

SCADA[™] for the Oil and Gas Industry

The advanced operations management system



ABB

SCADAverage™ core systems offer full featured performance

ABB has been a global supplier of automation to the oil and gas industry for decades. ABB knows that the oil and gas markets are demanding, and we're dedicated to offering solutions that meet our customers' needs. Uniquely designed for challenging oil and gas operations, ABB's SCADAverage™ was conceived for a dynamic industry that requires safe and reliable control of distributed assets, as well as a bi-directional interface with corporate systems.

A Powerful Core

SCADAverage™ is built on a reliable, high performance, relational database that is unique in the market.

Traditional SCADA systems depend upon memory link lists. SCADAverage™ uses a real-time relational Database Management System, referential integrity and active queries to enhance data retrieval, data integrity and the speed of data updates. Yet, SCADAverage™ consumes less computer memory than traditional systems.

The Database Management System combines standard SQL technology with powerful features that improve memory efficiency, performance, data quality and connectivity to external corporate relational databases. Data consistency is enforced through referential integrity.

An easily configured polling engine makes data acquisition function smoothly on low speeds or over noisy communication lines. Data polled from remote devices is collected and stored in an embedded historian that's included in the base license—another departure from traditional systems. Redundancy and database updates by exception provide superior performance and reliability.

Performance is crucial in today's control room environment, SCADAverage™ speeds up data interchange between servers and clients through a unique feature called "active queries". The server updates the clients with changed values only, which significantly lowers network traffic.

Because of its powerful core system, SCADAverage™ is a market leader for upstream and pipelines.

And with its easy, low cost maintenance (at least 30% lower than competitors' systems); SCADAverage™ is also the most cost effective system on the market.



Features that are always in control

safe, robust and reliable SCADAverage™



Replication

Distribution of the SCADA system is important to oil and gas companies. SCADAverage™ achieves full distribution through replication.

The data, database configuration and operator configuration are replicated and transferred to other servers in real time. The transfer is bidirectional, so commands and setpoints can be issued at the local facility or remotely at the regional center or from both locations, with appropriate interlocking (e.g., after hours). This consolidation of local and regional data and supervision gives extensive flexibility in system deployment and maintenance.

Replication occurs in two models:

- Hierarchical (local, regional and corporate levels)
- Peer-to-peer (offsite backup control center)

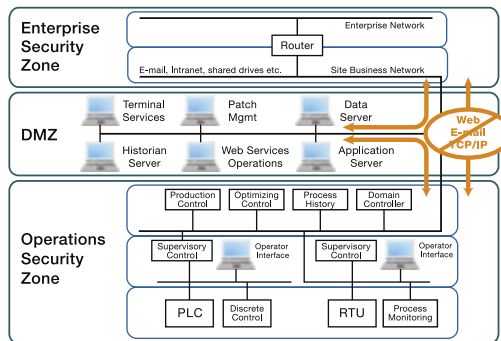
Replication allows automatic configuration to be:

- Centralized (remote non-intrusive)
- De-centralized (local to the server)
- Both

Security

Security is offered through a highly configurable authority system that prevents unauthorized persons from gaining access and activating commands. The multi-level security system conforms to any corporate standard functions and maintains a history on each user's access to objects and attributes, data, displays, production areas and controls. SCADAverage™ can be implemented on any security level, from the simple schemas of firewall protection to the most sophisticated architectures in the market, depending on the customer's preference.

- Re-routing of alarms for unattended areas
- Zones and zone groups access control
- Encryption and VPN support
- Inactivity logout
- Active directory support for centralized security with a password policy featuring:
 - Strong passwords
 - Automatic password expiry
 - Password re-use
 - Account lockout on repeat violations
 - Password length
 - Login auditing



Business Object Templates

Allow the user to build an entire object in the system with the push of a button.

