



Data Analytics and Applications Demonstration Newsletter

An EPRI Update on the Multi-Year International Demonstrations on “Big Data”

November 2013

ABOUT THE NEWSLETTER

The EPRI *Data Analytics and Applications* newsletter provides updates on EPRI’s “Big Data” demonstrations—the Distribution Modernization Demonstration (DMD) and Transmission Modernization Demonstration (TMD). These initiatives identify and analyze data-oriented applications and support infrastructure through collaborative demonstrations around the world. Contact Doug Dorr (DMD) (ddorr@epri.com) or Alberto Del Rosso (TMD) (adelrosso@epri.com) with comments or questions.

If you or a colleague would like to be (added or removed) from the newsletter mail list please email one of the demonstration managers listed above.

EPRI Perspective

Data and analytics are the new enablers for the smart grid. The utility industry is clearly in the midst of an evolution to data driven decision making. Some consider this a disruptive change while others embrace the opportunity as an important evolution of the smart grid. There are literally dozens of areas where improved grid visibility (achieved through data analytics) is going to re-script the way electric utilities view and manage their end product. This newsletter is designed to provide updates on a selection of interesting and evolving topics associated with analytics of the electric power system.



TECHNOLOGY TRANSFER AND INDUSTRY COORDINATION

More Insight from the EPRI “Big Data” Survey

EPRI’s 2013 “Big Data” survey was designed to collect information about the state of the electric utility industry in terms of big data, data analytics, and supporting infrastructure related preparedness, challenges, and opportunities.

Top Challenges

Understanding where existing big data challenges reside is an important aspect of framing the EPRI research around data analytics. One question set from the big data survey was related to issues the respondents felt were the most challenging for their respective companies in terms of data and analytics. While these are not ranked in any particular order the most prominent challenges were:

- Integration of multiple and disparate data sources
- Data Visualization
- General abilities around actionable analytics
- Financial and People resources
- Data Quality

An important takeaway is that each of these challenges actually represents an opportunity to move the industry to the next level of analytics capability. For example, EPRI is evaluating a selection of visualization tools around data veracity, information optimization and information insight. It is important to have a diverse set of visualization objectives moving forward as opposed to focusing solely on information insight.



Distribution

- Data Integration Issues
- Cyber Security Issues
- Changing Workforce Needs



Transmission

- Cyber Security Issues
- Integrity of the data or missing data
- Data Integration Issues



AMI

- Transitioning from Implementation to Analytics
- Cost and budget constraints for data related communications
- Data Integration Issues

EPRI Big Data Survey Results – Three Most Common Challenges (Based on the number of respondents listing each challenge but not in any particular priority)

Establishing Frameworks for Utility Analytics

As the utility industry moves forward with data analytics projects, there is clear need to get our collective arms around the topic of data governance. The goal here is to insure that every data driven project has measurable corporate value and each initiative can be tied back to core company values and/or strategic objectives. In this area of development, several approaches to utility data analytics were discussed and although several approaches are being pursued, no single answer fits every situation.

One concept termed the “Big Bang” approach invests significant amount of money and effort in a single project with the first significant results beginning to be produced in year 2+. This seems to be the least favored approach. Another approach coined “quick wins” or “rapid prototyping” has a smaller, targeted goal and produces data analytics results in 3-6 months. The key to this approach is to have an emphasis on solving a specific business problem and using this as a foundation that can be expanded to ongoing applications. Those just getting started in data analytics seem to favor this approach.

Several utilities have also formed “Analytics Centers of Excellence” to formalize a cross cutting team structure where the business drives the analytics and the information technology (IT) provides the

enabling infrastructure. Governance, technology, processes and people encompass the organizational aspects of this approach. The formation of the Centers of Excellence is early in the electric industry and the most prominent efforts have a deliberate top-down approach with executive leadership driving the implementation of these cross-departmental teams.

As part of EPRI's data analytics research in the DMD and TMD, one deliverable will focus on different organizational models that can be adapted by utilities to rapidly advance the maturity level with respect to the organization's Information Development competencies. This resource will consider formation of cross-departmental (Data Analytics Centers of Excellence) in the electric utility industry that can apply to existing and forward looking levels of maturity at five (5) different stages: 1) Aware, 2) Reactive, 3) Proactive, 4) Managed, and 5) Optimal.

