# GridWise™ Constitutional Convention

# PROCEEDINGS


December 6-7, 2005 Philadelphia, PA

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# Executive Summary

The GridWise™ Architecture Council (GWAC), a team of cross-industry experts representing the power industry, information technologies and telecommunications, industrial controls, buildings, economics, and regulatory policy, sponsored a GridWise Constitutional Convention in Philadelphia, Pennsylvania, on December 6-7, 2005. More than 100 delegates attended the convention, designed to establish consensus surrounding fundamental principles of interoperability and to develop buy-in from a broad base of industry stakeholders in the application of information exchange for effective operation of the future electric power system.

Major support for the GridWise Constitution on Interoperability came from key leaders in the electricity industry, including Nora Mead Brownell, Commissioner of the Federal Energy Regulatory Commission (FERC); Joe Desmond, Chairman of the California Energy Commission; Tom Welch, Vice-President of PJM Interconnection; and Senator Jeff Bingaman of New Mexico. Further support from key smart grid initiatives included EPRI IntelliGrid; the GridWise Alliance; the Center for Grid Modernization; and NRECA Multi-Speak.

Convention speakers included Eric Lightner of the U.S. Department of Energy's Office of Electricity Distribution and Energy Reliability; Rik Drummond, Chairman of the GridWise Architecture Council; and a panel of four visionary leaders, Glen Allmendinger, President and CEO of Harbor Research, John Petze, President and CEO of Tridium, Jim Luth, Technical Director of OPC, ICONICS, and Tom Welch, Vice President of PJM Interconnection. They challenged the audience to address improved consumer relationships, factory automation, and data management.

Additional keynote presentations were delivered by Jesse Berst, Center for Smart Energy, and Dean Kamen, President of DEKA Research and Inventor of the Segway™ Personal People Mover. Both challenged convention delegates to think broadly about the implementations across society of improving grid interoperability.

Convention delegates attended breakout sessions dedicated to each of the four areas identified as critical components to a well-rounded constitutional agreement: Business and Industry Models; Technologies; Public Policies; and Constitution Governance. Each breakout session developed a list of actions and commitments for continued support for the Constitution. From these discussions, and those of the plenary sessions both before the breakouts and during the concluding session, major findings and next steps were identified.

## *Major Findings*

- There is indeed enthusiastic, broad support for the principles set forth in the Constitution, and a clear desire to continue on the path started by the Constitution.
- There is a great need for increased awareness, understanding, education, and broad-based buy-in surrounding GridWise principles.
- There is currently a lack of an open architecture, common language, harmonization of standards, and unique device identification.
- There is a lack of infrastructure to support demand pull: smart meters, information

transparency and access, real-time consumption information and price signals.

- Inconsistent regulatory, technology, public policy, and business requirements for distributed generation connection to the grid hamper the interoperability infrastructure.
- The "patchwork quilt" of electricity regulations and operating policies across the country places a burden on developers and service providers, adds costs to implementation of interoperability, and creates inconsistency. There is a need for harmonized policies across state and utility lines, particularly those supporting value-based incentives.
- Product and service providers have successful project examples that can – and should – be used to build greater market acceptance. As consumer awareness of GridWise technologies, concepts, and applications increases, interoperability will become more commonplace and industry groups will become more cohesive. Common aims and market development strategies will result.
- There is a need to effectively use and integrate several decades of knowledge on electric power markets to better affect the challenges now facing the grid of the future.

*"This is a large, complex undertaking, which will require us to join forces to increase awareness and education and thus build credibility."*

- Federal and state policies responding to the recently enacted Energy Policy Act of 2005 must aim to secure an intentionally interconnected system and address critical reliability and security concerns – from coordinated business and operating rules for interstate electric transmission to enabling smart metering and demand side markets.
- No single organization can put in place the changes that are needed to enable interoperability.

### *Key Actions*

- Pursue interoperability-focused actions – working groups on modeling and mapping, development of a common language (semantics, vocabulary/glossary, information models, and consensus definitions), business models/standards, and exploration of model legislation and regulations.
- Govern the framework and process of change for the GridWise Constitution principles. At this stage the role for the GridWise Architecture Council remains central to the future of this organization.
- Create cross-industry forums to get broader, formal recognition of the Constitution, to review and refine business models, and to integrate energy architecture with other architecture development efforts, rather than "reinventing the wheel."
- Create cross-industry groups to speak with one voice to electricity decision-makers at the federal, state, and regional levels.
- Support progress toward greater use of market mechanisms on multiple levels, from disaggregating and unbundling electricity markets, to greater coordination and harmonization across markets, to increased market neutrality in terms of demand and supply.
- Provide information and policy support for GridWise at the state level, enabling demand-side metering and real-time information procedures to be implemented.

- Develop the “elevator story” on interoperability with a clear vision of benefits to create an easily understandable sound bite for stakeholders and the press.
- Communication is needed across the board, providing a knowledge base of modeling, architecture, projects, and case studies. These efforts should improve education and outreach, clearly communicating the value proposition of grid interoperability, targeted toward all stakeholder groups, and significantly expanding media interest in the GridWise concept and vision.

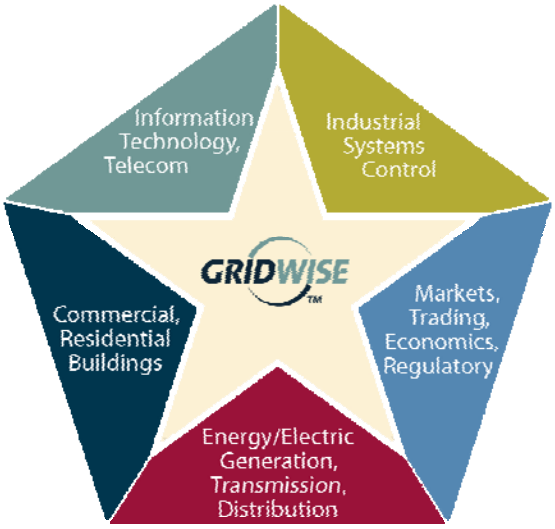
In a final plenary session, delegates reflected on their experience at the Convention and expressed their commitment to the principals of interoperability. They identified their own “next steps” for action. They recognized that no single organization or individual can put in place all the changes needed to implement the GridWise vision, and thus joined together to sign the Constitution on Interoperability as a group. Their success in implementing the Constitution will be proven in the months and years to come.

*“I will educate my clients, customers, and others about what we are about, the need to communicate in a unified way, and how we can help pass along the information we have learned.”*

# Introduction

The North American Electric Grid with all its components is among the most complex engineered system known to humankind. It is a system composed of many subsystems managed by independent parties bound by a general set of rules and practices.

The GridWise Architecture Council, a group of practitioners and leaders with broad-based knowledge and expertise in power, information technology, telecommunications, financial systems, and additional relevant sectors, is working together toward a coordinated GridWise vision - the transformation of the nation's energy system into a collaborative network filled with decision-making information exchange and market-based opportunities. The GridWise Sectors Star, shown below, graphically illustrates the interoperability "players" in this electric grid of the future.

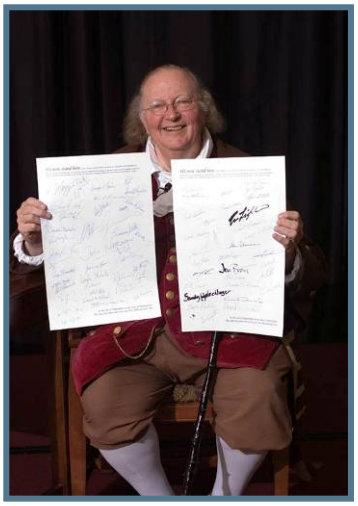



The Council sponsored a *GridWise Constitutional Convention,* held in Philadelphia on December 6-7, 2005, convening approximately 100 stakeholders representing these various sectors. The purpose of the Convention was to develop a common agenda and framework on interoperability, to involve industry sectors and policy makers for buy-in/ownership, and to identify and address priorities for advancement, including standards, regulatory issues, message communication, and community forums. The focus was on development of broad-based buy-in and input on the interoperability statements of principle that were created as a technical basis of support for the GridWise Vision:

> *"GridWise seeks to modernize the nation's electric system - from central generation to customer appliances and equipment - and create a collaborative network filled with information and abundant market-based opportunities. Through GridWise, we can weave together the most productive elements of our traditional infrastructure with new, seamless plug-and-play technologies. Using advanced telecommunications, information and control methods, we can create a "society" of devices that functions as an integrated, transactive system."*

The delegates signed a Constitution, the *GridWise Constitution on Interoperability,* that will guide critical future technology advancement over the next 10-30 years to realize a healthy, self-sustaining, highly interoperable electric supply system.

The Constitution consists of an evolving set of fundamental, strategic statements designed to facilitate the interoperation of electric system components, including production, transport, and use of electricity. Delegates participated in plenary sessions to hear formal presentations from industry leaders, and participated in breakout groups – Technologies, Business and Industry Models, Constitution Governance, or Public Policies – to accomplish the following:



- To identify, discuss, and prioritize grand challenges to GridWise interoperability, actions that must be taken to enhance interoperability across the electric system (including integrating new resources), and immediate paths forward,
- To re-enforce a sense of commitment and partnership among electric service providers, generators, end-user communities, facility process system control specialists, information technology suppliers, regulators, policy makers, and other key stakeholder organizations in the establishment of the GridWise Constitution statements of principle.

The Council's desired outcomes from the breakout groups, included:

- Agreement on the need to create a cross-sector governance body, ideas on what this might look like, and champions who might want to be involved in next steps.
- Interest for a new forum/conference on grid modernization that would bring interested parties together for panel discussions, provocative presentations, demonstrations, and exhibits.
- Acknowledgement of the value to align thought, or a common understanding, on concepts and strategies to enhance interoperation between devices and responsible organizations involved in the electric system.
- Agreement on the need for follow-on – next steps, conferences, workshops, or other meetings and/or activities.

This proceedings document provides a summary of the plenary sessions at the *GridWise Constitutional Convention,* and captures the discussions resulting from the breakout groups and the closing plenary session.

# Keynote Presentations

Convention delegates were welcomed to the meeting by Eric Lightner of the U.S. Department of Energy's Office of Electricity Distribution and Energy Reliability in Washington, D.C. Mr. Lightner stressed the positive attributes of the current electricity grid – safety, security, reliability. Our task at this GridWise Constitutional Convention was to establish consensus on the regulatory, public policy, technology, business, and governance environment so as to better enable intelligent systems and processes to improve the grid.

