

ELECTRIKGRID NEWS

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SUPPLIERS OF ELECTRIC MARKET SOLUTIONS

A Look At Suppliers of Electric Market Solutions

The question of how to provide systems at most reasonable cost for emerging electric markets requires knowing the market and grid requirements as well as the products and services of potential suppliers. The intent of this publication is not to favor or recommend any specific supplier, but to present a forum wherein a summary prepared by the selected suppliers might be presented as an overview of what the selected suppliers offer. It is not the intent to list all potential suppliers in this issue, nor is it intended to infer preference for these suppliers. It is only intended to present these. Future issues may present additional suppliers as well.

Looking at all potential suppliers, the potential buyer must consider the overall cost.

Overall cost

The overall cost of a project includes the contract purchase price, the final cost of implementation (including add-ons and change orders), the future costs of making changes and additions to the system, recurring costs resulting from the acquisition of the system(s), on-going licensing, integration, and incremental staffing costs necessitated by the system(s).

The least cost system may have the greatest overall cost once all these factors are considered. Of course, the least cost system might also represent the least overall cost. It all depends upon the specifics of an individual case.

Risk

Experience counts for a great deal in the evaluation process, but it is not everything. An experienced supplier will bring many "lessons learned" to the project, but the cost of the experienced supplier is often greater than that of less experienced suppliers. The lowest risk path is often that of the highest cost proposal. Taking some risk may be a prudent business decision and may tend to nurture greater competition. Savings and cost control always necessitate some degree of risk.

Providing opportunities for qualified suppliers that may have less experience in a given area may also produce cost savings and lower overall cost.

Integration

The electric market systems are hinged upon a single most significant factor: integration. Integration is everything, followed by functionality, cost, and user-friendliness. Good luck!

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The length of the suppliers' texts and order of the presentations are not indicative of preference or merit.

The suppliers selected for this summary presentation are presented in alphabetical order, being presented without text editing.

No inference of preference is intended by this Newsletter. It is, however, with gratitude that these suppliers have freely made this information available for potential buyers, as well as their competitors to read. Each of these suppliers are commended for their openness and willingness to make this information available for your 'one-stop' review. Thanks to each supplier!

The figures in each presentation are not numbered sequentially between suppliers and are unique to each suppliers presentation.

The vision of this presentation is to allow potential buyers information regarding these suppliers and the products and services they offer with regard to electric markets.

Future Newsletters may present additional interested suppliers.

ABB

Market Operating System (MOS)

A solution for the complex and unique RTOs' requirements is a Market Operation System. The logical diagram below, conceptually, lay out the Market Operation System in a modular fashion to explain its sub-systems like the Market Infrastructure (MI), the Market Applications (MA), the EMS system and its interfaces, the Commercial System encompassing the Settlements, billing and credit, funds administration, metering, etc. Additionally, it also lists out the key components, how the market participants interact with the MOS, and illustrates the key data flows for each of the sub-system.

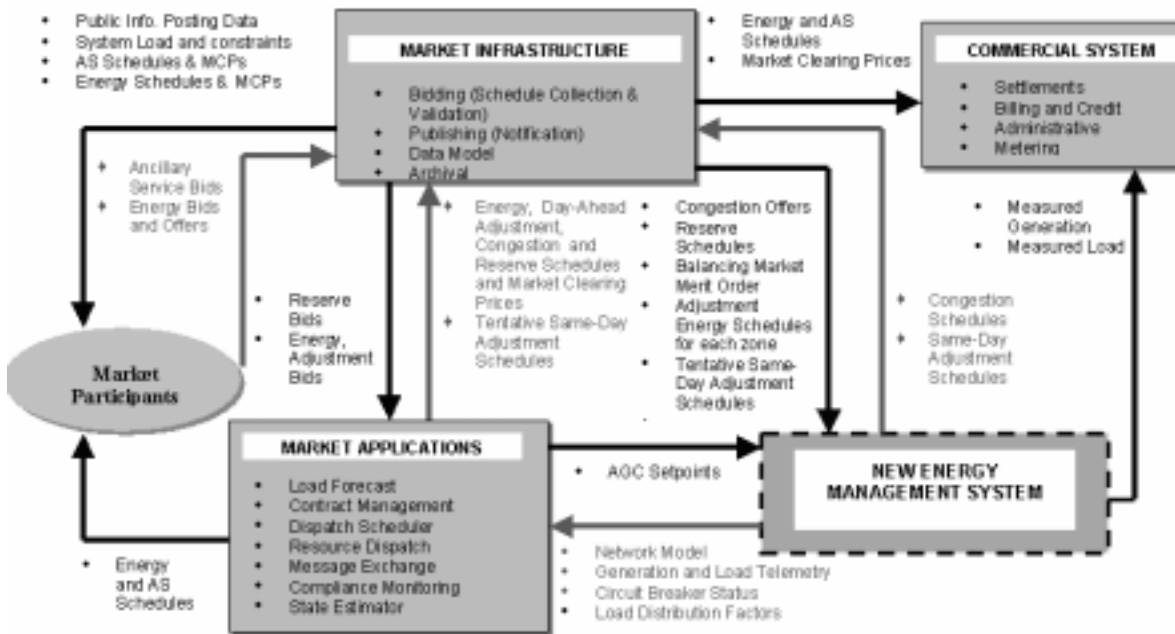


ABB Figure 1

A state-of-the-art Market Operation System solution encompasses the initial IT systems development, communications and network security, interface to the new and existing Energy Management System (EMS), modifications to IT system from market rules changes, market participant training, operator training, and market dry run support.

Architectural Overview

ABB's MOS uses an open architecture based on an Oracle database, a Web interface and a commercial middleware product for communications.

The following are the salient architectural features of the Market Operation System: N-tier architecture, scalability, security features, Oracle database tool, web browser-based GUI, UNIX servers, messaging-based middleware, load balancing and emergency backup centers, online backup and component hot swap, portability among different hardware platforms, application and workflow control (including failover), independent client applications, thin clients, e-commerce and mission-critical applications suited, easier system administration, large number of users capability, global applications,

diverse multi-media contents, high security with fine-grained controls, reusability of business components, and maintenance and support friendly.

Market Infrastructure Functionality (MI)

Market Participants to MI- Collecting, validating and storing incoming financial and physical market data; providing user interfaces (web forms, file upload/download and programmatic API) to create, delete, modify and validate bids, offers and schedules; ensuring security and confidentiality of data by authorization, mutual authentication, encryption, and non-repudiation; supporting data and participant activity tractability via audit trails and logs files. Data: Initial and revised bids and offers for forward energy and capacity reserve; real-time energy, operating reserves, bilateral contracts, self-schedules, intermittent generation, and non-dispatchable load and standing bids.

MI- Managing the process of opening and closing market windows; providing efficient data interfaces; clearing the Forward Energy Market and the Capacity Reserve Market; processing and formatting outgoing data such as final schedules, prices, and public market information; managing historical and archival data storage and retrieval capabilities.

