BIOGRAPHICAL INFORMATION

Hahn Tram
Executive Consultant
Enspiria Solutions, Inc.

Responsibilities

Mr. Tram joined Enspiria Solutions in 2004 and works with utilities to refine their strategy, and craft, plan, and implement enabling technology solutions to meet their business and operational needs. He helps utility businesses align their processes with advanced automation and information technologies to maximize the return on technology investments.

Experience

Mr. Tram has about 25 years of experience in planning, engineering, operating, automating, and managing energy delivery systems and assets. He has led numerous successful technology deployments at utilities worldwide. The technology solutions deployed included Geospatial Information Systems, System Planning, Distribution and Outage Management, Work and Mobile Workforce Management, Integrated Resource Planning, Asset Management, and Real-Time Energy Management Services. Mr. Tram has published and presented more than 75 papers in industry conferences and journals. Before joining Enspiria Solutions, he spent six years with Convergent Group and SchlumbergerSema, and prior to that ABB and Westinghouse Electric.

Education

B.S. and M.S. in Electrical Engineering, Texas A&M University

Professional Memberships

- Member, GITA
- Senior member, IEEE Power Engineering Society, Power System Planning and Implementation Committee and Distribution Design Working Group
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INTEGRATED RESOURCE PLANNING FOR MULTI UTILITY SERVICES

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ABSTRACT

To consider demand elasticity as well as alternative and distributed resources in system planning, Integrated Resource Planning (IRP) involves the forecast and analyses of demands and resources at the local level. While most utilities do IRP at the generation or bulk supply level, advances in geospatial information technology have made IRP practical and beneficial at the distribution level, improving overall asset and resource utilizations. The methodology is similar for electric, gas and water utilities. Many data needs and technology components such as spatial land-use data, small-area load forecasting, and automated meter reading are common. Exploiting these commonalities as well as similar business processes further improves the efficiency of planning, and quality of resulting plans, for multi-service utilities.

BUSINESS CONTEXT

The concept of Integrated Resource Planning (IRP) is not new. Utilities have tried various forms of IRP off and on for nearly twenty years and generally seemed to have lost interests in it in the last decade. Nevertheless, there appears to be strong interests in IRP again today. This section gives a quick review of IRP and explores why the renewed interests of utilities now.

Integrated Resource Planning

IRP takes into account the demand elasticity that the utility can potentially manage, as well as alternative and distributed resources, as part of system upgrade and capital project plans. For electric utilities, IRP means the consideration of load variations due to Demand Response programs from simple time-of-use rates to critical peak pricing and dynamic pricing models, distributed generation and advanced storage units in addition to conventional power plants. For water utilities, IRP means the consideration of Demand Response through conservation and pricing programs, water wells and storages in addition to conventional reservoirs and water treatment plants.

The IRP practice began in the form of direct load control and Load Management (LM) as a means to mitigate potential supply shortages in the 1980’s to maintain system reliability at the generation and bulk energy supply level. Load Management evolved into Demand Side Management (DSM) in the early 1990’s, incorporating flexible rate structures (e.g., time of use and interruptible rates) and began to be a factor in transmission and distribution system (T&D) planning *[Tram, 1994]*. Pure DSM then became IRP when taking into account distributed resources and made a major impact in T&D planning and design in the late 1990’s *[Willis and Scott, 2000]*.

The utility industry lost interests in DSM and IRP as a whole in the last few years but now shows strong signs of renewed interests again. The resurgence is evident in the market growth of Automated Meter Reading (AMR) with more advanced AMR applications, a core enabling technology of DSM and IRP (Figure 1).