Big Data Insights from Utility Analytics Week

In September 2013 EPRI sponsored two workshops at the second annual Utility Analytics Week Conference in Atlanta Georgia. This conference is organized by Energy Central Magazine and run by their subsidiary the "Utility Analytics Institute" or UAI. Overall, this event is fast becoming an important venue for bringing together electric, gas and water utilities with the vendor & consulting services community – to discuss and share challenges, opportunities and success stories around the topic of electric power system analytics. More on this conference can be found at <http://utilityanalytics.com>. While the conference had a very diverse selection of topics, the following sections describe some of the key outcomes from the EPRI workshops as well as the utility case studies from the conference. DMD and TMD project members can get copies of the EPRI presentations and materials by request from either of the respective program managers (listed in the front section of this newsletter).

Utility Analytics Week Topic 1: Recapping the EPRI Roadmapping Session

Approximately 70 utility representatives attended the EPRI analytics road mapping session on Monday September 23rd. The objective of the session was to obtain the input and vision necessary to align the (EPRI research and the demonstrations) around the most important analytics needs and challenges for the electric utility industry. This was the fourth such 2013 venue where EPRI asked for such industry input. The participants in these efforts have identified literally dozens of challenging topics with respect to data acquisition hardware, storage, queries, data volume, standards, governance, data source integration, time dependencies, system bandwidth and so on. With these many challenges in mind, it is important to host such workshops and industry forums and develop a strategy to support and accelerate the electric utility industry's transition to an industry that understands its data and knows how to derive optimal value from smart grid data. The full results of the roadmapping session will be aggregated with input and insights from EPRI's other 2013 events.

The following are just a few interesting quotes and topical recaps from the respective sessions – primarily focused around why the attendees were here and where they saw the greatest "Opportunities and Challenges" in this space:

- *"We are trying to understand how others are progressing with respect to data analytics."*
- *"We have the data, but we are looking to get better at predictive analytics."*
- *"We want the enterprise to consider the data an asset and learn how to make money from it."*
- *"A big challenge is leveraging the data to use it so it is valuable. You must have a data champion in your department that understands how the data is valuable to more than just their group."*
- *"Field (or wide area) visualization is a big opportunity. For example situational awareness before during and after storm events would be very valuable."*

- “A challenge (for our company) is in getting the value out of the data – this starts with getting the data out of the hands of IT and into the hands of people who can really leverage that value.”
- “Getting the data into the (innovators hands) can be a big challenge. We have great people, but it is not always easy to get through the system. There are lots of what we call “data jails”.
- “Traditionally IT is on one side and OT on the other – but the view is changing. Getting to the last mile is still tough. Data must be considered an asset to go that last mile,”



DISTRIBUTION MODERNIZATION

2013 DMD Activities and Deliverables

Big Data Immersions

EPRI continues to schedule and conduct Big Data immersions with each of the DMD project sponsors. The objectives of these workshops are to:

1. Identify those unique data-oriented applications and kernels of knowledge that are useful and insightful but have not yet become commonplace within the utility industry as a whole.
2. Establish a baseline for each project member to use as their relative metric in terms of how prepared they are (or will be in a few years) to take advantage of the data analytics applications.
3. Identify the best in class and best practices for managing data as an asset and document the state-of-the-art related to data analytics and visualization.

