fenix
Flexible Electricity Networks to Integrate the eXpected 'energy evolution'
... a step towards the future of electricity network

Bulletin 8
5/2009

What is new in fenix for network operators?

Introduction

by Christophe Kieny
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With FENIX, Distributed Energy Resources - DER will become an opportunity for the overall electrical system.

The integration of DER into the existing electrical grids raises several important issues: Voltage management, short circuit currents, false protection trips, harmonics, etc. During the last decade, DER were marginal (limited) allowing their connection with relatively simple and cost–effective solutions. However, as the share of DER increases, there is an increasing need for their optimal integration at the best economical conditions. For instance, the poorly predictable renewable energy sources will likely be a major generation share during some periods of the year. Therefore, network operators need to put in place specific provisions and manage all the flexible means to ensure system security.

FENIX offers an adequate framework to integrate DER into the existing network as well as for market management. In this bulletin, network operators give their views on how FENIX allows DER to be better visible from the operator, and how it permits DER to be controlled for security and network optimization in a practical manner.

What is new for network operators?

by Peter Lang (EDF Energy)

When EDF Energy Networks first considered participating in the Fenix project there was a great concern that small scale DER would become very popular and the techniques we use to control our networks and manage security of supply would need to change dramatically.

To date our predictions haven't been realised. The setting of EU climate and environmental targets of 20% renewables, 20% energy efficiency and 20% carbon dioxide reductions by 2020 network operators will increase the levels of DER connected to our networks. We need to be ready to accommodate increased levels of DER.

Currently there is little visibility of DER connected to low and medium voltage networks. In the UK customers who install domestic DG, less than 16Amps per phase, are required to inform the network operator within 30 days of their generator being commissioned.

This is fine if only one or two customers install a generator. However if an entire new housing estate is fitted with renewable technologies then network issues will be apparent at various times of day e.g. voltage rise early in the morning when demand is low.

Larger small scale generation (covered by G59 recommendations) need significant investment to meet the protection requirements for connection, including loss of mains. Again if one generator connects to a local network then the feeder protection can be designed to operate correctly. However if many generators connect to the same network and together they are able to match the demand there is a risk that an islanded network may continue to supply customers without being connected to the main grid.

If as a condition of the DER connection, a developer is required to install a Fenix box to inform the network operator of the DER's activity, then the network operator could model the export and manage the risk of when an uncertainty threshold of protection operation could occur.

Additional monitoring of the distribution network will allow the network operator to manage voltage profiles. The presence of Fenix boxes will provide additional data that could be used as measurement points for a distribution system state estimator.

The Northern Scenario was able to demonstrate that currently no constraint management is required. Having Fenix boxes installed at every generation site will allow the trends to be followed and smart grid technologies to be deployed to facilitate active network management in areas of high DER penetration sometime in the future.

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

Duration:
1.10.2005 - 30.09.2009

Contract-No.
518272

SIXTH FRAMEWORK PROGRAMME

www.fenix-project.org

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Benefits of Fenix for National Grid

by Lewis Dale (National Grid)

In the decentralised Great Britain wholesale energy market, electricity supply companies have financial incentives to contract accurately to meet the needs of their customers and generators have similar incentives to schedule their own plant to meet the contracts they have agreed.

The role of the TSO is to resolve any residual energy mismatch, manage congestion, and marshal the various other system services needed to maintain an adequately secure and quality supply. On an island system, it is particularly important to ensure the necessary frequency response and short-term reserves are available at all times. To undertake balancing efficiently, National Grid purchases standardised balancing service products (ancillary services) in open tenders.

The standardised product tenders are designed to encourage participation, competition and innovation by all generators and demand side providers. Smaller service providers can meet the minimum despatch sizes required by the system operator by participating via service aggregators. However, to encourage the flexibility needed to meet future requirements at an economic price, National Grid has been keen to explore the range of opportunities that Fenix can realise.

A particularly important feature of Fenix in respect of providing greater volumes of economic balancing services to TSOs is the opportunity, by use of automation, to harness service providers that, due to their size and distributed nature, have so far proved too complex and expensive to include in the rather niche markets associated with network balancing. Fenix offers the potential to share communication infrastructure and achieve low transaction costs by combining the provisions attractive to transmission and distribution system operators with services that offer value to suppliers and their customers in the main energy market place. National Grid therefore sees Fenix as an important enabling technology, building on smart meters and internet communications to expand decentralised/distributed markets.

Benefits of Fenix for Red Eléctrica

by David Alvira (REE)

Traditionally System Operation has been managed with the contribution of the generation plants connected to the transmission network. As long as most of the power is produced by facilities connected to the transmission network, this model continues to be valid.

The increase in power plants connected to the distribution network, e.g. via inclusion of DER, can lead to the need of their contribution to the Operation of the System to be considered.

Fig.1 – Renewable Operation Centre (REE)

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Distribution companies are the first to be affected by high penetration of DER, but when the power produced by DER increases above a certain percentage of the total, their contribution to System Operation is essential.

For this reason, above a certain penetration, Red Eléctrica (REE) needs visibility and even some sort of control over these facilities. This requirement has led REE to promote the creation of a special control centre (CECRE) capable of handling the most urgent issues related to security of the system (Figure 1).

FENIX has studied many different aspects of DER integration: technical, economical, legal, etc., looking further into the future than just the requirements of today's system. This project includes demonstrations and gets to the point of trying to obtain from DER the same contribution that is achieved from conventional plants. The results of this project will help prove which methods and tools are the best for high DER integration.

The most important issues, assessed in FENIX where the DER contribution to System Operations is needed, are:

- Voltage control

  Today, in Spain, DER contribution is achieved through fixed power factors. A reference voltage control method will probably obtain better contribution. Further enhancement could be obtained through a system like FENIX that permits real time communication.

- Tertiary reserve

  Today tertiary reserve provided by a group comprising power plants of different technologies is not permitted in Spain. FENIX aims to demonstrate that this service can be provided by a Virtual Power Plant (VPP) made up of DER of differing technologies. This demonstration will be essential for managing future scenarios with high DER penetration.

What is new for distribution system operators (DSO)?

by Juan Martí (Iberdrola)

Up to now, DER have been connected to the distribution network using a "fit and forget" approach. The DSO has had to manage this generation and impact DER may have on the network without having visibility or control. FENIX enables DER to offer new services by increasing their integration into the networks, and as first step, enabling them to be visible and controllable in real time. The DSO can take advantage of them and make use of these new services if necessary.

With FENIX, the DSO is informed of the DER generation schedule (of what is planned to be injected into its network) and gives the DSO, for the first time, the opportunity to validate this schedule. This means, that if the power injection of a certain generation is not technically feasible at distribution level (e.g. causes an overload or over-voltage), the output can be reduced or rejected.

This alone will have an important impact on the management, planning and operation of distribution grids, and it will also allow a higher penetrations of DER.

Besides, the capacity of sending real time control set points to DER via an Aggregator means that DER can provide ancillary services to the DSO. The southern demonstration shows that DER can help maintain the quality of service in the distribution grid and even support the power supply in the case of contingencies.

Thus, DER aggregation into Large Scale Virtual Power Plants and the existence of a communication infrastructure, can improve the management in the distribution network and can contribute to increasing the installed capacity of DER, without having a negative impact on the grid.

Next FENIX bulletin

The FENIX bulletin No. 9 will be published in July 2009.

Subject:
Regulatory and contractual framework for fenix

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