



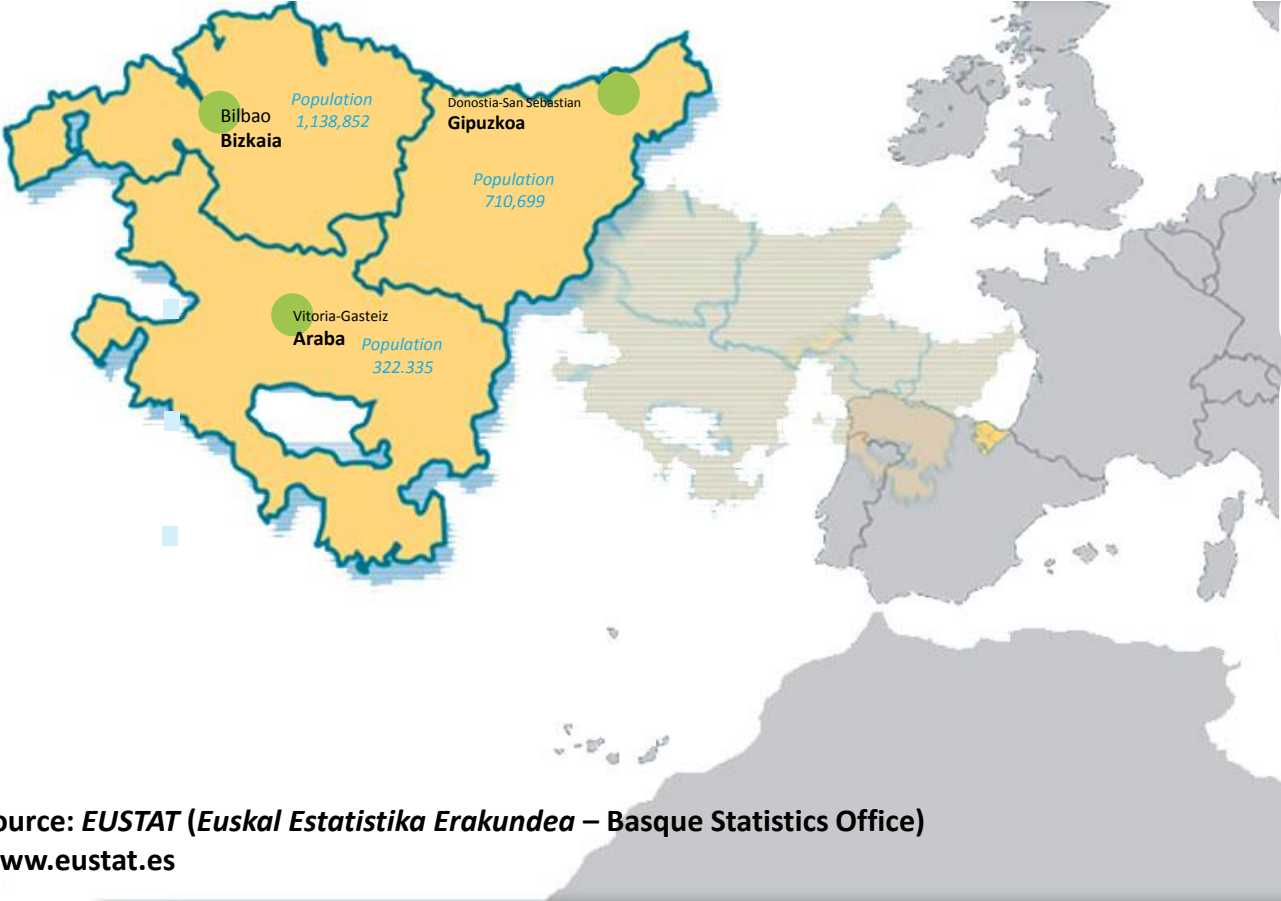
BASQUE ENERGY CLUSTER

CLUSTER DE ENERGÍA

GENERAL OVERVIEW

Basque Country: Socioeconomic data

Surface area	Population	Population density	Official languages
7,234 km ²	2,171,886	300 people/km ²	Basque and Spanish

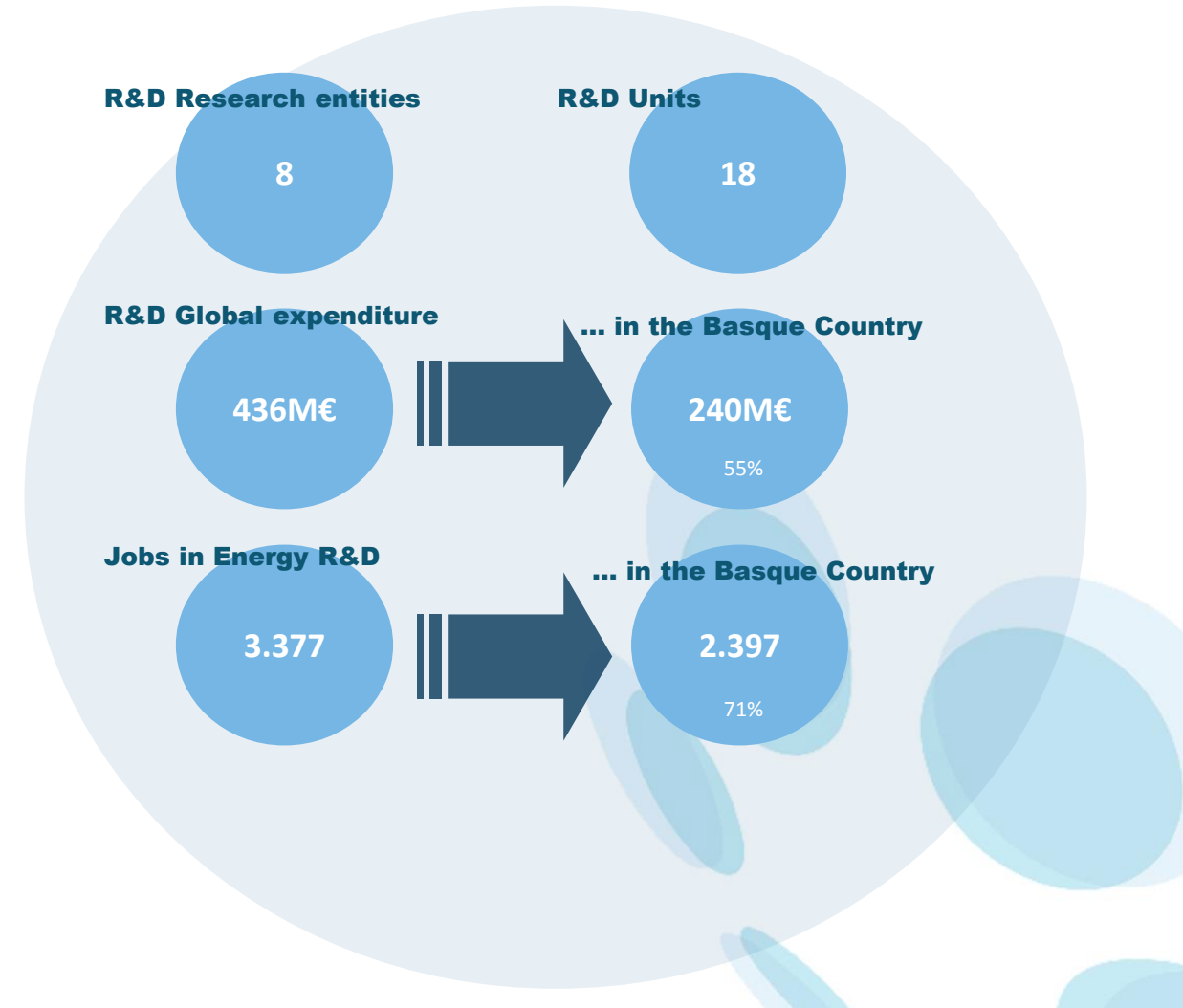
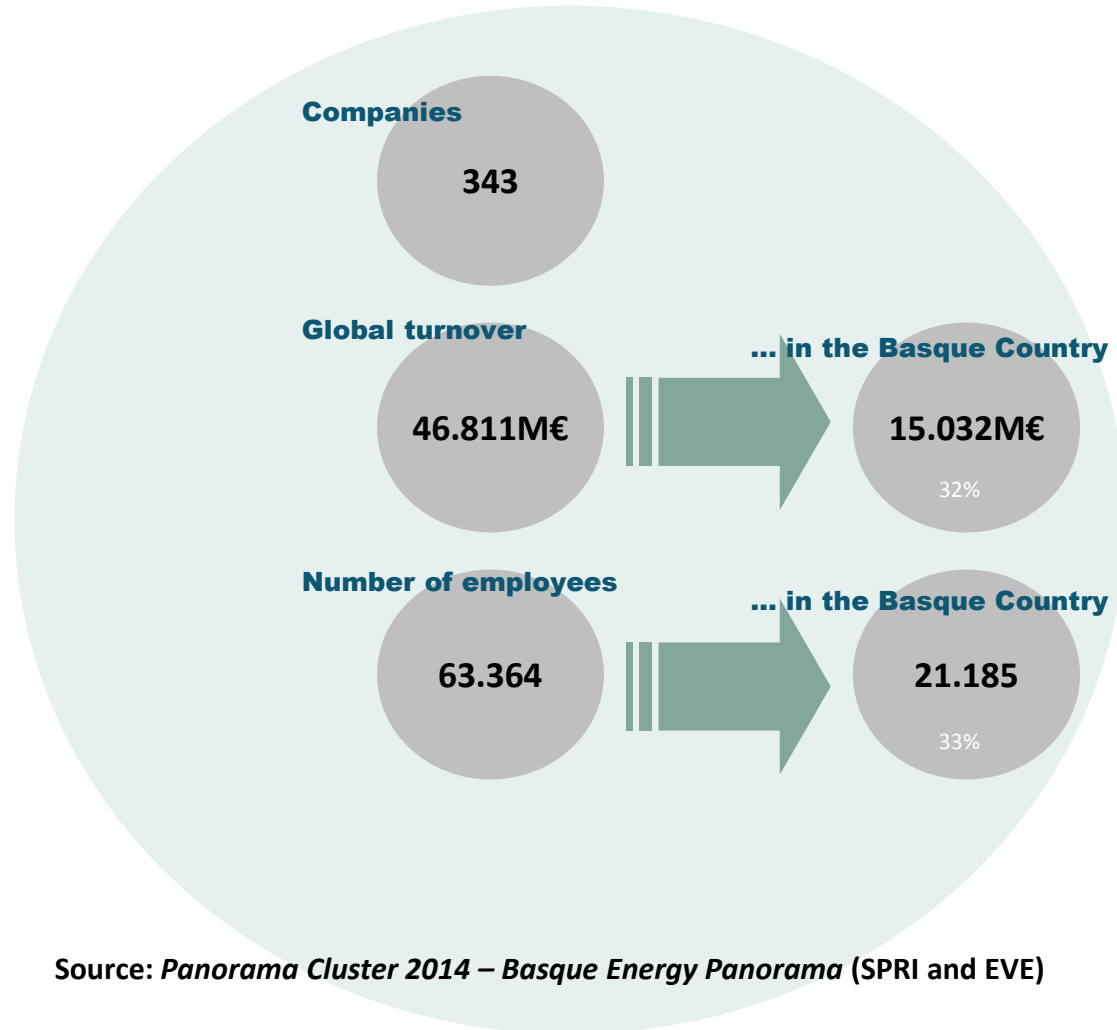


