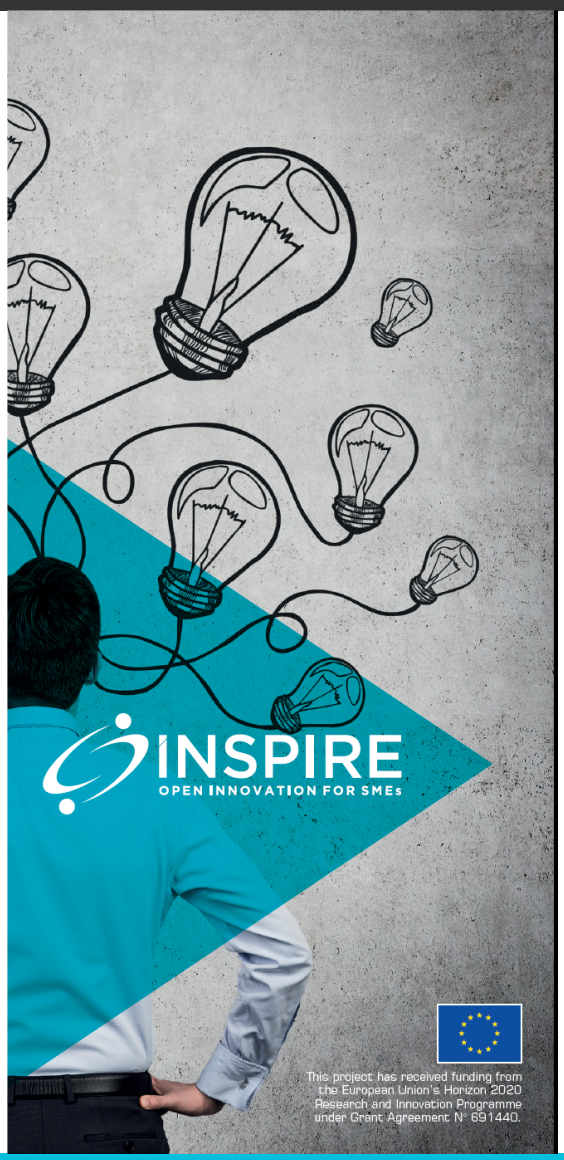

EMTECH

Greece, www.EMTech.global

A Greek SME exploits its know-how from working in the space sector to branch into the energy market and develop an energy-saving solution in collaboration with a lead customer

Executive Summary

EMTech, in collaboration with a Power Transmission Systems Operator, designed and developed an integrated solution, called iReact, which targets the automation of reactive load management in power distribution substations. The company was selected by the INCENSe accelerator and offered a grant and support services, consisting of a six-month acceleration programme, additional coaching sessions, tailored workshops on European funding programmes and business support to develop and test a new function of their integrated solution. This involved bringing electricity grids into the IoT era by successfully integrating state-of-the-art data fusion, prediction and automation. These OI collaborations have contributed to achieving a complete product range, powerful results and a solid case in favour of installing their iReact device.

CASE N°: SE56

SECTOR: SOFTWARE ENGINEERING SERVICES

TECH INTENSITY: HIGH-TECH

LIFE CYCLE STAGE: ESTABLISHED

INNOVATION VECTORS: PRODUCT, SERVICE

OI PARTNERS: LARGE CORPORATION, LEAD USERS/CUSTOMERS, ACCELERATOR

KEYWORDS: Smart grids, automation units, lead customer/user open innovation collaboration, accelerator scheme

- BACKGROUND FRAMEWORK
- INNOVATION CHALLENGE & MARKET OPPORTUNITIES
- OI TRAJECTORY
- BUSINESS IMPACT
- LESSONS LEARNED

BACKGROUND

EMTech focuses on developing innovative technology applications and software engineering services in the field of space and energy applications. The company started operations in 2008 and within a short time proved to be a reliable partner by playing a key role in several innovative projects. The company has already developed highly promising products in the field of real-time embedded systems and since 2009 it has been actively involved with spacecraft operational simulators. EMTech has received funding from the European Space Agency (ESA) to develop projects focusing on the parallelization and performance optimization of the simulation infrastructure software that ESA and the European Space Operations Center (ESOC) utilize for both training and mission-specific purposes.

So far, EMTech has delivered two major products to ESA/ESOC: a multi-threaded scheduler based on Conservative Parallel Discrete Event Simulation concepts (C-PDES) suitable for SIMSAT - the simulation engine designed and developed by ESOC which provides the infrastructure for all space missions requiring a spacecraft operational simulator - and a Performance Control and Optimization Framework (PCOF) facilitating investigation and optimization of spacecraft operational simulators. In 2010 EMTech was selected by ESA/ESOC to be a Qualified Partner (QPA) under the Competitive Frame Contracts for "Ground System Software Related Activities (2010 – 2014)" (the "GFC8 Frame Contracts").

In the energy domain, the company has designed and developed from scratch, an integrated solution for power transmission and distribution grids called iReact which has gradually grown and turned into a full product and applications range for managing the automation systems in substations, as well as for distribution system management and support.

