LOAD RESEARCH TRAINING
Consolidated Presenters' Recommendation Report

Summary of presentations:

Mr. Nuno Fidalgo, Portugal; INESC Porto

Presentation 1 – Benefits of load research
This presentation explained the advantages of performing load research studies. The lecture started with the description of the motivations that triggered the development of load research studies in the Portuguese case. Several Portuguese primary law and regulatory provisions concerning load research and energy market operation were also presented. Finally, developed load research tools were described.

Presentation 2 – Portuguese case study
In this presentation Mr. Fidalgo described the Portuguese case study. The presentation described the Portuguese tariff system and was followed by an explanation of the methodology adopted for the development of load research tools. The last part of the presentation presented the main results obtained in the study.

Presentation 3 – Technical aspects
The third presentation concerned technical aspects. The first part of the presentation includes a description of the costs involved in the implementation of the load research project, including hardware prices and the cost related to develop studies. The next phase described the staff that is usually involved in the development of load research studies in the Portuguese case. The third part presented the details related to the data acquisition phase. It also includes a description of hardware and software requirements necessary to accomplish the objectives of load research. The presentation concluded with an explanation of the use of load research in tariffs.

Mr. Dennis Kelter, USA; Commonwealth Edison

Presentation 1 - Performing a Load Research Study
The presentation focused upon sample design when conducting a Load Research Study. Included in the discussion were: (1) Different approaches to sample design (e.g., Random Sampling, Random Sampling with Replacement); (2) Criteria for developing the sample design – for example customer type and end-use. Also included in the presentation was a discussion of the sample design used by Commonwealth Edison Company.

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Presentation 2 - What Do You Need To Start a Load Research Program
Information on the organization and skill sets required to start a Load research Program were detailed in this presentation. Participants were provided information on potential utility organizational areas where a load research function could be placed (e.g., Planning Department, Regulatory Department, Finance Department or Customer Information Systems. Also included in the discussion were the skill sets required for a Load Research Function (Engineering, Math, and Statistics).

Presentation 3 - Commonwealth Edison Company Case Study
The presentation began with a discussion about the various places where the Load Research Function has resided at Commonwealth Edison, as well as a history of how long it has existed. Information in graphical form was provided that illustrated the results of sample data and the resulting estimated demands form that customer class. Also, a graph of the results of the company's Peak Day Study was discussed, accompanied by explanations of how customer class information was used to "build up" to the system peak load.

Presentation 4 - Load Forecasting and Weather Adjustments
A discussion of the uses of Load Research in developing the basis for Load Forecasting and Weather Normalization was provided in this presentation. Mr. Kelter explained the relationship between peak load and temperature, presenting a graph which illustrated daily load by type of day (e.g., weekday, weekend, holiday) versus temperature. The graph illustrated the "Hockey Stick" relationship illustrating that loads were at a minimum between 50-60F and increased when temperatures were above or below that band. A separate discussion addressed the issues detailed the use of Load Research data in providing the basis for sound Load Forecasting.

Ms. Tatjana Konjic, BiH; University from Tuzla

Presentation 1 - Organization of Load Research
Ms. Konjic explained how to define needs for Load Research, develop research methodology and define objectives of research. She described 12 phases in the Load Research process, how long each takes and an indicative budget for conducting the research. Ms. Konjic emphasized the importance of Load Research for all stakeholders, the importance of the regulators' participation in the process. She suggested that the utilities are the leaders in performing load research.

Presentation 2 - Common Methods used for Load Research
Ms. Konjic explained that different tasks (phases) in the Load Research process require different methods for their performing. She addressed and described three main groups of methods: methods for preliminary data analyses, measurement campaign definition and model development. Dr. Konjic stressed that there are a wide range of methods that can be used in Load Research, ranging from very simple statistical tools to advanced artificial intelligence based methods. The simpler methods should be used for preliminary data analyses, while those based on artificial intelligence should be used for determining load profiling and classification of customers.