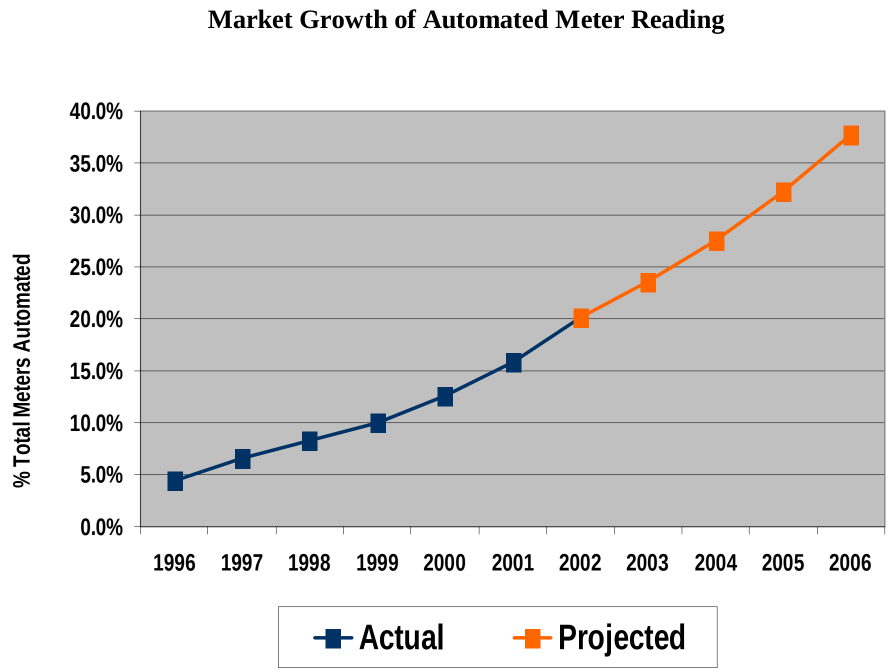

Figure 1 – Penetrations of Automated Meter Reading in Utilities. Besides increasing the number of AMR meters installed, utilities are implementing advanced AMR functions that support real-time energy management (e.g., Demand Response) and operations support (e.g., outage management).

Why IRP Again

There are four fundamental reasons for the renewed interests.

"Back to Basics" Business Environments – After years of "e-everything" and energy trading businesses, utilities are returning to their core business, adding and managing energy and water generation and delivery assets and resources. This includes the determination of not just when and how much, but also where to add capacities. For a multi-service utility, the additional question is, for example, whether the utility can delay construction of gas lines by target marketing and utilizing the electric assets more, and vice versa.

Encouraging Regulatory Environment – The Job Creation and Worker Assistance Act of 2002 provided financial incentives of accelerated depreciation deductions for AMR investments. The pending federal energy bill also includes provisions with requirements and incentives for utilities to consider energy conservation measures and alternative distributed resources. Some states such as California have already similar mandates.

Customer Awareness and Acceptance – The electric power crisis in California and wild spot pricing fluctuations a few summers ago and the Northeast blackout last August have made consumers more aware of and more open to participate in Demand Response programs. Recent results are encouraging *[Primen Outlook Conference, October 2003]*:

- PJM: Reduced grid demand by 6500 MWh in summer of 2002, resulting in peak pricing of $150/MWh during 2002 peak hours versus $900/MWh in 2001.
- Southern California Edison: Estimated 760 MW peak reductions in 2003 versus the CPUC 2003 target of 150 MW peak reductions.
- City of Seattle: Estimated 7% energy savings from the Smart Meter Watch program.
- New England ISO: Over100 MW peak reductions in Connecticut on 8/15/2003, relieving the state from the 2003 Northeast blackout.

Technology Advances – Advances in enabling automation and information technologies are making Demand Response programs and IRP effective and affordable. This is the focus of the remainder of this paper.

TECHNOLOGY SOLUTIONS

The practices of Integrated Resource Planning (IRP) are not new as discussed earlier. Many utilities have tried various forms of load control, load management, and demand-side management with mixed and generally less than satisfactory business results. So, what is going to help this time? This section explores the advances in technologies that make a positive difference in IRP design and implementation today.

Information Technology Requirements

When consumers become more active in Demand Response programs to lower overall costs by varying their usage in response to pricing signals dynamically, providing the utility with an alternative means to mitigate market pricing risks, both the utility and the consumers require much more information (Figure 2.)

