National Grid
Case Study

The National Grid Company is using Adroit Technologies' SCADA HMI in the first phase of an innovative new project.

Background

The National Grid Company (NGC) was formed in March 1990 as part of the privatisation of the electricity supply industry in England and Wales. The National Grid Group (of which NGC is a wholly owned subsidiary) was floated on the London Stock Exchange in 1995. National Grid runs the largest privately-owned, independent transmission company in the world and also one of the top 100 companies in the UK. NGC owns and operates the high voltage transmission system throughout England and Wales which is known as the "national grid" and carries electricity from the power stations where it is produced to the suppliers who deliver it to over 23 million customers. The national grid operates at 400,000 and 275,000 volts and is made up of over 7000 route kilometres of overhead lines carried on some 22,000 towers, more than 600 kilometres of underground cables and over 300 substations.

NGC has a statutory duty under the Electricity Act 1989 to develop and maintain an efficient, co-ordinated and economical Transmission System for the supply of electricity. One of NGC's statutory obligations is the requirement to maintain system frequency within the range 49.5Hz - 50.5Hz. This is achieved through the management of changing generation and/or demand. These services are automatic and can be required at any time to contain frequency deviations and recover it back to normal.

To date these services have been provided by Generators, obliged to have a frequency control capability by virtue of their Grid Code connection conditions, and large industrial electricity consumers capable of interrupting firm loads for a required time. Given the limited number of production processes able to offer a firm interruptible load, NGC has been developing a frequency response service through the aggregation of fluctuating electrical loads. By combining a large number of cyclic demands, a relatively firm level of response can be derived and delivered when required.

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The Project

It is now possible to trip demand sites automatically following the successful delivery of the Frequency Control by Demand Management information system (FCDM). The system is managed from National Grid's Wokingham site and is already in operation at 17 client sites - steel and cement manufacturers to date - throughout England and Wales, 2 business sites and 1 agent site, Yorkshire Electricity.

Installed and supported by Scomagg Ltd, the contract-based system has already resulted in a number of significant benefits to both National Grid and its clients. National Grid is able to map the available pool of power more thoroughly and has reduced the need to buy in extra power from other providers during periods of high load. Clients participating in the arrangement get paid to respond, with the protection of a guaranteed service.

Scomagg, an Adroit approved system integrator, secured this major project due to their extensive knowledge of both the power and industrial sectors and, working with Adroit Technologies, demonstrated a working model prior to contract award. They took complete ownership of the running of the project, illustrating their extensive analytical, design and technical strengths in both real time engineering and software disciplines, and, of course, designing and implementing the wide area network across all the sites.

Why Adroit?

A robust and reliable SCADA system is essential to the operation of the FCDM and a number of SCADA packages were evaluated and eliminated before the Adroit SCADA HMI was chosen. The Adroit package was primarily selected on the strength of its support for a high availability hot-standby system arrangement, which was essential to National Grid. Adroit's proven LonWorks® driver was also an important factor, as was the ease with which data can be read in from Excel and Access. In addition, Adroit's advanced client-server architecture enables Scomagg to maintain each site remotely via an ISDN line and modems.

The Adroit SCADA HMI replaced a similar but reduced functionality prototype, installed to prove the scheme feasibility. The new system is more powerful and enables more clients to participate. The flexibility of the system is such that it in its current form it can be expanded to include more than 250 sites.

How the System Works

Client sites are responsible for declaring and maintaining a pattern of MW availability for large industrial loads, with agreed 30 minute blocks of power being available for use elsewhere on the grid. This allows automatic tripping at pre-set frequency levels. NGC business sites are responsible for general system health monitoring, and for occasional special operations such as load un-suppression, and manual acceptance of availability data. The agent site, Yorkshire Electricity, is responsible for the setting up of advance Availability Declaration patterns, and the site engineering and communications work for their sites. Each class of user has had application-specific training from Scomagg and also, in the case of the client sites, from Yorkshire Electricity.

The SCADA HMI gathers information on clients' declared availability per half hour for the coming week and monitors frequency trips and "power returns". Significant transactions are reported to the relevant personnel via e-mail, with a log of site incidents being maintained in MS Outlook. Minute-by-minute plant data and end-user availability data is logged and sent to the main customer sites for analysis.

Comma separated files are generated every hour to provide information for other systems. Data is passed to the DEC Alpha based hub of National Grid's Frequency Control/Monitoring System to enable the National Grid Central Control Operator to make decisions about utilising the Frequency Response provided by the new System. Data is also exported for contract management audits.