Presentation 3 - What is the status of Load Research in BiH?
In her third presentation, Ms. Konjic presented the current status on Load Research in developing countries, including the present situation in Bosnia and Herzegovina. She explained reasons why utilities in developing countries paid little attention to Load Research

issue. The presentation described activities on Load Research undertaken in Bosnia and Herzegovina, with special emphasis on Load Research work in universities in Bosnia and Herzegovina. Ms. Konjic pointed out that all three EPs in Bosnia and Herzegovina have commenced the installation of incremental meters, along with complementary communication tools; however, there still is no systematic approach for Load Research.

Mr. Ralph Zarumba, USA; Navigant Consulting

Presentation 1- Tariff Design in BiH
Mr. Zarumba provided a discussion of the evolution of tariff design in BiH, the cost of service approach and pricing models. The central theme of the presentation was the risk that all stakeholders are exposed to if proper pricing and cost allocation does not occur and why Load Research is important to the process. Mr. Zarumba emphasized that customer flight and loss of economic load are concerns that utilities and regulators should be aware of when preparing pricing and cost allocation studies.

Presentation 2 - Critical Concepts in Load Research
In his presentation, Mr. Zarumba provided an overview of commonly used terminology and statistics in Load Research, along with approaches to develop preliminary estimates before the results of a formal Load Research analysis is available.

Conclusions

The presentations summarized above included a number of benefits from the institutionalization of load research in BiH, such as:

i Tariff design reflecting much better pricing and cost allocation with load research input;
ii The possibility of development and implementation of a program on Demand Side Management and Demand Response;
iii More information for Transmission and Distribution Planning, General Development Planning and Generation Scheduling/System Dispatch;
iv Cash Flow Planning; and
v Billing and Metering Development Planning.

In addition, on the basis of the presentations given by the training, the available literature on this topic, and the productive discussion that occurred during the training, Mr. Markovic proposed the following next steps in his presentation:

- Load Research and Regulation should be required by the regulators and implemented in BiH:
  - Load Research will give the Regulators sufficient information to develop pricing and allocate costs incurred by customers in a more accurate way insofar as cost causation is concerned and to improve the tariff design process to eliminate cross-subsidization between different customer groups, this being one precondition for successful market functioning;
  - Analysis of Load Research in BiH requires joint activities and dialogue between the EPs and Regulators; and

- Harmonization of the load research processes between the stakeholders is needed at least for the following reasons: to enable common use of results in BiH and to ensure that all traders receive transparent and harmonized outputs of Load Research in both entities in BiH.

- Load Research and Demand Side Management (DSM), DSM being a program that should be required and implemented in BiH:
  - Load Research is the input for DSM that can help the Sector in optimization of usage of available capacity. DSM, which requires little investment, can actually substitute for additional generation capacity and will postpone investments into building of new capacities;
  - The EPs should consider DSM as a tool to optimize the development and usage of facilities that can contribute to an increase of energy efficiency and CO2 reduction; and
  - Regulators should request that the EP's update their plans on purchasing and installation of new meters on a regular basis to ensure that meters' performance meets the requirements of DSM programs.

- Institutionalization of Load Research:
  - The EPs should consider the establishment of the function of Load Research and/or a separate group to perform it; and
  - Rules and Administrative documents that determine the methodology and processes of Load Research should be developed and approved.

- Resources for Load research:
  - Resources for Load Research include interval meters, telecommunication systems, database storage and analysis systems, and human resources;
  - The EPs and Regulators should include Load Research resources when implementing the new metering projects that are currently are being implemented; and
  - The EPs should immediately take the first steps in the Load Research process, which is preparation work, aimed to select customers where interval meters will be installed, and develop questionnaires for customers to determine actual customer usage patterns of electricity.

Some suggestions and advice on concrete steps to be undertaken when Load Research is started:

During the Training, the presenters recommended some concrete guidelines regarding specific issues related to Load Research. The most important suggestion made was that stakeholders in BiH should commence Load Research immediately; but before any significant investment are made in metering and other equipment, the presenters suggested that the regulators work with utilities and develop an implementation plan. This plan will help avoid pitfalls and provide for the efficient implementation of Load research Programs in BiH.