Consumer Needs – For planning purposes, consumers need historical usage patterns (load profiles) and applications to help them estimate the impact of Demand Response program participation on their end-uses (e.g., production for commercial and industrial customers and comfort for residential customers) For implementation, they need dynamic pricing signals and confirmation of their participation in settlement and billing.

Utility Needs – For planning, the utility needs up to date load profiles in short intervals (5 to 15 minutes) for each customer class and historical data on the actual impact of Demand Response on system and local loads. For implementation, the utility needs advanced metering functions to communicate dynamic pricing signals to consumers and confirm customer participation, and to capture the actual effects on loads at the substation and system levels to fine tune the Demand Response programs.

Increasing Information Needs of Demand Response Programs

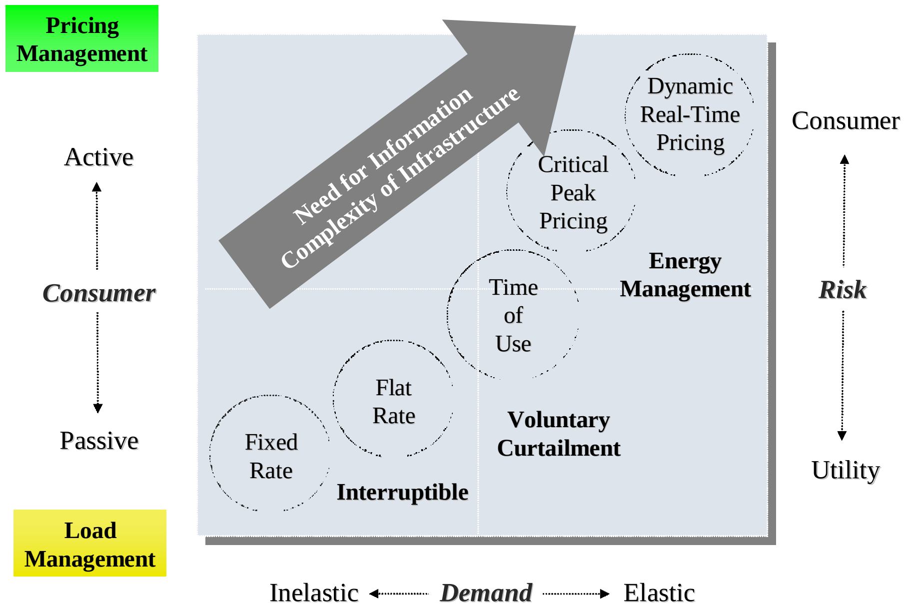

Figure 2 – Information Needs of Demand Response Programs. Both consumers and utilities manage demand more real-time information as they collaborate and share supply price risks to lower overall costs.

T&D Planning – IRP planning at the T&D level further involves the forecast and analyses of demands and distributed resources at the local, small-area level *[Willis and Rackliffe, 1994]*. Figure 3 illustrates a simple example of how spatial analyses of customer profiles and utility asset and operational data can help the utility focus their capital budget and operation and maintenance resources on areas that most meet customer needs and allow the greatest return on asset investments.

What Makes IRP Work This Time

Much advancement in information technologies is addressing the needs outlined above, from AMR, GIS, and operations management applications to enterprise application integration.

Advanced AMR Technologies – There have been many advances in metering and communication technologies in recent years. For example, Elster's EnergyAxis system provides reliable two-way communication with meters, and the Cellnet InfiNet provides a more affordable and flexible infrastructures for communication and real-time meter data management. Furthermore, many web based applications such as UtiliNet and Silicon Energy are available today to facilitate information access by consumers. *(Note: The above product references are intended as examples only and by no means imply the authors' product preferences or the products' market strengths.)*