EMTech is a founding member of the si-Cluster (the Hellenic Space Technologies and Applications Cluster), an emerging, industrially-led and user-driven innovation cluster in Greece, with a sizeable potential to compete worldwide in the challenging and fast-growing sector of space technologies and applications.

The company's vision is to continue offering innovative customer-oriented solutions by collaborating with other global industry members and academia, as well as achieving further international recognition for their consulting work in the area of research and development for embedded systems and software.

INNOVATION CHALLENGE & MARKET OPPORTUNITIES

Energy smart grids improve the reliability, efficiency and economics of electricity network operations by applying automation and ICT. Power substations are critical infrastructure assets for every energy transmission and distribution operator, providing an uninterrupted flow of huge energy volumes. Power Transmission Systems Operators employ various optimization techniques and in certain cases outstanding energy savings are achieved. Recently, the increasing uptake of renewable energy sources into the distribution grid has created highly dynamic behaviour, leading to vast reforms of the operational concepts of the electrical power grids.

In 2006, the Greek Power Transmission Systems Operator launched an open tender to automate the procedure for attaching/detaching compensation elements in power distribution substations. EMTech saw this as an opportunity to create new revenue streams by utilizing its expertise in modelling and real-time simulation methodologies - which they had developed over the years in space-related activities - and apply it to the energy sector.

Reactive power compensation - the management of reactive power to improve the performance of alternating current (AC) power systems- is important for all power transmission and distribution networks. Reactive power is "useless", but still needs to be transferred, thus lowering a network's active power capacity, inducing more heat loses and increasing transmission costs, as well as increasing risks of equipment failure and black-outs. Distributed and cooperative multi-agent intelligence between internet connected "things' seemed therefore to be the ultimate solution to address tomorrow's non-deterministic system response.

OPEN INNOVATION TRAJECTORY

Concept development

In collaboration with the Power Transmission Systems Operator, EMTech designed and developed from scratch an integrated solution for power transmission and distribution grids, i.e. iReact, which allows the automation of reactive load management in power distribution substations.

The development process, IPR and competition strategy

EMTech was awarded the tender and collaborated with the Power Transmission Systems Operator to produce, introduce and test their iReact solution. At the beginning of the development process, a critical challenge was to define the final solution together with the contracting authority, which would be both innovative and different to the existing solutions on the market by offering improved characteristics and performance as well as pricing. iReact consists of automation controllers, sensors and intelligent software for real-time monitoring and control, simulation and prediction using space-grade infrastructure.

Since the iReact solution was developed from scratch, turning the concept into a workable market offering through the design, prototyping and implementation phases was a challenging journey. The challenges involved redesigning some features and modules to validate the concept and convince stakeholders to get the 'go ahead'. This required more effort than originally foreseen in the project planning. As the project progressed the partners had to adapt their role and exchange views, needs and knowledge on technical and engineering issues. For instance, further software development was required to ensure smooth communication between the iReact automation unit and the existing components of the substation and address security considerations.

The distribution Substation Automation Systems (SAS) role is to secure an acceptable power quality level and voltage profile for all energy consumers. The iReact automation units further enhance that role with optimal real-time SAS management. Common power quality and efficiency objectives, such as power factor correction, are achieved through the automated control of regulating substation equipment driven by real-time and predicted operational quantities and weather conditions. Real-time measurements enable supervisory control and create a database of historical data that can provide thorough, user-defined reports on various operation, maintenance and economic aspects.

A cooperation agreement clarifying each team's knowledge input and IPR on the respective parts of the work was signed.

The transmission and distribution substation automation market that iReact is targeting is dominated by big players (Siemens, ABB, Alstom, GE) who offer turn-key solutions. However there are thousands of old technology substations worldwide that need automation and remote management capabilities. EMTech has designed all its controllers and sensors from scratch and has the flexibility to tailor the solution to any customer's requirements with affordable pricing. Moreover, the iReact solution is not all about saving energy: automation makes valuable human resources available for higher level tasks than having to be present in distant substations to attach/detach compensation elements on the electric power grid.

Commercialization and follow-up

The iReact offering was enhanced by the development of automation controllers, smart-sensors and backend software to facilitate joint reactive load compensation and voltage regulation, as well as the remote monitoring and control of key assets at substations. iReact devices were adopted by the Power Transmission Systems Operator and today are widely applied in more than one-hundred and twenty (120) power substations, achieving outstanding performance.

They have contributed to a reduction of power loss incidents (reactive power causes heat waste), released capacity, voltage stability and prompt maintenance alerting. Performance data has revealed an annual 8% average reduction in power loss incidents. When applied to the annual 3% known transmission losses, this amounts to a saving of some 15 800 MWhrs. Given that 1 MWhr costs about €50, the total yearly savings are in the region of €800 000.

Furthermore, reactive power captures a portion of the system's capacity and compensation releases it. Evidence from the iReact performance figures reveal an average of 14% extra peak power available at 750 MW yearly load which translates to 100 MW of released power. If these 100 MW were to be generated by new PV installations, they would cost about €100 million!