The implementation plan could contain the following elements:
(1) Definition of main goals of the Load Research Program taking the available data and budget thereof;
(2) Delineation of methodology;
(3) Analysis of the available information at the utilities and other bodies;

(4) Establishment of collaboration between utilities, regulators and local authorities to enhance the outcome of the research;
(5) The type of metering technology employed;
(6) A conceptual approach to developing the samples;
(7) A schedule for implementation of meters; and
(8) A budget for the Load Research Program.

Technology Choice

The choice of metering technology is critical for establishing a Load Research Program. Although the presenters do not want to make specific recommendations regarding technologies, they suggest the following general recommendations:

(1) At a minimum, the meters should have the ability to collect interval data. The intervals should be no longer than an hour and potentially shorter, depending upon local needs;
(2) Given that it is possible that data will not be collected on a monthly basis, the meters should have the ability to collect several months of data on multiple channels. The differences in the meter will be the amount of memory that is required and the associated incremental cost of the memory is very small;
(3) The mechanisms to collect the data should be low cost and reliable. Today, a number of mechanisms exist to collect data from meters that were not previously available. For example, a utility no longer needs to have a meter reader physically extracting data into a PC or similar device at the meter site. During the training, some of the utilities discussed their current plan to use GSM technology to extract data from the meters. This is probably a reasonable approach from a technology standpoint but should be evaluated regarding cost; and
(4) Metering technology changes rapidly; thus, any cost-benefit analysis should reflect the short service life. A common mistake made by utilities is to adopt a technology based upon benefits in the distant future. However, by the time the "benefits" accrue, the technology is obsolete and the equipment has been replaced by the next generation of technology. The presenters suggest that a service life of 7-10 years should be adopted when performing the cost-benefit analysis of any technology

Smart Meters

We suggest that the utilities avoid the temptation of pursuing the "fashionable" approach and attempt a full deployment of Smart Meters in an attempt to develop a "Smart Grid". The presenters' rationale for this recommendation is as follows:

(1) The cost to deploy a Smart Grid in BiH would be extremely high. Given the other needs of the utilities, the investment funds could probably be better deployed elsewhere;
(2) The electric power pricing structures in BiH are not as advanced as is required for a reasonable application of Smart Grid Technology; and
(3) A question exists regarding the sophistication of the regional (i.e., wholesale) market in BiH. If a transparent wholesale price signal does not exist, the value of a Smart Grid is limited.

Sampling

The utilities and the regulators should determine as part of the implementation plan discussed above an approach for developing the samples. All parties should avoid "over-analyzing" how these samples will be developed. After the initial year of data is collected; significantly more information will be available, and samples can be expanded or changed. We therefore suggest the following basic approaches to sampling:

(1) All tariff classes must be interval metered (in the case of the large customers) or sampled (in the case of the small customers);
(2) Separate samples (i.e., strata) should be developed for sub-categories of each tariff class. Examples of these categories are provided below:
    a. Space Heating Energy Type – Electric or other;
    b. Urban versus rural;
    c. Climate zone.

Much of this information can be developed based upon information currently available. If the information is not available on a Customer Information System, it often can be ascertained through more informal approaches, such as asking local utility personnel who has electric heat and who does not or examining monthly usage patterns from billing records.

Finally, the regulators should be cognizant of the fact that a biased sample design is a methodology to influence a rate design. The regulators should oversee the design of samples with sufficient care to ensure that no intentional bias is being introduced into the sampling.

Implementation Schedule

To avoid unnecessary delay in commencing (or continuing) Load Research Programs, the regulators could initially establish a schedule for the program. A realistic schedule would be no more than two years for full implementation with a complete year of data.

Interim Load Research Estimates

The training showed some data is available that could be used to develop Load Research estimates for tariff design. The regulators should consider whether to urge the utilities to adopt this data in tariff filings presented to the commission before the full roll-out of the Load Research Program.

Local Expertise

In the presenters' opinion, sufficient expertise exists in BiH to launch Load Research Programs.

Regional Load Research Association

Load Research is being introduced into other regions of Southeastern Europe. The presenters strongly suggest that a regional Load Research Association be developed which will allow for the exchange of knowledge between local experts.