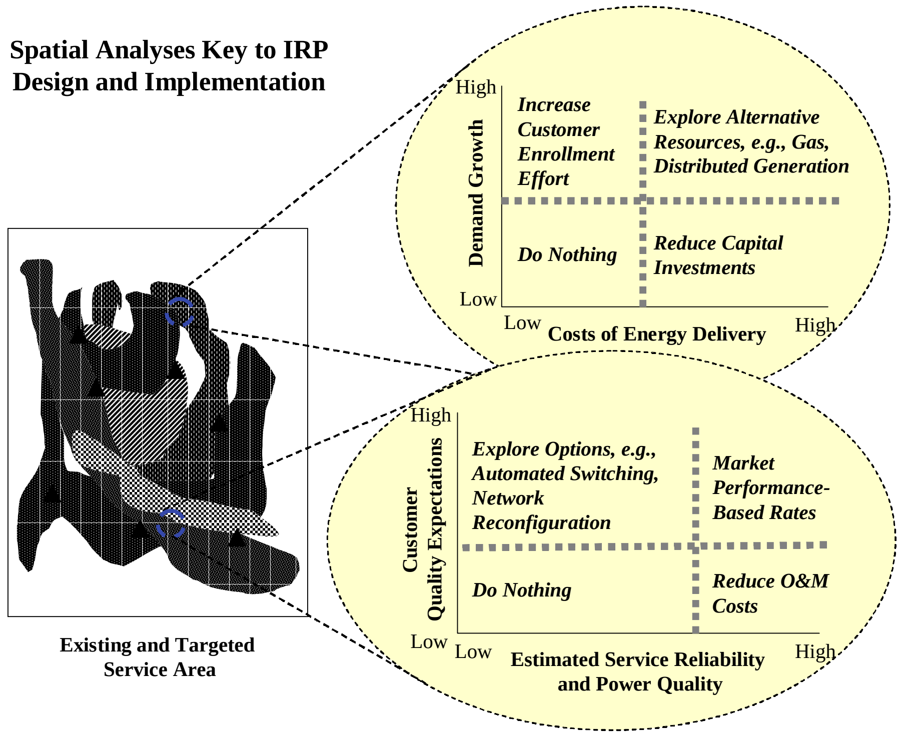

Figure 3 – Geospatial Data Needs of IRP. Utilities need to analyze operation and non-operation data geographically to realize the benefits of Demand Response and Distributed Resources at the T&D level.

Geospatial Information Systems – GIS products have become mature, more open, and more flexible, and come with more comprehensive starter GIS data models. The GIS databases now truly enable integrated asset data repositories for the utility. Besides meter and service locations for trouble outage and service order management, the interface between GIS and Customer Information Systems can also include customer classification and profiling to facilitate transformer load management and IRP. Just as importantly, good quality GIS data is available at many more utilities, and the costs of data conversion or migration are now much lower with good commercially available off the shelf GIS gateway applications.

Distribution Operation Management Applications – Many Distribution Management and Outage Management Systems (DMS/OMS) today not only automate control room and dispatch processes but also enable asset management strategies. They provide valuable historical data on utility asset performance and customer services to allow more effective capacity planning and asset maintenance management *[Tram, GITA, 2003]*.

Enterprise Integration – Enterprise Application Integration (EAI) technologies for standards-based integration are mature and now more commonly used among utilities *[Becker, 2000]*. The advancement and wide industry acceptance of IEC TC57 WG 14 standard Common Information Model for larger utilities, and Multispeak for smaller cooperative utilities enable standards based integration. Further, integration of geospatial and real-time technology has extended from standards based system interfaces to process based integration *[Tram, 2002; Tram, Primen*

Outlook, 2003]. Proven enterprise integration methodologies as well as the EAI technologies and utility integration standards allow to utility to leverage existing IT investments for IRP.

<u>Implementation Considerations</u>

The methodology and the many needed data and technology components are common for electric, gas, and water utility services. Multi-service utility companies such as JEA in Jacksonville, Florida, are deploying these common technology components, and leverage them across the different service business units to increase the return on investments in technology infrastructures.

