

## New Features Developed by Manufactures within fenix

### Introduction

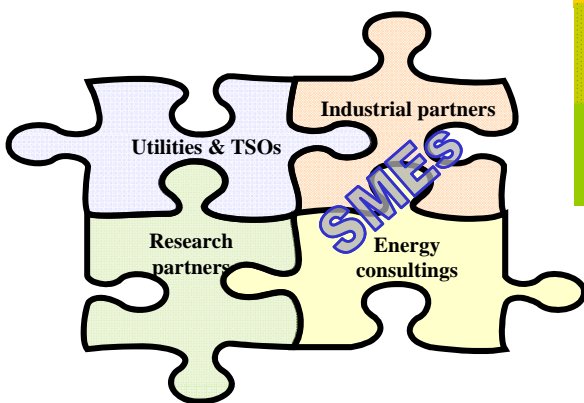
by Joseph Maire EDF

FENIX Strategic Steering  
Committee coordinator



At the very beginning of the project, the question of the FENIX consortium building has been discussed. It was decided to base it on utilities (DSO and TSO), with the academic support of universities, consultants and research centres without forgetting to leave a significant space to manufacturers representing the whole value chain needed for FENIX implementation:

- energy management and energy market software system and solution providers (AREVA and SIEMENS);
- manufacturer of wind turbine and renewable and energy sources installation provider (GAMESA);
- manufacturer of control, metering and communication systems from Medium to High Voltage electric power networks (ZIV);
- Consultancy and turn key projects for power systems field, electricity and ancillary services metering systems, design, development and solution provider for energy field, customer training for delivered products and solutions (ECRO).



This industrial participation to the project is a key issue of FENIX success. By the way, the only chance to go from the concept to the practical implementation is to associate those who know how to build with those who know how to use and operate and consequently to specify the needs. It enables to develop the ideas proposed by our R&D members without forgetting to associate those who check that economic viability has a chance to be there!

Thanks to the new features developed by the gifted manufacturers of our consortium, FENIX future seems obviously much more closer that it was three years ago as you'll discover it along this new bulletin !

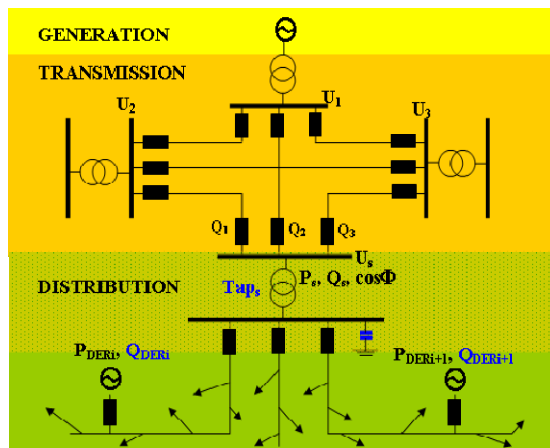
### Management Systems I

by Albana Ilo and Anton Heher (Siemens)

Energy Management Systems (EMS), Distribution Management System (DMS), and Decentralized Energy Management Systems (DEMS) are already standard solutions. Within the FENIX scope some function of these software systems are extended.

### Voltage VAr Control (VVC)

VVC is one of the advanced functions within DMS. With FENIX additional requirements are coming up to VVC, such as keeping contractual quality of supply to the end user or/and TSO requirements in boundary nodes (power factor). With the evolution and penetration of DER technologies new possibilities are available to control reactive power. The reactive powers generated/consumed from DERs are very powerful control variables for the controlling of VARs in DMS networks. The last ones are going to be treated as such in the VVC that will be demonstrated in the Southern Scenario.



In the figure above shows an overview of the power system with the 3 major stands - generation, transmission and distribution. Within the actual scope the intersection between transmission and distribution is relevant. The demand is to use the potential possibilities that do exist within the distribution network to keep the voltage at various buses in transmission network at the planned TSO values. Technically, it is not possible to reach this goal using only the resources that do exist within the distribution network because voltages at various buses in transmission network are defined from many different factors like generation, transmission network topology, flow, impedances, etc. that are not under the influence or administration of the DSO. The DSO can only move the voltage in the relevant bus 'Us' in the desired direction (increasing/decreasing), controlling the 'Qs' consumed/generated from its own distribution network.