Once all workshops have been completed, the data-related demonstrations phase of the DMD and TMD projects will commence. Some quick insights from these workshops are emerging and will help to shape the DMD and TMD research over time: A top ten list of some of the emerging findings and interesting Quotes:

1. There continues to be an underlying concern that more data being collected than there is value derived from that data. Getting value out of various data sources is therefore a timely and important objective regarding data analytics collaboration across the electric power industry.
2. Integration of disparate data sets and getting data out of silos is a major undertaking that has not been well resolved by the industry just yet. This is not unexpected as most data collection has traditionally been departmentally funded and as such that department tends to own and protect their data.
3. Many of the data analytics efforts outside of smart meters are at the pilot stage and not fully deployed. While we don't have an exact number, much of the value from analytics efforts to date is centered on AMI data.
4. Some utilities are making a concerted effort to reinvent the role and integrations of their IT groups. Some have brought in IT management with experience in the banking and data center industries where “big-secure-data” and “streaming analytics” is not a new concept. They bring perspectives on big data and understand the importance of data governance.
5. There continue to be hurdles with getting the analytics area of the electric service business funded. This is a twofold issue, first because many analytics projects and efforts to date involve point solutions for point problems, and secondly because of staffing and budget constraints.

6. Many utilities purport their programs and analytics capabilities to be much further along than they really are. This space is changing quickly but in general, a lot of the analytics are in the pilot demo stages.
7. Some utilities are successfully implementing secure cloud solutions for data cost management. These are again, point solutions and don't yet traverse the enterprise.
8. Many utilities are grappling with the questions around ownership of analytics and applications – Most clearly believe this ownership should be across business units and not residing in IT for example. IT should own and maintain the platforms, tools security etc. but the corporate buy in and ownership is an area where best practices for utility analytics must be vetted.
9. Data Governance – Many believe this should be a corporate function and not an IT function so that any point solutions can ultimately get mapped to the corporate smart grid business plans and feed/support the longer range (Smart Grid 2020) vision.
10. Value Streams – At the end of the day, every data set and every data analytics project must stand on its own, based on the value it brings to the enterprise.

Overall, this (top ten list) along with the many other notable insights gleaned from the “input of many” provides us with a roadmap for utility system analytics and demonstrations moving forward

DMD Application Highlights

Using Data and Analytics for Asset Health

Many of the EPRI DMD initiative members have described their emerging asset health and asset management analytics initiatives. When we combine what's going on across the membership, it adds up to a solid guidance document of best practices and innovative diagnostic advances.

Some of these subject innovations have been hidden in the data for a long time and have simply not been leveraged with the right data mining. For example the algorithms for capacitor bank health are a simple matter of knowing what to look for in the existing data and subsequently automating the analytics to not require human intervention. To turn one of the capacitor health algorithms into a very powerful diagnostic tool, a simple power factor metric with fifteen minute interval data is actually enough. With a few additional data points, it is even possible to tell exactly what is wrong in terms of the types of common failure points for capacitor banks. Was it a fuse? Was it a switch issue? Or was it one of the other half-dozen things that could fail?

These trouble cause enhancements to the analytics can be a very powerful tool in terms of efficiency when dispatching the maintenance and repair teams and the whole process can be as automated as the way shipping companies like UPS and FedEx accomplish pickup and tracking of overnight packages. EPRI continues to evaluate a number of these indicators that turn out to be very data-intensive but relatively simple once the algorithms are defined and the data sources and analytics engines are structured to deliver automated or on-demand information.

Asset health and management are examples of the analytics to be explored in the DMD and TMD research and represent just a few of the hundred plus data-oriented applications and algorithms identified by the projects thus far.



2013 TMD Activities and Deliverables

Big Data Immersions

A Big Data Immersion workshop at American Electric Power will be held on November 19, 2013. The workshop is organized as a joint meeting for TMD and DMD. The first part of the workshop will be a joint plenary session on best practices and organization models for data management and governance. Breakout sessions on specific data-oriented applications for transmission and for distribution will be conducted as well. This workshop is a cross-functional exercise involving different departments operations, planning, asset management, customer systems, IT telecom, IT enterprise architecture, Grid Modernization and a number of others. The outcomes from the series of immersions will provide important insights into the electric power industries data analytics capabilities today and in the near future. Specific outcomes will identify best practices, unique data analytics or visualizations in progress by some of the members, and prioritizations that will direct the demonstration element of the DMD and TMD projects.