Aligning business processes to leverage these enabling technologies is a key to realizing the business benefits. Figure 4 illustrates an example where network meter reads (NMR) and SCADA data are combined with geospatial information to improve asset management (transformer load management is shown in the figure) and electric T&D system planning.

Improved System Planning with Network Meter and Geospatial Information

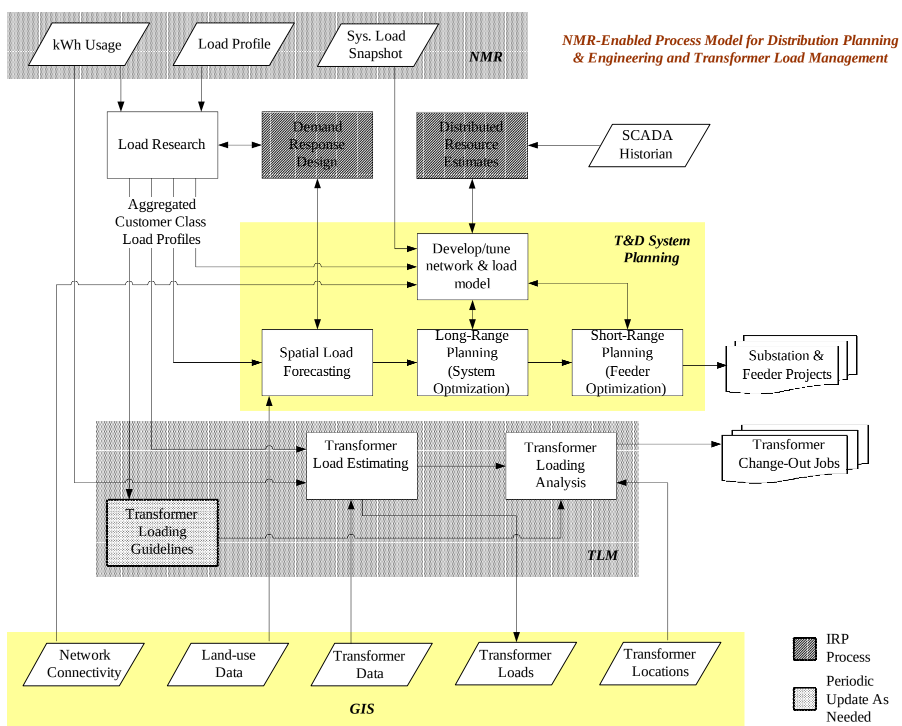

Figure 4 – Integration of Automation and Geospatial IT for IRP. This figure illustrates an example of how GIS can be integrated with AMR and SCADA to improve both system planning and asset management for a electric and water utility.

In the Figure 4 example, meter reads provide total customer usage and usage profiles as well as synchronized snapshots of loadings at distribution levels. This data may be adjusted for potential Demand Response programs before inputting to the T&D planning applications. SCADA provides historical loading and performance data at major network locations (e.g., substations), which can be used in conjunction of the NMR data to fine tune the network and load models for planning analyses. This historical data from SCADA may also be adjusted to reflect potential applications of Distributed Resources. The combined NMR and SCADA data, adjusted for potential implementations of Demand Response programs and Distributed Resources, is then analyzed together with geographically-referenced customer and T&D asset data using GIS functions to improve the overall T&D capital plans and asset management strategies.

Similarly, applying the same core technologies can improve operations in water delivery services. For example, a small-area demand forecast model was used at JEA as part of the Operation Optimization Collaboration Project of the American Water Works Research Foundation. The NMR water profile data, geographically referenced with GIS, can fine tune the demand forecast model, resulting in further improvements in water delivery operations.

SUMMARY

Integrated Resource Planning is back, and technology advances will make IRP more effective today than in the past. IRP involves the forecast and analyses of demands and resources at the local, small-area level. Key to IRP success is the enterprise integration and business alignment of real-time operation and non-operation data with geospatial information of customers and assets. The methodology and the many needed data and technology components are common for electric, gas, and water utilities. Exploiting the commonalities increases the overall effectiveness of IRP results while lowering the deployment costs.

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