The MI includes the following sub-modules:

Market Participant Interface

Market Information Request Processor

Proxy Server

User Profile Directory Server

Audit Trail Database

Client Interface

System Message Database

Market Operator to Participant Messaging System

Market Status System

Event Manager

Historical Information Management

Operator GUI

Market Applications (MA)

The Market Applications (MA) is a set of applications programs and services that are required to support the energy and ancillary service markets.

The logical diagram below illustrates the various Market Applications (MA) components (e.g. Load Forecast, Dispatch Scheduler, Compliance Monitor, Contracts Manager, Resource Dispatcher, etc.) and their interaction in a typical set-up.

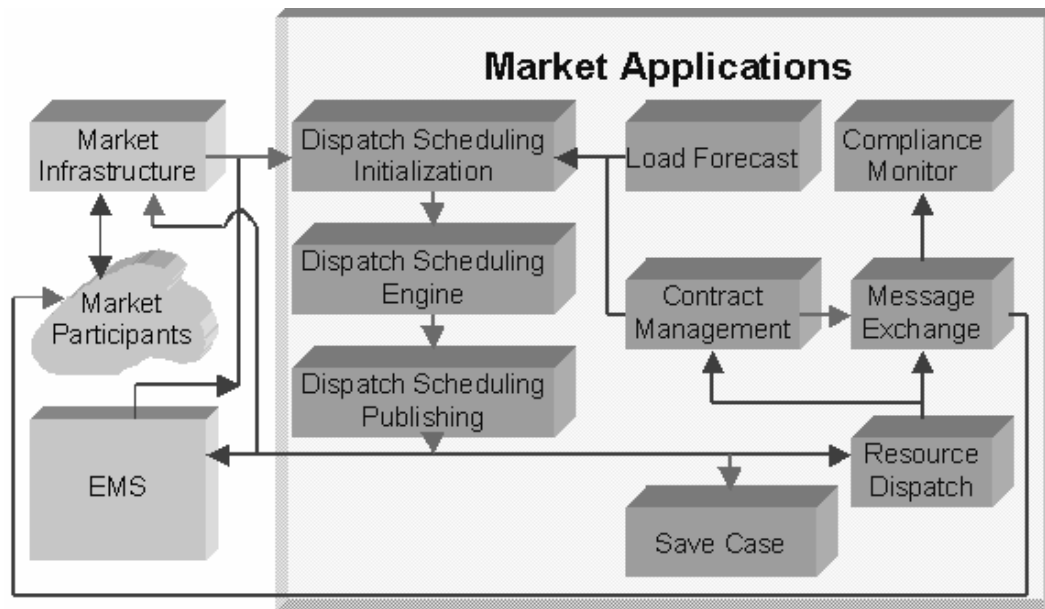


ABB Figure 2

The Dispatch Engine determines the schedules and market prices. A separate algorithm is used for the unconstrained and constrained problems due to their different requirements.

The Unconstrained Dispatch Engine calculates the Forecast Market Price, Forecast Market Volume and associated energy schedules with the major inputs being offer and bid data, generator parameters, transmission loss factors, and market demand. The result of the Unconstrained Dispatch Engine is the energy supply/demand curves.

The calculation of the clearing prices, clearing volumes and the determination of the supply/demand curves are accomplished by ordering the offers and bids in terms of the price segments in separate lists of net and gross load. The partial sums are calculated for each list with the intersection defining the clearing prices and volume.

The Constrained Dispatch Engine calculates the energy, reactive power, and ancillary service schedules to optimize the energy and reserve costs. The solution of the Constrained Dispatch Engine satisfies the demand, the network constraints and the system constraints. The network constraints can be for equipment operating limits, outage schedules, thermal/stability limits for both the intact state, and contingencies. The ancillary service requirement system constraints include primary frequency response, secondary frequency response, high-frequency response, standing reserve from fast start generators/loads and interruptible load, and power system management services (i.e. generating unit inter-trip and fast de-load).

Settlement, Billing & Invoicing

The commercial system will comprise of the following processing: metering data, bilateral contract data, daily monitored prudential risk analysis, scheduled data submitted by market participants, price calculated by the regulated body, physical

market settlement statements, financial market settlement statements, invoices for both physical and financial markets, settlement payments methods and schedules, preliminary and final statements, invoices, and payment dates.

Metering Data Acquisition System

The metering application will comprise of the following: metering service provider registration/revocation and de-registration, meter point registration & maintenance, measurement error correction, site-specific loss adjustments calculation from power transformers, totalized tabular report, delivery point relationships creation and maintenance, transmission tariffs delivery points creation and maintenance, metered market participant for an energy meter delivery point, and metering conformance monitoring.

Interface to EMS & EMS Modifications

SCADA/EMS system for the grid operation interfaces with the Market Operation System, with the SCADA/EMS being real-time control system and the MOS as the e-trading and market management system. The separation of the SCADA/EMS and MOS mirrors the grid operator and the market operator being two independent entities located at different sites with independent IT systems.

At the high level, the integration requires the MOS to receive real-time telemetry from the EMS and send back the generator base points for regulation purposes. The integration of EMS and MOS should be based on the standard features of an EMS product. This approach minimizes integration costs and will not complicate future system upgrades or replacements. Generally, the integration involves an interface module with a few new programs on both EMS and MOS sides. Experience has demonstrated that there has not been unsuccessful integration attempt from using different vendors for EMS and MOS.

ALSTOM-ESCA

From Energy Management Systems to Market systems: a 20+ year experience

For more than twenty years, ALSTOM has been a leading company providing solutions to a very large number of electric utilities worldwide. The first systems delivered were Energy Management Systems (EMS). At that time most electric utilities were still vertically integrated companies and ALSTOM was essentially communicating with their Network Operations department.

In the process of delivering EMS systems, ALSTOM has often been exposed to other departments of the Utility, such as the Operations Planning department, which usually works closely with Grid Operations. ALSTOM has delivered several projects where the real-time network management system was to be integrated with off-line planning or study tools.

Over the years, ALSTOM's list of products has grown to include EMS/DMS and Market Systems. In the meantime, the deregulation process has taken place, and electric companies have been unbundled to become independent generation, transmission or distribution companies, each of them using or developing new types of Information Systems. Consequently, ALSTOM is now delivering systems for a large variety of companies, all centered on the electricity business.

In most projects, ALSTOM has to deal with integration issues, and ALSTOM personnel have developed a lot of experience in integrating a variety of complex systems. Overtime, ALSTOM has delivered or integrated solutions linked with the following systems:

- Real-time Network Management Systems
- Planning Tools
- Asset Management Systems
- Geographical Information Systems
- Work Management Systems
- Customer Information Systems
- Market Systems
- Billing and Settlement
- Compliance Monitoring
- Market Interface (Registration, Bidding and Publishing)

For all these systems used by different departments in the Utility, there were several integration-related issues to be solved ranging from a simple application interaction to an in-depth integration including common data interchange, modeling of process logic and unified user interface.