All hardware units designed by EMTech pass through electromagnetic interference (EMI) and electromagnetic compatibility (EMC) testing by external certified facilities to ensure minimal interference to the industrial operation environment. Furthermore, EMTech has already successfully implemented upstream tests with external suppliers of iReact components to ensure their ability to respond to high volumes of production.

iReact has been supported by EU-funded CleanTech projects such as INCENSe (www.incense-accelerator.com), backed by major names like Enel, Endesa, Accelerace and Funding Box; for business acceleration through high quality training targeting a high investment readiness

level. Detailed data of the transmission grid, which are stored by the company's installed automation controllers and sensors, are processed by artificial intelligence algorithms to create load profiling that will be used to reach a near optimum performance for each installation. EMTech's participation in this six-month acceleration programme, including coaching sessions, tailored workshops on European funding programmes and business support provided by the INCENSe network, led to the development and testing of a decision support system, the iReact-Prognosis. The iReact-Prognosis decision support system provides the electric grid managers all the data needed to evaluate the performance of the iReact-solution and make decisions regarding their grid's sustainability.

iReact-Prognosis provides simulation functionalities with the capability to predict short-term load data variations at the substation by processing and manipulating historical and real-time load data and weather conditions. Advanced algorithms in iReact units process the predicted load dataset and schedule the regulating actions of the substation equipment. This feature has been tested and adopted by the Power Transmission Systems Operator and has provided powerful results and a solid case for the further installation of iReact units and the continued development of the functionality of the iReact product range.

EMTech follows a direct sales channel. It has applied an innovative license-based model for the targeted market (power transmission and distribution automation) rather than a pay-per-unit and support contracting model. They offer three types of licences according to the identified needs and user profile in a service based approach (mandatory installation licence, accompanying optional engineer and manager licences):

- The first licence that is mandatory is the "installation" licence: it provides the hardware and includes interfacing with existing infrastructure, real-time monitoring of measurements, data storage and reporting.
- The second type of licence (optional) is the "engineer" licence: it includes all installation licence type features plus remote control, alerting, maintenance and prediction.
- The third type (also optional) is the "manager" licence, providing business analytics features.

EMTech's flexible size, accumulated experience and skills make it possible to tailor the solution's features to comply with a potential customer's needs. This includes hardware modifications (such as additional digital inputs and command outputs, further analog inputs using different sensors, application-specific electronic modules, different communication means, etc.); firmware/software modifications (such as customer-defined automatic operation scenarios and algorithms, operation validation and alarm processes, menu options and languages, additional parameters, communication and networking protocols, etc.) and information system software modifications (such as customized graphical user interfaces, database changes and customized reporting, further communication protocols, customized alarms and notification automation procedures, etc.).

In addition to the further optimization of iReact solutions for Substation Automation Systems Management, EMTech is also focusing on Distribution System Support. The proliferation of distributed generation has increasingly indicated the need for the active and efficient management of the distribution grid. EMTech designs the new iReact-MGC unit to manage a variety of dispersed sources of power generation (solar, wind, diesel, etc.) and provide the distribution grid with real-time and scheduled services for optimized power quality and performance.

BUSINESS IMPACT

This open innovation project resulted in a new product line (iReact) allowing the automation of reactive load management in power distribution substations, its successful installation in 120 substations, as well as an innovative business model.

The team gained experience in managing OI projects and overcoming managerial, legislative, regulatory and bureaucratic issues, while at the same time developing its entrepreneurial/soft skills. The iReact OI experience led to the design, development and enhancement of a successful solution that has already been adopted by customers and introduced on a global scale.

EMTech received coaching and a 6-month personalized acceleration programme which supported the piloting, testing and validation of a new product. It also helped them to develop their pitching skills and access new networking opportunities.

The development of their iReact solution opened up access to a whole new market (energy) for EMTech and had a significant impact on the company's business.

LESSONS LEARNED

The company was driven by an identified need and its expertise in automation and both hardware and software development in numerous open innovation projects. It seized the opportunity to work closely with a lead customer to design, develop and deliver a new product line (iReact) allowing the automation of reactive load management in power distribution substations. Through this project EMTech was able to gain significant know-how and expertise in an industry in which they were not yet active and to develop, together with their lead customer, a number of solutions that were tested and are currently operating in situ with significant results.

A new feature –iReact Prognosis - was made possible through an EU-funded accelerator programme which enabled the further exploitation of the company's IP and products to include a decision support system.

Main lessons learned:

1. EMTech values highly the open innovation opportunities and initiatives with large companies and lead customers, as well as with other actors such as Research and Technology Organizations (e.g. ESA and collaborating RTOs) and business support organizations (e.g. the INSENCe acceleration platform). This is why the company invests time, resources and funds in such projects. In order to successfully exploit the IP generated from such projects, a solid and clear IP policy is necessary.
2. Open innovation projects that include core development processes may require a greater effort than originally foreseen in the project planning. It is crucial that all partners acknowledge that and be able to adjust to collaborate effectively.
3. Open innovation allowed EMTech to gain significant know-how and launch a new product line in a very demanding area that was new to the company, and the leading team was able to improve their skills in managing such demanding projects.