### Co-ordination:

Iberdrola Distribución

José Manuel Corera

Avda San Adrián, 45

Bilbao 48003

SPAIN

phone: +34 94 466 32 62

fax: +34 94 466 31 94

j.corera@iberdrola.es

The Co-ordination action is supported by the EC under the 6th framework programme

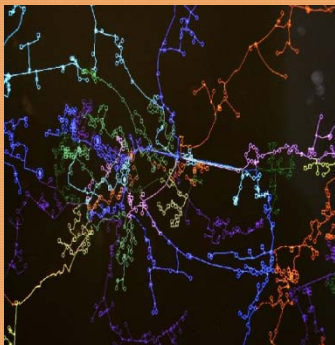
Duration:

1.10.2005 - 30.09.2009

Contract-No.

518272





Picture: Daniel Julien, EDF

Authors:

- Joseph Maire (EDF, France)
- Albana Ilo and Anton Heher (Siemens, Austria)
- Matthias Muscholl (AREVA, France)
- José Miguel Yarza (ZIV, Spain)
- Koen Kok (ECN, Netherlands)
- Mihai Sanduleac (ECRO, Romania)
- Maite Basurto RIVAS (GAMESA, Spain)

Liability

The authors are solely responsible for this publication, it does not represent the opinion of the European Community and the European Community is not responsible for any use that might be made of data appearing therein. Despite thorough control all information in this brochure is provided without guarantee.

Under no circumstances will liability be assumed for loss or damage sustained through the use of information provided.

More information about the FENIX project is available on the FENIX homepage:

Decentralized Energy Management System (DEMS)

The FENIX concept of Virtual Power Plants will enable active market participation of DER. Spot markets and ancillary service markets can also be addressed through aggregation of individual DER contributions. For using this concept, one has to make sure that the aggregated energy deals made by local DER are compatible with the local physical and operational conditions of the distribution grid.

DEMS configured as Commercial Virtual Power Plant (CVPP) enables the access of DER units to the national energy / ancillary service markets and further creates the capability that DER units contribute to local distribution grid services requested by DSO for system optimization.

Within the scope of the FENIX project DEMS has been extended regarding system connectivity (interface to FENIX box), reactive power control (Q set point) and system integration (with DSO using ICCP and energy markets using web services).

The design and prototyping of the information exchanges, between grid operators (DSO), aggregators (CVPP) and market systems, is based on exchanging single values (real-time) and schedules (day ahead).. The following figure shows the information exchange and its related protocols between the different FENIX parties involved.