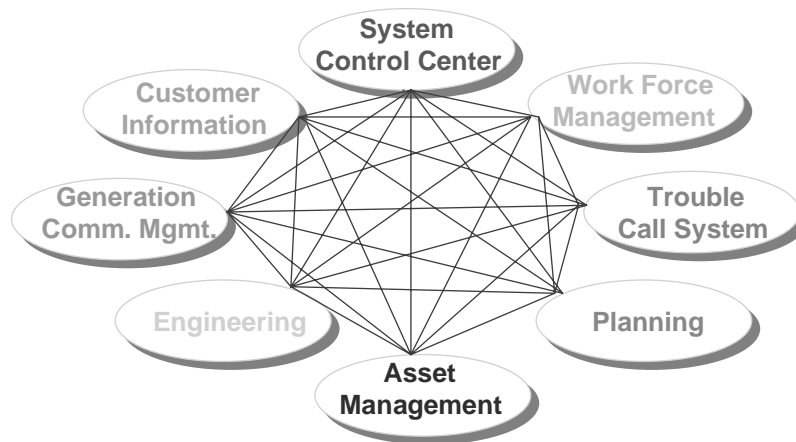
The next section below highlights the integration work performed on some of ALSTOM projects. These examples show different types of integration problems, and how they were solved by ALSTOM using different types of architectures.

Case Studies

The Florida Power & Light (FPL) project

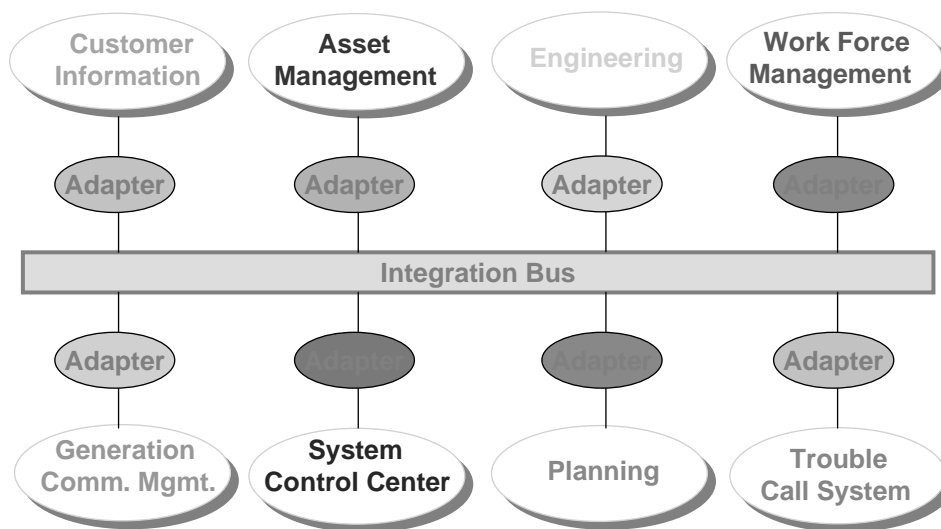
For integrating the Energy Management System (EMS) and Distribution Management System (DMS) of a new System Control Center (SCC) delivered by ALSTOM with new or existing systems of the Utility, FPL is implementing an enterprise wide integration infrastructure. The ultimate goal of this ambitious project is to lower life-cycle costs and improve business adaptability, as more applications are integrated. Beyond the technology, based on a commercially available Enterprise Application Integration (EAI) product, selected by FPL to implement a “Utility Integration Bus”, one of the most interesting aspects of this project is the industry standard semantics being used to describe the inter-application “common language”.

The first core systems to be implemented and integrated in this project, are FPL’s Asset Management System (AMS) and the EMS and DMS sitting at the new System Control Center.



ALSTOM-ESCA Figure 1: FPL systems involved in Enterprise-wide integration project

Figure 2 depicts FPL’s ultimate integration architecture, with the information systems owned by various departments, all connected to the Integration Bus through their respective adapters.



ALSTOM-ESCA Figure 2: FPL's ultimate integration architecture

The ERCOT (Texas) project

Earlier this year, ALSTOM delivered a system to ERCOT, the Independent System Operator (ISO) controlling the electric reliability region and operating the wholesale/retail electricity markets of Texas. This system, which is essentially a market system, takes a lot of benefits from ALSTOM's ability to provide a technology for integrating other core systems.

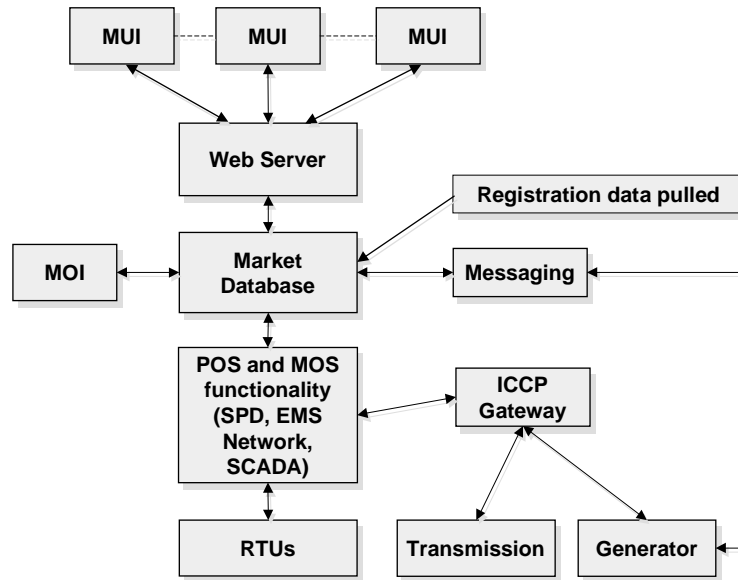
With the ongoing restructuring of the United States electricity industry, ALSTOM is facing major demands for such systems, which integrate market systems with classical EMS'. In order to keep up with such demand, ALSTOM is developing enabling technology for such integration. This technology is described in greater detail later in this document.

Production Operations. This task involves system security, planning, and market support. The technical requirements include supporting resource and obligation scheduling, real time operations, operations analysis, system planning, analysis and data collection. All these functions are covered by a "classical" EMS-type system and associated tools.

Market Operations. This includes monitoring the intricate balance between forecasted electrical power generation schedules and actual electrical demands among all competing market participants. In this process, ERCOT conducts detailed studies of the estimated electrical generation and demand requirements of the marketplace for 15-minute intervals of every day. In addition, ERCOT assesses the ancillary services required to maintain reliable electrical production for the actual demand at any moment. Tools and applications dedicated to the energy markets cover all these functions.

In the system delivered by ALSTOM, these two subsystems, referred to as POS and MOS, are seamlessly integrated within the integration infrastructure, which allows relevant data to be sent back and forth.

ALSTOM-ESCA Figure 3, below, highlights the system data flow.



ALSTOM-ESCA Figure 3: ERCOT system data flow

The system is being used not only by ERCOT personnel, but also by a number of market participants, external to the company. Access to the various applications is made transparent to all end-users by a unified Web-based User Interface, which also supports the registration function and access control.

The RTE project

ALSTOM recently delivered to the French ISO Réseau de Transport d'Electricité (RTE) the first phase of a system dedicated to the French competitive balancing market.