2015 Data

- GDP (% growth)**
2014: +2%
2015: +3%
- GDP per capita**
31,851 €
Spain: 23,200 €
Eurozone: 28,800 €
- % of GDP in R&D**
1,93% (2015)
- % of Industry in GDP**
2008: 24,5%
2015: 21,7%

Source: EUSTAT (Euskal Estatistika Erakundea – Basque Statistics Office) www.eustat.es

Basque companies that operate in the Energy Sector account for a global turnover of 46.800M€ and more than 63.000 employees worldwide, 21.000 of them located in the Basque Country



Source: *Panorama Cluster 2014 – Basque Energy Panorama* (SPRI and EVE)

Brief description

Set in 1997, the Basque Energy Cluster integrates the main companies in the energy sector supply chain in the Basque Country:

- Energy operators
- Component and equipment manufacturers
- Service companies

More than **60%** of the companies are **SMEs**.

Research Centres, Universities and public agencies involved in the **energy area**, can also be found between our members.

Members of the Cluster represent more than 80% of the turnover and employment of all energy business activity in the Basque Country.

In figures...

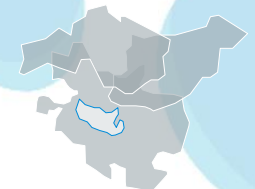
“Cluster de Energía” Association

Associated members	185
Global Turnover	43.135M€
Employees	49.307
R+D Expenses	374 M€
R+D employees	2.833
Turnover	12.207 M€
Employees	15.041
R+D Expenses	180 M€
R+D employees	1.862

Global figures



In the Basque Country



MISSION

IMPROVE GLOBAL COMPETITIVENESS of the BASQUE ENERGY SECTOR COMPANIES

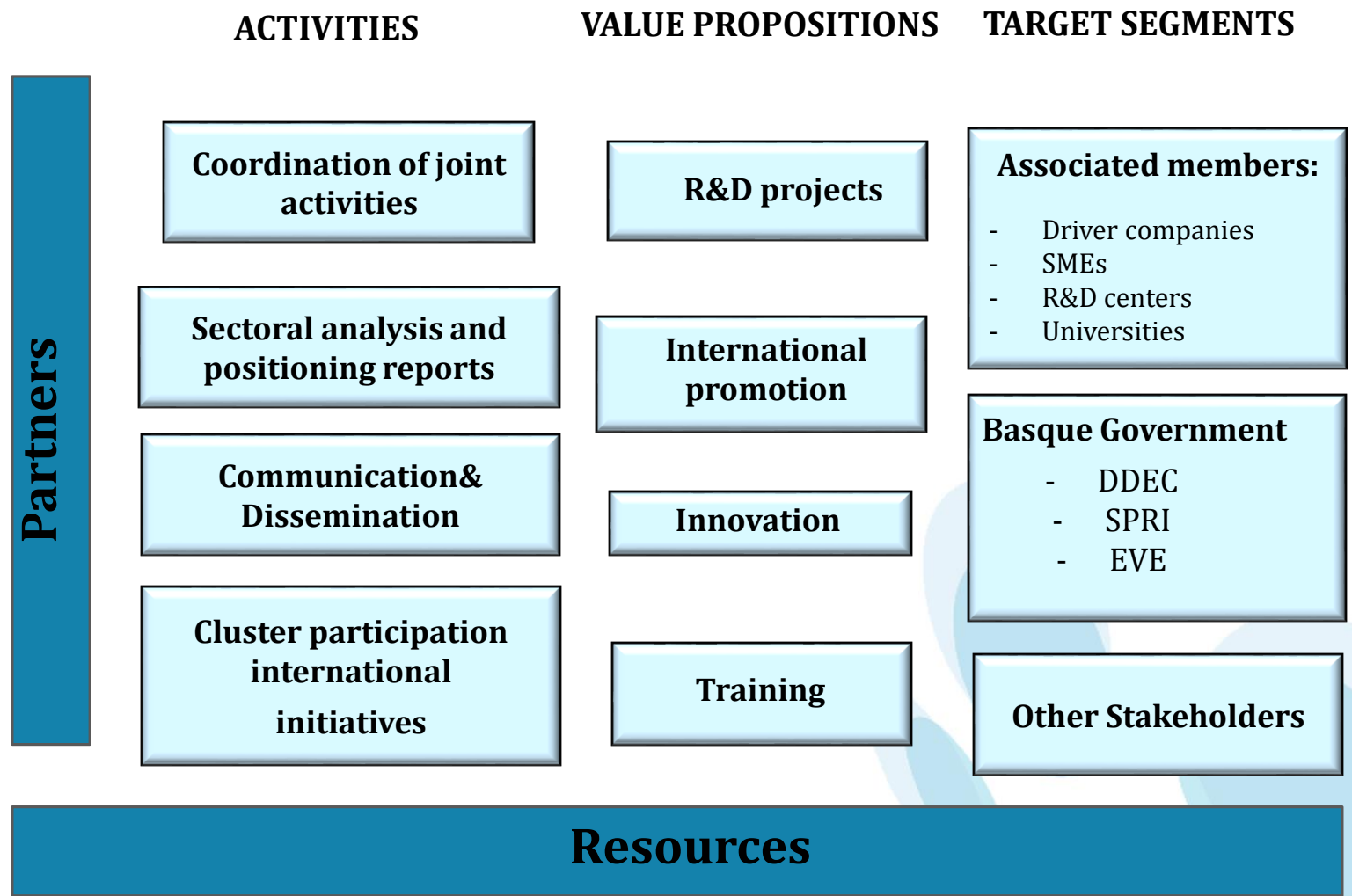


- ✓ facilitating business collaboration along the value chains
- ✓ seeking public-private partnerships