Rik Drummond, Chairman of the GridWise Architecture Council, then provided the context for this Convention. He described the opportunity, challenges, and "plan of attack" for consideration by delegates:

- Apply the capabilities of information technology to enhance coordination of the diverse segments of the electricity system
- Address the vast nature of the electric system recognizing the need for more than one enterprise architecture or standard and the need to support a highly reliable, 24/7 system with an evolving set of technologies; and
- Develop a common agenda and involve industry sectors and policy makers in advancement of interoperability standards, regulatory issues, message communication, and community forums

Our action plan for this convention was to establish the constitution process, foster cross-industry segment collaboration, and facilitate a framework for interoperability.

Senator Jeff Bingaman (New Mexico) was unable to attend the convention in person, and thus sent a pre-recorded message to delegates. The thrust of his message was the need to use the recently enacted Energy Policy Act of 2005 (EPACT 2005) to create the competitive markets, innovative technologies, and institutions necessary to foster a highly-functioning electricity grid. He focused on the need to address these issues at both the national level, within FERC, but most importantly to open regional markets through creative state and regional actions. He urged delegates to work on policies, technologies, and business models that will allow consumers to "have a say" in their energy supply.

Our keynote speaker was The Honorable Nora Mead Brownell, Commissioner of the Federal Energy Regulatory Commission (FERC). Commissioner Brownell identified the energy system today as undergoing "seismic change." She challenged the audience to focus their attention on state policy leaders, including both elected and appointed officials, who have to become better educated on energy and environmental policies, which are so entwined. Ms. Brownell acknowledged that FERC needs to communicate more effectively and more often about technologies and policies that work, and about "early adopters" who are making electric transmission and distribution improvements that are serving the needs of their communities.

As delegates were reminded during thought-provoking presentations by Jesse Berst, Center for Smart Energy, and Dean Kamen, President of DEKA Research & Development and inventor of the Segway™ Personal People Mover, the grid must be renewed. Mr. Berst challenged delegates to adopt a "platform for prosperity," to generate electricity from renewable sources first; attention to national security and reliability; and development of a digital economy; all of which will lead to growth and prosperity. He reminded us that as electricity demand has increased, grid spending has decreased; it is at capacity in many regions of the country, and nearing its design life in a number of key geographic areas. We cannot afford to ignore the imperatives of this infrastructure, or the challenges of an interoperable framework.

*"This is not a U.S. issue only, but a world issue, so we need to look at world solutions."*

Mr. Kamen presented his views on technological innovation, and called on convention delegates to utilize "out of the box" distributed generation technologies for those throughout the developing world – in non-grid connected societies. He asked us to weigh the relative significance of GridWise interoperability in a world environment where more dire social and survival issues rule individuals' waking hours. And finally, he challenged us to engage in community leadership to improve the status of human progress and the opportunities for educating young people in future generations.

# Visionary Roundtable and Constitution Signing

A group of visionaries discussed the GridWise concept and the need for both technical and institutional leadership during an informal roundtable. These individuals included Glen Allmendinger, President and CEO of Harbor Research, Inc., John Petze, President and CEO of Tridium, Inc., Jim Luth, OPC Foundation Technical Steering Committee Chairperson and Consulting Engineer at ICONICS, and Tom Welch, Vice President of External Affairs at PJM Interconnection. They stressed that public needs and new technologies need to be "meshed" so that the grid can work to its ultimate potential. Consumer relationships with the future grid are key and will be supported through improved factory automation and data management techniques. Other issues discussed included the challenge of securing the grid, the need for shared knowledge, and methods of obtaining high quality megawatts from on-site power generation and selling them on the grid in a safe, secure, and cost-effective manner.

Convention delegates were then treated to a visit by Benjamin Franklin in full regalia, who offered his view of the opportunities presented by the signing of the *GridWise Constitution on Interoperability.* Delegates joined Dr. Franklin and the Architecture Council as they stepped up to the stage to sign the Constitution. A copy of the signed document appears as Appendix A to this proceedings.

Convention delegates were assigned to one of four breakout sessions, Business and Industry Models, Technologies, Public Policies, or Constitution Governance. The table below illustrates the content of each breakout session topic:

| Breakout Topic | Explanation |
|---|---|
| Business and Industry Models | Structure and terms of contracts, market rules, marketplace transactions, market transformation strategies, business practices and processes, and implementation costs and benefits |
| **Technologies** | **Automated equipment, information science, information modeling, system components, system security and privacy, and e-business** |
| Public Policies | The role of regulatory agencies, social equity and public benefits, system reliability, competition, environmental protection, and federal, regional, state and local rules and laws. |
| **Constitution Governance** | **Organizational options, levels and types of participation, mechanisms for communications, outreach, and evaluation of progress, GridWise Architecture Council membership and branding, ongoing focus and sustainability** |

Each group discussed three specific Focus Questions:

1. *Assume that it is the year 2030. A high degree of automation throughout the electricity chain coordinates activities in response to continual changes in the physical and economic landscape. What grand challenges will interfere with the transformation implied by this vision in terms of technologies, public policies, Constitution governance, or business (depending on the breakout group)?*

2. *What actions must be taken to meet these challenges and enable the transformation implied in the GridWise vision for 2030?*

3. *For the top priority actions, what immediate next steps can we commit to taking in the immediate future to achieve these actions and enable/accelerate the transformation implied by the GridWise vision?*

# Business and Industry Models

Profitable business and industry models are paramount for achieving market acceptance of GridWise technologies, concepts, and applications. There are currently many types of companies that have an interest in developing and marketing GridWise-related products and services, including major electric utilities and information technology companies, and also a wide variety of smaller-scale providers and start-ups. Federal and state policy makers will be attracted to the jobs-creation possibilities that GridWise represents, as well as the potential for strengthening electricity delivery, energy reliability, and overall electric grid modernization.

The existing structure of the electric power industry has enabled GridWise-related products and services to be introduced to consumers in certain market segments, but these opportunities have been piecemeal and geographically isolated. There is widespread interest in furthering the market potential for GridWise products and services, including the general sense that such development is inevitable as the electric power industry moves from the "analog" to the "digital" age. But substantial changes will be needed in the structure and operation of electric power markets for GridWise business and industry models to move beyond the market entry stage.

**Business and Industry Models**
**Participant List**

| Name | Organization |
|---|---|
| Jay Britton, GWAC Member | AREVA T&D |
| Richard Brooks | ISO New England |
| Donald Collins | National Energy Technology Laboratory |
| Toby Considine | University of North Carolina/OBIX |
| Brian Costa | Power Control Solutions |
| Dave Darnell | Systrends |
| Albert Esser, GWAC Member | Emerson Network Power |
| Roger Gale | GF Energy |
| Joe Gould | RuggedCom, Inc. |
| Randy Haines | Thomas Jefferson University |
| Tom King | Oak Ridge National Laboratory |
| Tim Kingston | Gas Technology Institute |
| Dirk Mahling | Webgen |
| Jack McGowan, GWAC Member | Energy Control Inc. |
| Paul Myrda | Trans-Elect |
| Jatin Nathwani | Hydro One Inc. |
| John Petze | Tridium |
| Andy Rodriquez | PJM Interconnection |
| Larry Simpson | Everwild Enterprizes |
| Larry Silverman | Broadband Energy Networks |
| S. Lynn Sutcliffe | The EnergySolve Companies |

**FACILITATOR:** RICH SCHEER, ENERGETICS INCORPORATED

## *Grand Challenges*

There are a number of significant challenges to address to expand the possibilities for profitable business and industry models for GridWise. For example, the lack of national policies, and inconsistencies in business and operating rules for both the interstate electric transmission system and retail electric distribution systems, places a burden on GridWise developers and service providers and adds costs which interfere with the development of standardized product and service offerings and inhibits the formation of profitable business and industry models. The "patchwork quilt" approach of state electricity regulations in the U.S. contributes to the fragmentation of GridWise product and service development.

Consumer awareness of the potential benefits of GridWise technologies, concepts, and applications is at a low level. For example, public awareness about the costs of power outages, power quality disturbances, and energy supply disruptions may be high for a short time after major events, but the awareness fades quickly after normal services have been restored. There is no widespread infrastructure for smart metering and other demand-side technologies that could be used for enabling consumers to receive real-time electric price signals and respond with demand reductions during times of electric system needs. Dynamic pricing that reflects

marginal costs, and is generally available to all customer classes in every state, is one of the keys to the future development of profitable business and industry models and markets for GridWise products and services.

### *Actions and Paths Forward*

To address these challenges, the immediate need is for efforts to expand media interest in GridWise technologies, concepts, and applications and widen the stakeholder base. For example, a "casebook" needs to be developed that contains both actual examples of GridWise products and services, primarily highlighting the consumer's perspective, as well as illustrative scenarios of broader applications and benefits. This needs to be supplemented by expanded efforts to demonstrate GridWise concepts and to encourage government-utility-consumer teams for field testing and demonstration projects. In addition, public relations needs to be expanded with effort aimed at the trade press and trade associations, including technical articles, presentations, and keynote addresses at major conferences and industry gatherings. A comprehensive web strategy needs to be developed to link GridWise companies and strengthen the GridWise presence in general on the web.

*"For every one of you here, there are ten other people we need to get involved."*

In the next year, GridWise stakeholders need to coordinate and collaborate with trade allies on EPACT 2005 requirements for state regulatory authorities to open dockets on smart metering. This requirement presents an important opportunity for the industry to speak with "one voice" and to encourage smart metering and other demand-side market development. Ideas for actions include the development of a "GridWise Ambassadors" program to recruit people to assist in smart metering proceedings in all 50 states. A website could be developed to house information such as calendars of events and hearing dates, lists of key allies and consumer advocates, analysis of key issues, and key media outlets.

Over the next several years, there need to be coordinated efforts to develop standardized product and services offerings and to encourage the development of nationally-consistent market rules for distributed energy systems, demand response, smart metering, real time pricing, and other GridWise products and services. The GridWise stakeholder community needs to develop working groups, prepare white papers, and develop a common vocabulary/glossary of terms to enable the discussion of standard products and services and uniform market rules to move forward. There needs to be planning for several technical workshops where these issues can be discussed.