Again, this project, which encompasses market functions as well as optimization and planning tools, is based on new technology developed by ALSTOM for such systems. The main idea driving this development is the capability of building systems from components where components re-usability and ease of assembly into systems are primary engineering goals.

The RTE project architecture relies on the use of an application server, which hosts the business logic of the system. Application servers are a good fit with Enterprise integration, because the architecture provides for a centralized server that is able to process information from many different resources such as databases and applications. Moreover, they ensure delivery of information from one application to the next and support a distributed architecture.

Application servers are also interesting because they address the front-end of many integration initiatives. Application servers are often associated with Web applications, which are today the most attractive way to provide a unified composite user interface.

Such Web user interfaces are often referred to as portals, because from an external user perspective, they can be seen as the single entry point to all the services provided by the

company. Some of these portals even combine Business to Business (B2B) and Business to Consumer (B2C) services, but in any case the user is first identified, and all his actions are then security controlled.

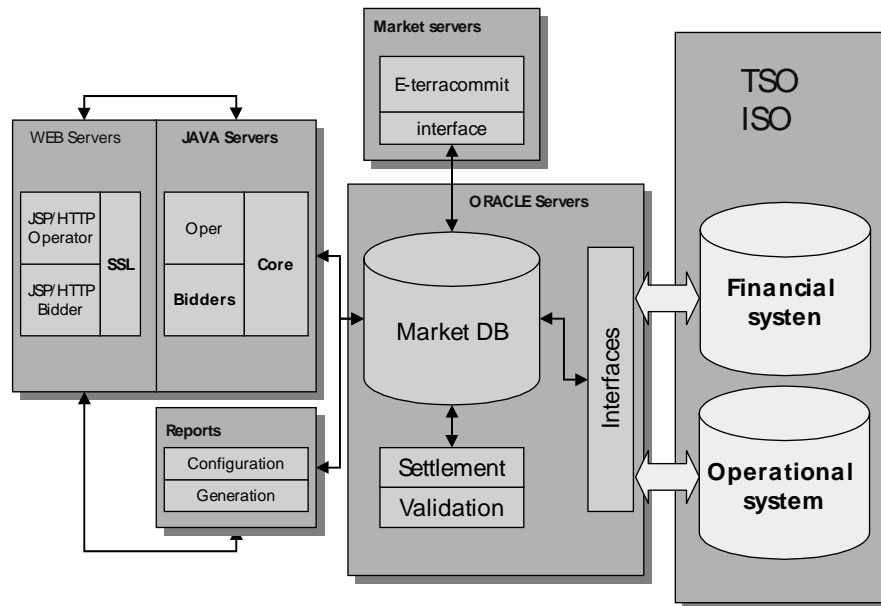
The most common functions supported by portals are:

- Login
- User authentication
- Registration
- Access control definition
- Audit trail
- Notification

In some cases, they allow the user to customize his environment, and may also offer some space for storing private data.

Like any other B2B system, the RTE project developed by ALSTOM, includes a portal functionality, which helps the end-user navigate between applications by organizing the Web pages, authenticates the market participants, controls their access to the system functions and performs the activity logging. The Web browser, the Web server and the upper layer of the application server code jointly support this functionality.

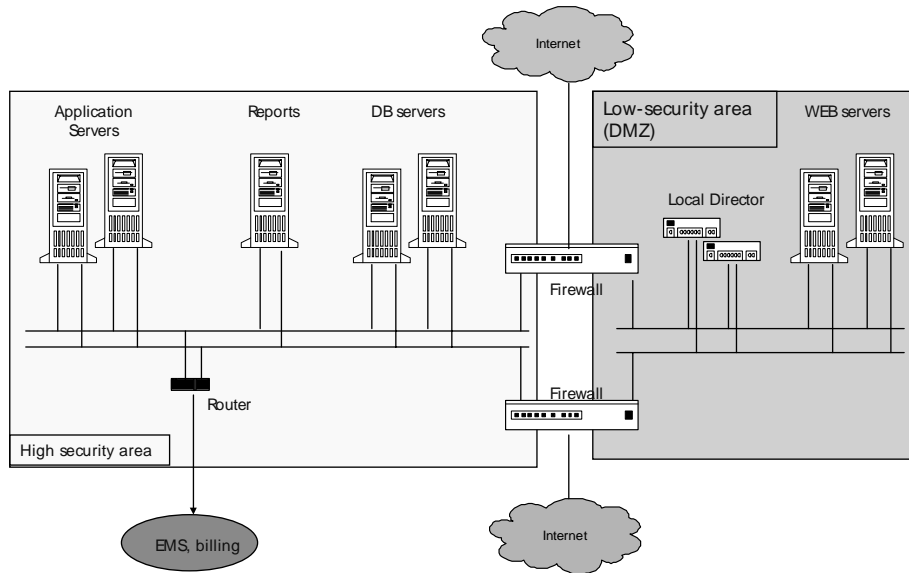
Figure 4 shows the application server, the database server and market server, which are three main components of the RTE project architecture.



ALSOM-ESCA Figure 4: Application server, database and market server

Figure 5 below shows typical hardware architecture with two different types of security areas:

- A low security area, on the right-hand side of the drawing, which stands in front of the firewall, and is potentially, exposed to any security attack from the Internet. No critical data is ever stored on the servers in this area.
- A highly secured area, on the left-hand side, where the critical applications reside.



ALSTOM-ESCA Figure 5: Typical hardware architecture to ensure system security

Market-inspired technology

The share of non-EMP based solutions delivered by ALSTOM EMM has grown rapidly in the recent past years. From the revenues reported last year, more than 50% come from such systems. As a consequence, EMM has recently embarked on an ambitious research and development (R&D) program, which aims at developing a foundation platform for these systems.

Because these systems often relate to energy markets, names chosen for these new products clearly refer to the markets. But, some of them, being actually the infrastructure building blocks, can be used as the foundation of any integration-related type of projects. Below, is a brief presentation of two of them, namely MarketWare and MarketPortal.

Marketware

Marketware is primarily concerned with providing tools to reduce the cost and risk associated with building large systems by improving the re-usability of software and the convenience of system-oriented tasks.