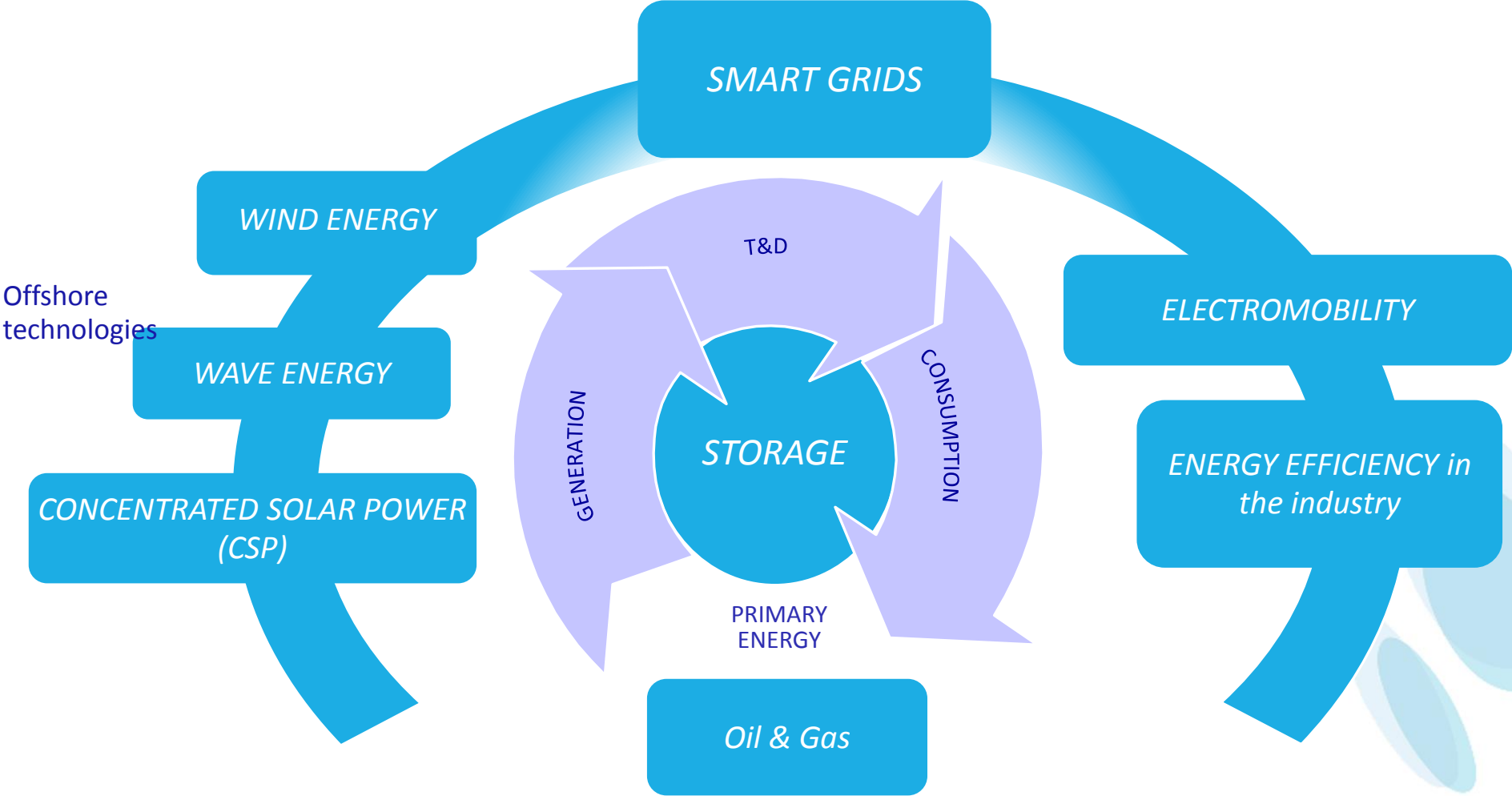
VISION

Contribute to the positioning of the Basque Country's energy sector as an international benchmark, based on its specialization and competitiveness in the selected energy value chains.

CLUSTER BUSINESS MODEL

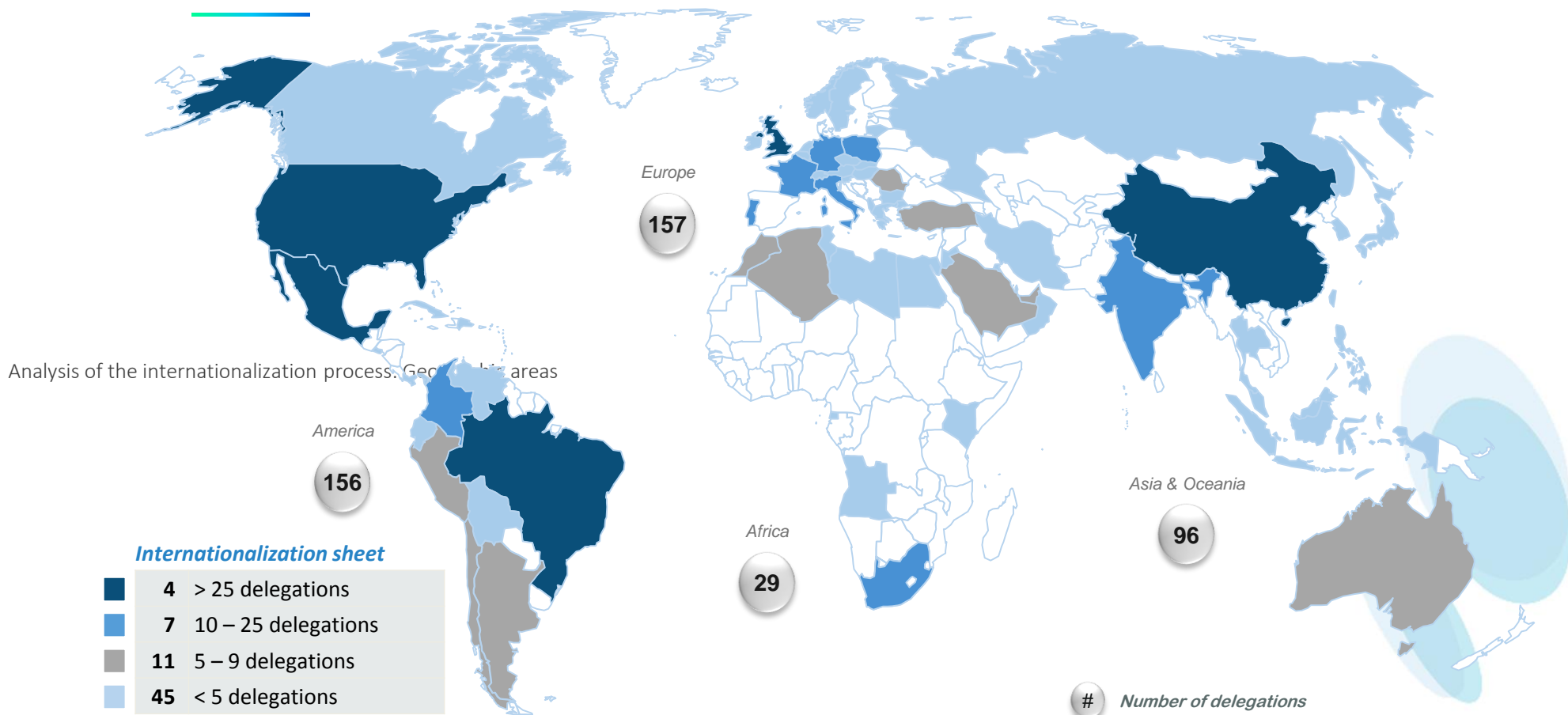


Strategic value chains in the Basque Energy Cluster



The analyzed companies are directly present in 67 countries with a total of 438 delegations

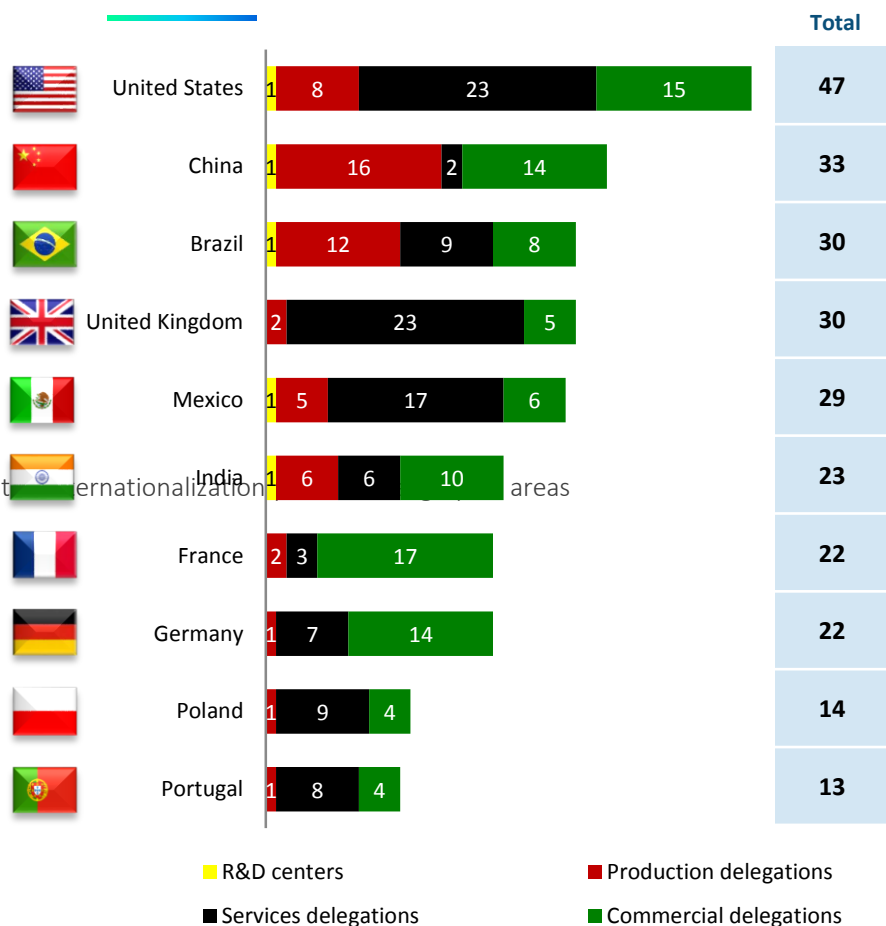
Global presence map



United States, China, Brazil, Mexico and the United Kingdom are the only countries with more than 25 delegations, followed by France, Germany and India, which each have 23 delegations