These templates can be used to create:

- RTUs and PLCs
- Flow measurement devices (liquids and gas)
- Pump-off controllers for rod pumps
- VSDs for PCP and ESP pumps
- Pumping and compressor stations
- Flow stations

The result is a remarkable simplification of system maintenance.



SCADAverage™ adapts to industry demands

Redundancy

Real-time server redundancy allows the system to run with an active/standby configuration. Redundancy is also supported for communications (network, serial, satellite, radio, leased lines, CDPD, etc.) and through levels of replication. Unlike many competitors' systems which handle only hardware monitoring, SCADAverage™ supports both hardware and software monitoring to give advanced protection against failure.

Business Systems Interface

SCADAverage™ supports open, real-time, international standards of connectivity, such as ODBC, OLEDB, OPC DA, AE and HDA. These standards are also supported by most corporate databases and systems such as SAP, Pi, PVR, FieldView, Maximo, Silicon Graphics VRC and Slumberger Epinet. External relational databases can communicate with the SCADAverage™ real-time database, allowing remote procedure calls for easy bi-directional data transfer meeting any connectivity standard.

Communication

SCADAverage™ supports and monitors multiple paths of communications for:

- LAN/WAN and leased lines
- Licensed and spread spectrum radios
- Microwave
- Cellular digital packet data (CDPD and CDMA)

Communications analysis is available through real-time screens and trends. The system includes a protocol analyzer for radio and TCP/IP communications.

Protocols supported:

- ROCTalk and ROC Talk plus
- BSAP (including RBE and immediate mode)
- Modbus (TCP/IP, RTU, ASCII)
- Allen Bradley DF1
- Totalflow
- HP 48000
- Kimray
- Adept
- Hex repeater (Amocams)
- Toshiba G2
- DNP3 (OPC)



Reports

Provides comprehensive data reporting to production, operations, maintenance, engineering, accounting and management. Database, system and communication function logs are available. Reports are provided through Active Reports, an integrated up-to-the-minute package that's one of the leading report systems in the market.



Historical Data

SCADAverage™ has two types of historians:

The first historian is based on internal logs for polled real-time data and calculated points. As part of the core system, this historian does not require a separate license. The database consists of raw, hourly and daily values, limited only by the size of the disk. This data is used to supply trend values and also supports automatic archiving and de-archiving.

The second historian, based on Microsoft SQL, is called Production Data History. This historian holds regulatory data, such as gas measurement data in compliance with API 21.1 and AEUB Directive 17th. With this historian, production data can be uploaded daily.

Flexible architecture

handles current and future operations

In the current operational environment, it is essential to move operations from the reactive to the proactive. SCADAverage™ applications not only help operational staff with monitoring and control, they provide the right analysis for accurate, timely decisions.

Ease of configuration and useful applications provide a powerful tool for cutting downtime and optimizing production.

Upstream scalability

The system architecture was designed with flexibility in mind. SCADAverage™ can be deployed simply as a local HMI for a facility, grow to include the wells in the area and take on more applications as needed.

The local system controls operations in the field. Multiple local systems can be connected to a consolidated, central, regional system. The regional system replicates information from all areas and handles daily optimization and coordination of activities.

Multiple regional systems can then be consolidated automatically to a corporate center that links to systems like Pi, SAP and Maximo.

Different scenarios are possible such as:

- Local > Region > Corporate
- Field > Country > Headquarters (different country)
- Operational level > Optimization level > Economic/
Strategic level



SCADAverage™ Benefits

- Efficient use of communication bandwidth
 - Deadbands
 - Data compression
 - Publishing and subscribing
 - Update by exception
- Simple and consistent configuration
 - Consistent look and feel in SCADAverage™ explorer
 - Dynamic, self-configuring maps
 - 2 step full configuration of wells, metering and compressor stations
- Low license cost
 - Competitive server licenses
 - *No license* required for workstations
 - *No license* required for trending historian
- Support for industry standards in real-time
 - ANSI SQL
 - ODBC
 - OLEDB
 - OPC DA, AE and HDA

“ This rapid increase in production activities might normally mean doubling the number of pumpers/operators. Automation will allow us to keep up without adding pumpers/operators.”