Marketware is based on the idea of building systems from components, where component re-usability and ease of assembly into systems are primary engineering goals. By relying on Marketware components, ALSTOM project teams will be able to build, test and catalog individual components. They will be able to assemble and test

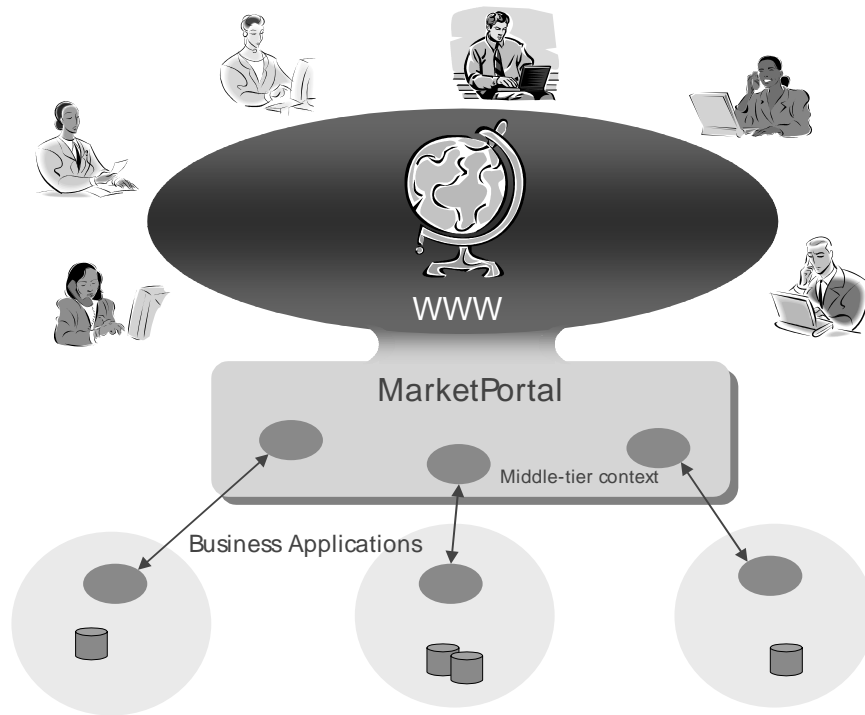
systems made from components, using a framework for plugging them together. Components will present public interfaces, which allow them to be plugged together. Components and systems will be configurable to maximize re-usability in engineering and minimize risk. Testing, documentation, error reporting and administration of systems are designed into the component assembly process. Perhaps most challenging of all, components will contribute UI modules to a system UI which has consistent look and feel, and is effective even when business processes involve interactions with multiple components.

MarketPortal

The interface between different market systems and their participants is typically through some web applications. More generally, this also applies to most B2B systems no matter how they may be used by people located inside or outside the company. With Extranet systems being natural extensions of Intranet systems, Web applications become the preferred technology to create a uniform User Interface across all enterprise systems. This is why ALSTOM is developing MarketPortal as part of its core infrastructure products. This development program aims at providing the capability to create scalable and robust system interface applications by anticipating the effort required to develop the commonality identified between systems.

Some of the ideas driving MarketPortal development can be summarized as follows:

- Each system design is unique in terms of its data model and the business process.
- The requirements of the web interface functionality differ in accordance with the varying design needs.
- The web application is hit concurrently by millions of users – a typical web-based application performance issue.
- The information exchanged through the interface is quite data intensive – another performance issue arising due to high dimensionality of power system data.
- Specific security control mechanisms need to be supported according to the requirements of the business process.
- The entire application has to be integrated into a web portal framework, as a typical enterprise-wide system likes to have a portal with a single point of entry.
- The application should support mechanisms for keeping track of activities performed over the web interface.
- The web interface application may need to handshake with other applications in accordance with a specific project needs.



ALSTOM-ESCA Figure 6: MarketPortal Overview

The MarketPortal development is aimed at providing capabilities for supporting web based interface applications. As such, the application features will include customer registration, data upload and download, business information posting, Business to Business direct communications, secure access to other applications, performance and reliability.

SIEMENS

RTO System - Executive Overview

Introduction

A contract for a RTO (Regional Transmission Organization) system recently awarded to Siemens consists of the following four major subsystems.

1. Energy Balancing System
2. OASIS (Open Access Same-Time Information System)
3. Tagging and Scheduling
4. Billing and Settlements

Siemens is supplying subsystems 1 through 3. ICF Consulting is providing subsystem 4. This document focuses on subsystems 1 through 3. Siemens will host the entire system at the Siemens Energy Management and Information System facility in Minneapolis, Minnesota. As an Application Service Provider (ASP) Siemens will host its own software as well as software from 3rd Party Vendors such as ICF Consulting (Billing and Settlements) and IBM (MQ Series Software, which is an integration software bus solution). The ASP approach also enables Siemens to address the software solution and system infrastructure to provide a complete solution set to the RTO.

The four subsystems are interconnected via an Enterprise Integration Bus. This provides the flexibility for plug in of future components in a seamless fashion. Transmission owners Energy Management Systems are also interconnected to the Enterprise Integration Bus vis-à-vis Inter-Control Center Communication Protocol (ICCP) links.

Energy Balancing System

The Imbalance Engine consists of the following modules:

- | | |
|---|-----------------------------|
| 1. Market User Interface | 4. Market Optimal Dispatch |
| 2. Energy Imbalance Forecast | 5. Balancing Energy Pricing |
| 3. Energy Measurements
Processing, Archiving and
Accounting | 6. Market Monitoring |

FERC (Federal Energy Regulatory Commission) Order 2000 requires that an RTO implement an Energy Balancing market. The Balancing System enables an RTO to operate a load following scheme to ensure fulfillment of the FERC Order 2000 requirement for implementation of an equitable Energy Balancing market for Day 1 operation. The Energy Balancing system provides a key co-ordination role within an RTO to assure an optimal and market based scheme for load following, regulation and conformance to operational standards for the whole interconnection.

The Balancing System:

1. Improves economic efficiency of energy deliveries in the RTO region

2. Minimizes the capacity required for regulation
3. Optimally improves control performance of control areas
4. Equitably provides key coordination capabilities for control areas within the RTO region

The system is designed for flexibility and it allows for the addition of future additional markets (e.g. Ancillary Services or FTRs).

The following capabilities are provided:

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Market Participant registration 2. Bid data entering and validation | <ol style="list-style-type: none"> 3. Market dispatch and pricing results presentation 4. Market time-line control 5. Bulk upload/download interfaces Load Forecast |
|---|--|

This system includes a Load Forecast application. Load Forecast determines 5-minute average load for the next three 5-minute intervals for each Control Area individually. Accordingly, all Imbalance Requirements and Market Participant MW set points are determined as 5-minute average values.

Historical and Information Systems

Siemens archiving and energy accounting component Historical Information System/Energy Accounting (HIS/EA) provides the following calculations and historical data for time periods beyond real-time-operation:

- Collection, processing, and integration of Control Area generator and tie-line analog measurements
- Calculation of loads for RTO and each Control Area
- Collection of weather data required by the very short-term load forecast and imbalance energy forecast
- Calculation of Control Areas ACE, frequency bias, inadvertent energy and net interchange
- Collection, tracking and performance calculation of unit response to imbalance control signals over extended period of time necessary to track unit control performance and to use this data to predict the response in terms of ramping rates, overshoot, gain and other performance tracking measures
- Collection of data necessary for preparation of imbalance settlement data
- Support of Market Participants in analyzing their long-term performance in energy Imbalance Market
- Imbalance Energy market audit support
- Support for market monitoring

- Long-term archiving and off-line storage of all relevant data from Imbalance Engine

The RTO will operate as a transmission provider and a virtual control area. The RTO intends to use existing EMS control systems to adjust generation output of generators willing to adjust output for compensation via imbalance pricing. The Imbalance Engine will rely on the existing EMS systems and associated control systems for implementation of imbalance signals. The RTO will send dynamic schedules to EMS systems within its jurisdiction that represent individual purchase or sale of imbalance energy. These schedules represent set points for units in the imbalance market and they will be expected to follow the signals in a controlled and reasonably predictable manner.