The first 10 countries, led by the U.S. and China, make up 60% of the identified international delegations

Ranking of the Top 10 countries by delegations



Other countries with delegations

Europe

- Italy (12)
- Romania (9)
- Bulgaria (4)
- Greece (4)
- Sweden (4)
- Hungary (3)
- Austria (2)
- Belgium (2)
- Ireland (2)
- Czech Republic (2)
- Russia (2)
- Switzerland (2)
- Albania (1)
- Slovakia (1)
- India (1)
- Lithuania (1)
- Montenegro (1)
- Norway (1)
- The Netherlands (1)
- Slovenia (1)

America

- Colombia (10)
- Chile (9)
- Argentina (8)
- Peru (6)
- Canada (4)
- Venezuela (3)
- Ecuador (2)
- Panama (2)
- Dominican Republic (2)
- Bolivia (1)
- Cuba (1)
- El Salvador (1)

Africa

- South Africa (10)
- Algeria (6)
- Morocco (5)
- Egypt (3)
- Angola (1)
- Equatorial Guinea (1)
- Kenya (1)
- Libya (1)
- Tunisia (1)

Asia & Oceania

- UAE (7)
- Turkey (6)
- Australia (5)
- Qatar (4)
- Singapore (4)
- Japan (3)
- Saudi Arabia (2)
- Kuwait (2)
- South Korea (1)
- Philippines (1)
- Indonesia (1)
- Iran (1)
- Jordan (1)
- Malaysia (1)
- Oman (1)
- Thailand (1)
- Taiwan (1)

Analysis of the internationalization areas

The growth of the United Kingdom, which has become a country of reference in services delegations, is because this analysis takes into account all of Scottish Power's delegations, which was acquired by Iberdrola in 2007

Working Groups, driving companies and Research entities, brands

SMART GRIDS

SMART GRIDS
BASQUE COUNTRY



IBERDROLA



WIND ENERGY

wind energy
BASQUE COUNTRY

offshore wind energy
BASQUE COUNTRY

Gamesa

IBERDROLA
Renovables

Adwen
AN AREVA GAMESA COMPANY



WAVE ENERGY

wave energy
BASQUE COUNTRY

bimep

EVE | Ente Vasco de la Energía

tecnalia
Corporación Tecnológica



CONCENTRATED SOLAR POWER

SENER

CSP energy
BASQUE COUNTRY



ENERGY STORAGE

Orona

IK4
Research Alliance

CIC energigUNE
energy cooperative research centre



ELECTRIC VEHICLE

IBIL

IBERDROLA

Ingeteam

ZNV



ENERGY EFFICIENCY IN INDUSTRY

edp naturgas energia

Proyecto CALOR

innobasque



OIL & GAS

Petronor

BBG7
BAHIA DE BIZKAIA





SMART GRIDS
BASQUE COUNTRY





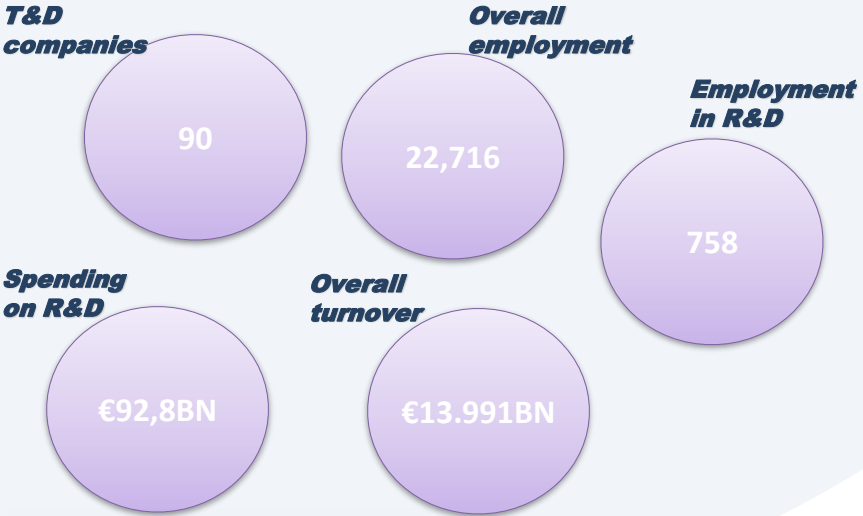
Basque Country: competitiveness hub in power networks . . .



One of the primary strengths of the Basque Energy Cluster is its experience and capacities in the field of power grids (power transmission and distribution networks)

Operations figures for Basque companies working in this field clearly demonstrate their level of domestic and international competitiveness