Over the long term, there is need for the community of GridWise stakeholders to band together and speak with one voice before the U.S. Congress to advocate for more open and competitive electric markets that make maximum use of market mechanisms, wherever feasible. A working group needs to be formed, that includes the broadest possible participation, to explore model legislation and regulations.

Exhibits 1, 2, and 3 provide the specific results of the breakout group discussions.

# Business and Industry Models

## EXHIBIT 1. BUSINESS AND INDUSTRY MODELS - GRAND CHALLENGES

◆ = HIGHEST PRIORITY

| REGULATORY POLICIES | PRODUCTS AND SERVICES | CONSUMERS | INFRASTRUCTURE | INVESTMENT CLIMATE |
|---|---|---|---|---|
| • Lack of a single national policy for operating the transmission "backbone" ◆◆◆◆◆◆◆◆<br>• There is regulatory patronage favoring incumbents ◆◆◆◆◆◆◆<br>• Consumers lack the ability to freely choose power providers ◆◆◆◆◆<br>• There is currently a lack of enforceable penalties and performance targets for service reliability ◆◆◆<br>• There are no uniform national standards for utility business practices ◆◆◆<br>• There is a lack of market power mitigation ◆<br>• Cultural change is needed to open markets<br>– Reliability can be technically isolated<br>– Lines of demarcation can be redrawn<br>• Lack of a "level playing field" | • Lack of uniform, global markets where product and service offerings are standardized ◆◆◆◆◆◆◆◆◆<br>• The structure of the market needs to be disaggregated into four parts: generation, Transmission, Distribution, and End-Use ◆◆◆◆◆◆<br>– Create competitive retail markets – long distance telephone model<br>– Generation market issues (how do generators make $?)<br>• Lack of tools to facilitate easy market participation by consumers ◆◆◆<br>• Too much fragmentation – "roll-up" small companies for complementary solutions ◆ | • Lack of general awareness ◆◆◆◆◆◆◆◆<br>– It takes something disruptive (blackouts, price spikes)<br>- Even disruptions fail to sustain awareness | • Lack of real-time consumption information for consumers and utilities ◆◆◆◆◆◆◆◆<br>• Lack of an open architecture (extensible) for electricity and IT ◆◆◆◆◆◆◆<br>• Lack of regulatory and technologies for easy connection of distributed energy to the power grid ◆◆◆◆◆◆<br>• Lack of technology rules (e.g., object and services model) ◆◆◆◆ | • Lack of price signals to consumers and other market participants to drive new round of investment in T&D, IT, and other equipment ◆◆◆◆◆◆◆<br>• High capital intensiveness, slow stock turnover, high financial risks and uncertainties |

## Exhibit 2. Business and Industry Models - Actions

◆ = Highest Priority

| What Industry Needs To Do | What the Federal Government Needs To Do | What State Government Needs To Do | What New Market Entrants Need To Do |
|---|---|---|---|
| • Get media interest and broaden stakeholder support<br>◆◆◆◆◆◆◆◆◆◆◆◆<br>- Develop "casebook" of customer stories and practical scenarios<br>- Conduct consumer-oriented demonstration projects with write-ups for non-industry press<br>- Form government-utility-consumer teams to demonstrate GridWise concepts<br>• Develop consensus definitions over the next five years of "core" products and services that can be standardized<br>◆◆◆◆◆◆◆<br>- Provide a forum to review, refine, and detail submitted industry business models<br>- Develop model standards for IT<br>• Create uniform, national market rules that can be endorsed by regulators<br>◆◆◆◆◆◆◆<br>- Create standard buying and selling processes<br>- Rules for broad access to consumer information<br>- Work with FERC and the states<br>- Establish standards setting entity<br>- Establish national standards for distributed energy and demand response | • Comprehensively disaggregate electricity markets into generation, transmission, distribution, and end-use components and make maximum use of market mechanisms wherever possible to enable more competition<br>◆◆◆◆◆◆◆◆◆◆<br>- Open retail markets in all 50 states<br>- Legislation to create single market?<br>- GWAC write and send letters to Congress and FERC<br>• Implement greater coordination across North America of transmission markets<br>◆◆◆◆◆<br>- Federal government lead "build out" of national transmission backbone and intelligrid concepts<br>- Finance development through "wires charge"<br>- Other federal financial incentives (e.g., taxes, loan guarantees)<br>• Implement incentives for demand-side management<br>◆◆◆◆<br>• Have FERC take on more authority over state PUCs<br>◆◆◆◆<br>• Encourage Congress to appropriate $ for smart metering subsidies<br>◆◆◆<br>• Ask FERC to integrate the ISOs into a "U.N. of the Grid"<br>◆◆◆<br>• Ask FERC to implement and enforce one electric code for North America<br>◆◆◆<br>• Ask Congress for a law which gives consumers property rights over their electric consumption information<br>◆◆<br>• Ask Congress to appoint a "national commission" to make recommendations for creation of a national grid<br>◆◆ | • Implement policies that result in huge increases in demand-side metering and real-time information<br>◆◆◆◆◆◆◆◆<br>• PUCs develop common policies and strategies fro GridWise concepts<br>• PUCs implement rate designs for consumer demand response | • Establish market place "rules of engagement" and support state and federal policies that encourage new businesses to form<br>◆◆<br>• Do not encourage central standards and support competition to let best solutions win<br>◆◆ |

## EXHIBIT 3. BUSINESS AND INDUSTRY MODELS – NEXT STEPS

| TOP PRIORITY ACTIONS | Over the long-term, industry needs to coordinate and speak with one voice to the Federal government (Congress and FERC) to disaggregate electricity markets into generation, transmission, distribution, and end-user segments and make maximum use of market mechanisms wherever possible to open markets and encourage competition | In the mid-term, assemble stakeholders to develop consensus definitions for a "core" set of product and service offerings that can be standardized across North America | In the mid-term, GridWise stakeholders to coordinate the development of a uniform set of market rules and propose their acceptance to Federal and State regulators | In the near-term, GridWise stakeholders to coordinate and urge states (PUCs and legislatures) to increase investment in demand-side metering for expanded real-time information to utilities, consumers, and GridWise services providers | Immediately, GridWise stakeholders need to pool resources to educate media and broaden the stakeholder base |
|---|---|---|---|---|---|
| **NEXT STEPS** | • Form working group to develop model legislation<br>• Raise funding for advocacy | • Form a working group to develop a common vocabulary/glossary of terms<br>• Hold a technical workshop to discuss glossary and share information about service offerings<br>• GridWise volunteers develop draft interoperability concept for the workshop<br>• | • Form a working group to develop a common vocabulary/glossary of terms<br>• Study "lessons-learned" from other industries and globally | • Follow-up in 50 states on EPACT 2005 "states must consider" provisions regarding smart metering<br>• Collaborate with DRAM, NAESCO, ASE, USCHPA and other trade allies<br>• Form working group to develop standard message and testimony<br>• Conduct analysis of key group, allies, and foes in 50 states, including consumer advocates<br>- "Board of Advisors" in each state<br>- Identify key customers<br>- Calendar of dates (regulatory and legislative)<br>- Key consumer advocates<br>- Key media<br>- Key industry players<br>• Create "GridWise Ambassadors" program to represent stakeholders and communicate concerns<br>• Urge Congress to fund DOE smart metering and demand response technical assistance | • Develop a "casebook" of illustrative scenarios and actual examples of GridWise concepts, costs, and benefits<br>• Develop documentation of this convention and issue press releases to publicize key outcomes<br>• Engage the trade press and trade groups be writing articles of examples of GridWise applications and providing speakers to address key workshops, conferences, and conventions<br>• At the next meeting have a "press event" with press kits and sufficient advanced notice to alert key media<br>• Develop a web strategy that includes quickly sending links for all GridWise stakeholders to link together |

### *Conclusions*

Profitable business and industry models are one of the cornerstones for achieving the GridWise vision for interoperability and a modernized electric grid. GridWise product and services providers are just beginning the market entry phase and have many successful project examples that can be used to build greater market acceptance. The greatest challenges lie in establishing greater consumer awareness of GridWise technologies, concepts, and applications; educating Federal and state policy officials about what they can do to foster development, and in getting fragmented and nascent industry groups to work together to identify common aims and market development strategies.

*"We need to continue to show leadership and demonstration of interoperability and to leverage other industries, including banking and insurance."*

# Technologies

Nearly all sectors of our economy interact with the electric power infrastructure. Beyond automation in present use, system and business processes that cross organizations in many sectors (domains) require greater integration and interoperability.

Interoperability assumes that all participating entities agree to cooperate toward a shared set of expectations, meanings, and responses to information exchanges. The advancement of information and communication technologies is changing process interoperation with greater use of automation between organizations and devices. Technology solutions are needed to make integration and interoperability less complex, reliable, economic and scalable. Interoperability between automated systems will unleash greater capabilities, innovations, and many business opportunities. The GridWise Architecture Council has taken the lead to define interoperability and provide a path forward to establish a common understanding, identify challenges, and prioritize near-term actions that may resolve interoperability and integration issues.

**Technologies**
**Participant List**

| Name | Organization |
|---|---|
| Ron Ambrosio, GWAC Member | IBM Research/Gridwise Arch Council |
| Tom Basso | NREL |
| Jean Beland | Hydro-Quebec |
| Ray Bell | Silver Spring Networks |
| Oscar Bolado | ZIV USA, Inc. |
| David Cohen, GWAC Member | Infotility |
| Jim Crane | Exelon |
| Hal Gentry | GridLogix |
| David Dell | SPG |
| Fred Elmendorf | TVA |
| Joseph Franz | Constellation New Energy |
| Chris Greenwell | Tridium |
| Erich Gunther, GWAC Member | EnerNex |
| Joseph Hughes | EPRI |
| Kevin Komara | PJM |
| Per-Anders Lof | UTRC |
| Jim Luth | OPC Foundation |
| Andy McMillan | Teletrol Systems |
| Terry Mohn | Sempra/SDGE |
| Terry Oliver | Bonneville Power Administration |
| Jean-Louis Poirtier | GF Energy LLC |
| Marzio Porzuoli | RuggedCom |
| Jeremy Roberts | LonMark International |
| Bob Saint | NRECA |
| Mallik"arjun" Shankar | ORNL |
| Aaron F. Snyder | Itron |
| Andrew Thomas | RTP Controls |
| Stephen Waslo | DOE-CH |

**FACILITATOR:** JOSEPH BADIN, ENERGETICS INCORPORATED

## *Grand Challenges*

There are many challenges surrounding interoperability between stakeholders in the electric system that can, and should be addressed through technology change. A variety of opinions exist on the matter. Where stakeholders overlap, a thorough set of agreed upon interoperability terms and concepts needs to be achieved. Key technology and policy standards need to be integrated and harmonized to avoid traditional territorial behavior by individual organizations. There also needs to be an educational effort among these players as to the adoption of common open standards and common language semantics and ontology. The energy system must be able to share and exchange information and communicate with business systems and all devices. In order to achieve this goal, each entity must be able to be identified as well as each networked device. Data collection devices need to be installed at critical points on the grid. A major challenge is physical and cyber security of a self-organizing system. Finally, the ability to incorporate and manage legacy systems is an on-going challenge. There needs to be a continuing transition plan for legacy systems, technology adoption and life-cycle replacements.

