ENERGY CAMPUS

ENERGY TO EXCEL

SUMMARY

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UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

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SUMMARY

Current situation

During this second stage "Energy Campus. Energy to excel", which was positively assessed last year (Score: A), has continued to work on **consolidating the International Campus of Excellence** project by implementing and building on the actions identified in its strategic plan. These actions—some completed and others under way—are creating a true innovation ecosystem within the framework of the national strategy set out in the University Strategy 2015 of the Ministry of Education, Culture and Sport.

In recent years the energy sector has undergone an unprecedented transformation. In the new scenario that has emerged, immediate action is required to tackle challenges arising from the need for energy sources that are sustainable, safe and competitive.

CINDA Representatives

Energy has traditionally been one of the UPC community's main areas of interest. In recent years, this had led to an increased focus on research and teaching activities in this area, and energy concerns are even reflected in the way the University is run. Key milestones were the recognition of the Energy Campus as an International Campus of Excellence in 2010 and the approval of the UPC's participation in the KIC InnoEnergy Consortium funded by the EIT (The European Institute of Innovation and Technology). Also, the UPC has joined a number of networks of universities of excellence (CINDA, UNITECH or CLUSTER are some examples), which provide visibility and lead the interests and strategies of the institution at the international level.

Focusing on energy issues has become one of the most important ways of tackling the challenges that lie ahead. The UPC has a vital role to play in contributing new visions to guide social and technology-related debates on future energy models. In light of the current economic crisis, it is essential that public resources are directed to activities that emphasise results and harness knowledge-intensive instruments to create wealth (i.e. economic benefits and inclusive, balanced outcomes). One of the objectives of the Energy Campus is therefore to maximise its impact in economic and growth terms by ensuring that its strategies are rigorous, focused (concentration of resources and priorities) and results-oriented.

The UPC has sufficient capacity to actively pursue both its own strategies and any broader initiatives designed to achieve these goals. According to the April issue of the SIR World Report, the UPC has maintained its position as the top-ranked technical university in Spain and advanced one position in the overall ranking. The UPC is the third-ranked Catalan university, the first-ranked technical institution and now occupies the fourth position among Spanish scientific institutions. It is also the number one university in Spain in the engineering field according to the I-UGR ranking published in May 2013, and the second most productive university in Spain according to the ISSUE-P ranking of Spanish universities.

The UPC has also maintained its position among the 100 best universities in the world according to the Times Higher Education's "100 Under 50" ranking. The THE list identifies the top hundred universities in the world under fifty years old based on thirteen performance indicators that reflect the core missions of higher education institutions: teaching, research, knowledge transfer, international outlook, and citation impact (+Info).

All the foregoing points show that the Energy Campus has achieved a leading position based on an innovative overall strategy that emphasises the international orientation required at this time and in the current international context.

The Energy Campus is also involved in various lines of action being defined at the regional and European level. The Campus is aligning its action plan with the regional government's *Pacte +Indústria* plan (aimed at boosting industrial activity in Catalonia) and with the Research and Innovation Strategies for Smart Specialisation (RIS3).

The Industry Plan launched by the Government of Catalonia in 2012—with the backing of leading business and professional associations, trade unions and universities—identifies the energy sector as a key strategic area. The Energy Campus has worked with the committee responsible for developing proposals aimed at reinvigorating Catalan industry. A total of 18 new proposals have been included in the Industry Plan.

The mobilisation of resources through the Energy Campus—in the form of public capital, private funding, and the UPC's own resources—is consolidating an ambitious project that reflects a regional priority (as defined by the political bodies of the autonomous regional government) in relation to Catalonia's strategy for economic transformation, in which the Energy Campus is playing a central role.

Academic improvement and adaptation to the EHEA

With the aim of offering a selection of courses that is attractive both within Spain and internationally, the Energy Campus has continued to consolidate a programme of bachelor's degrees and, in particular, postgraduate courses that are distinguished by their quality (with several Pathway to Excellence awards from the Ministry of Education), including Erasmus Mundus master's degrees and doctoral programmes. As a complementary measure, spaces have been reserved for students enrolled in these courses to facilitate study and group work.

The **postgraduate course offering** of the Energy Campus currently includes 13 master's degrees and 24 doctoral programmes. Overall, the UPC offers around 65 master's programmes distributed in 11 areas of knowledge in which energy is a cross-cutting element (including Architecture, Urbanism and Building Construction; Applied Sciences; Health Sciences; Aerospace Engineering; Civil Engineering; Biosystems Engineering; Industrial Engineering; Informatics Engineering; Telecommunications Engineering; and Environment, Sustainability and Natural Resources). Twenty-five of these courses are taught entirely in English, 13 are recognised as Erasmus Mundus programmes (three on the Energy Campus), and 25 are interuniversity programmes.

