is ITER for?

Demonstrate fusion as practicable energy source

- Fusion energy generation on large scale
- 10 times more energy generated than consumed (500 MW)
- Study of “burning plasma” and its long operation
- Testing key technologies for future fusion reactors
The ITER project

Each party contributes its best capabilities

- Domestic Agencies and Central Team develop and deliver different ITER components
- Europe is the main contributor, about half of the components
- Domestic agencies work with research centers and industry to design and manufacture components
What is the ITER Central Team?

The integration and operation team for ITER, coordinating all 7 domestic agencies

- International organization, established in 2007
- 7 parties
- Headquarter: Cadarache, France
- Staff: 500+
What is Fusion for Energy?

The European domestic agency for ITER and the development of fusion energy

- European joint undertaking, established in 2007
- 29 member states (EU28 + CH)
- Headquarter: Barcelona, Spain
  Other sites: Cadarache, France
  Garching, Germany
  Rokkasho, Japan
- Staff: 400+
- 2007-20: approximately € 6 B € for ITER
- Remaining Budget to 2020: ~1.5 B €
F4E’s mandate

Developing fusion energy through three projects

- Ensuring the European contribution to **ITER**
- Coordinating European collaboration with Japan in bilateral fusion research projects, **Broader Approach**
- Preparing the technological and industrial capacity for the following demonstration of a fusion power reactor, **DEMO**
1. The ITER project & F4E
2. Industrial Involvement
3. Procurement Processes
4. Business Opportunities
5. Securing the Supply Chain
ITER matters to economy

Benefits for economy, knowledge and growth

- Promote advanced knowledge and spin-offs
- Connect enterprises and research organizations to deliver innovation
- Increase potential for large industry and SMEs
- Promote European competitiveness
- Generate economic growth and jobs
Commercial benefits

Direct Commercial (Jobs, growth)
Indirect Commercial
Innovation and Human
ITER R&D
ITER Construction
ITER Operation

ITER Construction
ITER R&D
Innovation and Human
Direct Commercial (Jobs, growth)
Indirect Commercial

AIPE Workshop on ITER and Fusion Energy
F4E industrial policy

**First Objective (Priority)**
Deliver the European contributions to ITER and the Broader Approach within the agreed budget and schedule making best use of the industrial and research potential and capabilities of all F4E members, in line with competition rules.

**Second Objective**
Broaden the European industrial base for fusion technology for the long-term development of fusion as a future energy source and to ensure a strong and competitive European industrial participation in the future fusion market.

**Third Objective**
Foster European innovation and competitiveness in key emerging technologies to further the development of the Innovation Union and its impact at the international level.
Work Contracted Around Europe

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Italy
- Latvia
- Netherlands
- Poland
- Portugal
- Romania
- Slovenia
- Spain
- Sweden
- Switzerland
- United Kingdom

Contracts

Grants

Third Country
Work Contracted in Italy

<table>
<thead>
<tr>
<th>Number of Items</th>
<th>Number</th>
<th>Awarded value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracts</td>
<td>78</td>
<td>~650 M €</td>
</tr>
<tr>
<td>Grants</td>
<td>18</td>
<td>~15M €</td>
</tr>
</tbody>
</table>

Example of the Neutral Beam Test Facility in Padova with several Italian contractors or subcontractors
1. The ITER project & F4E
2. Industrial Involvement
3. Procurement Processes
4. Business Opportunities
5. Securing the Supply Chain
F4E's rules and regulations

• Contracts according to transparency, proportionality, equal treatment and non-discrimination
  - No mandatory geographical distribution

• Tenders competed to all European economic operators
  - Tender worldwide if necessary
  - Share information with other Domestic Agencies and IO (eg: Joint Procurement)
  - Negotiate directly if justified

• Best value for money
  - Cost and quality awareness
  - Risk Management rather than Risk Avoidance
Procurement procedures

Fusion for Energy

Administrative Procurements
- F4E’s Administrative functioning & needs
- Call for Tender
- Full funding

Operational Procurements
- F4E’s Operational tasks
- Call for Tender
- Full funding

Contracts

Grants
- Research & Development
- Call for Proposal
- Partial funding (40%)
**Procurement procedures**