### *Actions and Paths Forward*

To address these challenges, several high priority actions need to be planned out and initiated in the very near-term. Action areas include modeling, architecture development, network mapping, requirements definition, application development, education and outreach, and regulatory actions. No single organization can put in place the changes needed to achieve the GridWise vision. Through collaborations and working groups comprised of the greater electric system community, the information technology community, government, regulators, and other colleagues in related industries, the path forward to practical interoperability can be implemented. Working groups can share information, experiences, perspectives on tools and methods, and make the necessary connections across disciplines and domains.

*"I will take the message from this meeting to management that new technology advances will allow us to take things to the next step and we need to embrace that."*

Cross-industry working groups should be formed to tackle the following issues:

- Identify security definitions and policy.
- Address common languages and semantics/ontology.
- Integrate energy architecture with other architecture development efforts to create policy harmonization and create an architecture of architectures.
- Create a knowledge base of modeling, architecture efforts, projects and activities. Maintain, update, and share the knowledge base.
- Develop techniques and programs to simulate power system operation and communications interdependence.

Working groups focused on these activities will develop the technology standards and usability guidance that will enable interoperability across the various communities and help to achieve the GridWise vision.

Exhibits 4, 5, and 6 illustrate the detailed discussions within the technologies group.

## EXHIBIT 4. TECHNOLOGIES GROUP - GRAND CHALLENGES

◆ = HIGHEST PRIORITY

| SELF ORGANIZATION | LEGACY MANAGEMENT | MODELING | METHODOLOGY | IDENTIFICATION | SECURITY | APPLICATIONS |
|---|---|---|---|---|---|---|
| • Negotiate information to be exchanged and the role of a specific widget ◆◆◆<br>• Utilities must harmonize efforts to avoid territorial behavior | • Technology adoption, lifecycle replacement ◆◆◆◆◆◆◆◆◆<br>• Ability to effectively utilize and incorporate several decades worth of legacy systems and components ◆◆◆◆◆<br>• How do you coordinate transition plans for legacy systems? ◆ | • Common language, semantics/ontology focus on meaning not implementation details ◆◆◆◆◆◆◆◆◆◆◆◆<br>• Integrate and harmonize key standards where appropriate ◆◆◆◆◆◆◆◆<br>• Minimize the scope of what needs to be universally agreed to (e.g., data primitives) ◆◆◆◆<br>• Layered architecture instead of vertical seams ◆◆◆<br>• An integrated energy and communication infrastructure ◆◆◆ | • Education between players (federal/state/ utility/ISO/RTO/ Manufacturer ◆◆◆◆◆◆◆◆◆◆◆◆<br>• Future procurements standards based inter/ multi utility participation<br>• Paid staff ◆◆◆◆◆◆◆<br>• Fast track process and deployment ◆◆◆◆◆◆<br>• Transition R&D adopting new products ◆◆◆◆◆<br>• Define and apply systems engineering methods ◆◆◆<br>• Adoption of common open standards ◆<br>• Cost appropriate to value ◆<br>• Short release cycle | • Lack of device identification and electric distribution system (changeable) topology ◆◆◆◆◆◆◆◆◆<br>• Entity identification<br>• Lack of networked device identification | • Cyber security ◆◆◆◆◆◆◆◆◆◆◆<br>• Ability to contain failures in a system that is intentionally interconnected (logic failure propagation) ◆◆◆◆◆◆◆◆◆<br>• Federated trust model ◆◆◆◆◆◆◆<br>• Securing a self organizing system ◆◆<br>• Develop management and security with (not after) applications | • Installation of data collection devices at critical points on the grid ◆◆◆◆◆◆◆<br>• Policy management architecture ◆◆◆<br>• Conversion of a billion points of data to useful information |

## EXHIBIT 5. TECHNOLOGIES GROUP - ACTIONS

◆ = HIGHEST PRIORITY

| EDUCATION, OUTREACH | APPLICATION DEVELOPMENT | REGULATORY ACTIONS | CROSS-CUTTING ACTIONS | MODELING, ARCHITECTURE, MAPPING | REQUIREMENTS DEFINITION |
|---|---|---|---|---|---|
| • Create a knowledge base of modeling, architecture, efforts, projects, etc. and keep up to date ◆◆◆◆◆◆◆◆◆◆<br>• Lobby for capital investment to consider system (grid) externalities ◆◆◆◆◆◆◆<br>• Promote university involvement ◆◆◆◆<br>• Working group to facilitate education between utilities and other industries ◆◆◆◆<br>• Apply and contribute to the maturation (and integration) of key industry standards ◆<br>• Establish new curriculum in universities for power systems engineers that includes I.T. and S.E. disciplines<br>• Industry collaboration* and support for research institutions (including universities)<br>* advisory committees<br>• Pull together an information hot team to advocate to Congress, regulators, et al. | • Develop simulation techniques/programs to simulate power system operation and communications interdependence ◆◆◆◆◆◆◆<br>• Create virtual company (DARPA example) ◆◆◆◆◆◆<br>• Development of tools and methods to analyze control interaction ◆◆◆<br>• Illustrate the possibilities by fast-track demonstrations ◆◆<br>• Define R&D agenda for stakeholders (DOE, GENCOS, DISCOS) ◆<br>• Devise algorithms that maintain reliability under deregulation ◆<br>• Installation of time stamped (GPS) data collectors and data concentrators | • Regulatory acknowledgement that interoperability is important ◆◆◆<br>• Enforced NERC guidelines for cyber security<br>- Mandatory compiling by all entities by specific date, e.g., 2006 ◆◆◆<br>• Create regulations that incent utility deployment of new technology ◆ | • Create security definitions and policy ◆◆◆◆◆◆◆◆<br>• Evaluate legacy systems and sunsetting policies arising from new requirements, i.e., security ◆◆<br>• Develop an authentication/ verification system that will scale to all participants and be administered by government organization ◆<br>• Maintenance of models and protocols (libraries) for legacy equipment ◆ | • Create a cross industry modeling group to address common language and semantics/ontology ◆◆◆◆◆◆◆◆◆◆◆◆◆<br>• Integrate Energy Architecture with other architecture development efforts ◆◆◆◆◆◆◆◆<br>• Separate finance control for information exchange ◆◆◆<br>• Create an architecture of architectures ◆◆<br>• Set up a paid* Grid Soft Tech group to spec out a layered architecture as opposed to solving seams). Group to include representatives of other initiatives/Iintelligrid, etc.) (*Grant) ◆◆<br>• Agree on interoperability framework ◆<br>• Create an IT/Web/ e-commerce/utility working group to solve interoperability security<br>• Use a systematic, top-down approach to architect the new grid<br>• Create a technology strawman vision architecture<br>• Adoption of a common communication network control plane (L2 & L3) layers | • Other industries' tech groups should be consulted to avoid "reinvention of the wheel" (Learn from/borrow from others) ◆◆◆◆◆◆◆<br>• Create use-cases to identify all the entities (don't use current products to propose what is possible) ◆◆◆◆◆◆<br>• Identify "weakest links" (utilities and customers) ◆◆◆<br>• Cross-reference and rationalize the tech challenges with the challenges from the other breakout teams<br>• Identify standards capable of exposing rich ontologies<br>• Identify and utilize key players that can accurately reflect industry segments<br>• A governing body must set-up "strawmen" to seed scenario-simulation resolutions |

## EXHIBIT 6. TECHNOLOGIES GROUP - NEXT STEPS

| TOP PRIORITY ACTIONS | Identify security definitions and policy | Create a cross-industry modeling group to address common languages and semantics/ontology | Integrate energy architecture with other architecture development efforts (create architecture of architectures) – Policy harmonization | Create a knowledge base of modeling, architecture efforts, projects, etc. and keep up to date | Develop techniques/programs to simulate power system operation and communications interdependence |
|---|---|---|---|---|---|
| **NEXT STEPS** | • Identify sources of security policy<br>  - NERC<br>  - Others<br>• Identify groups that utility industry can provide domain expertise to<br>• Risk assessment procedures and application gridlines<br>• Requirements use cases technology selection<br>• Identity, key management, crypto, and legacy equipment password management<br>• Apply which technology where? | • Identify participants – all industries<br>• Identify existing model development and modeling groups build on this work<br>• Find a home<br>  - New group<br>  - Existing host organization<br>• Web-based collaboration site | • Identify participants and original experts<br>• Identify mandatory architectures (PJM, DODAF, etc.)<br>• Liaise/link with modeling group and knowledge base<br>• End game guidelines for application of architectures. Compatibility issue resolution<br>  - Identify interface boundaries and suggest ways to resolve<br>• Gather requirements and sponsorship from North America regulatory entities FERC, DOE, NERC, etc. | • Identify and bring together existing knowledge base<br>• Two core uses<br>  - Input to Working Groups<br>  - Repository of Working Groups results<br>• Create a process to keep the knowledge base up to date<br>  - Many domains<br>• Repository of:<br>  - Use cases<br>  - Ref designs<br>  - Architectures<br>  - Models<br>• Repository of<br>  - Processes<br>  - Requirements<br>  - Projects<br>• Hierarchy of use cases<br>  - Specific functions<br>  - Architecture application<br>• Model application | • Identify who could/should develop these tools<br>• Identify roles for academia, software vendors, utilities<br>• Identify, prioritize tools required and develop requirements and use cases<br>• Gap analysis technology development simulate the simulator field trial<br>• What are the functional specs for the Smart Grid? |

### *Conclusions*

Integration and interoperability of information driven technologies and processes across stakeholders' domains are needed to achieve the GridWise vision. The greatest technology challenges include securing an intentionally interconnected system, integrating and harmonizing key standards, understanding a common language, identifying devices, and managing legacy systems. By forming appropriate working groups of technology stakeholders, these issues can be addressed. These groups should identify and create technology-based definitions, requirements, and policies as well as knowledge bases, modeling collaborations, and simulation techniques and programs that will enable seamless integration of power, information, and communication systems.