Kevin Kilstrom
Production Manager
Marathon Oil Corporation



SCADAverage™ provides a full featured daily production package

Production Data History (PDH)

Daily production reporting is at the center of upstream production operations while accurate reporting and audit trails are at the heart of the pipeline industry. The historical database of SCADAverage™ was designed to easily accommodate these requirements.

The Production Data History (PDH) application in the upstream provides daily production reporting and is fully regulatory compliant. PDH is based on Microsoft SQL server using an object-oriented model that gives users the flexibility to add or modify entities.

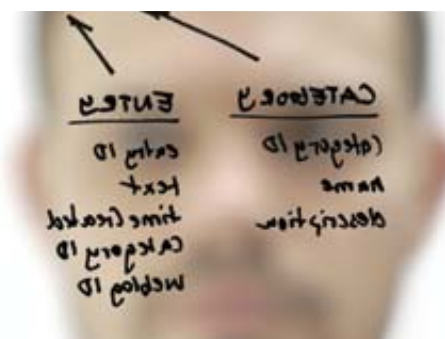
Data and configuration are date sensitive, allowing quick re-configuration and accurate reporting even when changes occur in the middle of the reporting period. Unlike other databases, PDH also stores relationships between entities, including:

- Facilities, wells, meters, etc.
- Operating areas, business units, operator runs, gathering systems
- Product Ownership interest (working interest) records

A comprehensive audit trail is available for:

- Entities (meters, wells, etc.)
- Gas composition and meter parameters
- Measured values
- Edits

PDH meets the requirements of API, government regulations and joint venture partners for maintaining a history of metered, tested, flared and injected volumes.



Powerful

alarm callout and telephone call-in

Alarm Call-out and Call-in Application

In the ongoing drive to lower operating costs, upstream oil and gas companies increasingly implement unmanned remote facilities. To ensure safety, operators need a robust warning system. With the Call-out and Call-in application, SCADAventure™ provides for alarm escalation in addition to on-screen alarms in a control room, plant site, dial-up laptop or handheld device.

In addition to screen warnings, SCADAventure's™ integrated Alarm Call-out and Call-in application can command a PLC to sound an alarm horn if the site is experiencing a priority alarm condition. Further, a list of escalating contacts and receiving devices is configured in the Call-out application.

Designated personnel receive audio or visual notification of operating problems through:

- Cellular or land phones
- Electronic mail
- Voice radio
- Numeric or alphanumeric pagers
- Communications-enabled PDAs

Authorized personnel can dial into the system and use the phone keypad to request meter pressures, flows or temperatures. They can request data for a single well or for a range of meters by keying in a pre-defined report number. Based on the report, operators can plan an appropriate intervention.

The Alarm Call-out and Call-in application can be configured to escalate an alarm. The system automatically calls out to a series of telephones or other devices in an escalating pattern, if the alarm is not acknowledged within the configured response time. The application conforms to all levels of SCADAventure™ system security so an audit trail of the escalation is saved in the database.

Blackout periods can be configured to temporarily disable alarm signals to specific users or groups. A blackout is useful when a person is on vacation or off shift or for locations where personnel are working on-site and can hear local alarm signals or where operators are monitoring alarm screens from a central control room.



On screen analysis tools, queries and messages complement alarms, real-time and historical graphic trends and reports for managing production, injections, wells, metering stations, batteries, satellites, plants and pipelines.



SCADAventure™ is state-of-the-art in handling abnormal states

“We’ve chosen
ABB because
they offer
state-of-the-
art technical
solutions at
competitive
prices within
short delivery
times.”

Liu Xiang Dong,
PetroChina
Project Manager



Enhanced Alarm Management Application (EAM)

Alarm Management is key to improving operations at complex process plants. There are no general rules and guidelines; often all the required information is distributed among hundreds of different documents. That’s where EAM proves its advantage.

