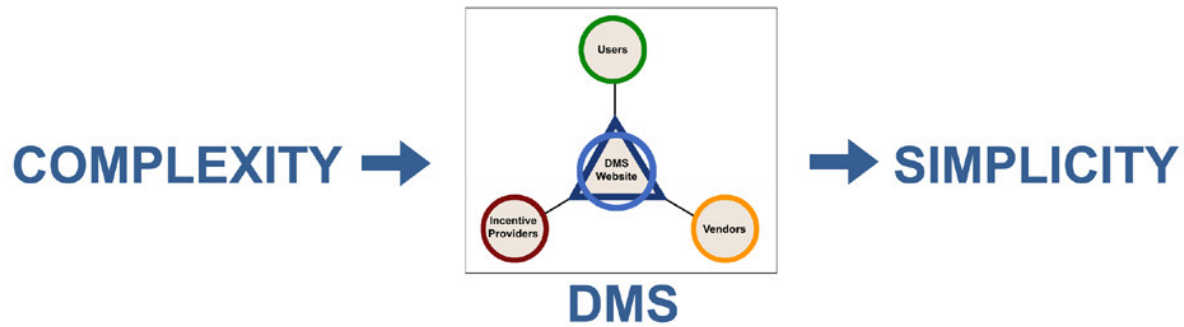


Cleantech Brief: Data Management in the Clean Energy Economy

A Draft White Paper for discussion

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Data and information management is of paramount importance to various aspects of the Clean Energy Economy. As increasing non-fossil electricity production capacity is introduced to the grid, new load, peaking, storage and power conditioning requirements are emerging – all of which necessitate real-time data management and analytics. When many of us think of the Clean Energy Economy, images of wind generators, biofuel pumps and solar panels often come to mind. However, there are many less apparent aspects of the Clean Energy Economy (from energy conservation to distributed clean energy production) that require advanced, complex Data Management Systems (DMS's) that function similarly to internet communications systems and that transform complexity into simplicity.



As a variety of biomass resources are harvested, transported, processed, refined and the resulting bio-energy products are distributed, increasingly complex data gathering and management frameworks are needed to control costs and production quality. As consumers and business managers alike seek greater participation in the environmental and economic benefits that the Clean Energy Economy has to offer, a variety of organized, geo-spatial and user-type data is needed to enable rational decision-based behavior changes. And as all of the aforementioned converges in the single energy management framework conceived of as the “Smart Grid,” integrating these various data frameworks in a seamless web will be tantamount to transforming the complex into the simple and to ushering an era of clean energy and sustainable economies.

“Everything should be made as simple as possible, but not simpler” - Albert Einstein

DATA MANAGEMENT: DRIVING BEHAVIOR CHANGES & MARKET FORCES

As increasing economic and environmental benefits accrue to consumers and business managers in all industry sectors, information organization and access is becoming one of the most significant enablers (where sufficiently developed) or road-blocks (where insufficiently developed) to wide-spread adoption of renewable energy and energy efficiency products and services. By organizing the information behind all of these myriad opportunities in infinitely scalable inter-related data tables with unlimited attribute cataloguing, advanced DMS's transform an otherwise overwhelming and unruly universe of possibilities into customized, prioritized and easy to understand opportunities for each consumer and business manager – tailored specifically to her needs and requirements. The delivery of these critical mechanisms, made possible through advanced DMS's, is tantamount to widespread adoption and implementation of Clean Energy products and services – and is at the foundation of the whole-sale market and social transformations necessary for a sustainable future.

“The electric industry is poised to make the transformation from a centralized, producer-controlled network to one that is less centralized and more consumer-interactive. The move to a smarter grid promises to change the industry's entire business model and its relationship with all stakeholders, involving and affecting utilities, regulators, energy service providers, technology and automation vendors and all consumers of electric power.”

**-US Department of Energy,
“The Smart Grid: An
Introduction” (p. 14)**

DATA MANAGEMENT: BIOMASS & BIO-BASED SUPPLY CHAINS



While much attention is currently being paid by policy makers, financiers and industry to the development of advanced biorefining and bio-processing technologies (and for good reason), many of which contain data-intensive, precision controls for bio-chemical and thermal-chemical processes, there are several other links in biomass and biorefining supply chains that require advanced DMS's. Regardless of the biomass or process technology in question, from the harvesting/collection of the bio-resource through the distribution and delivery of the final bio-products, every link in the supply chain requires advanced DMS frameworks in order most effectively and economically to:

- Manage Costs & Margins
- Manage Logistics
- Manage Environmental Impacts
- Manage Price & Supply Risk

Because most of the biomass resources that we utilize in increasing quantities are generally far less “energy-dense”¹ than the fossil energy resources we have built our industrial extraction, manufacturing and distribution infrastructures upon, it is critical that these total biomass supply chains are managed in such a way as to reduce harvesting, aggregating, processing, logistics, and distribution costs as much as possible. Advanced DMS's are requisite to “unlocking the value” from these resource streams with

¹ ENERGY DENSITY = the amount of energy (often measured in British Thermal Units, or BTU's) per material density (mass/volume).

maximum efficiency. Further, as performance in these supply chains is measured in increasing dimensions² only advanced DMS's are capable of quantifying and cross-analyzing economic/environmental performance across these multiple and inter-related variables. Ultimately, our deployment of DMS's will allow us to unlock value and efficiently achieve unprecedented levels of natural abundance in our bio-based Clean Energy systems.



DATA MANAGEMENT: THE SMART GRID



The Smart Grid will evolve over the next decade as a direct result of both policy decisions and industry innovations – ultimately yielding a highly integrated, decentralized and multi-nodal energy management web. This web will likely include hundreds of consumption (“load” – from appliances and other electricity-consuming devices) and generation nodes *per person/household* and from hundreds to several thousands of such load and generation nodes *within each business!* All of this will comprise a dynamic and resilient energy management framework in which increasing portions of produced energy are from renewable sources and load/consumption levels per person and per business are minimized through intelligent conservation.³ Business managers and consumers alike will manage their facilities and homes through web-integrated communication devices – from computer interfaces to cell phone interfaces to “smart-phone” PDA devices, and to smart-integrated automobiles and other transportation devices that themselves will function as generators, consumers and storage facilities for electricity! All of this complex, decentralized Smart Grid framework will have very advanced DMS's at its foundation. Such DMS's will deliver highly empowered individual actors the information and power to help create and sustain a Clean Energy future.



Advanced Data Management Systems are at the core of developing a Clean Energy Economy – and are the next step in the information revolution as it converges with the natural abundance and sustainability of an efficiently managed renewable energy, energy efficiency and Smart Grid future.

² These dimensions include traditional micro-economic measurements such as the fixed, semi-variable and variable costs used in business cost accounting, as well as newer environmental attributes such as green house gas footprint, water consumption/utilization, life-cycle analysis and energy-yield measurements – many of which will likely be reflected in new revenue and cost items via carbon management regimes and other national and international frameworks required to manage environmental resources in balanced macro-economic terms.

³ The Smart Grid will enable reductions in energy consumption both in terms of total demand (per user) and in terms of diminished peak-load demand (reducing the maximum peak generation requirements on the grid).