Market User Interface

The Market User Interface is the gateway between the Market Participants and the RTO system. The Market User Interface is a web based stand-alone module.

Information Model Manager

The Information Model Manager is a fully CIM Compliant data management system. The Information Model Manager, which is the central repository for static Engineering Data for the RTO System, also includes the customer registration module. The customer registration module is a web-based module that allows market participants to register for participation in the RTO market. The Information Model Manager is a facility that enables input and maintenance of power system related data throughout the enterprise.

OASIS

The Open Access Same-Time Information System is an Internet based electronic commerce application mandated by FERC to provide open and nondiscriminatory access to information on the wholesale use of the electric power transmission grid. The regulatory requirements placed on all owners of transmission assets used for interstate commerce are set forth in Title 18 of the Code of Federal Regulations Part 37 – Open Access Same-Time Information Systems and Standards of Conduct for Public Utilities. The technical specifications mandated for OASIS compliance to these regulations are set forth in the Standards and Communications Protocols for Open Access Same-Time Information System (S&CP). The original specifications for OASIS were adopted in 1996 and subsequently revised in 1998. A further revision of the specification (Version 1.4) will be implemented in 2001. FERC has also issued an Advanced Notice of Proposed Rulemaking (ANOPR) seeking industry direction on the development of OASIS Phase 2 functionality, which will incorporate electronic scheduling.

OASIS provides all system users with the ability to view selected information related to the transmission provider's transmission system and to submit requests to reserve specific use of the transmission system. This is subject to the terms and conditions of the provider's Open Access Transmission Tariff (OATT). Information related to the products and services offered by the provider, costs of those services and the amount of each product or service available over time must be posted on OASIS ('offers'). Transmission customers wishing to reserve transmission and associated ancillary

services offered by the provider must submit requests for service to the provider vis-à-vis OASIS ('reservations'). Providers are obligated to respond to all requests for service, indicating whether they are accepted or denied, as well as provide the means for any transmission customer holding a reservation for service to offer that service for sale on a secondary market supported by the provider's OASIS node. Users have a limited ability to tailor their queries for information maintained on OASIS. A full audit trail of all transactions performed on OASIS must also be maintained and fully accessible to the users. The specific information that must be made available to the user and the format for presentation of that information are established, in part by the FERC approved S&CP document.

Tagging and Scheduling

The Tagging and Scheduling subsystem is needed to support RTO Operations as a transmission provider and virtual control area. The Tagging and Scheduling subsystem is a schedule entry point. This subsystem provides the following functionality:

1. E-tagging approval node
2. OASIS node interface for tag validation
3. Maintains RTO schedules
4. Provides schedules for the other subsystems
5. E-tagging standard 1.7 support

Tagging and Scheduling consists of two separate but connected subsystems. One is tagging, which is an approval service for E-tagging. The other is scheduling, which supports traditional EMS scheduling functionality.

A tag is an electronic documentation of an energy transaction that requires coordination of and approval from all operating entities involved – origin, intermediate, and destination. The transaction is described within the tag as an 'energy schedule' to be transferred over a prescribed path for a specific duration and timeframe. Tags are transmitted via computer-to-computer, point-to-point method over the public Internet using protocols defined in the NERC Electronic Tagging Functional Specification.

Tagging is a computerized process with human intervention, after a tag is submitted, limited primarily to the assessment of the acceptability of the transaction made at the tag approval service level.

Three tagging 'services' have been defined in the E-tag Functional Specification – Tag Agent, Tag Authority and Tag Approval. The interaction of these services is the heart of the tagging process. Although defined as software components of the tagging process, each has a distinct manner of operation and level of autonomy.

The Tag Agent service refers to the software that provides an electronic interface between the purchasing-selling entity (PSE) and the tagging process. PSEs are responsible for providing this service or they may arrange to have a third party provide it. The Agent service provides the user interface on which the required tag information is entered. The Agent service validates the information, and if everything is in order, creates a tag and sends it via the Internet to the Tag Authority service associated with

the Sink (Load) Control Area (LCA) identified in the tag. The Agent service provides a mechanism for the PSE to view the approval status of their transactions either by simple polling (querying the Authority service at periodic intervals) or via an optional unsolicited notification mechanism. The Agent service also provides facilities for the PSE to force the cancellation or replacement of any of their tags. A PSE's Agent service doesn't have to be available 24 hours a day, seven days a week. Following the initial submission of a tag, at a minimum, the Agent service will only be needed to query the Authority service for the status of the tag. However, if the Agent service is registered to receive notifications at all times, the Authority service would be able to communicate tag status changes to the PSE as they occur.

The Tag Authority service refers to the software that provides the focal point for all interactions with a tag and maintains the single authoritative 'copy of record' for each tag received from a Tag Agent service. Every control area is responsible for providing this service directly or by arranging with a third party to provide this service as its agent. There is one Tag Authority service for each tag, and that is provided by or for the Sink (Load) Control Area. The Authority service distributes a tag it receives to all tag approval services associated with each entity that has been identified in the transaction as having approval rights over that transaction.

The Authority service collects the approvals and denials issued by the Tag Approval services and sends the final disposition of the tag to the originating Tag Agent service and all Tag Approval services involved. When a tag goes Conditional or Implemented, the Authority service sends a copy of the tag to the Interchange Distribution Calculator (IDC).

The Tag Approval service refers to the software that receives tags forwarded by the Authority service and provides a means for the approval or denial of the tags by the approval entity. Any entity (CA, TP, PSE, or SC) identified along the transaction's scheduling path that has (or may ultimately have) the right to verify the contents of and approve or deny a tag, is responsible for providing Approval service directly or for arranging with a 3rd party to provide this service as their agent. Under Functional Specification Version 1.5, only CAs and TPs currently have tag approval rights. An approved tag received by a PSE via its Tag Agent service is confirmation that the transaction has been approved.

Short Term Trade Evaluator Application (STTE)

The Short Term Trade Evaluator application provides facilities for evaluation of various energy trading scenarios.

Given a particular resource commitment pattern, the application helps a user to study different energy sale and purchase transactions. Both cost based and price based evaluations are provided. The application is suitable for studying central market based and bilateral trades. Both locational and zonal pricing schemes are supported.

STTE also models high level financial and pricing information and may serve as a link between Generation Management System (GMS) and the Financial Risk Management facilities of an organization.

Application Overview

STTE provides four major functions as described below:

Market Price Evaluation (MPE)

For specified price levels of energy, the optimal production level is determined. The optimality criterion in this case is profit maximization (or Cash Reserve maximization). Economic performances are calculated and deviation from base case is indicated.

Real time, hour ahead, day ahead market or bilateral trade prices may be used. Transmission constraints and loss factors are considered in the analysis. Additionally, energy price variations are evaluated.

Compared with a classic economic dispatch study, which provides a minimum cost solution for a given volume of demand, this function allows to the user to study profit maximization scenarios.