Enhanced Alarm Management (EAM) is a powerful application developed to replace alarm printing or enhance system alarms. It provides additional functions for intelligent alarm monitoring and archiving, off-line alarms and event analysis. EAM provides real-time alarm analysis and management for the SCADAventure™ system and beyond; it covers the entire automation system.

Virtually every device capable of sending ASCII data through a communication port can be connected to EAM. ASCII data may consist of alarms, messages, events and/or reports. EAM also fully exploits the features of OPC alarm and event protocol.

Various SCADA, PLC and emergency shutdown systems can be connected to EAM. Data collected, filtered and parsed from EAM is saved in an Open Database (ODBC) based on SQL server. This offers a new method for offline alarm analysis and improves process alarm handling by SCADA operators.

The ABB Enhanced Alarm Management comprises three software modules:

- Database Manager Server
- Event Viewer Client
- Analysis Toolkit Client

The modules are tightly and seamlessly connected together, to provide an integrated, scalable solution.

Abnormal Condition Management Application

SCADAventure™ uses a powerful feature called control sequences to track certain configured conditions. These conditions are defined in easily customized triggers using SQL, If-Then-Else-End values or even external programs called with parameters. These triggers return a true or false condition.

If the evaluation of one or multiple triggers is true, the actions specified in the control sequence execute. These actions are again very flexible. They range from setting a set point or sending a command to executing complex logical steps in a pre-determined sequence or invoking the action of an external application or system.

The Abnormal Condition Management application adapts to the customer’s environment by allowing the customer to define the condition under which the action should be taken. In corporate implementations of SCADA systems, this application makes possible the automation of repetitive tasks that operators would otherwise handle manually.

Bringing operational efficiency to well test

Automated Well Test Application

When well production is measured at a group meter rather than at the individual wells, such wells must be tested at intervals to meet government regulations, partnership agreements and joint venture contract reporting requirements or to determine the profitability of each well. The flow rate tests determine each well's gas, oil and water production rate.

Each well is flowed through a test separation facility for a specified period that typically includes a purge time plus up to 24 hours of stable test time. The test results are used to pro-rate monthly production from the group measurement point back to individual wells and to determine production from a formation or pool.

An Automatic Well Test algorithm running in a Programmable Logic Controller (PLC) located at the satellite facility automates well testing steps. The PLC allows a choice of three well test methods that differ based on the level of automation:

- Semi-automatic valve changes requiring manual intervention.
- Fully automatic valve changes put new wells on test using an ordered list configured in the PLC.
- Statistical well testing which controls valve changes based on a calculated appropriate purge time plus a designated stable flow time.

All test data is stored for viewing in SCADAverage's™ Production Data History database. Any authorized user can accept or reject a completed well test. Both accepted and rejected values remain in the database. The application allows users to view which well is currently being tested and to review results by specifying a device or a unique well identifier or a range of dates.

A user can view or edit automatic well test information for a specified time range and for one or more wells. The integral audit trail and security functions ensure any change to a well test value must be accompanied with a reason for change. In some circumstances, certain test values are derived by calculation rather than by measurement. In these cases, if an edit is performed, the well test history editor automatically recalculates the values.



“ In active drilling areas, customers are drilling 20- 30 wells per month. SCADAverage™ automates and simplifies addition of wells to the system for significant lifecycle cost savings.”



Allocating daily production accurately

Production Allocation

Group metering is used at test facilities and plant inlets. While measurements may be combined, monthly production must still be reported on a well-by-well basis to meet government regulation, royalty regimes and sales contract requirements. With SCADAverage's™ Daily Volume Allocation, this process is fully automated.

