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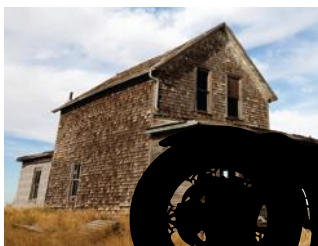
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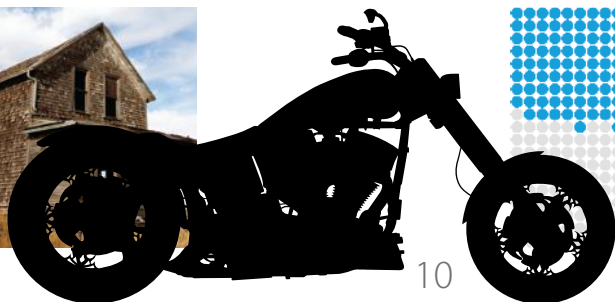
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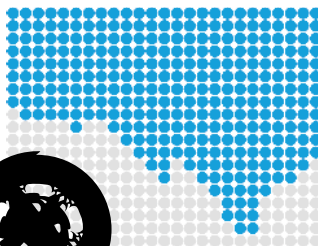
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The Smart Grid for Water

The power and potential of the data

DR. PETER GLEICK of the Pacific Institute recently wrote that due to limitations on water supply and the high costs of developing alternative supplies, maximizing the efficiency of water use is paramount to achieving sustainability. He notes: “A key to improving efficiency is understanding where, when, and why we use water” (Gleick 2010). Unfortunately, data of this granularity is hard to come by in the water industry. In most utilities, data is a sparse commodity or is collected in such vast and widely varying platforms that interrelationships are missed or remain hidden.

The development of the Smart Grid for Water is challenging this approach, by increasing the availability of data and information. The Smart Grid for Water can tell us not only *how much* water is used, but *where* and *when*. The Smart Grid for Water represents a paradigm shift from a data-poor, hardware-centric model, to a data-rich environment that is 100% accurate and complete with location and GPS coordinates. This new approach has created the “Geo-Temporal Data Model”, providing the “where, when, and how” necessary to understand water use.

The future for efficient utilities lies in collecting and analyzing this data, and converting it in real-time to information. To be successful, we will need to increase our data awareness by:

- increasing the amount of data (data density) available to the utility and its customers;

- increasing the capability of our systems to manage and analyze this data; and
- increasing our ability to present this information in meaningful ways to shape behavior patterns of customers and the industry.

INCREASING DATA DENSITY

In the past, water utilities employed a data-poor model upon which to make decisions. One read per month—or worse, one read per quarter. Automated meter reading (AMR), while notionally increasing the data density available to the utility, in many cases only supplanted the meter reader. The result: one read per month. There was no increase in available data, but timeliness and

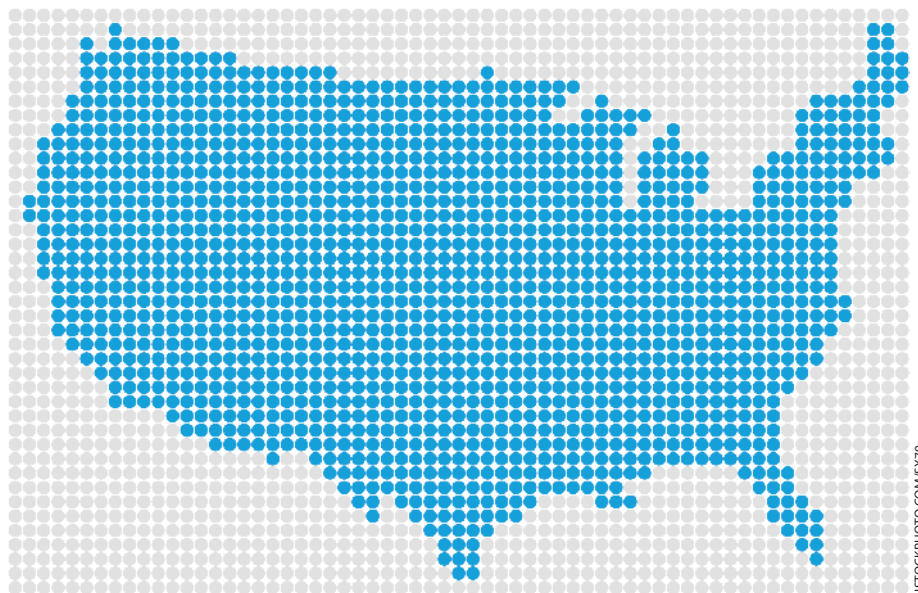
accuracy were arguably increased.