Production Cost Evaluation (PCE)

Starting from a selected base case, separate sale and purchase energy production curves are constructed for each time interval. For each energy block, economic dispatch is executed to calculate operating costs, marginal costs, and average costs for the system and each unit and each study time step. Regulation and reserve service requirements are fixed during evaluations of energy blocks.

Interchange Evaluation (IE)

This module provides Economy A transaction functionality. It assists the operator in evaluating a potential sale or purchase of energy with an external company. IE computes the cost and price of proposed transaction, compares the production and interchange cost, with the planned interchange activated and without the planned interchange activated.

In the case of proposed energy purchases, IE analyses the offers, comparing the cost of self generation and the purchase price. In case of proposed energy sales, IE determines the additional cost for the additional generation. This is used as a basis for finding the optimal sale price. IE uses Economic Dispatch to determine the best MW generation values for a proposed transaction. IE computes costs and prices for transactions.

Trade Pricing Region Recommendation (TPRR)

The purpose of this study is to identify price floor (for sales) or price ceiling (for purchases) for given volumes of energy trade (purchase or sale). The basis of calculated price floor or ceiling is the indication provided by the production costs associated with the user's generation resources. For example, for a given volume of energy sale, the recommended minimum price is the higher of average and marginal production costs. Facilities are provided for the user to specify a price adder to produce the actual offer price. Price-quantity curves are constructed for the system and each unit. Energy sale and purchase pricing are supported separately. The key consideration in calculation of the price limits is that the system must not incur economic losses under any trade conditions.

Modeling

STTE models various types of thermal units, dispatchable transactions and takes into account miscellaneous generation as fixed production values. Hydro units may be modeled using the associated water worth curves.

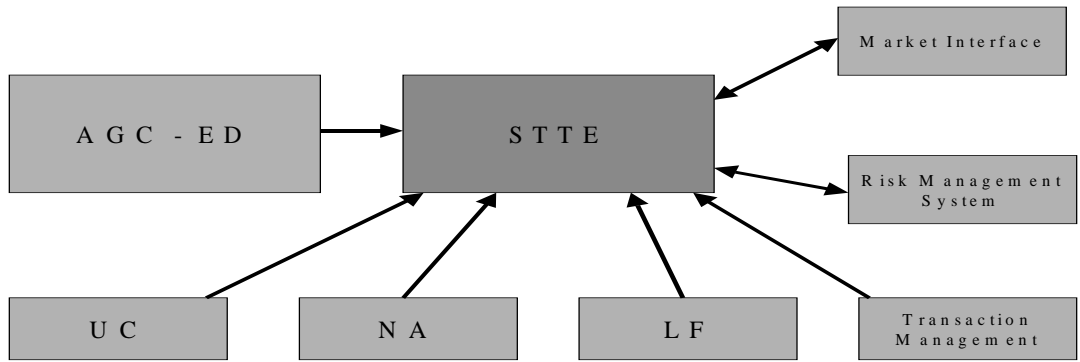
Pump storage units are modeled as being in either pumping or generating modes. In pumping mode, these units are modeled as loads. In generating mode they may be dispatched with cost curves reflecting system's incremental cost of energy at the time of pumping. Market or bilateral trade prices may be modeled on a zonal or locational basis. System, plant, unit, and transaction constraints considered by STTE are:

- Generation/load/interchange balance requirement
- Spinning reserve requirement
- Operating reserve requirement
- Unit operating limits
- Plant operating limits
- Unit maximum sustained ramp rate
- Unit availability status
- Unit spinning reserve capability
- Dispatchable transactions
- Transmission system constraint

The study horizon can be from the next study time step up to 24 hrs ahead into the future.

Interfaces

The Short Term Trade Evaluator (STTE) application runs in Study Mode and has interfaces with a number of real-time and study applications. STTE studies may be initiated from a real-time (AGC) or from study applications such as UC. Network information such as constraints, generation sensitivity factors, ATC etc may either come from network analysis functions or from other sources such as NERC facilities or a particular RTO/ISO's web site. Energy transaction information may be retrieved from Transaction management system. Facilities to support exchange of information with an organization's Risk Management System and a Market Operator system are provided. Figure 1 below provides an overview of the interfaces.



Siemens Figure 1 STTE Interfaces

OTHER SUPPLIERS OF SERVICES AND SYSTEMS

THAICOM

Creation of Integrated Solutions

The introduction of electric markets introduces a need to manage many processes, create innovative software solutions, make procurements, and provide integration project management with a strong IT expertise.

ThaiCom has strong IT experience and experience with providing software solutions, managing projects, and project integration management. ThaiCom offers the following values to help achieve success: (1) Excellent proven ability to manage large and small projects; (2) Inherent Thai language advantage, as well as high level English for optimum communication; (3) Knowledge of state-of-the-art technology; (4) Knowledge of basic utility terms; (5) Resources that include electric utility and market skills from the United States and UK; and (6) A focus and ability to provide fast, responsive service to meet a client's needs.

ThaiCom Management Group was founded in 1993, to provide:

- IT consulting and
- Software development.

For the past 9 years, ThaiCom has been to providing the best business solutions and consulting services on data management and information technology management. Our services include conceptual data modeling, database management tuning, data warehousing, financial applications, human resource for medium and large organization, dynamic web applications, e-commerce, advanced technologies solutions and etc. With years of experience in CASE methodology made us the leader in the software solutions providers.

Our major clients consisted of various Thai government agencies, large state enterprises, multinational firms and others. Examples: Ministry of Agriculture and Cooperative, Ministry of Interior, Ministry of Commerce, Ministry of Finance, Petroleum Authority of Thailand, Government Housing Bank, Hoechst Pharmaceutical, and others. ThaiCom is ready to carry this experience into the electric marketplace in a deeper and more innovative way.

Our solutions include:

- Financial and Human Resource software suites
- Budget planning
- Budget management system
- Finance and accounting management system
- Procurement management system
- Personnel management system

- Dynamic web pages
- Agriculture information center, including web consumer prices and indexes
- Web Applications
- Loan information application
- Budgeting Request system
- IT consulting services
- Database and operating system tuning
- Project planning
- Project management
- IT budget estimation
- IT master plan
- IT related training
- Support of electric market restructuring processes

Project highlights

Department of Agriculture , Ministry of Agriculture and Cooperative, Thailand

ThaiCom was responsible for developing the financial applications for the Department of Agriculture. The application includes the budget allocation system, budget management system, finance management system, accounting system, personnel system, procurement system, research information management, horticulture and plan pathology web publication. All application systems developed using Oracle Database version 7.1, Oracle Designer version 1.2 (CASE) and Oracle Development tools version 4.5. The applications operated under Digital UNIX on Digital Alpha 2100 under large FDDI local area network with approximately 80 concurrent users.