SCADAverage's™ Volume Allocation application uses well test results to quickly and accurately allocate the volume measured at a group meter to the associated wells. The inputs to the allocation calculation include:

- Last valid test gas, oil and water volumes for each well in the group
- Total group metered gas, oil and water volumes for the day

A well's production hours can be entered manually by an operator or automatically by the system, if appropriate telemetry is installed at the well. SCADAverage™ automatically monitors low flow or no flow sensors. It uses this information to determine when a well has been shut in and thus calculates and stores total monthly production hours. The allocation process also adjusts the reported well volumes for recovered fluids such as load oil or diluents used to flow heavy oil.

| Well | Location | Date For | Allocation | Planned Volume | Oil Volume | Gas Volume | Water Volume |
|-------|-------------|-------------|------------|----------------|------------|------------|--------------|
| Well1 | Well Site A | Feb 11 2008 | Test | 4000 | 1000 | 100 | 100 |
| Well1 | Well Site A | Feb 12 2008 | Test | 1000 | 200 | 50 | 50 |
| Well1 | Well Site A | Feb 13 2008 | Test | 1000 | 200 | 50 | 50 |
| Well1 | Well Site A | Feb 14 2008 | Test | 1000 | 200 | 50 | 50 |
| Well2 | Well Site B | Feb 15 2008 | Test | 2000 | 500 | 100 | 100 |
| Well2 | Well Site B | Feb 16 2008 | Test | 2000 | 500 | 100 | 100 |
| Well3 | Well Site C | Feb 17 2008 | Test | 6000 | 1500 | 300 | 300 |
| Well3 | Well Site C | Feb 18 2008 | Test | 6000 | 1500 | 300 | 300 |
| Well3 | Well Site C | Feb 19 2008 | Test | 6000 | 1500 | 300 | 300 |
| Well3 | Well Site C | Feb 20 2008 | Test | 6000 | 1500 | 300 | 300 |
| Well3 | Well Site C | Feb 21 2008 | Test | 6000 | 1500 | 300 | 300 |

Optimization to artificial lift pumps

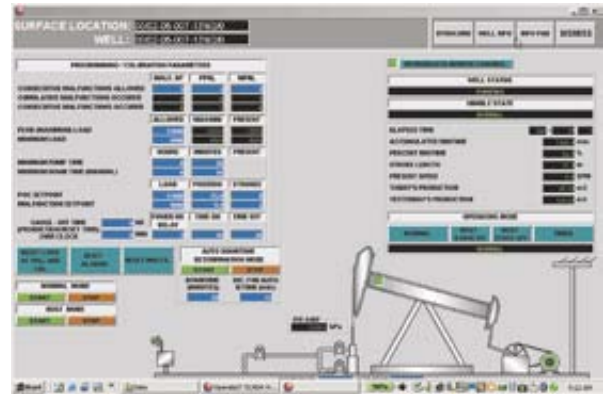
Rod Pump Optimization

Production engineers are constantly looking for ways to optimize pump jacks on oil wells with minimum site travel. A dynamometer is an important analysis tool for measuring downhole pump efficiency. A series of measurements from the load cell and position indicator over each full pumping cycle are recorded by a pump off controller installed at the well.

The SCADAverage™ Dynamometer application assists operations personnel to:

- Quickly monitor remote wells
- Focus on problem wells
- Reduce driving time
- Reduce damage to well head equipment
- Detect abnormalities
- Reduce power consumption
- Plan and extend maintenance cycles

The SCADAverage™ Dynamometer application interfaces to the most popular pump off controllers. The application reads and graphically displays the results of the Dynamometer measurements as a DynoPlot. This plot or graph represents a full pumping cycle by displaying measurements of rod position on the X-axis and rod load on the Y-axis. By using external applications, the downhole card can be calculated or uploaded, if the controller supports it.