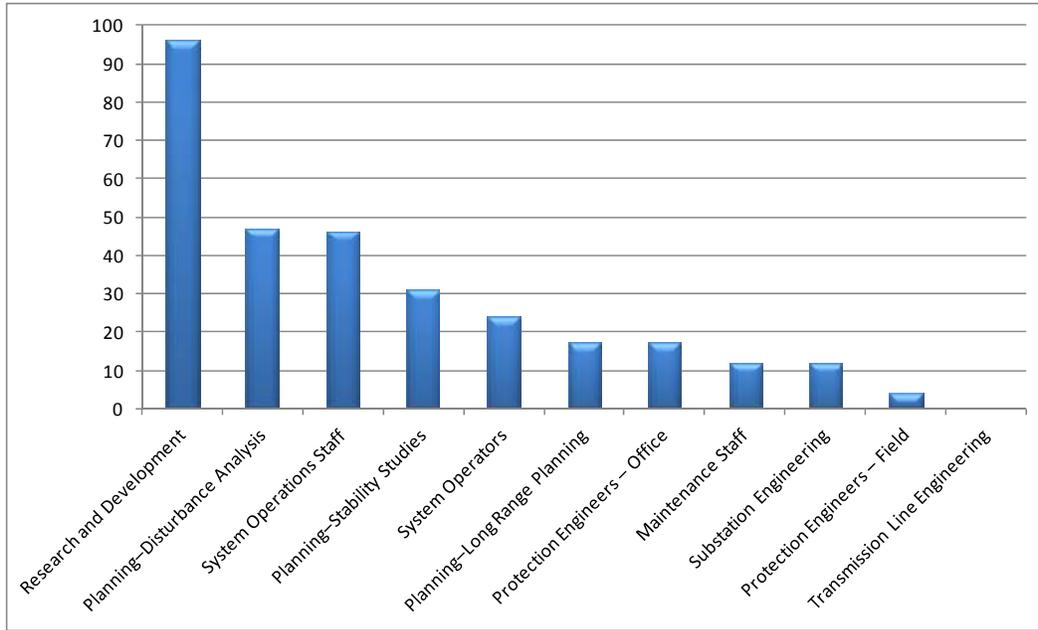
TMD Application Highlights

Are PMU-based applications today mature enough to be effective tools for system operators and planners? - Highlights from the EPRI industry survey on PMU technology

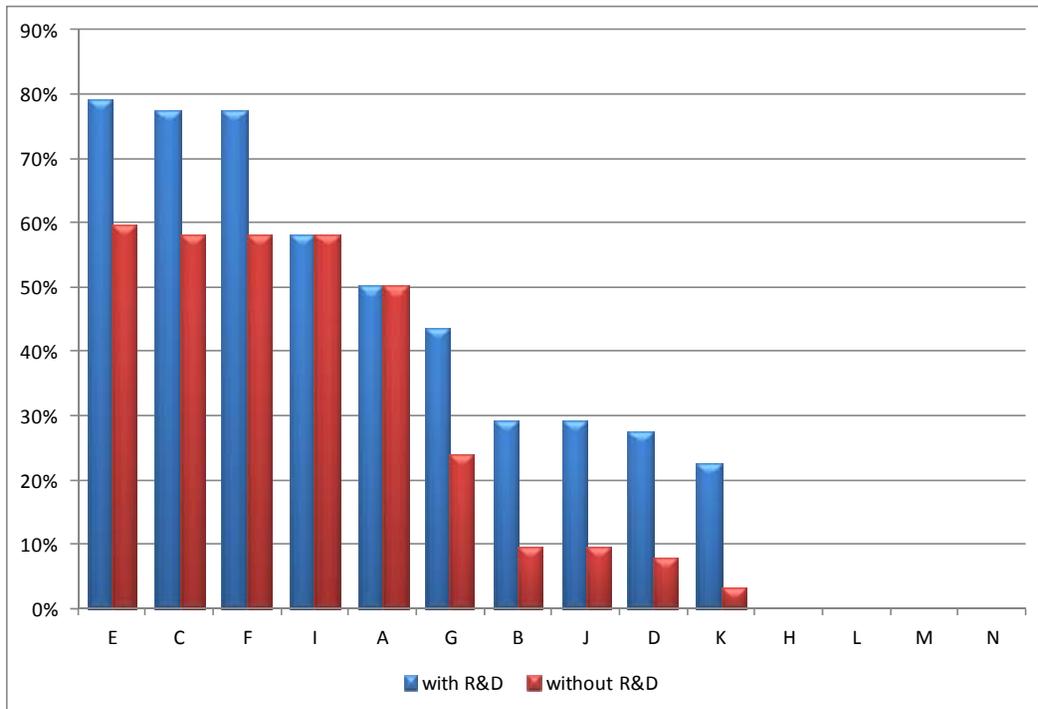
In the last few years a significant advancement has been made around the world in the development and deployment of synchrophasor technology. In North America many transmission owners and system operators have been awarded grants to deploy a large number of PMUs across their respective service areas, along with the related communications and IT infrastructure. There is consensus in the electricity industry that the availability of this new infrastructure enables the development and implementation of new tools that utilize time-synchronized dynamic measurements to support planning and operation processes, but in order to realize this potential a suite of highly reliable, robust and fully supported and maintained applications is needed.