- **Procurement contracts to secure goods, works or services through:**
  - Open procedure: all interested economic operators can submit a full tender
  - Restricted procedure → Phase 1: Selection, following a call for expression of interest
    → Phase 2: Invitation to tender: only for selected companies
  - Competitive dialogue (2 steps procedures): for particularly complex contracts, collaboration with industry to clarify tech specs
  - Negotiated procedure: only for contracts below 250 k€ or exceptional cases

![Diagram of procurement procedures](image)
• More flexibility (room for negotiations) in procurement procedures for not off-the-shelf components

• New thresholds – negotiated procedure based on single tender
  ▶ In particular negotiated procedure based on single tender for supplies/services the result of which is for R&D purposes in ITER/BA context below 135 K EUR.
  ▶ “contracts for supplies and services, the result of which is intended to be used for the purposes of research, experiment, study or development within the context of the implementation of the Joint Undertaking’s operational tasks” (Art. 85d)

• More flexibility for contract modifications
Exclusion criteria

• **Exclusion from participation if:**
  - bankruptcy procedure
  - conviction of an offence
  - serious professional misconduct
  - non-fulfilment social security
  - tax obligations
  - fraud, corruption
  - serious breach of contract in the past

• **Model declaration on honour** must be provided as part of the procurement procedure

• **Only awarded tenderers are required to provided evidence backing the declaration on honour.** Eg: Certificato del casellario giudiziale, Certificato assenza di fallimento, Comunicazione di regolarità fiscale, Documento Unico di Regolarità Contributiva
Selection Criteria

• Is the tenderer qualified to carry out the contract? Yes/ No answers

• Economic & financial capacity:
  ▸ Noteworthy values: Turnover, Simplified Cash Flow
  ▸ Minimum viability standards: Liquidity, Solvency, Profit Margin, Gross Margin

• Technical & professional capacity:
  ▸ list of similar projects, CV’s of staff, QA, list of equipment etc.

The selection criteria are proportionate to the scope of the contract = No preference for large companies
• the Best Value for Money award procedure
The contract is awarded to the compliant tender with the best price-quality ratio, taking into account criteria justified by the subject of the contract.

Tech. score = tech. points tender / tech. points from best tech. tender x 100
Financial score = lowest price / price tender x 100

Example award formula
Total score = 40% X technical score + 60% X financial score

• the automatic award procedure (Lowest price)
The contract is awarded to the compliant tender offering the lowest price.
Information to be provided

• Administrative documents (Most of it can be re-used)
  Eg.: Identification Form, Legal Entity Form, Financial Identification Form, Financial Capacity Assessment Form, QA Questionnaire etc.

• Financial proposal

• Technical proposal
  ▸ Specific technical information in relation to the scope of the procedure
  ▸ Preliminary Quality plan (Most of it can be re-used – min 10% of technical points)

Formal but standard way to request the information
Part of Information can be re-used → accessible investment
Procurement procedures

- **Organization**
  - Procedure managed by Technical Project Officer and
    - Procurement Project Officer

- **TPO and PPO have support of specialists**
  - Legal and Finance Officers
  - Market Intelligence Officers
  - Quality Officers
  - ...

- **External networks ensure good market contact**
  - Industrial Liaison Officers (ILO)
  - European Fusion Laboratories Officers (EFLO)

  - Only F4E point of contact for questions during competition
  - F4E point of contact for pre-competitive questions
  - Local point of contact before, during and after competition
Procurement lifecycle

F4E Business Intelligence – F4E Industrial Policy

F4E signs PA with IO

Procurement strategy

Call for Tender

Contract with supplier

Delivery

Supplier Evaluation

F4E Industry Portal

Market analysis

User Registration
Pre-qualification
Industry Mapping

PA = Procurement Arrangement
IO = ITER Organization
TED (F4E shown for Spain):

- [http://ted.europa.eu/TED/browse/browseByBO.do](http://ted.europa.eu/TED/browse/browseByBO.do)
F4E Website & F4E Industry Portal

F4E is accessible via 2 distinct channels:

- **F4E Website:**
  - Latest News about ITER Project
  - Corporate Information about F4E
  - Links to F4E Tools & News


- **F4E Industry Portal:**
  - Interface between F4E & Industry
  - Home of Announcements, Calls & Market Surveys
  - Host for ILOs National Initiatives
  - Supplier database & Industry Mappings

See F4E Industry Portal: [https://industryportal.f4e.europa.eu/default.aspx](https://industryportal.f4e.europa.eu/default.aspx)
F4E Suppliers Referencing