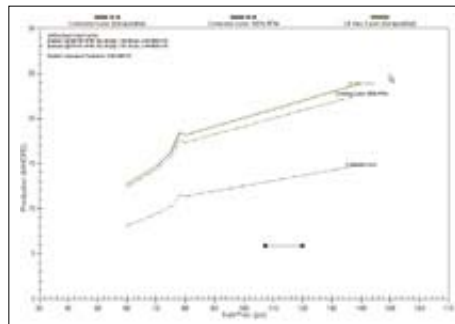
SCADAverage™ — providing compressor optimization



Reciprocating Compressor Efficiency Application

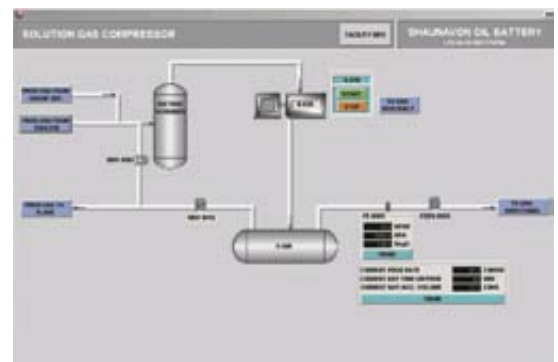
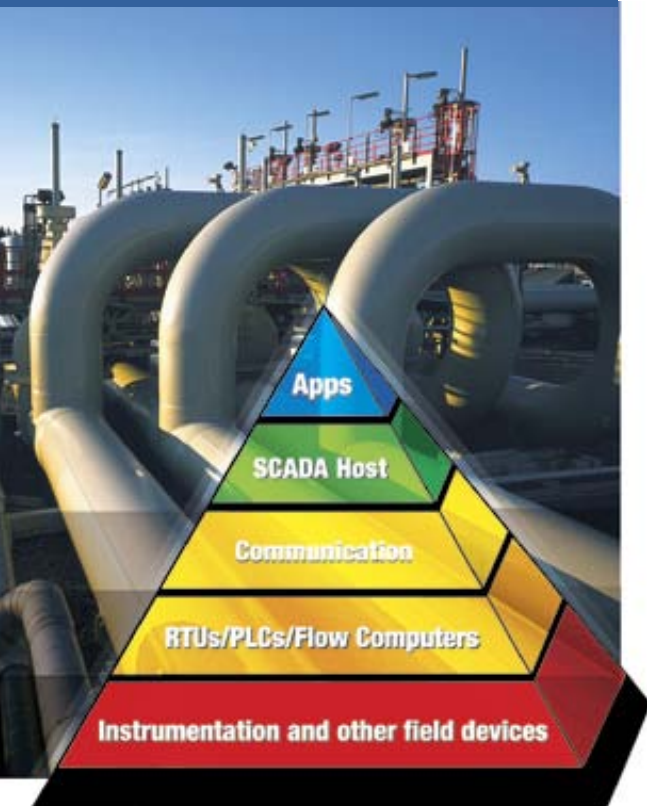
Production and sales of upstream oil and gas depend greatly on available compressor capacity. Accurately monitored and optimized compressors are important in alleviating production bottlenecks.

The Compressor Efficiency application provides a diagrammatic view of reciprocating compressor efficiency. The diagram can be for a single compressor, or several parallel compressors. Various compressor characteristics are displayed including current net flow, maximum capacity, and potential maximum capacity that might be expected from the compressor(s).



Engineers use these diagrams to quickly assess a compressor's production capacity and determine what pocket settings or speed changes could optimize production. Zooming to any diagram section reveals additional details.

In the case of a parallel compressor efficiency diagram, a composite capacity curve is calculated and displayed. Current operating conditions, maximum speed conditions and the ultimate maximum curves for all contributing compressors are displayed. If a compressor shuts down, the application automatically re-calculates a composite curve for the remaining compressors.



A Solid Foundation for Pipeline Operations

Efficient pipeline management is the basis for improving throughput and information management. SCADAventure™ provides internal and external applications that are integrated with the real-time system to facilitate the collection, management, processing and (optionally) validation of gas flow measurements from a variety of data sources. SCADAventure™ meets the information needs of Gas Transmission, Distribution and Production systems.