In the last few months, EPRI conducted a comprehensive industry survey to gain a baseline understanding of the status of implementations in terms of mature uses of synchrophasor technology, data management and storage issues, the implementation and deployment challenges, as well as the value and benefits of different applications. The survey was a coordinated effort between the Intelligrid program (P161B), TMD, and the System Operation program (P39). Twelve domestic utilities and one international company responded to the survey.

In order to get insight into the level of maturity and current uses of synchrophasor-based applications, the survey sought to determine who in the utility organization uses synchrophasor data. The survey identified 11 departmental functions and asked how often each department accessed the data. The predominant user of the data is still the Research and Development staff. They are followed by the System Planning and Operations Staff. The breakdown of usage by department is shown in the following figure.



To define a “maturity factor” outside the Research and Development group, the data was further analyzed to determine which companies have moved beyond the R&D mindset to a broader level of engagement by line organizations. The figure below illustrates that in most companies the R&D department is still a major user of the data. Only two of the surveyed companies indicated that R&D was not a major consumer of the data. In most cases the R&D group was actually a frequent user of the data rather than just a casual or non-user.



Data usage with and without R&D included

The main conclusion from these results is that while synchrophasor technology is well-established and supported, most applications are still in early stages of development with a need for more testing, validation and verification to move them to production-grade status. A collaborative demonstration effort is an appropriate means to fully assess the performance of existing applications, identify gaps and elaborate research and development roadmaps for the industry to accomplish a selection of fully mature applications, in terms of their solution accuracy, credibility and readiness for implementation.

Grid Analytics Europe 2013 - Big Data Management and Analytics for Utilities Wednesday 23rd & Thursday 24th October 2013, Hilton London Docklands, United Kingdom.

Dr. Alberto Del Rosso – Manager TMD – participated as speaker at the Grid Analytics Europe 2013 in London, UK, giving a presentation on the EPRI approach to assess the value of data sources and analytics in power systems applications. The event is a dedicated conference, exhibition and networking forum designed to provide implementable information and guidance to translate electric utility data into valuable information for improved asset management and system planning.

The conference brought together over 100 technical experts involved in utility data management and analytics from TSO and DSO organizations, technology suppliers, consultants and system integrators. More than 30 advanced technical level presentations were given during the two-day event. Actively participating in this event has been very important in raising awareness of the EPRI big data collaborative effort among the principal European utilities and system operators and provided a forum for disseminating the results. More information about the conference can be obtained at the website <http://www.gridanalytics-europe.com/>.



DMD TMD DELIVERABLES UPDATE

2013 Activities and Deliverables

The Data Analytics research deliverable set for 2013 includes strategic documents indentified by project members as key foundational elements of the program. These include topical white papers, industry watch materials, application insights, workshop summaries and state of the industry validations. The listing of deliverables and the timeline is shown in the following figure. Some of the longer range DMD TMD deliverables are also included for better visibility on overall project outcomes.