*"Look at how the grid converges with the Internet; I will get involved with projects that demonstrate the benefits of GridWise!"*

# Public Policies

Without clear and effective public policies for grid interoperability, advanced technologies and business practices cannot be put into practice. The business of our electric grid has been conducted, since its inception, under a formal, regulated set of rules or laws meant to follow policy guidelines. These rules are set, maintained, and enforced by various local, state, and federal agencies in accordance with the jurisdictions in which they operate. Business and technology activities associated with the electric industry are monitored by those regulatory bodies whose role it is to ensure a viable electric system environment that supports our economy and balances issues of social equity.

The GridWise Architecture Council developed two overarching public policies included in the Constitution. The first is that interoperability strategies and issues must be communicated in a form understood by regulators and policy makers. The second is that there is a need for interoperability approaches that allow regulators the ability to verify that business is conducted within established rules and that all relevant transactions are auditable. GridWise Convention delegate broadened these principles, suggesting that public policies for interoperability require attention to regulatory practices, market design, efficient markets, information transparency, and education.

**Public Policies**
**Participant List**

| Name | Organization |
|---|---|
| Jason Black | MIT |
| John Boot | CURRENT Technologies |
| Mia Paget Bosquet, GWAC Administrator | PNNL |
| Larry Colton | Echelon |
| Dan Delurey | DRAM |
| Paul Duncan | Airak, Inc. |
| Ed Gray | National Electrical Manufacturers Assoc. |
| Stephanie Hamilton, GWAC Member | Southern California Edison |
| Mark Hegerle | Office of U.S. Sen. Jim Talent |
| John Jimison | U.S. Combined Heat & Power Assoc. |
| Joe Kerecman | PJM Interconnection |
| Brett Kilbourne | United Power Line Council |
| Lynne Kiesling, GWAC Member | Northwestern |
| Anthony Mazy | California PUC |
| Dick Munson | Northwest-Midwest Institute |
| Pino Porciello | RuggedCom. |
| Alison Silverstein | Consultant |
| Mayur Subbarao | Sustainable Profitability Group Inc. |
| David Thompson | Penn State University |
| Greg Urbin | Constellation New Energy |
| Sandy Wollschlager | 3M |
| Eric Wong, GWAC Member | Cummins Power Gen |

**FACILITATOR:** JAN BRINCH, ENERGETICS INCORPORATED

## *Grand Challenges*

A number of key challenges stand in the way of effective public policies for grid interoperability. They include:

- The utility value proposition needs to shift so as to move from a cost-based to a value-based model.
- Spot and forward energy commodity markets can be realized by the unbundling of energy sales from transportation service.
- Utilities need to have access to bandwidth.
- Interconnection needs to be standardized and made easier on customers.
- Regulatory jurisdictions need to be better clarified in the areas of eminent domain, market power, environmental and security concerns, grid maintenance, and security.
- The utility footprint needs to be lessened while early adopters need to be empowered to take on risks.

- Incentives need to be continued and expanded, with defined cost and performance risks.

Most importantly, competitive retail markets must encourage market efficiency, even though information needs continue to be challenging to fulfill. High information transparency and use of ubiquitous smart meters would significantly improve public policies for interoperability.

### *Actions and Paths Forward*

Actions need to be taken in the areas of regulatory decision-making and practice; market design; incentives; technology development; and information, education, and awareness. At the top of the list is communication of the benefits of interoperability, some would say, creating the "elevator story" on interoperability. Policymakers and stakeholders need to be able to understand the concept and the steps for success – in simple, easy to grasp, terms. Development of an *EnergyStar* award, or Gold Carrot Award for interoperability, is one suggested path.

In the regulatory arena, all federal power agencies should be required to provide inter-operability policies and strategies for their wholesale clients, to illustrate leadership within the federal government sector. Other regulatory actions include requiring state commissions to allow development of micro-grids and to utilize smart meters. Development of a mandatory reliability standard for interoperability – a "NERC" for interoperability – would also be of value.

*"When we talk about the 'value proposition' for GridWise, we are adding jobs to America."*

Incentives are a key element of public policy – they "kick start" the process. One such incentive for interoperability would be rewards for utilities to increase system efficiency and environmental benefits, rather than through-put. Similar incentive recommendations have been discussed for quite a long time – and not yet put into place. Other incentives for early adopters, for manufacturing design of interoperable technologies, for deployment of smart meters, and for utility investment in other new technologies, would "kick start" interoperability, and serve consumers at the same time.

Market design is an area of public policy that needs to be addressed both at the federal and state level. Time-based pricing for basic default service is one such policy that needs to be put into place. Differentiated value-based rates and services – for energy, ancillary services, reliability, and distributed generation – should be established and utilities paid for providing these resources.

Exhibits 7, 8, and 9 provide additional detail on the actions and paths forward identified by the Public Policies breakout group.

## EXHIBIT 7. PUBLIC POLICIES GROUP - GRAND CHALLENGES

◆ = HIGHEST PRIORITY

| RULES OVERSIGHT (SUBSTANCE) | REGULATORY PRACTICES | MARKET DESIGN | MARKET EFFICIENCY | INFORMATION | TECHNOLOGY |
|---|---|---|---|---|---|
| • Utility value proposition shifts from cost-based to value-based incentives ◆◆◆◆◆◆◆◆◆◆<br>• Separated energy sales from wires rental – unbundled retail "natural monopoly" ◆◆◆◆◆<br>• Bandwidth access for utilities ◆◆◆◆◆<br>• Regulation making paradigm is changed to value proposition for customer energy efficiency ◆◆◆<br>• Federal or state mandates for efficiency, demand response renewables, building codes ◆◆<br>• Government encouragement of industry standards of communications | • No easy DG interconnection ◆◆◆◆◆◆<br>• Need to revise regulatory jurisdiction and remaining necessary roles ◆◆◆◆<br>- Eminent domain<br>- Market power police<br>- Environmental<br>- Security<br>- Grid maintenance<br>- Safety<br>• Harmonization of regulatory policy (related to grid management) across state and utility lines ◆◆◆◆<br>• Need to break down regulatory silos ◆<br>• Lack of a coordinated strategy; regulators have too much information<br>• Need to shift utility value proposition from cost based to value based incentives<br>• Need for easy DG interconnection | • Need to adjust utility footprint and remaining natural monopoly functions ◆◆◆◆◆◆<br>• Need for early adopter customers to be empowered to take on risks voluntarily ◆◆◆◆◆<br>• Continue and expand incentives with defined cost and performance metrics ◆◆◆◆<br>• No differentiation in terms of quality of service – regulators don't think consumers are smart enough<br>• Rate structures that capture generation, transmission, and distribution benefits/risks ◆◆◆<br>• Need for market neutrality in terms of demand and supply ◆◆<br>• Lack of standardized utility requirements ◆◆<br>• Lack of customer choice ◆<br>• Need for competitive retail markets | • Need for competitive retail markets ◆◆◆◆◆◆◆◆<br>• No demand pull (creating consumer demand through incentives) ◆◆◆◆◆<br>• Urgent need for upper management leadership<br>• Need for diverse electricity/energy packages | • Need for ubiquitous smart meters ◆◆◆◆◆◆◆◆◆◆◆◆<br>• Need for high information transparency and information access ◆◆◆◆◆◆◆◆◆◆<br>• Need for ubiquitous LMPs ◆◆◆<br>• Lack of price transparencies ◆<br>• Need for high information transparency – high information access | • Life cycle of energy needs to be recognized and measured ◆ |

## EXHIBIT 8. PUBLIC POLICIES GROUP – ACTIONS

◆ = HIGHEST PRIORITY

| REGULATORY (RULES) SUBSTANCE | REGULATORY PRACTICE | MARKET DESIGN | INCENTIVES | INFORMATION, EDUCATION, AND AWARENESS | TECHNOLOGY STANDARDS DEVELOPMENT |
|---|---|---|---|---|---|
| • Require all federal power agencies to procure interoperability ◆◆◆◆◆<br>• Change PUC code to allow microgrid ◆◆◆◆◆<br>• Mandate installation of smart meters to all (market and utility) ◆◆<br>• Shift value focus to customers and increase importance of microgrid capability ◆◆<br>• Redefine property rights so customers own their own data and not utilities ◆<br>• Remove regulatory barriers to the deployment of new technologies on utility infrastructures ◆<br>• Create true level playing field to enable competitive retail market<br>• Create standard DG interconnection standard<br>• Neutrality/equivalency of supply and demand in planning and dynamic market<br>• Allow the construction of private wires<br>• Advocate performance-based transmission and distribution rates at states for technology | • Crate a "NERC" for interoperability that's mandatory ◆◆◆◆◆<br>• Minimize regulated utility roles to natural monopoly functions (if any) ◆◆◆<br>• Federalize the commerce of power<br>• Regulators unite around the open standards (of interoperability) | • Time-based pricing for basic/default service ◆◆◆◆<br>• Create differentiated value based rates and services (energy, ancillary services, reliability, distributed generation) ◆◆◆◆<br>• Establish "tiers of reliability" in appropriate price structures ◆<br>• Eliminate cross-subsidy, bundling*, etc. of infrastructure and energy services *(and joint accountability) | • Reward utilities for increased system efficiency and environmental benefits, not through-put (assets) ◆◆◆◆◆<br>• Provide incentives to early adopters to accept increased risk (with potential pay-off) ◆◆◆◆<br>• Incentives for manufacturing design of interoperable technologies ◆◆◆<br>• Remove disincentives and create incentives for utility investment ◆<br>• Advocate incentive and performance based rates for technology at FERC<br>• Incentive (tax break) for smart meters ◆<br>• Create utility incentives for deploying smart metering ◆<br>• Incentives for deployment of interoperable technologies ◆<br>• Provide rewards for interoperable implementations and penalties otherwise | • Quantify – communicate $ benefits of interoperability ◆◆◆◆◆◆<br>• Energy Star brand expansion into interoperability ◆◆◆<br>• Focus – target key markets for early success (CA, TX, NY) ◆◆◆<br>• Golden Carrot Award for interoperability ◆◆◆<br>• Open discussion on "permanence" of IOIU role in infrastructure development and management (Is project motive at odds with info-structure) ◆◆<br>• Craft the elevator story/vision with benefits clear ◆◆<br>• Policies to educate/inform about smart electricity ◆◆<br>- Value<br>- Differentiated services<br>- Real time price<br>- Options<br>• Identify state level champions develops value proposition to sell these champions ◆<br>• Link interoperability to grid reliability to get DOE-OE and FERC support ◆<br>• Government/legislators can require development of state and regional energy plans that require cost effective technology development (TDPS) | • Define interoperability in terms of open public non-industry (private) standards ◆◆<br>• Create/mandate minimal smart meter communication framework – define Smart Meter |