Scope:
- Referencing Process applies to all Legal Entities
- By default status is “Not Started”
- Systematic review operated by BI Group

Objectives:
- Review of Legal Entities’ documents with focus on:
  - administrative documents,
  - financial capabilities,
  - previous experience,
  - quality management system
- Provide personalized support to LEs throughout the process
- Ensure closed follow-up with all LEs during first steps and data update

Advantages of the Referencing:
- Increased visibility within the Fusion Industry
- Get recognized among pairs within the F4E Industry Portal
- Label trustworthy LEs through systematic review
- Give advantage to pre-qualified LEs for upcoming business opportunities
- Encourage LEs pro-active data management
F4E Request for Partnership

Scope:
- Networking feature available to all LEs
- ILOs have a consultation role
- BI Group monitors all publications made by LEs

Objectives:
- Enhance industry cooperation among operators
- Offer a networking platform for first exchange
- Find technical solutions or help
- Encourage LEs pro-active data management
- Promote pre-qualified operators

How it works:
- LEs can publish announcement to ALL
- LEs can contact specific operators (dedicated email)
- ALL profiles can use the F4E Suppliers Database

2 Easy Steps:
1. Any LE can publish a New Announcement
2. An Additional email can be sent out to specific LEs for specific business opportunities
1. The ITER project & F4E
2. Industrial Involvement
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5. Securing the Supply Chain
How to assemble it?
Contract Map for ITER Assembly & Installation

ITER Organization

1. Construction Manager-as-Agent (CMA)

Domestic Agency Works Contractors

2. Machine Assembly Works
   - ASY

3. Mechanical & Piping Works
   - MCP

4. Electrical, I&C Works
   - EIC

5. Specialized Works
   - SPx
     - Super Conducting Joints
     - Special Techniques

Tokamak Works Contracts

Balance of Plant Works Contracts

Support Contracts

6. Lifting & Handling
   - LFT

7. Scaffolding
   - SCF

8. Access, Plant Hire
   - APH

9. Civils & Finishing
   - CIV
MITICA Beam Line Components (BLCs)

• MITICA BLCs – Delivery in Padova (NBTF) - 2016 (Q4)
  - Actively cooled - 2.4 MPa water pressure
  - Water cooled OFHC copper (Max power density≈ 0.5 MW/m²). Water Cooled Panels or tubes in CuCrZr (Power density > to 1MW/m²)
  - Structure and piping manifold made out of AISI 316 L. Numerous heterogeneous joints are present
  - Welding techniques needed. Electron Beam (EB) Welding foreseen
  - Deep drilling technology for the walls of NED and RID
  - Vacuum expertise necessary. Assembly and metrology (alignment) competencies required

Neutraliser (NED) - (0.5 MW/m² to 3MW/m² leading edges) 5.5MW - 15 tons

Calorimeter 14MW/m² - 18MW - 7tons

Electrostatic Residual Ions Dump (RID) 6MW/m² - 19MW - 5 tons
LIST OF MAIN HNB CONTRACTS (2 INJECTORS) FOR ITER TO BE LAUNCHED BY F4E (DELIVERY CADARACHE) - CfT aligned to ITER 2016 scheduling underway

<table>
<thead>
<tr>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Beam Line Components (Neutralizer, Calorimeter, RID)</td>
</tr>
<tr>
<td>2 4 lots:</td>
</tr>
<tr>
<td>• Vessels (Beam Line + Beam Source),</td>
</tr>
<tr>
<td>• Drift Duct,</td>
</tr>
<tr>
<td>• Exit Scraper,</td>
</tr>
<tr>
<td>• Fast Shutter- All except Exit Scraper are SIC-1 (RCC-MR code)</td>
</tr>
</tbody>
</table>

For more details, please consult the presentation made at MIIFED/IBF 2016 and published on the F4E Industry Portal: Click HERE
ITER HNB components

The NBI Vessel

An extension of the primary vacuum confinement and of the primary safety barrier – SIC1 (RCC-MR code)

2 x 2 Stainless-Steel Tanks (Beam Line Vessel and Source Vessel) - (5 x 5 x 15 m³)

Weight: BLV -> about 40 tons - BSV -> about 30 tons
ITER HNB components
(Front End components)