Following the reorganisation of the UPC's Doctoral School last year, the University has been awarded 25 Pathway to Excellence awards by the Ministry of Education out of a total of 51 programmes offered this academic year, which include seven Erasmus Mundus Joint Doctorates. Four of these doctorates are offered by the Energy Campus, and topics covered include sustainable energy, energy conversion, minimisation of energy consumption, and energy harvesting.

Another initiative that the Campus and the University are strongly committed to is the new **Industrial Doctorate programme**, a strategy of the Government of Catalonia aimed at contributing to the competitiveness and internationalisation of the industrial fabric, retaining talent, and providing doctoral students with an opportunity to carry out RDI projects in companies. The stakeholders involved in the Industrial Doctorate Plan are companies, universities, doctoral students, and the Government of Catalonia.

Formula Student race car

Finally, in terms of **teaching innovation**, an ongoing effort is being made to promote Problem-Based Learning (PBL). Projects like the 3Cat-1 nanosatellite platform and the Formula Student competition give students a central role in learning that is based on problem solving.

This new student - centred methodology involves learners working in groups while teachers act as facilitators.

These initiatives are further evidence of the direction that both the University and the Campus wish to pursue. The goal is to introduce innovation into teaching, create flexible working environments with an international dimension, and remain open to new ideas that bring improvements at all levels.

Scientific improvement and knowledge transfer

During this period, particular emphasis was put on scientific improvement, leading to outstanding results that point to significant progress in this area. Work has continued on the living research labs, a new R&D group has been set up on the Energy Campus, and participation in European calls and consortiums has increased, resulting in an expansion of the portfolio of international energy projects. The UPC is the leading university in Europe when it comes to attracting funds for ICT projects. Our aim now is to achieve the same leadership position in the energy area by actively developing the Energy Campus.

The activity of the various **living research labs** has continued and has led to outstanding results, including participation in international projects and competitions and the publication of papers in energy-sector journals. At the same time, interesting new projects have emerged, such as the creation of a massive open online course (MOOC) on sustainable housing, and joint projects based on collaboration with companies that have joined the Energy Campus consortium.

The most notable efforts in this area are those aimed at expanding the portfolio of European energy projects. The UPC's leadership in terms of participation in and coordination of European projects in the ICT sector is unquestionable, and one of the proposed goals for the Energy Campus is to increase the involvement of research groups in European energy projects and take on the coordination of European consortiums funded under FP7 calls, as envisaged in the Strategic Plan for Excellence, which sets out a roadmap for transforming the Energy Campus into an International Campus of Excellence.

The **increased level of participation** that has already been achieved is reflected in projects such as EPHOCELL, aimed at developing a smart system for collecting light to improve performance of solar cells; EUROENERGEST, the objective of which is to achieve a 10% reduction in consumption of energy in specific areas of the automotive industry (HVAC); RESEEPE, a project that seeks to develop retrofit solutions and services to improve energy efficiency in public buildings; and SWINGS, a consortium of ten European and eleven Indian partners, which pursues a number of objectives, including the goal of maximising energy saving. Mention should also be made of the Nanophotonics for Energy Efficiency Network of Excellence (N4E), which aims to promote nanophotonics research in energy-efficient applications by bringing together nanophotonics laboratories and R&D groups from across Europe.

As for **coordination activities**, one Energy Campus research group is leading the FLEXICAST project, the objective of which is to develop a new technology that integrates the various phases of the conventional foundry process in a single production cell. The new technology will reduce energy consumption by up to 30%.

The University also coordinates two Marie Curie actions: COTRAPHEN, a project on modelling, experimentation and applications in clean energy, micro-analysis and water treatment; and GREENET, which focuses on the analysis, design, and optimisation of energy-efficient wireless communication systems and networks.

At the European level, in the most recent CC Iberia call for proposals, the European Institute of Innovation and Technology, through the InnoEnergy Knowledge and Innovation Community (KIC), funded over ten **innovation projects** related to renewable energies, smart cities and buildings, smart grids and energy storage.

Internally, the newly launched SUMA project is a crowdfunding initiative that seeks to broaden and diversify sources of funding for innovative projects, while also raising awareness of the University's commitment to driving scientific and technological development and social entrepreneurship.

A final development related to scientific improvement and knowledge transfer is the incorporation on the Campus of a **new research group**, GreenTech, which focuses on developing efficient thermal systems based on the use of green energies.

In summary, significant progress has been in recent months on actions that focus on improving scientific and research activities.