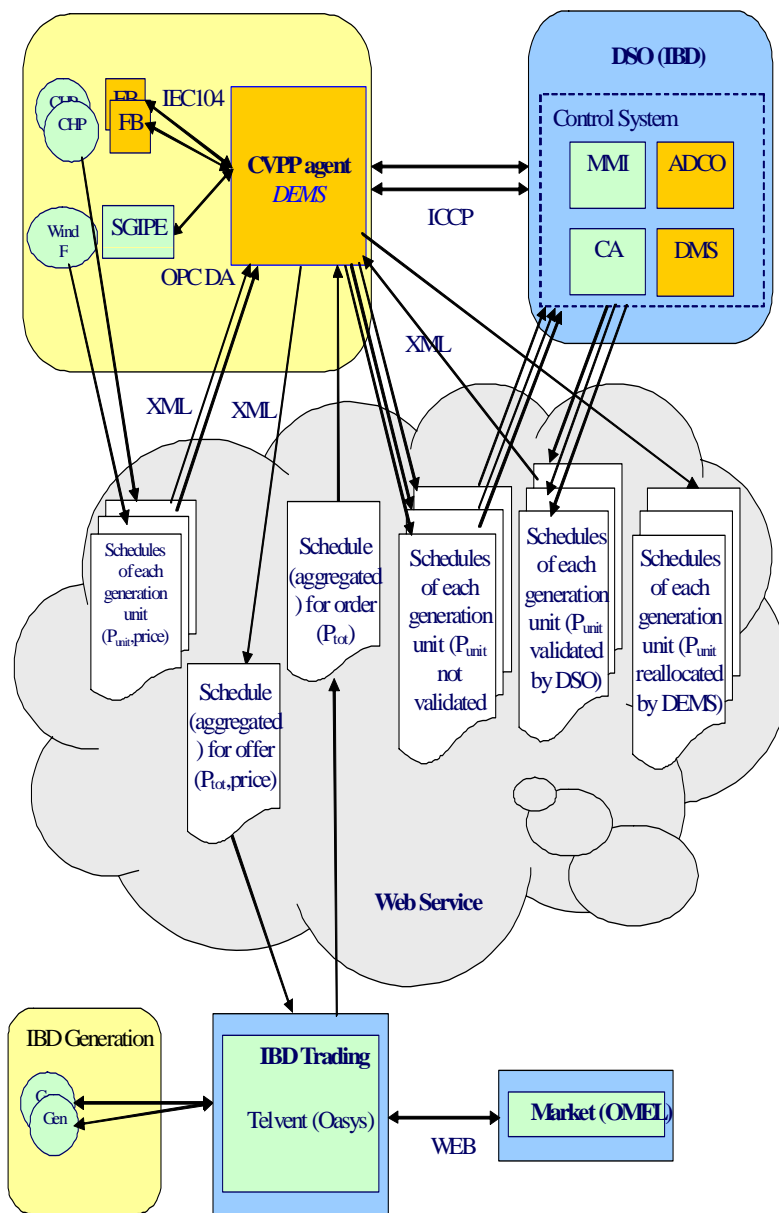


Figure: Interoperability scheme between DER, CVPP, DSO and Market systems (IBD = Iberdrola)



## Management Systems II

by Matthias Muscholl (AREVA)

In most of the countries with significant wind power penetration, moving from wind generation monitoring to wind generation control is perceived as a key factor for system reliability by the TSOs. The FENIX project implements new functions in EMS and DMS systems to perform such a change.

### Real-time visibility and control

In addition to voltage control, DER when aggregated in a VPP can also provide tertiary reserve. Tertiary reserve is an ancillary service for deviation correction. Participating generators have to be able to deliver or cease to deliver a certain amount of active power within fifteen minutes and hold it for two hours. The FENIX box is a key component to achieve this as it allows the CVPP in real-time to get and aggregate technical data from DER, when a notification is received from the balancing market, disaggregate it and send the corresponding active power set points to the required DER through the communication link. The FENIX box also provides for the collection of metered data, which allows the DSO to follow up on the actual generation of DER and historicize this data that could be used for settlement purposes for example.

### Network contingencies

Once a mechanism for DER to offer their flexibility exists, and this is provided by FENIX solution, it can be used in many other different network situations. Some of them will be simulated in the Southern demonstration:

- DER can help to avoid load shedding in the case a conventional unit is lost
- DER can help the DSO to keep service in an area where a substation has been lost, without too many network reconfiguration.

The FENIX concepts thus open a lot of possibilities. I encourage all of you to follow the outcomes of the Southern Demonstration and its evolution.

## Conferences

- International Electrical Equipment Conference - JIEEC 2009, 25-26 May, Bilbao  
[www.jieec.com/en/Index\\_en.htm](http://www.jieec.com/en/Index_en.htm)

- CIRED - 20th International Conference and Exhibition on Electricity Distribution, 8-11th June, Prague 2009  
[www.cired2009.org](http://www.cired2009.org)

- PowerTech 2009, 28 June - 2 July 2009, Bucharest, Romania  
<http://ewh.ieee.org/conf/powertech/2009>

## FENIX Box

by José Miguel Yarza (ZIV)

The real implementation of a Virtual Power Plant requires monitorization and/or control of loads and generators. From a technical point of view, it's necessary to install new devices for metering, communications and data management, to provide information to the upper level of applications (Distribution Energy Management Systems - DEMS), where the logical aggregation takes place.

This new generation of devices, called FENIX Box, represents intelligence at local level, that is to say, at the level of the loads and generators. It makes DER visible to the distribution system, provides control capabilities over the loads and generators from the distribution system by means of standard protocols, and allocates local agents for automated local operation.



FENIX Box belongs to a family of devices designed to function as Substation Central Units, Transforming Station Central Units and/or RTU's, resolving communications and data handling requirements for protection, control and metering devices in electrical installations.

The main functions of FENIX Box devices are described below:

- a) High level communications management (Control Centers or DEMS) by means standard protocols like IEC 60870-5-101/104, DNP3 or WISP+ Extended .
- b) Communication concentrator designed for the Automatic measurement of electric energy meters:
  - i. Up to 800 single-phase or three-phase meters.
  - ii. Support the international standard IEC 60870-5-102. Communications through PLC and ETHERNET.
- c) As IEC 61850 client, or by means other standard protocols like PROCOME, DNP3, MODBUS, IEC 102 and IEC 103, can communicate with protection, control and metering devices.
- d) Allocation of local and remote agents for automated local operation by means MSMQ and WEB services.
- e) Execution module for system central programmable automation and logic.
- f) Generation of databases in real time of all variables: alarms, measurements, status, controls, etc.