RCC-MR Code
<==>
ASME Section III

**Drift Duct**

**SIC1** (RCC-MR code) → Casing and Stainless Steel Bellows
Non SIC → Internal liner Deep Drilled in CuCrZr

**Fast Shutter**

SIC1 (RCC-MR code)
Stainless Steel Casing

**Exit Scraper** - Non SIC
Stainless Steel Support +
Deep Drilled Panel in CuCrZr
Blanket Cooling Manifold

Task 1: Chimney Pipes

Task 2: 6 Sectors IB+OB
Task 3: 3 Sectors IB+OB

Task 5: Upper Port Pipes

Inboard system (IB) = 8-pipes bundles

Outboard system (OB) = 12-pipes bundles

Task 4: Lower Port Pipes feeding NBI modules

Task 6: Branch pipes + Coaxial Connectors (ITER Assembly Phase 2)
Skills and competencies expected from the tenderers:

- Cold bending of pipes of relevant dimensions;
- Accurate shaping of pipe profile (e.g. ± 1.5mm at critical locations);
- Fast and accurate laser survey methods during production;
- Stress annealing by heat treatments;
- Pipe Welding (TIG) with and without filler material;
- Non-Destructive Examination (visual inspection, X-ray, ultrasonic testing);
- Application of ceramic/alumina coating on Stainless Steel (SS) as electrical isolation;
- Brazing of CuCrZr on ceramic/alumina and CuCrZr on SS.
### Blanket Cooling Manifold
Summary of next calls for tender

<table>
<thead>
<tr>
<th>Systems</th>
<th>Planned activities</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanket Cooling Manifold</td>
<td>Information day at F4E Barcelona</td>
<td>TBD</td>
</tr>
<tr>
<td>Blanket Cooling Manifold</td>
<td>Call for Tender 1 (Tasks 1 to 3)</td>
<td>TBD</td>
</tr>
<tr>
<td>Blanket Cooling Manifold</td>
<td>Call for Tender 2 (Tasks 4, 5)</td>
<td>TBD</td>
</tr>
</tbody>
</table>

- **TBD dates:** To Be Defined after approval by the ITER Council of the on-going 2016 ITER scheduling.

- For more details, please consult the presentation made at MIIFED/IBF 2016 and published on the F4E Industry Portal: [Click HERE](#)
Divertor Cassette Assembly
Installation of Plasma Facing Components

VERTICAL TARGET
INNER AND OUTER

PIPE STUBS

KNUCKLE

DOME

NOSE

CASSETTE BODY (CB)
STEEL STRUCTURE
Main operations of the Plasma Facing Component (PFC) installation work:

- Design & procurement of welding and inspection tools;
- Jigs and fixtures for the assembly of the PFCs onto the Cassette Bodies (CB);
- The qualification of the assembly procedures by means of the full-scale PFCs and CB prototypes;
- Acceptance tests of the Divertor cassette assembly as follows:
  a. Cold water flow test
  b. Hydraulic Pressure test
  c. Cold He leak test
  d. Dimensional control
Full scale dummy prototype manufacturing and testing

Achievements (2005):

- Verification of the hydraulic design of the divertor.
- Verification of assembly and integration procedures on a full-scale prototype with realistic tolerances, dimensions, weight and accessibility.

ANSALDO (Manufacture) & ENEA (Installation)
Technical experience in:

- Assembly of High Vacuum components (for pressure equal to or less than $10^{-2}$ Pa);
- Welding, inspection and welding qualification of austenitic stainless steels materials in accordance with standards;
- Precise machining (e.g. interfaces adjustment);
- Helium leak testing (leak rate equal to or less than $1.10^{-7}$ Pa.m$^3$.s$^{-1}$) of components with dimensions equal or greater than 2 m x 0.5 m x 0.5 m;
- Hydraulic flow and pressure testing (equal or greater than 50 bars);
- Dimensional inspection and precise handling (survey of components of 2 m x 1 m x 0.5 m with tolerances equal or less than 0.1 mm).
## Divertor Cassette Assembly
### Summary of next calls for tender

<table>
<thead>
<tr>
<th>Systems</th>
<th>Planned activities</th>
<th>Call</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divertor Cassette Assembly</td>
<td>Market survey to provide F4E with preliminary information on possible candidates.</td>
<td>TBD</td>
</tr>
<tr>
<td>Divertor Cassette Assembly</td>
<td>Information day to allow exchange of information with possible bidders prior to the Call-for-Tenders.</td>
<td>TBD</td>
</tr>
<tr>
<td>Divertor Cassette Assembly</td>
<td>Call-for-Tender for the installation of PFCs on the Cassette Bodies.</td>
<td>TBD</td>
</tr>
</tbody>
</table>