## EXHIBIT 9. PUBLIC POLICIES GROUP - NEXT STEPS

| TOP PRIORITY ACTIONS | Quantify and communicate the benefits of interoperability | Reward utilities for increased system efficiency and environmental benefits – not through-put | Create a "NERC" for inter-operability that is mandatory | Allocate spectrum for electricity purposes | Require all federal power agencies to procure inter-operability |
|---|---|---|---|---|---|
| NEXT STEPS | • Conduct case studies on inter-operability costs and benefits<br>  - DG "horror stories"<br>  - Open source it<br>  - Regulatory/policy focus<br>• Communicate the value streams to the right people<br>• Make data available to all<br>• Craft the elevator story/ vision with clear benefits<br>• Lack of inter-operability cause costs – see what the benefits could be | • Use incentives to achieve transition to new interoperable regime, not to distort newly created markets<br>• Interview customers on need for incentives<br>• Identify what regulators need<br>• Aggregate information on incentives that already exists<br>• Leverage off existing innovative rate design studies (e.g., RAP-Weston) | • Put together working group of existing standards organizations to look at ways to integrate inter-operability into their missions (e.g., IE, ITC) | • Conduct an independent study on the need for some kind of spectrum<br>  - Value<br>  - Stakeholders<br>  - Impediments<br>  - Nay-sayers | • Take the elevator story to the politicos – get their buy-in<br>  - TVA<br>  - WAPA<br>  - DOD<br>  - BPA<br>  - FEMP<br>  - GSA<br>• Write interoperability guidelines for procurement in conjunction with TVA, BPA, GSA, and FEMP<br>• Inter-operability strategies and issues need to be communicated more clearly to regulators and policy makers<br>  - Technical language<br>  - Details<br>  - Us vs. them mentality<br>  - Transparency<br>  - SMD<br>  - Education<br>• Inter-operability approaches must allow regulators the ability to verify that business is conducted within established rules and that all relevant transactions are auditable<br>  - Too much data?<br>  - Transparency<br>  - Problematic<br>  - Parties themselves are responsible<br>  - Regulators' involvement |

### *Conclusions*

The public policy environment for interoperability, as well as for the entire utility industry, is in flux. Federal and state policies affected by the recently enacted Energy Policy Act of 2005, will be analyzed and most probably amended to address critical reliability and security concerns. Demand response policies will most likely be put in place throughout the country, which will affect and be affected by interoperability. The focus will thus need to be less on "horror stories" and more on the bottom line – what works, what does not, the nuts and bolts of interoperability. Crafting the "elevator story" will become even more critical, since both policy makers and consumers throughout the country will need to understand interoperability at a basic level. All participants in the grid – including suppliers, end users, and data controllers, will need to be considered when public policies are put in place; what works for one group might not work for all. In short, utility policies will need to become better aligned with public policy objectives.

*"It's important to stress how interoperability helps with the economy, something regulators like to hear."*

# Constitution Governance

The Interoperability Constitution is a living document that will evolve over time in order to accommodate the revolutionary changes called for in the GridWise Vision over the next 10-30 years. The governance principles of the Constitution represent a consensus view across all stakeholders with the goal of defining responsibilities of a core group of leaders, while establishing checks and balances. Given the strategic goals of the North American power grid and the complex number of players, the governance principles allow for maximum flexibility while driving the organization forward on a clear and measurable path. This GridWise organization would establish rules of engagement for stakeholders, allow other interested parties to participate in the organization and thereby realize benefits, and allow champions to take on leadership roles.

**Constitution Governance Participants**

| Name | Organization |
|---|---|
| Juan DeBedout | GE Global Research |
| Anto Budiardjo | CLASMA Events |
| Joe Bucciero | KEMA, Inc |
| Rik Drummond, GWAC Chair | Drummond Group, Inc |
| Pat Duggan | Con Edison of NY, Inc |
| Tara Faherty | Energetics Incorporated |
| Doug Fitchett | AEP |
| Steve Hauser | SAIC, GridWise Alliance |
| Doug Hinrichs | Sentech Inc. |
| Eric Lightner | DOE |
| Larsh Johnson, GWAC Member | eMeter Corporation |
| Bill Moroney | UTC |
| Michael Pehosh | NRECA |
| Don Von Dollen | EPRI |
| Don Watkins, GWAC Member | BPA |
| Tom Welch | PJM Interconnection |
| Paul Wang | Concurrent Technologies Corporation |

**FACILITATOR:** BONNIE RAM, ENERGETICS INCORPORATED

The GridWise Architecture Council has been leading the effort to articulate a set of guiding principles. It was not assumed that this entity would necessarily become the umbrella organization for implementation of the Constitution. It is important, however, to allow for consistency in leadership in order to guide the evolution of the Constitution with as neutral a stance as possible. For example, the governing principles of the GridWise organization would include encouraging standards, if appropriate, but not detailed specifications or new ones. Whatever structure was considered for the governing organization, one of its main functions would be to disseminate information with clear messages enabling vast scale interoperability. As important, this organization would be flexible while remaining true to the constitutional principles.

### *Grand Challenges*

There are a number of significant challenges for the governing entity that will advance the GridWise vision and develop consensus to support it. Clearly one of the key challenges is to identify a broad-based multi-stakeholder group and continue to keep these stakeholders engaged and focused. The organizational structure for this governing body needs to speak with "one voice" with an authority and identity that is recognizable. The activities of the organization would focus on providing good examples of what is happening in the marketplace as well as identify gaps and problems that need resolution. One of the central challenges is to make the Constitution an authoritative guide that is accepted by a range of stakeholders and then measure its success by whether the grid is being run as a "single business."

### *Actions and Paths Forward*

To address these challenges, the immediate need is to encourage participation of a diverse group of stakeholders and to develop a compelling value proposition that will continue to attract new interested parties. The governance group would raise awareness through periodicals and the media, including an aggressive regional education and outreach campaign to enlist new parties. These activities would develop a process of engagement as well as provide a forum for feedback on the Constitution. Since one of the priorities is to disseminate information, development and circulation of documented case studies on implementation of the GridWise vision would be valuable. In order to position or "brand" the path forward, a GridWise certification could be established (e.g., analogous to the Energy Star certification). In order to carry out these new activities, the organizational structure would need to be defined, such as formation of a board of directors and procedures for membership and voting. To maintain momentum, a staff (though lean) would be needed. In turn, this would require raising money and finding other resources.

To obtain feedback on the Constitution, there should be "formal recognition" of the Constitution from other standing bodies and standards groups, e.g., IEC and IEEE. The most expeditious way to initiate this activity is by getting a commitment from the participants that they will individually begin to inquire within those organizations in which they are active, as to how this formal recognition could occur. They should begin circulating the Constitution within those entities. The GridWise "brand" should be used for the immediate future, while developing a "message" for each stakeholder segment. Keeping in mind the immediate steps, it is emphasized that the governance group should keep focused on what should be done following the "inflection point." Without that focus, the strategic goals would be lost and the group would not stay ahead of the evolution. In regards to establishing a methodology for evaluating success, a self-evaluation could be the most effective mechanism, e.g., a checklist posted on a website. Clearly, developing an accessible resource with a website is needed. This may foster submission of relevant case studies across the industry that would be ranked in terms of "best case examples" such as projects currently underway at LIPA and Keyspan. By recognizing and celebrating good case studies of interoperability, other industries may follow suit and better understand the path forward and its benefits.

Exhibits 10, 11, and 12 provide more detail on the actions and paths forward in the area of constitution governance.

## EXHIBIT 10. GOVERNANCE GROUP - GRAND CHALLENGES

◆ = HIGHEST PRIORITY

| STAKEHOLDER ISSUES | ORGANIZATIONAL STRUCTURE/OPERATIONS | ACTIVITIES | BEHAVIOR | SUCCESS INDICATOR |
|---|---|---|---|---|
| • Ensure buy-in by stakeholders ◆◆◆◆◆◆◆<br>• Identify broad-based multi-stakeholder value proposition ◆◆◆◆◆◆◆<br>• Encourage low threshold (for members) and large participation ◆◆◆◆◆◆◆<br>• Keep stakeholders focused and engaged ◆◆◆◆◆◆◆<br>• Enable self sustaining proliferation ◆◆◆◆◆◆ | • Find a way for the organization to speak with one voice ◆◆◆◆◆◆<br>• Determine organizational formation and viability; is it self-governing? When does it become obsolete? ◆◆◆◆<br>• Keep GridWise Architecture Council involved ◆◆◆◆<br>• Ensure recognizable identity and authority ◆◆◆◆<br>• Build, manage and monitor ownership ◆◆◆<br>• Establish a court model through an educational process that can/will be fair to all ◆<br>• Find ways to continue to be relevant and effective<br>• Keep advisory relationship to standard groups | • Be able to give good examples, identify gaps, and problems to work on ◆◆◆◆◆◆<br>• Ensure recognizable identity and authority ◆◆◆◆<br>• Influence public policy, etc. ◆<br>• Propagate ideas<br>• Develop economic model to support GridWise | • Determine how to make the Constitution an authoritative guide ◆◆◆<br>• Stay high level<br>• Avoid rushing to standards | • Be able to run the grid as a single business (success indicator) |