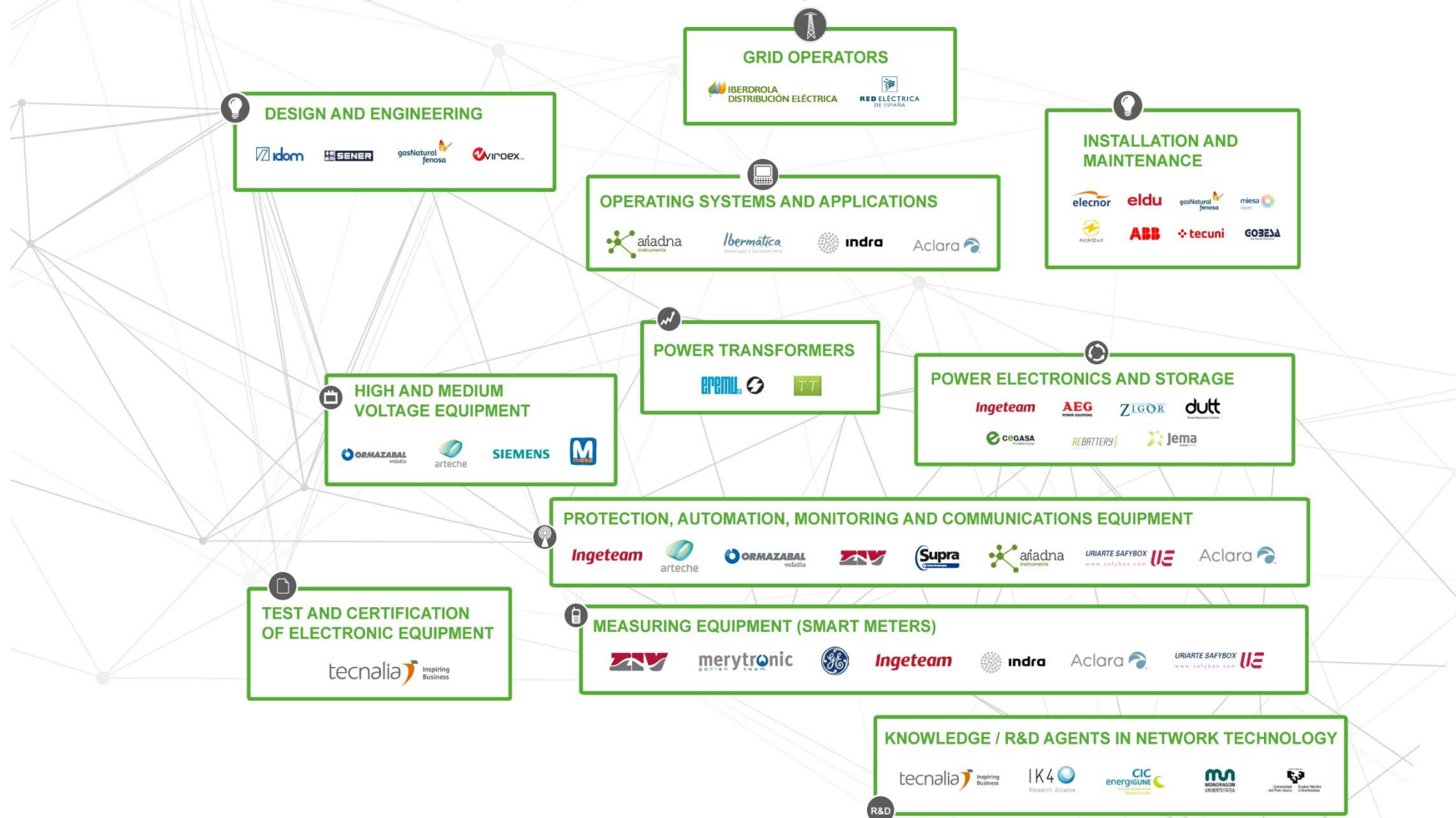
T&D in the Basque Country, 2011 figures



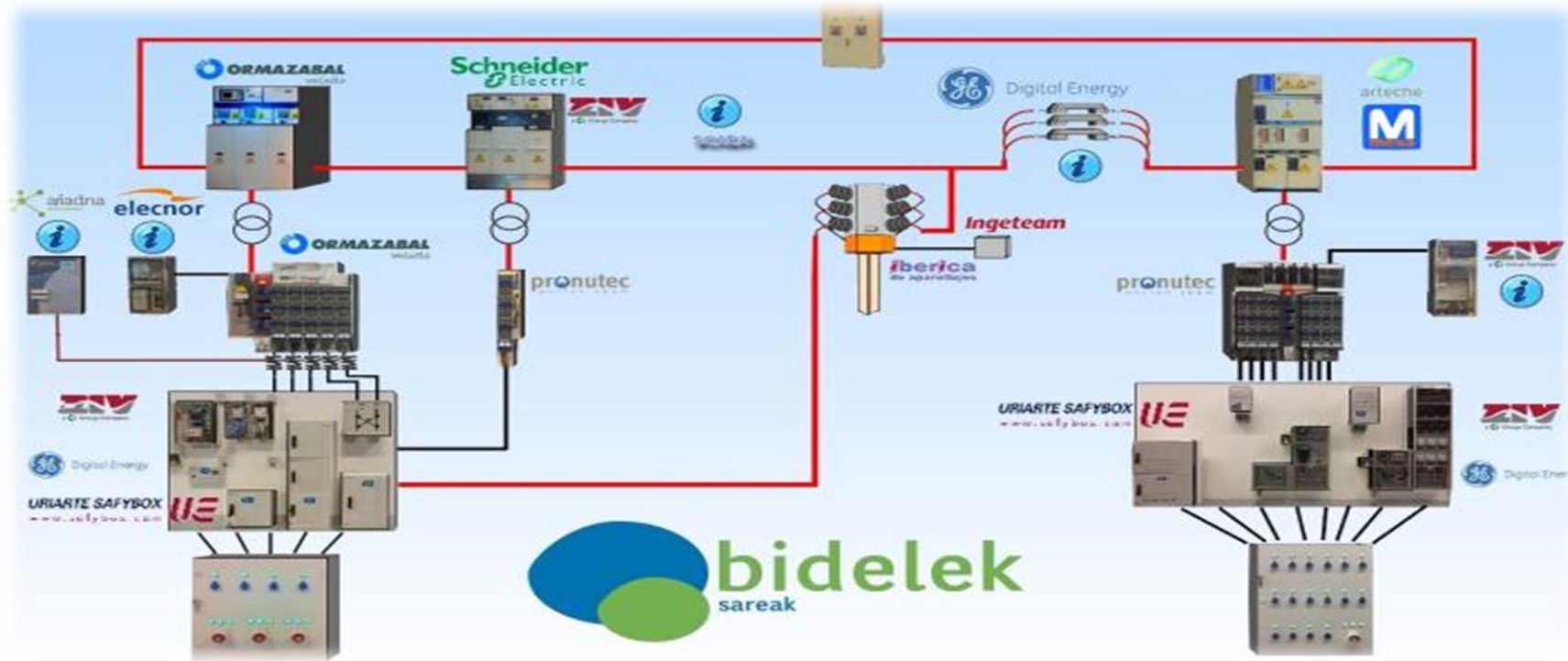
Source: Panorama del Clúster de Energía del País Vasco 2011, EVE/Cluster de Energía



... that interact in a complex value chain with a wide presence of Basque companies in all segments



SMART GRIDS DEMO PROJECT IN BILBAO





wind
energy

BASQUE COUNTRY

Industry for the wind future



The Basque Country is a top player through its experience in onshore wind

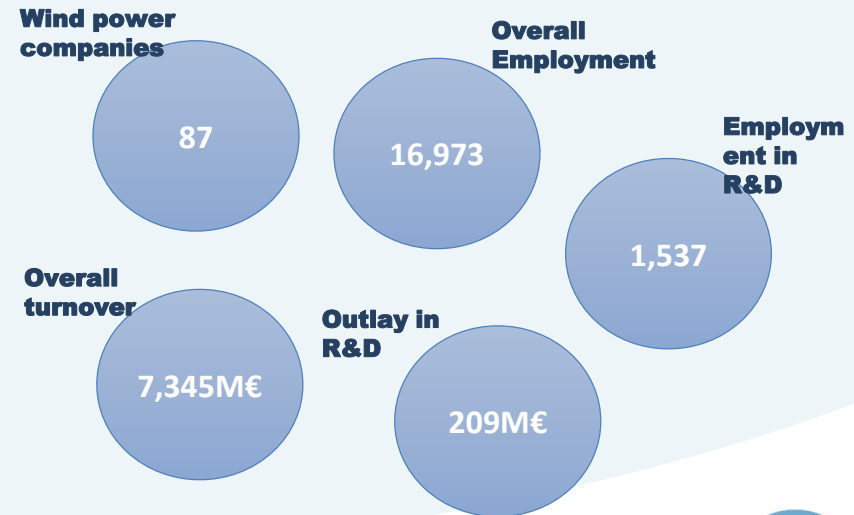


The Basque Country has developed a strong industrial framework in the wind power sector thanks to the driver effect of leading international companies such as Iberdrola and Gamesa, playing a prominent role in technological and market development (with over 22 GW installed in Spain since the outset in the mid 1990s as a pioneering country at an international level)



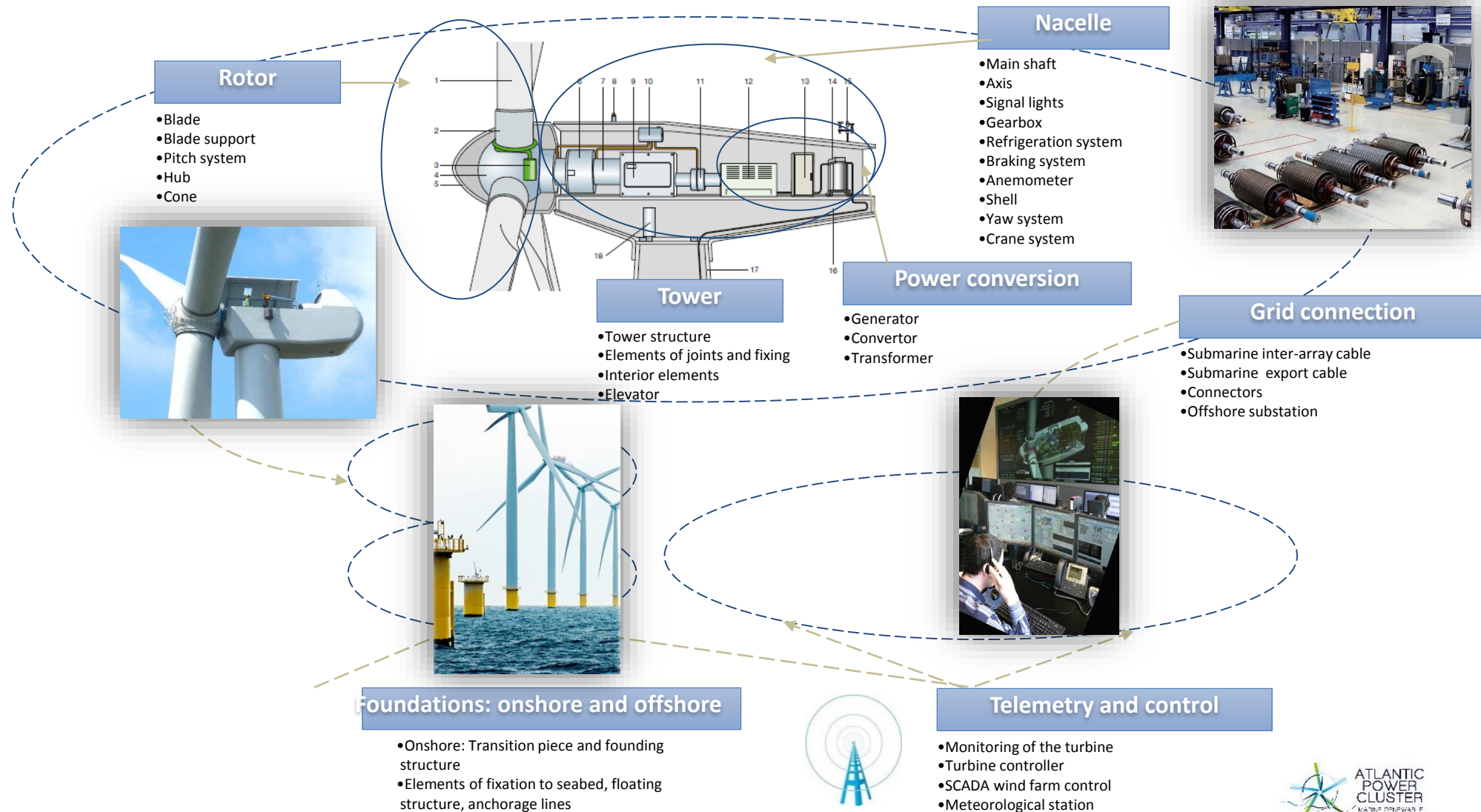
The overall figures of activity of Basque companies in this field clearly show the competitiveness and the level of development which has been reached, both industrially and technologically

Wind power activity in the Basque Country, data 2011



Source: Panorama of the Cluster de Energía of the Basque Country, 2011 EVE/Cluster de Energía

A wind farm incorporates numerous components and systems...