- **TBD dates:** To Be Defined after approval by the ITER Council of the on-going 2016 ITER scheduling.
- **For more details, please consult the presentation made at MIIFED/IBF 2016 and published on the F4E Industry Portal:** [Click HERE](#)
VACUUM PUMPING PROCUREMENT - CRYOPLANT

- **Equipment:**
  - Cryopumps = vacuum pumps which trap gases and vapours on a cold surface.
  - Cold valve boxes and cryolines.

- **Duties:**
  - To provide torus and cryostat with clean, ultra high vacuum at large pumping speed.
  - To pump the gas fed to the ion sources and neutralizers of the neutral beams.
  - To distribute helium to and from the cryopumps.

- **Experience required:**
  - For design: vacuum, cryogenics, construction codes.
  - For manufacturing: welding and machining, helium leak detection, metrology, cleanliness, coating, pressure equipment.

*For more details, please consult the presentation made at MIIFED/IBF 2016 and published on the F4E Industry Portal: [Click HERE](#)*
Overview of Relevant Business Opportunities for Italian Industry

- ITER Organization Assembly Calls
- Neutral Beam Components (both for NBTF and NBI)
  - MITICA Beam Line Components
  - HNB Beam Line Components
  - NBI Vessels
  - NBI Front End Components (Drift Duct / Fast Shutter / Exit Scraper)
- In-Vessel Components
  - Blanket Cooling Manifold
  - Divertor Cassettes Assembly
- Cryoplant & Fuel Cycle
  - Vacuum Pumping

Overview of possible relevant business opportunities pending approval by the ITER Council of the on-going 2016 ITER scheduling

For more details, please consult the presentation made at MIIFED/IBF 2016 and published on the F4E Industry Portal: Click HERE
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5. Securing the Supply Chain
Securing F4E’s Industrial Base

- F4E and the ITER Project face similar challenges:
  - Industrial heritage from previous fusion/fission programmes
  - Securing long term industrial base
  - Economic pressure and challenges
  - Capabilities challenges
  - Quality challenges

- Need for the development of integrated and reliable supply chains:
  - Define what good Knowledge Management means across the nuclear industry
  - Break down silos and share
  - Consult with integrated supply chain
Securing the European Supply Chain for ITER

What do we need to do now to secure the European supply chain for future fusion developments?

• Let’s work together:
  • Develop the overall supply base
  • Create safety culture
  • Facilitate knowledge / technology transfer
  • Build upon existing capabilities

• Stimulate Supply Chain Innovation:
  • More agile and responsive integrated supply chains
  • Introduce knowledge management
Towards commercial power-plants

ITER is about integrating suppliers and their expertise
Feedback from Italian Contractors - OCEM

Challenging experience but exciting!

- Management of complex projects / contracts
- Intellectual Property / Supplier management
- Advanced Quality Assurance management system
- Motivation of staff
- "Think big"
- Cooperation with Research Centers and Universities
- Development of innovative solutions / products
- Visibility

OCEM’s own Experience:

Over 100 jobs were preserved

F4E’s contract of 20 million EUR helped to attract a new investor and secure the long-term viability of the business

“We are an SME...we are small but this kind of project helps us to think big”

Giuseppe Taddia OCEM
Ion Source and Extraction Power Supplies System
Feedback from Italian Contractors - OCEM

• **Some improvement opportunities / issues / challenges**
  - High level of skills are required and people need continuous training.
  - Discontinuity of business
  - Costs and resources to prepare an offer
  - Tight and uncertain schedule
Stories of (recurrent) success

Product-centric
Components
Big Science as any other business

Technology-centric
Sub-systems
Big Science as springboard into mainstream

Skill-centric
Pooling capabilities to deliver systems
Big Science as core business
Whole is more interesting than parts
Summary

ITER project is an accessible Big Science Project, an investment with concrete industrial benefits

All kind of companies can inbound to the European contribution to ITER

Industrial involvement of Italian companies is a pre-requisite to the ITER project success

Integrated Nuclear Supply Chain and Continuous Improvements aligned with the F4E Industrial Policy
Thank you for your attention

www.f4e.europa.eu
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