In many cases the distance to pumping or compressor stations and to isolation valves requires local control and buffering of data in case of communication interruptions. These interruptions may cause corrupted data or data loss. SCADAventure™ uses configurable data integrity checks and local data storage to ensure data quality and prevent data loss.

Pipeline scalability

SCADAventure™ can be deployed as a local HMI, monitoring and controlling block valves and pumping or compressor stations.

All stations and valves can be automatically consolidated into a control room system using replication. The control room typically runs the operational and commercial applications that result in efficient pipeline management.

Back up control rooms are easily configured using peer-to-peer replication, which keeps them synchronized with the main control room. Since SCADAventure™ supports all standards of connectivity, customers have the freedom to choose ABB applications or any third-party application that supports such standards as OPC, OLEDB or ODBC in real-time. This becomes especially important for system replacement when a pipeline company already has applications in place.



On major gas pipelines, customers are adding approximately 2-3 metering stations per week. ABB's competitors typically take 2-3 days to integrate a metering station into their system.

Using SCADAventure™, this task can be completed in 2-3 hours, contributing to significant lifecycle cost savings.

“ABB provided the efficient way to execute and complete our refined products pipeline SCADA project.”

Liu Weiguo
Operations Manager
SINOPEC

Gas pipeline core applications



Linepack

Linepack calculations are performed by the system to maintain an estimated inventory quantity. The system also tracks current pack and change in pack at hourly and daily intervals. Linepack calculation results are processed by the system against customer-definable parameters, allowing operations personnel to define alert levels. Graphical interfaces show Linepack changes over time in the form of trends and coloured pipeline segments.

Schedule tracking

Gas schedule tracking calculations are performed periodically to establish the forecast end-of-day (EOD) contract quantity and the required flow rate to meet the quantity required by each contract. The forecast EOD contract quantity calculation uses real-time input analog points to specify the accumulated volume and current daily flow rate for the current gas day at a particular receipt or delivery point in a pipeline network. It then extrapolates the anticipated total volume or energy.

Worldwide Support and Integration Centres

We recognize that an oil company's specific service requirements are based on the criticality of its assets to production and the level of in-house expertise. ABB service contract agreements are adjusted to complement the in-house expertise and provide additional capabilities needed to maintain asset performance at the required level.

Agreements range from call-up support services to complement a self-maintenance strategy all the way to dedicated on-site resources. Programs providing software management and version upgrades are also available.

Our experienced service professionals can help implement the right support services. ABB offices are located in most oil producing countries to offer the first line of support. They can call on our major execution centers all over the world when the urgency or complexity of issues demands further help. The benefits of this arrangement are:

- Expanded maintenance capabilities
- Improved system and equipment utilization
- Effective maintenance planning

ABB service professionals also provide expert on-site installation and commissioning of ABB systems, devices and instrumentation, ranging from start-up to full project management. The benefits are:

- Smoother installations
- Faster start-up at lower cost
- Improved efficiency

Training

A skilled and efficient workforce means full system utilization — a very valuable corporate asset. Through our training program for SCADAventure™, ABB helps to increase the skill level and knowledge of the workforce. Their responses to system and process challenges are more productive and their analytical skills are improved.

Training is available at our major centers and can be customized at the customer's request. The available courses are:

- SCADAventure™ Operations
- SCADAventure™ Administration Course
- SCADAventure™ Advanced Configuration



Asset Information operational gains

Compliance with Microsoft standards means fast, intuitive learning and lower support costs. Training can focus on optimizing production and efficiency.

Integrated automation, SCADA and telecom user environment

Centralized management and low cost maintenance

Increased safety and environmental control

Reduced cost of ownership

More reliable production and more efficient operation

“ABB has supported us with SCADA technology for the last ten years, making a continuous expansion and upgrade of the system possible.”

Javier Pellón
Technical Manager
ENAGAS





For further information please contact
your local ABB office, or visit us at:
www.abb.com/oilandgas

© ABB Inc. 2008