... which are integrally covered by Basque industry







The Basque coast is ideally located for developing and testing wave power generating devices ...

AN EXCEPTIONAL SITE

With its excellent marine resource, the Basque coast is in a unique position to benefit from wave energy and to develop and test wave power generating devices.

Regions located between 30 and 60 degrees latitude in both hemispheres present the greatest wave energy flows, varying between 20 and 70 kW/m.

The Basque coast, with a medium-high potential, allows devices and new technologies to be tested in a less aggressive environment than other locations.

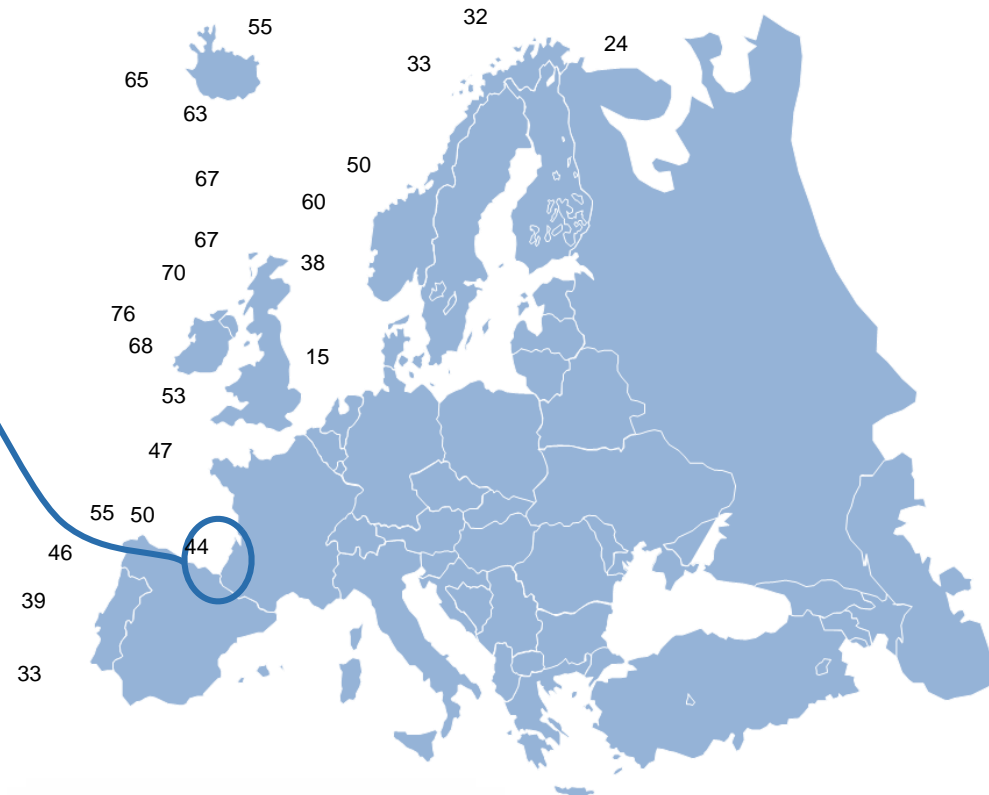


Basque Country

Wave energy Flux

From 25 to 44kW/m depending on the season and distance from the coast line

Wave energy resources in Europe



Source: CRES (Centre for Renewable Energy Sources)



... and the Basque Country has an industrial and technological base to position itself as a global competency centre for marine energy

INDUSTRIAL SUPPORT FABRIC

We have a strong business fabric operating in the two principal specialities, which can provide the knowledge and experience required for developing wave energy

Basque energy industry



Number of companies

>350

Overall turnover

€44 bn

R&D spending

€400 m

International Business

65%

Source: Basque Energy Cluster

Basque shipbuilding and auxiliary industry

Number of companies

>150

Overall turnover

€2.15 bn

R&D spending

€215m

International Business

80%



Source: Basque Maritime Forum



...that comprise a new value chain with extensive presence of technical agents and companies





Alignment between business, research centres and government translates into intense collaboration in R&D projects...

The objective is to develop a set of industry-enabling cost-effective and reliable components which will be available as a commercial product for a wide range of ocean energy converters, arrays and facilities

RECODE OCENERA-NET

The main goal of this project is to produce a step change in the overall performance of Power Take-Off (PTO) systems used for Wave Energy harvesting.

SEOLTA CENIT programme

The objective is to gain open sea operating experience by means of floating OWC wave energy converter (OCEANTEC) and two field test sites (Mutriku and bimep) to reduce the cost of wave energy by 50% in the long term

OPERA HORIZON 2020 Programme

Development and viability of offshore wave farms using overdamped point converters

UHINDAR Basque Government's Etorgai Programme

Network of 16 managers of R&I programmes from 9 European countries to coordinate funding programmes between European countries and regions to support research and innovation in the ocean energysector

OCEANERA-NET VII Framework Programme

Network of research centers and organisations that aims to streamline and facilitate testing by offering periods of free-of-charge access to world-class test facilities

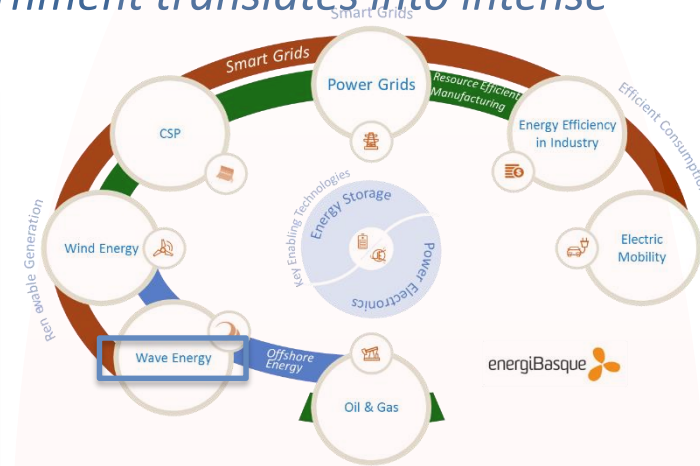
MARINET VII Framework Programme

European collaborative project funded by the European Commission which provides design tools for deploying the first generation of wave and tidal energy converter arrays

DTOcean VII Framework Programme

Companies and players in the scientific-technological field of Basque Country are conducting joint activities of R&D in the area of wave energy. This is complemented in parallel by the regional existing expertise in marine renewable energy technologies, based on inter-cluster collaborations...

...with a network of high experienced research groups, based on technological excellence, that are reference in energy wave projects within the EU framework programme...
...such as TECNALIA, which also chairs the 'Ocean Energy Systems' association.



ENERGIBASQUE The Basque Technological and Industrial Development Energy Strategy

Wave energy is one of the prime commitments of the Basque Technological and Industrial Development Strategy (energiBasque). Through this strategy, the Basque government and its support bodies are creating an environment that will promote development of existing capacities in the region's energy industry





...and in the construction of pilot plants with wave technology such as the Mutriku plant

ENERGIAREN EUSKAL ERAKUNDEA
ENTE VASCO DE LA ENERGÍA

Developer:
Ente Vasco de la Energía

World's first commercial wave plant (2011)

16 turbines with total capacity of 296kW

Investment:
€2.3m

Uses OWC technology

The wave-based power generation facility is located inside the seawall of Mutriku

During winter 2015 a major milestone reached; its first GWh of electricity supplied to the grid

Mutriku: pioneering wave-based power generation facility and Up-and-running test site for new concepts in air turbines, generators, control strategies and auxiliary equipment; first grid-connected wave energy plant in Europe (mainland)