## EXHIBIT 11. GOVERNANCE GROUP - ACTIONS

◆ = HIGHEST PRIORITY

| STAKEHOLDER ACTIVITIES TO ENCOURAGE PARTICIPATION | INFORMATION AND OUTREACH | POSITIONING/ BRANDING | ORGANIZATION STRUCTURE CHALLENGES |
|---|---|---|---|
| • Develop a compelling value proposition that will attract a large group of diverse stakeholders ◆◆◆◆◆◆◆◆◆<br>- Conduct aggressive outreach campaign to enlist/educate interested stakeholders<br>- Conduct regional workshops to ensure broad-based participation<br>- Identify and recruit missing key stakeholder<br>• Organize feedback on applicability of the Constitution ◆◆◆◆◆◆◆◆<br>• Raise awareness through periodicals and other media ◆◆◆◆<br>• Solicit and publicize "technology needs" ◆◆<br>• Develop a process of engagement ◆<br>• Develop and convey successes and needs ◆<br>• Evangelism through survey (e.g., interviews)<br>• Provide incentives/to encourage more participation<br>• Prepare periodic reports on key markets (value propositions to maintain interest)<br>• Monitor results and report | • Document case studies and their value to broader audience ◆◆◆◆◆◆◆◆◆<br>• Develop searchable database of successful cases and pitfalls to avoid ◆◆<br>• Create an e-opinion-like forum | • Establish a GridWise evaluation ◆◆◆◆◆◆<br>• GridWise report "branding" card ◆◆◆◆<br>• Design a collaborative process ◆<br>• Seek "sanctification" by IEEE | • Raise money/resources ◆◆◆◆◆◆◆<br>• Define membership and voting processes ◆◆◆◆◆◆<br>• Form a board ◆◆◆◆<br>• Create a lean, but technically broad staff, to keep momentum and stakeholders ◆<br>• Write a mission statement<br>• Limit terms (rotating) |

## EXHIBIT 12. GOVERNANCE GROUP - NEXT STEPS

| TOP PRIORITY ACTIONS | Organize feedback on application of the Constitution | Develop a compelling value proposition that will attract a large group of diverse stakeholders | Establish a GridWise evaluation | Document case studies and their value to broader audiences |
|---|---|---|---|---|
| **NEXT STEPS** | • Get formal recognition of Constitution, e.g., IEC, IEEE<br>• Organize stakeholders<br>  - Form working group of interested attendees to further develop outreach strategies<br>  - Create/form board<br>  - Identify "top 10" key stakeholder organizations (that are representative of the core)<br>• Continue to push the concept of the interoperable grid through my company<br>• Select a date for the next face-to-face meeting | • Develop "message" for each segment; industry value proposition and case study<br>  - Include high level policy/reg/leg<br>  - Promulgate, present, and recruit new members<br>• Define what should be managed after the 'inflection" point:<br>  - Content?<br>  - Compliance?<br>• Use the GridWise brand (for now anyway) | • Establish a self-evaluation methodology/feedback mechanism,<br>e.g., checklist | • Set up a accessible resource, e.g., webpage<br>  - Develop internet database, e.g., ongoing projects that exhibit GridWise principles<br>  - Perform outreach and gather feedback<br>  - Publicize the Constitution<br>• Foster submittal of case studies and publish best cases<br>  - Case study of CIM implementation by the LIPA/Keyspan project<br>  - Develop business case for major EMS vendors for interoperability devices/ interfaces<br>  - Encourage and celebrate interoperability projects<br>• Develop litany of benefits to grab stakeholders, e.g., lifecycle of transfers vs. embedded computers |

### *Conclusions*

Establishing forums for organizing feedback about how the constitutional principles relate to a range of stakeholders are activities in the near term that would enhance the application of interoperability in the industry and disseminate the message of benefits. There is a growing body of evidence of successful case studies that will highlight to stakeholders how these principles can benefit their industry and the marketplace. Governing the framework and the process of change over the next few decades is critical to the success of the GridWise vision. At this stage the role for the GridWise Architecture Council remains central to the future of this organization. They will keep in mind that building alliances and collaboratives is more critical than building the structure of this organization. While focusing on immediate next steps, this organization must also target how it will operate when there is more traction on interoperability in the marketplace. The Architecture Council will define an outreach strategy to build the base of support while taking deliberate steps forward to enhance the credibility of the governance principles and innovative industry practices through self evaluation and periodic meetings that exchange information and spread the gospel of interoperability benefits.

*"I am encouraged that GridWise is focused on being the 'overall umbrella' to unify existing groups and architectures. I am committed to participating in this process."*

# Closing Session

The final session of the GridWise Constitutional Convention provided an opportunity for representatives from each of the four breakout groups to report on their deliberations and most importantly, on the actions and paths forward identified as critical in their area – business and industry, technologies, public policies, and governance. The major findings and key actions listed below represent the over-arching messages of this constitutional convention.

### *Major Findings*

- There is indeed enthusiastic, broad support for the principles set forth in the Constitution, and a clear desire to continue on the path started by the Constitution.
- There is a great need for increased awareness, understanding, education, and broad-based buy-in surrounding GridWise principles.
- There is currently a lack of an open architecture, common language, harmonization of standards, and unique device identification.
- There is a lack of infrastructure to support demand pull: smart meters, information transparency and access, real-time consumption information and price signals.
- Inconsistent regulatory, technology, public policy, and business requirements for distributed generation connection to the grid hamper the interoperability infrastructure.
- The “patchwork quilt” of electricity regulations and operating policies across the country places a burden on developers and service providers, adds costs to implementation of interoperability, and creates inconsistency. There is a need for harmonized policies across state and utility lines, particularly those supporting value-based incentives.
- Product and service providers have successful project examples that can – and should – be used to build greater market acceptance. As consumer awareness of GridWise technologies, concepts, and applications increases, interoperability will become more commonplace and industry groups will become more cohesive. Common aims and market development strategies will result.
- There is a need to effectively use and integrate several decades of knowledge on electric power markets to better affect the challenges now facing the grid of the future.
- Federal and state policies responding to the recently enacted Energy Policy Act of 2005 must aim to secure an intentionally interconnected system and address critical reliability and security concerns – from coordinated business and operating rules for interstate electric transmission to enabling smart metering and demand side markets.
- No single organization can put in place the changes that are needed to enable interoperability.

### *Key Actions*

- Pursue interoperability-focused actions working groups on modeling and mapping, development of a common language (semantics, vocabulary/glossary, information models, consensus definitions), business models/standards, and exploration of model legislation and regulations.
- Govern the framework and process of change for the GridWise Constitution principles. At this stage the role for the GridWise Architecture Council remains central to the future of this organization.
- Create cross-industry forums to get broader, formal recognition of the Constitution, to review and refine business models, and to integrate energy architecture with other architecture development efforts, rather than "reinventing the wheel."
- Create cross-industry groups to speak with one voice to electricity decision-makers at the federal, state, and regional levels.
- Support progress toward greater use of market mechanisms on multiple levels, from disaggregating and unbundling electricity markets, to greater coordination and harmonization across markets, to increased market neutrality in terms of demand and supply.
- Provide information and policy support for GridWise at the state level, enabling demand-side metering and real-time information procedures to be implemented.
- Develop the "elevator story" on interoperability with a clear vision of benefits to create an easily understandable sound bite for stakeholders and the press.
- Communication is needed across the board, providing a knowledge base of modeling, architecture, projects, and case studies, aimed at education and outreach. Such efforts must clearly communicate the "value propositions" of grid interoperability, targeted effectively toward all stakeholder groups and significantly expanding media interest in the GridWise concept and vision.

The GridWise Constitutional Convention achieved its objectives. Agreement was reached among a very diverse group of stakeholders on interoperability challenges that must be addressed through technology change; improved public policies; forward-thinking business and industry models; and a governance structure that will endure over time. All in attendance agreed to continue working to achieve the grand challenges and actions identified in their breakout groups. Enthusiastic and energetic commitments were made to continue the dialogue begun at the Convention, and to share the knowledge gained with colleagues.

Convention delegates were united in their support for a secure, interconnected electric grid, which will allow the nation to grow and prosper. By working collaboratively, building on existing knowledge and improving market acceptance for interoperability within the electric system, and using the technology and business tools in the industry today, the GridWise vision will be accomplished.

# We the People of the North American electric system, in order to form a more perfect electric grid, enhance reliability, insure domestic distribution, provide for the common defense, promote availability of electricity, and secure the blessings of liberty and information technology to ourselves and our posterity, do ordain and establish this GridWise Constitution for Interoperability.

## Article B - Business Principles

Context: Subject to the regulatory environment in which they operate, organizations are free to structure themselves in the manner they see fit to best deliver goods and services and compete with other businesses. They interact with other organizations through contracts of their own choosing in as open a marketplace as possible. Enterprises can be categorized into wholesale and retail segments; however, the path from producer to consumer may pass through a variety of businesses each providing their unique value added contribution. There is no standard process of running a business.

**B01** Subject to regulatory monitoring requirements, interoperability approaches should focus on the information exchange and the interaction at the boundary between transacting parties while respecting the privacy of the internal aspects of their business (technology choice and processes).

**B02** Interoperability approaches must support the ability to roll out changes to contracts or market rules while preserving stable operation of the overall electric system.

**B03** Interoperability approaches must address the common types of marketplace transactions among parties along the path between producers and consumers appropriate to the level of service provided.

**B04** Interoperability approaches must consider implementation costs/benefits and impacts to the parties involved in the transaction.

**B05** Interoperability approaches must support verification and auditability of transaction completion and be able to validate that contract terms have been met.

## Article U -Usability Principles

Context: Electricity users have a wide range of needs and energy management capabilities, as well as varying degrees of willingness to pay for any given energy product. The new frontier in a transformed energy system is the participation of new parties in overall system operations, including end use, distribution, transmission, and generation.

**U01** Interoperability approaches should address the technical capabilities needed to support the emergence of markets for consumers to choose the appropriate electricity service program they desire.

**U02** In the event of a communications failure between interacting parties, the parties must assume operating positions that best preserve stable operation of the overall electric system.

**U03** Interoperability strategies should be communicated in appropriate ways that can be understood and adopted by all stakeholders in the electric system.

## Article I -Information Technology Principles

Context: Advances in information technology empower electronic business and intelligent machine connectivity. Large sectors of the economy rely on information technology to enable greater levels of productivity, efficiency, and reliability of service. This provides a vast marketplace for the application of information technology and reduces the need for industry specific information technology approaches. Information technology is characterized by a high rate of innovation with impacts to large scale systems of systems that must cope with the deployment of new solutions as legacy approaches continue to operate in tandem.