Moving to a true “data-rich” model requires Advanced Metering Infrastructure (AMI) with its attendant communication backbone and increased frequency of reads. When combined with geo-spatial referencing, the data model achieves the data-rich capacity of the Geo-Temporal Data Model.

The transition from a “data-poor” condition to a “data-rich” environment not only provides better information upon which to base decisions, but increases the speed at which those decisions can be made. For example, by deploying a system that can provide real- or near-real-time water-pumped versus water-delivered reports, a leak can be recognized immediately. Water theft can be identified rapidly. Missed meter data can be noticed instantly.

But such data-rich systems are a double-edged sword. The vast quantities of data accumulated can easily overwhelm information technology (IT) systems and the human capacity to assimilate. It is the pitfalls of data management and analysis that hinder the successful integration of utility data systems into the Smart Grid for Water and prevent transforming these databases into a coherent *information system*.

Utilities often struggle with the AMI data tsunami. Management systems designed for one meter-read per month



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are now seeing 720 reads per month. A “simple” meter read is now represented by a data stream that is three orders of magnitude above what many systems can handle. And it does not stop there. When additional data such as leak/tamper flags, time/date stamps, peak/average flow tags, etc. are factored in, the data volume increases exponentially. As with many data collections systems, in the Smart Grid for Water, the bottleneck has shifted away from the data collection to data analysis (Baraniuk 2011).

The benefits of the Smart Grid for Water data can easily vanish in this data tsunami. The result is that, in many cases, data collection is “dumbed down” to the lowest common denominator of the systems. This could be a limitation on the customer information or billing systems platform (e.g., systems can only accept one read per month), a limitation on storage capacity (physical or virtual), or a limitation on the ability to comb through the data to create information (analytical capacity and capability). In these cases, the increased data availability becomes a curse, and the response can be to rapidly reduce data collection from 720 reads per month back down to one. The utility has just inadvertently bought itself a very expensive meter reader.

INCREASING DATA ANALYSIS

The Smart Grid for Water has been erroneously defined as the “hardware-centric” AMR/AMI systems; that is, focused around the end-point and the communication infrastructure. But it will prove to be much more. The power of the smart grid is in the convergence of hardware, data, and software to search for and identify trends in data streams, and maximize the efficiency of water delivery, customer service, and utility operations.

Some of this analysis is already embedded within the AMI systems or meters themselves. For instance, leak detection and tamper flags are processed signals that are derived from raw data in the endpoint or meter register. This frees the human operator from divining this information from the raw data.

But the real benefits of the Smart Grid for Water lie in aggregative, integrative, and derivative information that can be gleaned from combining data, particularly from those three critical databases that all utilities have or should have: Customer Information Systems databases answering the question “who, coupled with financial information”; AMI databases, answering the questions “how much, and when”; and geospatial databases answering the question “where”.

That is reviewing data from numerous sources and developing tangible, actionable information. Under this approach, a meter read is not just a meter read. It forms a key part of the billing record; it forms a fundamental part of the leak loss (pumped versus billed) analysis; it establishes peak and average demand parameters; it is a key measure of the performance of water conservation activities; it forms the basis for feedback to the consumer directly on their impact on resources; and it is the foundation for key reporting elements associated with regulatory requirements such as compliance with California’s 20 x 2020 Water Conservation Plan.

The key is that while this information is aggregated and derivative, the data source itself is singular. There is no need to store this data point across multiple platforms. Gather the data once; use it many times. A recent International Data Corporation report notes that “nearly 75% of our digital world is a copy—only 25% is unique,” and “the greatest challenges are related not to how to store the information we want to keep, but rather [in] extracting all of the value out of the content that we save” (Gantz and Reinsel 2010). A properly deployed smart grid for water provides the analytical tools to solve this dilemma.

INFORMATION PRESENTMENT

Having masses of data and the algorithms to reduce it to information are only as good as the tools provided to people to action the information. Information presentment represents the kernel of actionable information from

the data: something that can be done, a change made. It can take the form of instantaneous water-pumped versus water-billed reports reconciling flows on a daily basis, maps of unauthorized water usage, egregious water users, or super-conservers! Or it can demonstrate to consumers their water consumption versus their neighbor’s or their community, or allow them to track daily their gallons per capita per day on a year-to-date basis.

But these information presentment tools are often ignored. As the volume of data increases, “the extra effort of making our data understandable, something that should be routine, is consuming considerable resources” (Fox and Hendle 2011). Survival in the smart grid for water data universe will depend on our ability to manage data and turn it into information. The ease at which we can take smart grid data, convert it into information, and present it in a form that results in change will determine the success of any smart grid installation.

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Trevor Hill is president and CEO at Global Water Resources.

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