The system runs on Compaq Proliant servers and Compaq Deskpro PC's. The Central Business Site has two Adroit servers operating in hot standby. For confidentiality and security, the system uses a firewall hosted on a HP Vectra Series 8 PC. Plant equipment is monitored via a LonWorks® network, communicating with a Low Frequency Relay over a serial line. LonWorks was selected as it provides a high performance solution at low cost.

The system also links to a Rugby clock via a Ruggedised Active MSF Antenna and a Time & Frequency Solutions M210 Time System, as time synchronisation is crucial for accurate time-stamping of real-time data across all sites.
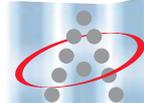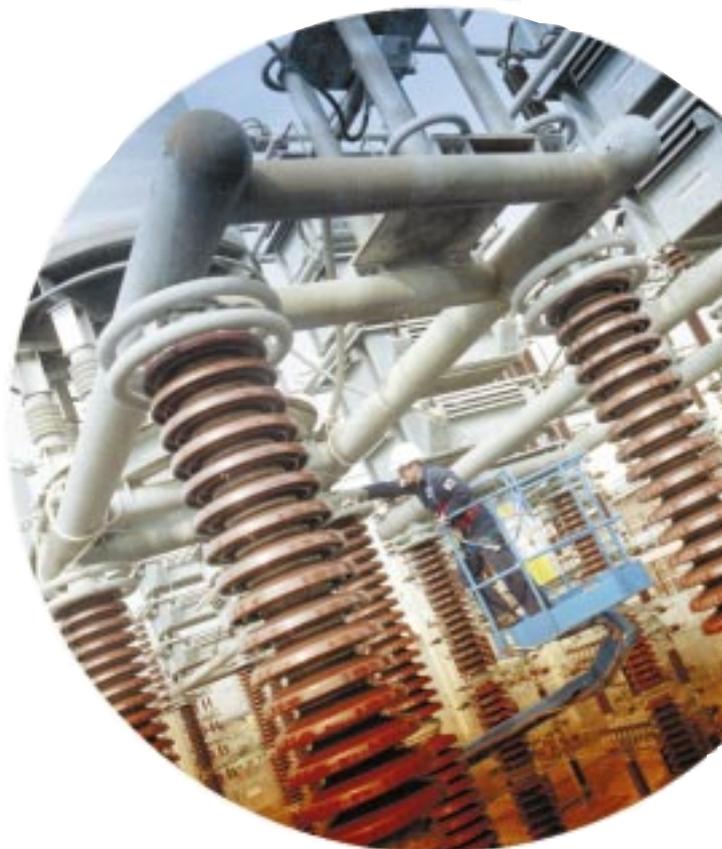
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The system was written largely in C/C++ and Visual Basic, with user interfaces being written in Visual Basic with C back ends. Client/server communication is implemented using RPC to optimise throughput on existing telephone lines. Most of the programs run as NT Services, although some programs are batch queue initiated. There are 21 programs and 12 Dlls including a proprietary OLE Dispatch interface to Adroit.

Key Benefits

From a technical standpoint, the main benefits of the system are high availability and reliability combined with ease of use and powerful functionality. The automatic operation of the system also means low maintenance.

Quotes

Stuart Baldry, Scomagg's Engineering Manager comments "The success of the Frequency Control by Demand management system was not only due to the technical competence of all concerned. A major factor was the relationships built and the team-working carried out between all the organisations involved. National Grid, Yorkshire Electric, Scomagg and Adroit worked very closely at all stages of the project to ensure the end result was a reliable and commercially viable solution which met National Grid's business requirements. It is very pleasing when a project leads to such good relationships and I hope the friendships and business relationships built through the FCDM project will continue."

Nigel Ball, Sales Director of Adroit Technologies adds "The NGC project utilises several of Adroit advanced features, including hot standby, support for time stamped data, remote dial in for maintenance and connectivity to the Microsoft® Office™ suite. The project is complex and its successful implementation is a tribute to the good working relationship developed between Scomagg, NGC and ourselves."

The system has been designed with extensibility in mind - up to 255 client sites, with other agents as necessary. Site visits are underway for prospective client sites. NGC's Transmission Services project manager, Ron McCormack, concludes "There's scope to bring in many more customers, as tripping demand can be competitive with the equivalent generation response. The key is to find demand side processes with steady interruptible loads or unsteady loads that can be grouped together to give a probabilistic steady load."
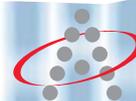
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