Gemasolar Plant, owned by Torresol Energy, developed by SENER

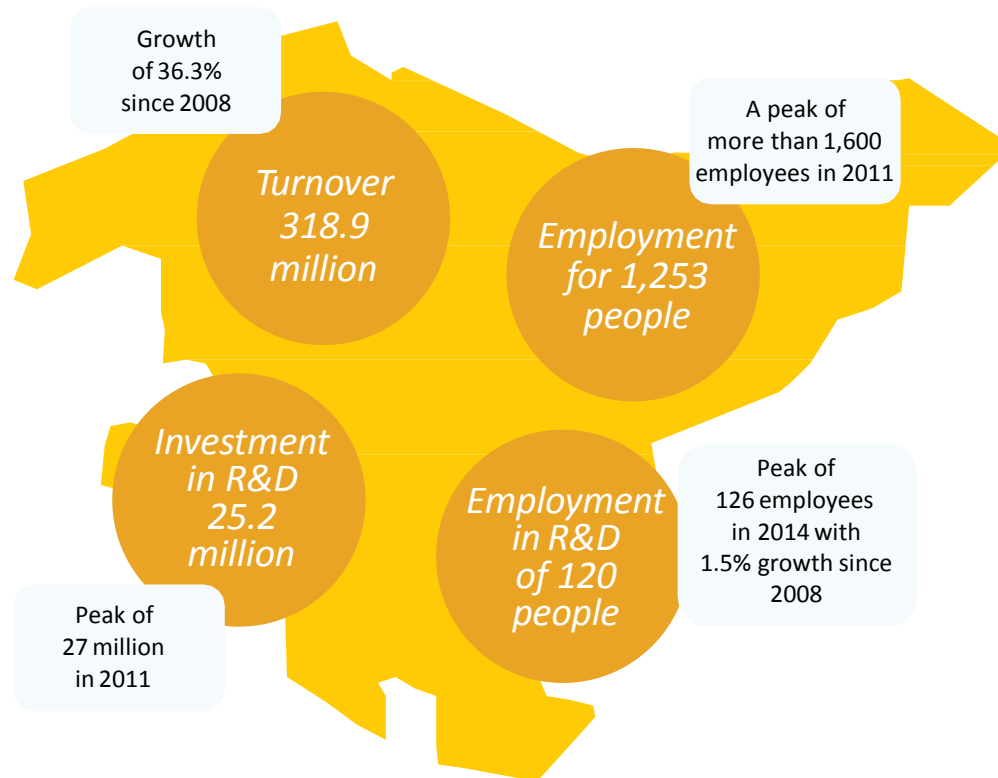


©SENER



The Basque Country has a powerful industrial sector in solar thermal power

CSP sector activity in the Basque Country. Average 2008-2014



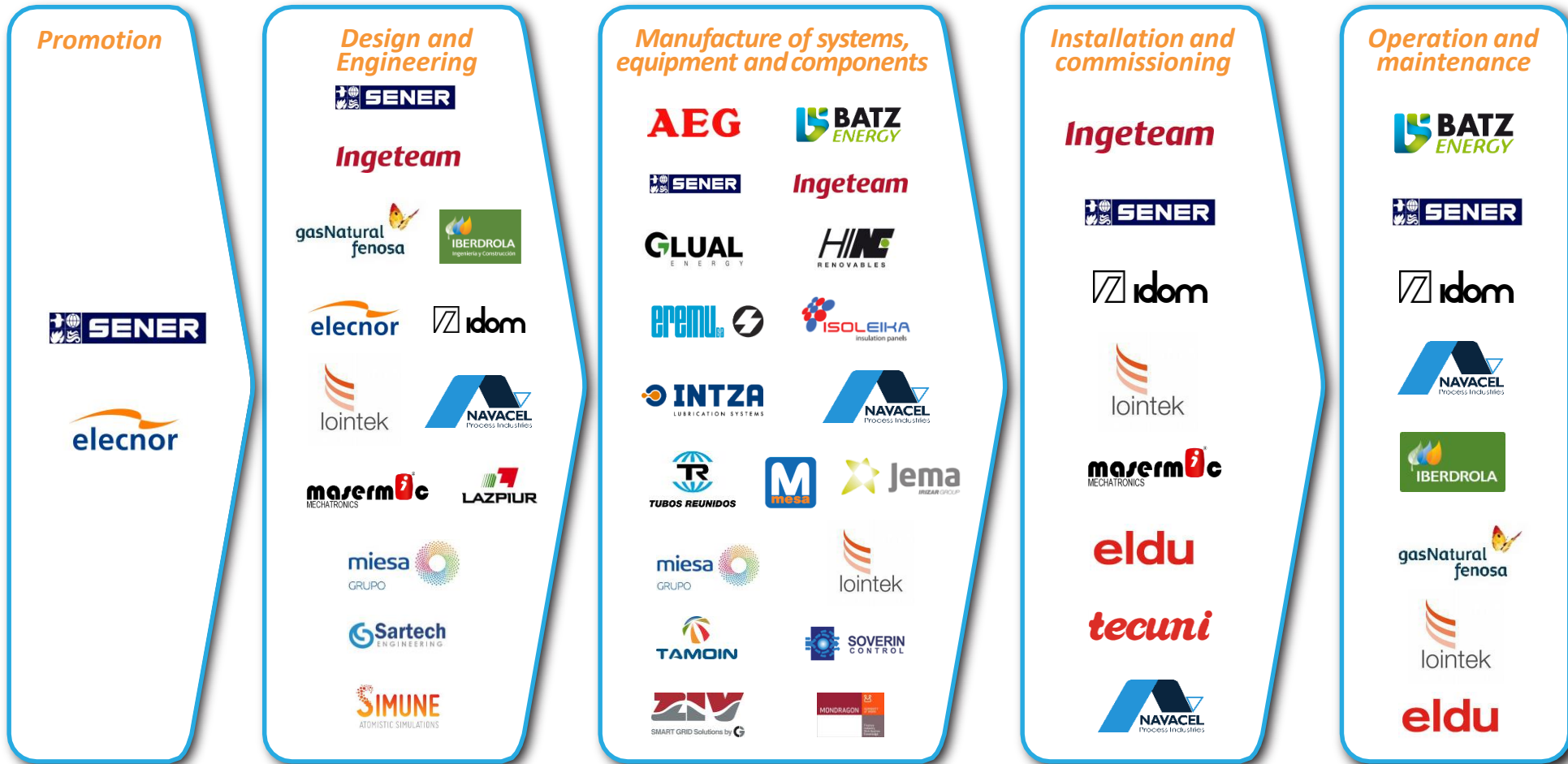
- The extraordinary development of CSP in Spain and the presence of world-leading company such as SENER have enabled the set up of a dynamic and competitive business network covering the whole value chain of solar thermal power.
- In spite of the fact that, due to the climatic conditions, it has no CSP plants, it is estimated that the Basque Country has 20% of the direct jobs in the solar thermal power value chain in Spain.
- Basque CSP companies are prepared to actively participate in the expected growth and development of this type of technology at global level in the years to come.



Source: General view of the Basque Energy Cluster



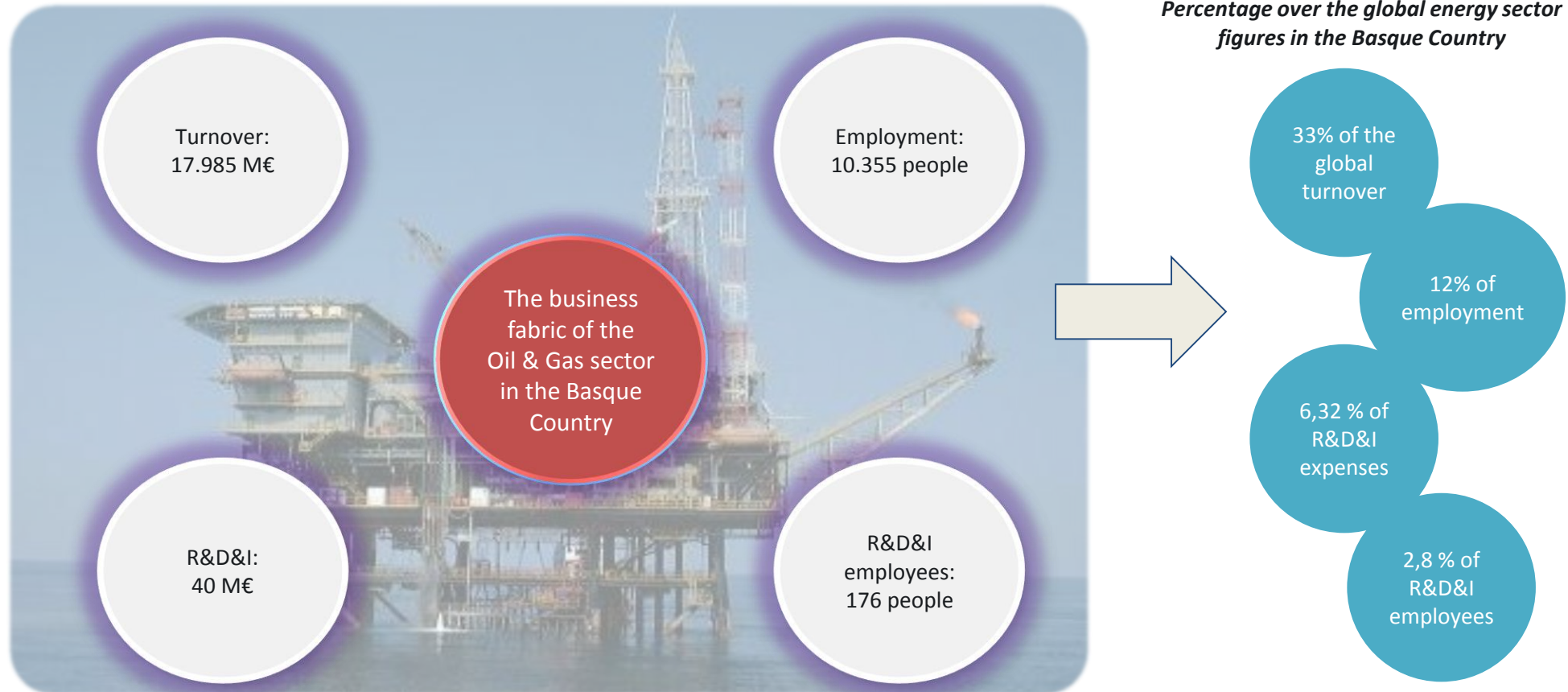
Companies in the Basque Country solar thermal value chain