One such industry watch document involves the creation of a catalog of third-party applications and resources that are potentially beneficial for pilot and or full-scale data analytics. The purpose of this catalog is to increase awareness of the applications that are available in the public domain or commercially and to provide more information on their potential as the data analytics research efforts move forward. These applications are divided into four categories: data sources, resources, software applications, and vendors. Regardless of the category, all of the applications reviewed must meet the following criteria: third party-sourced, commercially available, and utility/energy-specific. The EPRI role with respect to the subject material is to review and provide concise and useful guidance on a select number of applications that have the potential for the most impact in power systems operation.

Joint 2013 Deliverables for DMD & TMD	
Joint Newsletters (2+ in 2013)	
Data Analytics Preparedness Survey (10/2013)	
Workshops & Meetings (2 in 2013 (Sept & Oct))	
Public Web-Site (on smartgrid.epri.com) (11/2013)	
Third Party Resources Catalog (12/2013)	
Organizational Models for Enterprise Information Management (PROPOSED: 12/2013)	
Cyber Security Risk Assessment Methodology (PROPOSED: 12/2013)	
Joint White Paper Series – One Topic Each Quarter (Q3/2013 to Q4/2017)	
DMD Deliverables	TMD Deliverables
Individual Utility Immersions	Individual Utility Immersions
Catalog of Dx Applications (12/2013)	Catalog of Tx Applications (12/2013)
Bi-Monthly Webcasts	Bi-Monthly Webcasts
Dx Data Analytics Guidebook	Tx Data Analytics Guidebook
DMD Combined Immersions Roadmap	TMD Combined Immersions Roadmap
DMD Case Studies	TMD Case Studies

To provide further guidance, the catalog divides the third-party applications into the following categories:

Data Sources: External information that has the potential to feed into software applications or allow users to demonstrate ideas for potential applications. With the rise of distributed renewables, attention has been given to include long-term weather and solar data for the purpose of forecasting. In addition, data sources on current topics – such as Green Button data and utility rates – have been included.

Resources: A variety of items, such as newsletters, interest groups, websites, conferences, and any other educational resources regarding data in the utility space. 2013 saw a great rise in the number of data analytics conferences specific to utilities. This has served well to address a growing need for collaborative insight in the utility industry, but also has brought awareness to the public about the relevance of these issues.

Software Applications: These are standalone tools that demonstrate an application example and are not enterprise solutions. These applications cover functions such as situational awareness, data visualization, customer segmentation, load management, and utility business support.

Vendors: These offer enterprise solutions by providing infrastructure, software tools, analytics, and/or customer support. There are two types of vendors featured in the catalog: domain-specific (where the vendor’s sole focus is the utility industry) and market-varied (where utility solutions are a subset of the vendor’s overall product line).

The third-party applications catalog contains information for over two dozen entries. Each application is preceded by a short descriptive table, followed by a more detailed description that includes online references and product photos. The anticipated release date is December 2013.

KEY DATES

CaFFEET'13 – How Can Big Data Boost Society's Resilience?

CaFFEET – the California France Forum on Energy Efficiency Technologies is hosting their annual workshop with this year's theme on How Can Big Data Boost Society's Resilience? The forum will be held on November 21–22, 2013, at Stanford University. EPRI is participating and contributing with Matt Wakefield, Director of Information Communication Technology, as one of the presenters. A summary of this meeting will be included in the next DMD TMD Newsletter.

DistribuTech 2014 – EPRI Data Analytics and Applications Workshop

Doug Dorr (DMD Program Manager) and Brian Deaver (Distribution Program Technical Executive) will facilitate a focused session on (distribution related data analytics topics) at the January 2014 DistribuTech conference in San Antonio, Texas. The session will be part of the “Utility University” pre-conference events. The workshop is listed under the Big Data track from 1-5pm on January 26th (UU 121: Leveraging New Data Sources and Analytics for Improved Distribution System Performance). More information can be found at www.distributech.com.

DMD and TMD (Member Steering Committee) Webcasts

The schedule for DMD and TMD member steering committee webcasts is finalized for 2014. These interactive sessions are held every other month. Content and agenda material will be supplied to each of the DMD and TMD technical contacts for dissemination to their respective teams.