Department of Fishery, Ministry of Agriculture and Cooperative, Thailand

The initial phase of MIS project for the Department of Fishery was development of the financial application systems. The application ThaiCom developed for the Department of Fishery includes the budget allocation system, budget management system, and finance management system, accounting system and procurement system. All applications developed using Oracle Database version 7.3, Oracle Designer version 1.2 (CASE) and Oracle Development tools version 4.5. The applications operated under Solaris UNIX on Sun Sparc 3500 under large fiber optic TCP/IP local area network with approximately 100 concurrent users

Petroleum Authority of Thailand

ThaiCom was responsible for the development of PTT's internal health care claim management system. The application includes the claim management and Oracle General Ledger and Account Payable interfaces. This application was used in both Oil and Gas

Business units. The application also supported employees' data transferring between business units. The application was developed using Oracle and Developer/2000.

Department of Land, Ministry of Interior

Department of Land has been developing applications over the past 10 years with the partial funding from World Bank. Over the past 3 years ThaiCom assisted the department to develop new applications, convert the legacy system to up-to-date technology and etc. The applications developed include budget management system, procurement system, executive information system (personnel), and internal audit system. The legacy systems conversion includes land title information management system, Condominium title information management system. All applications developed under Oracle Database version 7.3, Oracle Designer version 1.2 (CASE) and Oracle Developer/2000 tools version 4.5. The applications are running on Digital UNIX on Digital Alpha 1000 under large UTP TCP/IP local area network with approximately 30 concurrent users

Office of Agricultural Economic, Ministry of Agriculture and Cooperative, Thailand

ThaiCom has worked with the department for the past 3 years. Most of the services provided include agriculture statistic survey, project management, IT consulting services and software development. The department has been going through many computer restructuring and legacy systems conversion. Since the department was one of the very first departments in Ministry of Agriculture whom has Mainframe, most of their existing applications are still running on the mainframe. ThaiCom also developed the personnel system. It was one of the first client/server financial systems for the department. The application developed under Oracle database version 7.3, Oracle Designer 1.3 (CASE) and Oracle Developer/2000 version 4.5. The applications are running on Microsoft NT under small local area network with approximately 10 concurrent users

Department of Business Economic, Ministry of Commerce, Thailand

ThaiCom developed the consumer prices and indexes web publishing system for the department. The web publishing system is the dynamic web system. All reports and user interface managed by the embedded database programs. The entire web system was embedded in Oracle database. The application developed under Oracle database version 7.3 and Web server version 1.0 running on Microsoft NT.

Government Housing Bank, Thailand

ThaiCom developed the loan information system under web application environment with java, developer/2000. The application interfaced with very large Oracle Database system with current of 20 GB of the initial data with projection of 300 – 500 MB incremental data monthly. The application developed under JDK1.1.6, Developer/2000, Oracle database version 8i and Application Server version 4.0, Oracle Designer/2000 version 6.0 running on Sun Enterprise 450.

Department of Cooperative Promotion , Ministry of Agriculture and Cooperative, Thailand

ThaiCom was responsible for developing and implementing the financial applications and other specific requirements for the Department. The application includes the budget allocation system, budget management system, finance management system, accounting system, personnel system, procurement system, cooperative information systems, fund

management system. All application systems developed using Oracle Database version 8i, Oracle Designer version 1.3 (CASE) and Oracle Development tools version 6i. The applications operated under Digital UNIX on Digital Alpha DS20 and local area network with approximately 30 concurrent users.

Office of Permanent Secretary , Ministry of Justice, Thailand

ThaiCom was responsible for developing and implementing the financial applications. The application includes the budget allocation system, budget management system, finance management system, accounting system, personnel system. All application systems developed using Oracle Database version 8i and Oracle Development tools version 6i. The applications operated on Microsoft NT and local area network with approximately 30 concurrent users.

Corporate Leadership

Mr. Anukul Tamprasirt holds an MS Degree in Computer Science from Memphis State University, USA and has over 15 years experience in IT industry from product development to product sales and services. Experience includes software development, sales and marketing, project management, training, IT consulting and utility related support. Ms. Parinda Tamprasirt holds an MS degree in Management from Milledgeville, Georgia, USA and a Masters in Information Management System Science from Georgia State University, USA with over 10 years experience in software development and implementation. Ms. Tamprasirt has been developed many applications under CASE environment and is a CASE methodology and development tools expert and has provided support in the Thai electric market restructuring processes.

Electric Market Skills

With current knowledge of the electric restructuring efforts internationally and within Thailand, ThaiCom offers an alternative path for emerging markets to develop the participant information interface as well as providing innovation for developing settlement, banking interface, and business IT systems. ThaiCom also offers the integration management with a real success record from experience. ThaiCom offers a low risk, high quality alternative for clients that require assistance in these specific areas or in the integration between various market systems.

TRIMARK ASSOCIATES

Metering Data Systems

Trimark Associates is a rapidly growing engineering and consulting firm that specializes in installation and configuration of ISO Metering and Data Processing Gateways (DPG). The DPG is the required telemetry device for Non-AGC generating facilities participating in the ISO markets.

Trimark currently performs more DPG installations and configurations in California than anyone else.

The staff, in addition to being skilled metering installers and inspectors, has extensive, direct experience with the ISO and their considerable requirements for documentation of metering and DPG installations.

Additionally, Trimark offers a range of other communications and metering products and services to fit the needs of any generating facility.

Trimark also offers a variety of consulting services that can assist Utilities, Scheduling Coordinators and other customers with their settlements and billing needs.

Trimark Associates Inc. (Trimark) was formed in April 2000 with the objective of providing technical services to participants in the deregulated electricity markets.

We have provided start-up services to many of the Independent System Operators across the country (including the CA-ISO) and have a good understanding of the current issues and technologies affecting the electricity markets.

We welcome the opportunity to help your company succeed by leveraging our experience and service offerings. In particular, your success in the CA-ISO Demand Response program is an objective of ours.

The two main areas where we would like to help you succeed in the Demand Response programs are as follows: Project Management and Consulting and Meter Data Management.

Trimark is a California based corporation with operations in the Sacramento area and has clients in the United States and Canada. Providing professional services to our clients wherever they are located or whatever their business model is is paramount to our company philosophy. Again, your success is how we measure our success.

In order to help streamline the compliance process for generators and loads participating in California ISO energy and ancillary services market, Siemens Corporation, Telegyr and Trimark Associates have teamed up to provide a selection of turnkey solutions. We understand that the ISO requirements are complex but, our experience with the DPG and metering technology coupled with our excellent working relationships with ISO staff will make for a smooth system deployment.

Since the requirements of each project will be unique, we will work closely with you and your staff to ensure that all aspects of the installation are coordinated. Our objective is to have an efficient integration of the DPG and metering equipment into your facility.

Project Management and Consulting: Working closely with your staff, we will ensure that the right technical solution and efficient business processes help you profit from participation in the load participation projects. Our experience with large project management efforts have led to the successful deployment of large scale computer systems and efficient work practices at the California ISO, ISO New England and the Ontario IMO.

Meter Data Management

Trimark operates an MV-90 meter data management system and understands the CA-ISO requirements regarding meter data reporting for verification of compliance with load curtailment dispatch orders. By leveraging our services in meter management, you are ensured accurate and timely reporting of meter data to the CA-ISO.

You will find that our meter data processing rates are very competitive when compared to other meter data management companies, which will further enhance your bottom line.

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