Technological Development

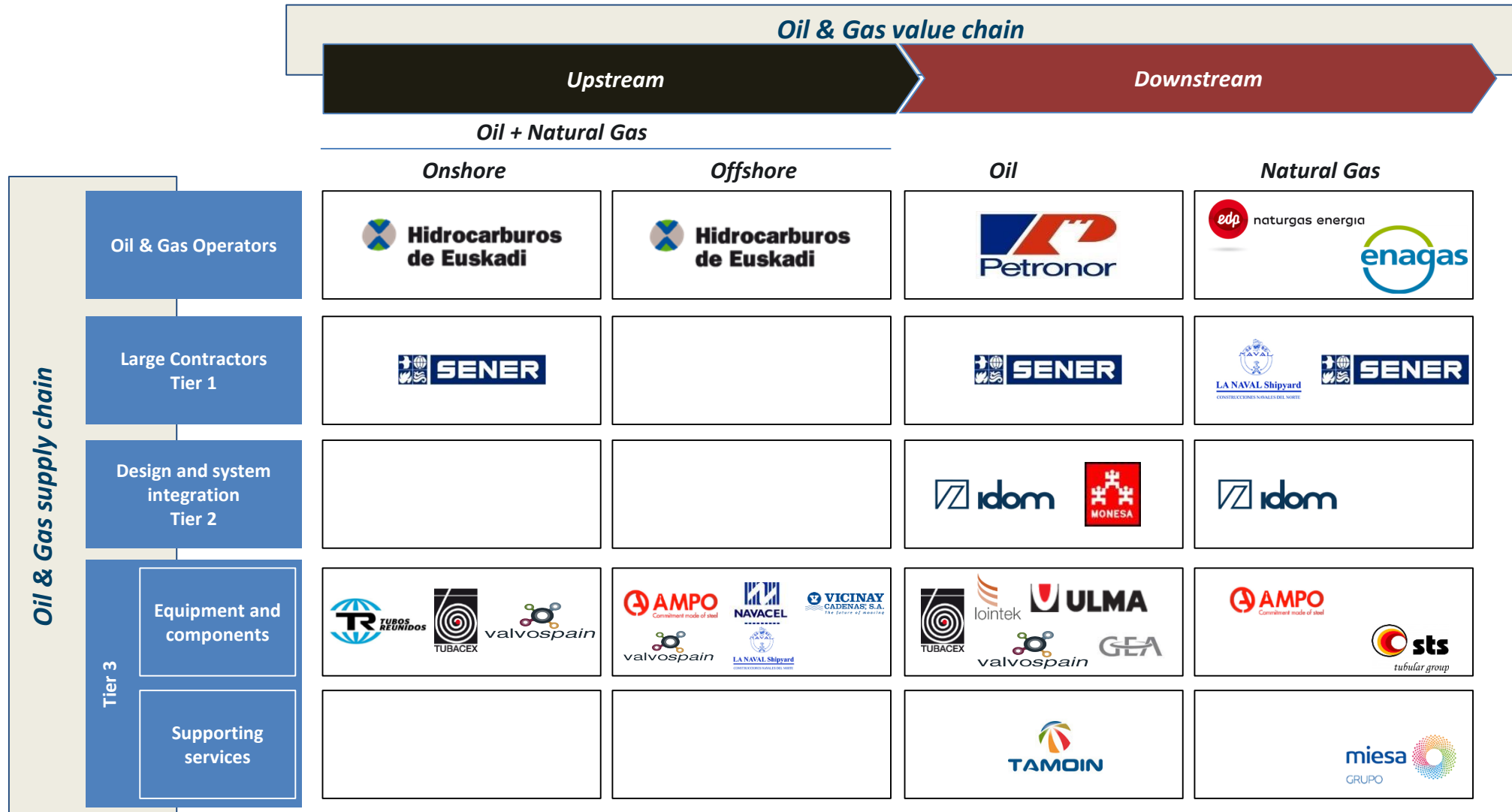
The Oil & Gas sector represents, by turnover, one of the main energy value chains in the Basque Country

Key figures of the Oil & Gas industry in the Basque Country (2011)



The development of the industry has been driven mainly by the relevant activity of the refining (Petronor) and distribution industry

The core business of the Oil & Gas activities in the Basque Country lies on the downstream sector, with an emerging activity in the upstream



STRATEGIC AREA: ELECTRIC VEHICLE



Ingeteam

AEG

Power Solutions



ORMAZABAL
Especialistas en Media Tensión



FAGOR
Fagor Electrónica



The energy sector is supported by a robust R&D network , accounting 240M€ of turnover and 2.397 researchers in the different Energy technologies

A top level research center in energy storage



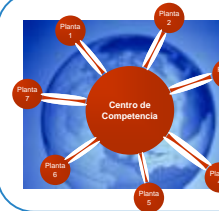
- **CIC energigUNE...**
... with a world class infrastructure and significant capabilities in energy storage, a key technology priority for developing other energy fields

R&D Corporate Centers



- **18 business R&D units...**
... which implies that new business R&D units have been created in recent years and existing ones have significantly improved (like the Demonstration and Experimentation Unit (UDEX) of Ormazabal and the Ultra-high voltage laboratory of Arteche)

Competence centers of multinational groups



- **7 centers of international competence...**
... with cases like General Electric in protection and monitoring, the Power Electronics laboratory of MESA (Schneider Electric), etc.

Top level university centers



- **Different research groups and institutes specialized in multiple áreas...**
... like the Energy unit of DeustoTech, established in 2008 to investigate the fields of energy efficiency and T&D of electricity

Large technology corporations



- **2 large technology corporations...**
... with Tecnalía, which has recently opened the new experimental infraestructura for Smart Grids inGRID
... and IK4, which participates in singular infraestructures like iSare y Windbox

A research center in nanotechnology



- **CIC nanoGUNE...**
... with activity in biofuels, storage, energy efficiency and materials

Singular infraestructura for marine energies



- **BIMEP...**
... a singular infraestructura for real-scale testing and validation of marine energy components and systems

IN Smart Grids: Powerful infrastructures for testing and certifying equipment for electricity grids



The work of developing equipment and systems for power networks is backed by the availability of top-level infrastructures for product experimentation, testing and certification



In Wind energy: Advanced manufacturing and validation Centre...



- The objective of WINDBOX is to have a **unique piece of high standard equipment available to allow the integration and validation of multi-megawatt wind turbine subsystems (>5MW)**.
- The capacity to test components integrally and under conditions as near as possible to those in the windfarms (charges, temperature, humidity, vibration) will allow manufacturers to optimize their design, efficiency and reliability, resulting in a major improvement in technological positioning and international competitiveness for suppliers and integrators of products and systems in the wind energy sector.
- With the support of this initiative, the Basque Government begins to implement its Advanced Manufacturing Strategy, one of the cornerstones for the improvement in Basque industrial competitiveness, fully aligned with the Industrialisation Plan and the Regional Innovation Smart Specialisation Strategy (RIS3), which has defined both advanced manufacture and energy as two of its strategic priorities.



PARTNERS

SUPPORTERS

windbox
ADVANCED TEST & VALIDATION CENTRE FOR WIND POWER



In wave Energy: bimep is a unique infrastructure for real-scale testing and validation of marine energy components and systems



The bimep (Biscay Marine Energy Platform) initiative was launched in 2011. It is 80% owned by Ente Vasco de la Energía and 20% owned by the IDAE (Institute for Energy Diversification and Saving)



The infrastructure is available to technology and product developers, enabling real-scale research and demonstration of wave energy capture and conversion devices and systems



Key bimep characteristics



EVE Ente Vasco de la Energía



IDAE
Instituto para la Diversificación y Ahorro de la Energía

- 20 MW total capacity
- 4 converter connection points
- Facilities for installation, trials, tests and operation
- Associated research centre
- SCADA monitoring and control system
- Research and data control centre
- Depth: 50m-90m

Bimep is located off the coast at Lemoiz-Armintza. It occupies a surface area of 5.3 km² and stands at a distance of 1.7 km from the coast. It is located 15 km from Bilbao Port, one of the most important logistical centres on the European Atlantic axis

KEY MESSAGES

- The energy sector plays a key role in the economy of the Basque Country. The Basque Government has therefore identified the energy sector as a priority in their technological and industrial policies (Energibasque, RIS3, Science and technology Plan).
- The Basque companies within the energy sector form a strong “cluster”, based on: Quality and technology in products and services; International presence in global markets; complete and interrelated value chains
- Basque companies have taken advantage of the business opportunities that electricity generation, transmission and distribution have offered along the years, giving way to “success stories” such as the Smart grids deployment in Bilbao or the wind Energy development in Spain.
- The key challenge of the Basque energy sector focuses on generating growing activities and creating jobs, through competition in the international markets. Internationalisation has become a competitive advantage for companies in the energy sector, leading to opportunities for cooperation in different global markets.
- Basque companies have been very active in the international markets for the last 10 years, with a highly competitive positioning in the electricity grid, wind and solar sectors, as well as suppliers of equipment for the "Oil & Gas" sector. Basque companies are willing to offer their expertise and contribute to the development of countries and regions with long term energy investment plans.

Cluster Energía

BASQUE ENERGY CLUSTER