**I01** A broadly held interoperability strategy can help organize and advance the large scale integration of automated equipment, business processes, and human interactions.

**I02** Strategies for interoperability shall adopt the broadly applicable best practices of information science to improve end to end performance of both business and the electric system's operation and managerial processes.

**I03** An interoperability framework shall address a strategy for the identification of system entities beyond organizational boundaries to ensure unambiguous interactions, and shall support the naming of groups or collections of system entities.

**I04** An interoperability framework shall incorporate information modeling approaches that define the shared meaning and relationships of entities and concepts applicable to interactions in an area of industry or commerce.

**I05** Interoperability strategies shall address time synchronization, sequence of events, time tagging, and other requirements related to time as appropriate to the service provided.

**I06** Interoperability strategies shall address the ability to set up (i.e., discover and configure) system components so they can join, modify (e.g., upgrade), and terminate their positions in the system.

**I07** An interoperability framework must address information system security and privacy concerns, balance them appropriate to the service provided, and support adaptation to future risks.

**I08** As appropriate to each interaction, an interoperability framework should address strategies for e-business transactions that may include creation of a transaction, negotiation, scheduling, operations, settlement, billing and financial transfers.

**I09** An interoperability framework must be practical and achievable:
- Meets performance requirements.
- Is reliable.
- Is scalable.
- Has sufficient breadth to meet the range of business needs.

**I10** An interoperability strategy must accommodate the coexistence of and evolvement through several generations of IT standards and technologies that will reside at any point in time on the Grid.

## Article R -Regulatory Principles

Context: Business is conducted under a formal set of rules or laws meant to follow policy guidelines. The rules are set, maintained, and enforced by various local, state, and federal agencies in accordance with their jurisdictions. Business interactions associated with the electric industry are reviewed and monitored by those regulatory bodies whose role is to ensure a viable electric system environment that supports our economy and balances issues of social equity.

**R01** Interoperability strategies and issues must be communicated in a form to be understood by regulators and policy makers.

**R02** Interoperability approaches among organizations must allow regulators the ability to verify that business is conducted within established rules and that all relevant transactions are auditable.

## Article G -Governance Principles

Context: This constitution is a living, evolving document that influences the long-term future of the electric power system. Though the Statements of Principle are meant to be long lived, the ability to correct, update, and clarify this constitution is recognized.

**G01** An interoperability framework must consider the needs and views of the full range of stakeholders in an integrated view of the electric system.

**G02** Governance processes should measure successes and shortcomings of the interoperability framework, and drive improvement.

**G03** The governance of this constitution must be independent of any particular standards organization and preserve the technical neutrality of these principles.

**G04** With regard to encouraging standards and standards development, the governance of this constitution:
- Will encourage development of standards where appropriate to constitution objectives and work with existing groups to guide standards development toward better achieving interoperability;
- Will endorse and/or recommend standards where appropriate to constitution objectives; and
- Will proactively encourage collaboration, merging, and rationalization of standards where appropriate to constitution objectives.
- Does not develop detailed specifications for standards

**G05** These long lived Statements of Principle and the strategic approaches that derive from them must be able to change through time in a prudent, controlled manner.

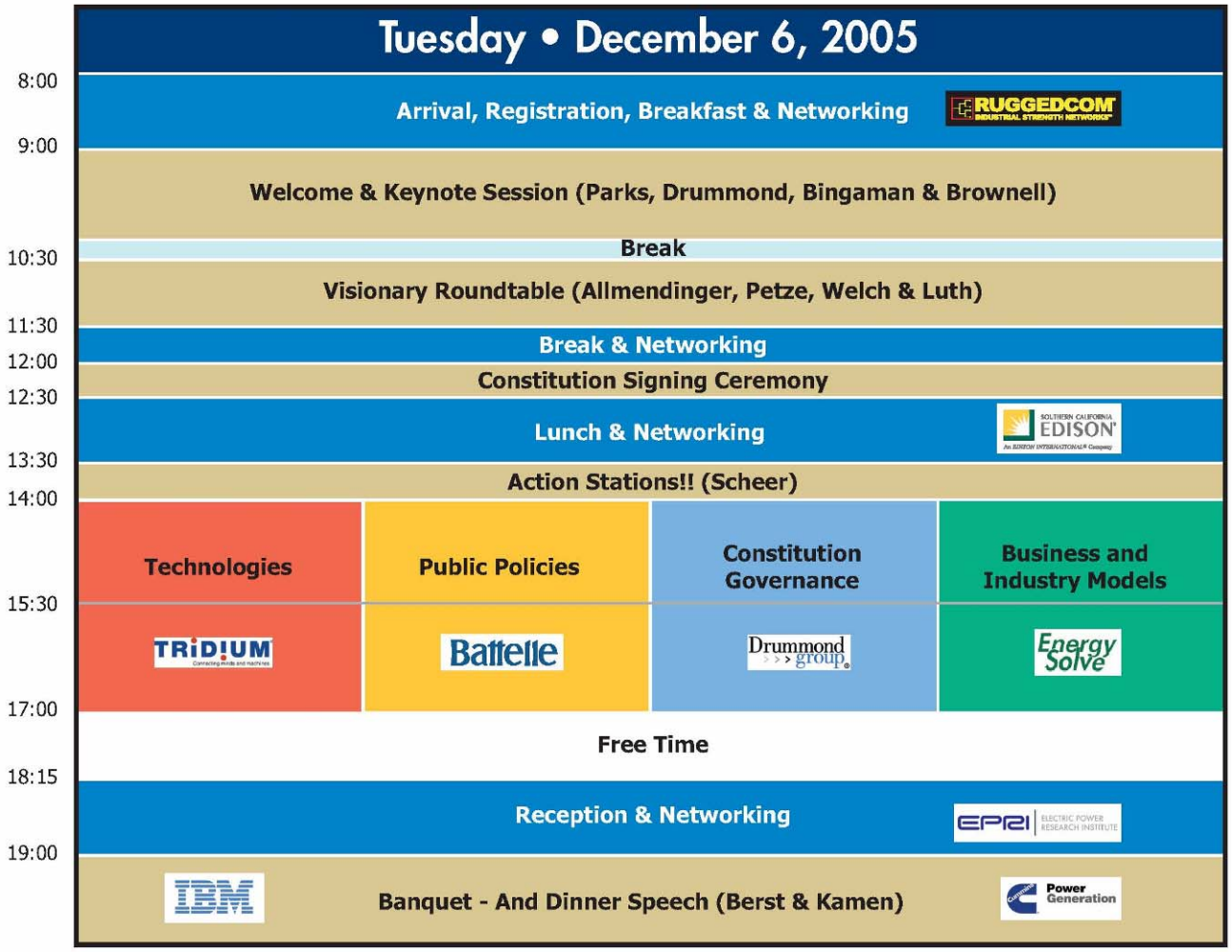
These statements of principles represent a mature draft created by the GridWise Architecture Council, with input from significant number of industry stakeholders, it is work in progress and subject to change with participant input during and after the Constitution Convention.

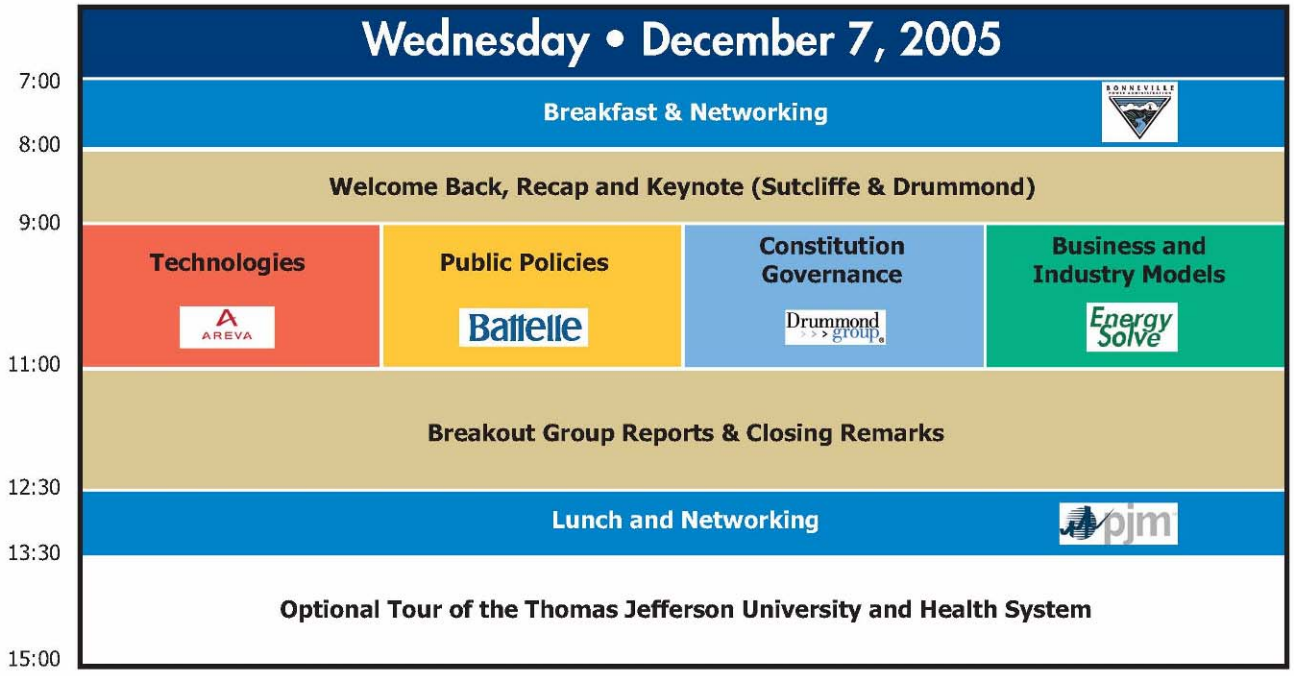
GRIDWISE

# We now stand here at the GridWise Constitutional Convention as stakeholders in the movement to advance the cause of interoperation of information systems as they flourish throughout the electric power grid. We pledge ourselves to promote and improve these statements and the objectives they serve. In witness whereof We have hereunto subscribed our names.

*In the city of Philadelphia in the state of Pennsylvania*
*This date December 6th in the year Two Thousand and Five*

# Appendix B. Agenda




Presentations will be available to delegates post convention. Agenda and times are subject to change.

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