All these features make the FENIX Box a powerful machine to enable the Smart Grids of the future.

**Co-ordinator:**  
IBERDROLA  
José Corera  
Camino de San Adrian 45  
48003 Bilbao  
Spain  
phone: 3494 4663262  
fax: 34 944 165262  
[jose.corera@iberdrola.es](mailto:jose.corera@iberdrola.es)

The Co-ordination action is supported by the EC under the 6th framework programme  
Duration: 2005/10/01 - 2009/09/30  
Contract-No. 518272





## PowerMatcher

by Koen Kok (ECN)

PowerMatcher technology is a distributed energy system architecture and communication protocol which facilitates implementation of standardized, scalable Smart Grids. Scalability is key here. Through intelligent clustering, numerous small electricity producing or consuming devices operate as a single highly-flexible generating unit, creating a significant degree of added-value in electricity markets.

Using a highly efficient, low bandwidth communication protocol, DER units communicate their near-real-time flexibility options requiring the transmission of a minimal amount of information.

In the Northern Demonstration of FENIX, PowerMatcher Technology optimizes the potential of individual electricity producing or consuming units to adjust their operation in order to achieve virtual power plant (VPP) operation. The PowerMatcher VPP connects to AREVA's E-TerraTrade for receiving production schedules. The VPP provides info on plant technical capabilities and marginal production costs.



## Linux based FENIX Box

by Mihai Sanduleac (ECRO)

FENIX concept is expected to be finally deployed down to hundreds of thousands or even millions of small DERs. In this view, the Fenix Box - which integrates the local Fenix intelligence, should be flexible and cheap and should use wide-spread internet based communication.

With this target in mind, ECRO SRL developed an affordable Fenix Box solution, with an estimated 100 Euro price in big quantities, targeting especially small DERs with flexible loads.

The solution is based on an embedded Linux platform running AVR 32 bit RISC processor. The connectivity with CVPP is ensured by Web Services technology through an Ethernet interface connected to internet. A second Ethernet interface creates the DER local network and enables acquisition of DER metering data and of other needed local information. An additional RS232 or RS485 interface allows data acquisition from local devices having such connectivity.

Key features included in the Linux Fenix Box: internal relational database storage, web server for human interaction by using web browsers, wide connectivity through HTTP / HTTPS, e-mail, FTP etc. The software package includes DLMS metering readout and day-ahead, intraday and next-day support applications. New local software agents suitable for different business models can also be added on request.

## FENIX Wind Farm Tests

by Maite Basurto (GAMESA)

In order to demonstrate the proof of concept and support the overall aim of the FENIX demonstration project, GAMESA as industrial partner has developed remote control and monitoring of active and reactive power for a Large-Scale Virtual Power Plant (LSVPP). All preparation activities have been performed successfully. A wind farm with installed GAMESA wind turbines in operation is now ready for full scale testing as part of a LSVPP.

## FENIX Laboratory Tests

GAMESA in close cooperation with the work package leader (IBERDROLA) and Decentralized Energy Management System (DEMS) developer (SIEMENS) has verified the FENIX system functionality in laboratory environment.

Basically the laboratory scenario consists of a SCADA System installed and running as an OPC Server, connected to a Wind Farm Simulation tool, which allows the Decentralized Energy Management System (DEMS) to interact with the Virtual Power Plant via GPRS / Ethernet connection.

The results from laboratory testing illustrate a very high degree of correlation to the expected results.

## FENIX Field Tests

The field tests planned for the Southern scenario include the remote control of active power and reactive compensation in the Urkilla wind farm (Alava, Spain) by means of its communication with the Distributed Energy Management System (DEMS).

GAMESA has already completed configuration and preparation of the selected wind farm for field testing so the next step is to accomplish the full scale testing.

In addition to the field testing a series of documents has been created for the specification and development of the system, and for laboratory tests completed.



## Next FENIX bulletin

The FENIX bulletin No. 8 will be published in May 2009.

**Subject:** What is new in FENIX for network operators?

### Co-ordinator:

IBERDROLA  
José Corera  
Camino de San Adrian 45  
48003 Bilbao  
Spain  
phone: 3494 4663262  
fax: 34 944 165262  
jose.corera@iberdrola.es

The Co-ordination action is supported by the EC under the 6th framework programme  
Duration: 2005/10/01 - 2009/09/30  
Contract-No. 518272