Transformation of the Campus to develop a comprehensive social model

The UPC's International Campus of Excellence project is based on a strong commitment to elements such as social responsibility, sustainability, regional development and entrepreneurship—key factors for the future transformation of the Campus. The fundamental change now under way has a physical dimension—the construction of the Diagonal Besòs Campus—and also involves **shifting towards a model of socioeconomic development based on knowledge**.

This transformation also entails the adoption of new, innovative management models that will change the way the Campus is governed in the future, and the introduction of collaborative approaches that link people in different management units, facilitating a connected approach to tackling problems.

The transformation of spaces that is under way encompasses numerous actions aimed at adapting buildings and classrooms to the requirements of the European Higher Education Area (EHEA) in a cost-effective way. These steps include renovations to classrooms, the auditorium, and the learning and research resource centre in Terrassa. A larger scale action is the construction of the **new Diagonal Besòs Campus**, a space for teaching, research, innovation and business activity that focuses on engineering-related disciplines and is adapted to the specific requirements of the EHEA.

The Diagonal Besòs Campus (CDB) offers a new model for social and territorial integration. One of the planned buildings will house the new facilities of the Catalonia Institute for Energy Research (IREC), which is a member of the strategic alliance. In addition, the Campus will deliver social and economic value by driving regeneration of the local area: new businesses will open to provide basic services; the Campus will draw undergraduate, postgraduate and doctoral students eager to participate in local community life; the libraries and residences currently under construction will be another local asset; and the opening up of Barcelona and Sant Adrià del Besòs to the sea will transform what was once a rundown area into an environment able to drive the generation of knowledge at the European level.

Panoramic view of the Diagonal Besòs Campus

Another set of actions that converge in this transformation in a less tangible way are those related to awareness campaigns and educational activities. Such actions seek to highlight the importance of adopting a new development model, focusing on issues such as energy saving and the need to reduce consumption, and on stimulating entrepreneurial spirit from an early stage.

Interaction with the business environment and local area

The UPC has traditionally maintained a close relationship with local business in the areas where its schools and campuses are located. This connection has been sustained and strengthened in recent years. Indeed, as new energy-sector companies have joined the Energy Campus project, the relationship has intensified and taken on an international dimension.

New partners in the project include a number of spin-offs that have emerged from the University itself, including AleaSoft, Dexma, GoldEMar and Hyds; SIMON, a Barcelona-based firm which belongs to an industrial group made up of 25 companies around the world that produce and sell low-voltage electrical equipment and other products (with a focus on energy efficiency); and Gas Natural Fenosa Foundation, an institution set up by one of the leading multinationals in the gas and electricity sector.

All these partners have signed a collaboration agreement as part of their commitment to jointly construct a strong consortium that will allow the objectives set for the International Campus of Excellence project to be achieved.

The shared commitment of the consortium members has borne fruit in a number of initiatives, including the Solar Pond project, which was carried out with the company Solvay and entered in the EU's World You Like Challenge, and a series of Energy Campus working sessions involving various UPC spin-offs and energy-sector companies.

Also worth noting are promotional **actions** carried out at global trade fairs and conferences with the aim of publicising the Campus technology portfolio, both within Spain and internationally, and the initiatives Energy Observatory and the K2M GAIA Ecosystem.

CONCLUSIONS

The achievements of Energy Campus within the academic improvement and adaptation to the EHEA area, are quite remarkable since most of the actions planned have been successfully completed. Thus, the Campus has a multidisciplinary course offering based on international and quality standards, a PhD School fully operative and in tune with KIC InnoEnergy, and new short-term targets as developing teaching innovation and the Industrial Doctoral Plan.

With regard to the scientific improvement and knowledge transfer area, it is important to stress the effort of the Campus on increasing the number of research projects on energy funded by European calls, effort that will be extended into the next Framework Programme: Horizo2020. In addition to Technology Offers (energy sector) and CIT UPC (energy and environmental technologies), and in order to complement the valorisation of research results, the Energy Campus will strengthen promotion and internationalization aspects.

The elements that support the transformation of the campus area are, first, finishing the construction of the Diagonal Besòs Campus, which will host some of the buildings planned in the project and the energy-related studies (expected to be operational in the year 2014-2015). And secondly, the adoption of a new economic model based on knowledge that takes into account aspects such as energy efficiency, social responsibility and entrepreneurship.

The interaction with the business environment and local area has been part of the UPC's activity since its inception, thus the project of Campus of International Excellence has only converged towards the quadruple helix model which involves knowledge generators and transformers, economic and regulatory actors and civil society and social networks.

Finally, the project governance has undergone internal and external consolidation incorporating an energy expert on the structure and involving KIC InnoEnergy actors, to reinforce the international dimension.