

## Annex A: Case studies

### Case study selection

The case studies were selected in partnership with DG ENER and F4E, and also drawing upon the responses to the survey which asked if respondents would be willing to cooperate as a case study. This led to a longlist of around 30 firms as possible case studies. Each of these were approached and from this those that were able to cooperate were interviewed and with the support of desk-research a case study was drafted.

### The case studies

#### *Case study 1: ITER benefits medicine, life science and materials analytics (Bruker Biospin)*

##### The company

Bruker Biospin is one of the subsidiaries of Bruker Corporation, with worldwide more than 6,000 employees at 90 locations. Bruker delivers the world's most comprehensive range of research tools enabling life science, materials science, analytical chemistry, process control and clinical research. Bruker is also the leading superconductor magnet and ultra-high field magnet manufacturer for NMR and MRI solutions. Bruker Biospin, specialising in Magnetic Resonance & Preclinical Imaging, has some 61 offices over all continents.

##### Main case-study characteristics

The ITER contract involves the delivery of niobium-tin strands for the superconducting magnets used to confine the plasma at ITER. The experience gained at ITER has contributed to making niobium-tin the standard for high-end Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) technology, and helped to make Bruker Biospin a world leader in these fields. The contract came about through a long-standing research cooperation between Bruker and the Karlsruhe Institute for Technology (KIT) that still continues today. NMR and MRI are widely applied for research and imaging in medicine, life sciences and materials analytics.

Main characteristics	
Company	Bruker / Bruker EAS
Country	Worldwide / Germany
Contract title	Supply of Chromium plated Niobium-Tin Strand (OPE-005)
Contract value	EUR 22.8M
Contract period	2009 - 2014
ITER Component	Magnets
F4E Work Package Code	11

##### Description

Nuclear fusion at ITER requires superconducting magnets able to confine the ultrahot plasma in which the fusion processes take place. New materials have to be developed for these magnets which can be applied in a wide range of analytical applications that can be used in areas varying from medicine and life sciences to materials analytics.

In ITER, 18 coils will shape a magnetic cage responsible for keeping the plasma away from the walls of the vessel. Europe has been tasked with the production of 10 of these so-called ‘Toroidal Field coils’ (one of which will be kept as spare), whilst Japan will manufacture the nine others. Bruker Biospin, is responsible for producing the specific niobium-tin strands for the coils. In 2009, Bruker EAS was awarded by F4E a contract for the procurement of 37 tonnes of niobium-tin superconducting wires, worth EUR 24,5 million.

### **Main impacts**

#### **New business opportunities**

Supplying ITER with niobium-tin superconducting strands, Bruker Biospin improved its own tin wire manufacturing process: the company had to overcome technical issues in terms of strand quality, which triggered improvements in the whole manufacturing line: yield, stability and quality. This know-how helped in increasing the yield and quality of the tin wire manufacturing process and enhanced process stability. The tin wire required for ITER procurement were of higher quality than wires normally produced by Bruker, notably in terms of external roughness.

In 2016, Bruker held a share of about 10% in the global superconducting wires market, valued at US\$ 638.1 Million in that year. In the same year Bruker also acquired Oxford Instruments, holding another 8.8% of this market. As a result of the ITER contract, Bruker was able to improve its knowledge on the application of superconducting strands, which contributed to its use in other analytics application fields - in particular MRI and NMR. In these markets Bruker is one of the main actors, with clients for instance including Siemens, CERN, Philips, General Electric and Mitsubishi Electric. The global size of the MRI market accounted for a revenue of US\$ 6.6 billion in 2017 (€ 6.1 billion), and it is expected to grow at a rate of 6.6% during 2017-2022. With a revenue of \$ 107 million in 2016, Bruker holds a share of 1.6% in this market. The NMR market amounted to 0.77 billion in 2016 and is projected to reach USD 0.95 billion in 2022. With a revenue of \$0.56 billion in 2016, Bruker is the world leader in this market (73% market share).

#### **Employment and growth**

For the ITER contract, 12 people were hired temporarily. After expiration of the contract, these people have permanently joined Bruker Healthcare Business Unit. The team has spread the acquired knowledge in particular in Bruker’s MRI business unit.

The ITER contract allowed Bruker to improve its manufacturing line and expand its production process. In 2009, Bruker Biospin manufactured and sold about 30,000 km of superconducting wires; the company now delivers more than 60,000 km of such wires per year.

#### **Human capacity building**

The specific requirements of the ITER contract improved Bruker’s R&D capacity, and provided beneficial experiences to the teams involved in terms of troubleshooting and high-performance. The team members have since transferred methodology to other processes. Internal transfer of knowledge to other business units started immediately after the end of the project, as well as the hiring the temporary project staff as permanent staff by the MRI business unit.

### **Innovation and technology transfer**

The ITER project contributed to niobium-tin becoming the standard for the current generation of high-performance superconducting magnets used for NMR worldwide.

### **Networking and synergies**

The niobium-tin contract is the result of a long-lasting cooperation between Bruker and the Karlsruhe Institute of Technology, that already exists for decades. For the contract, Bruker fortified its existing cooperation with the KIT and also acquired in 2003 the superconducting wire producer Vacuumschmelze. More recently, in 2016 also the wire producer Oxford Instruments was bought, making Bruker now the largest superconducting wire producer in the world.

### **Conclusion**

This case shows that a materials supply and development contract for ITER can also contribute to improving high-tech analytics in many other fields, including medicine, life sciences and materials analytics. The company in this case used the ITER contract to expand a market position in the field of superconducting materials. The knowledge generated in this way was used within the same company for improving its activities in other areas. Although the direct employment within the company generated by the ITER contract was limited, the ITER contract knowledge showed important for market expansion in MRI and NMR analytics. Also, new strategic collaborations were established for the contract which formed the basis for a now leading position of the company in the superconducting wires market today.