Science, Technology and Telecommunications Committee New Mexico State Legislature

New Mexico: Leading the Electric Revolution

September 27, 2010

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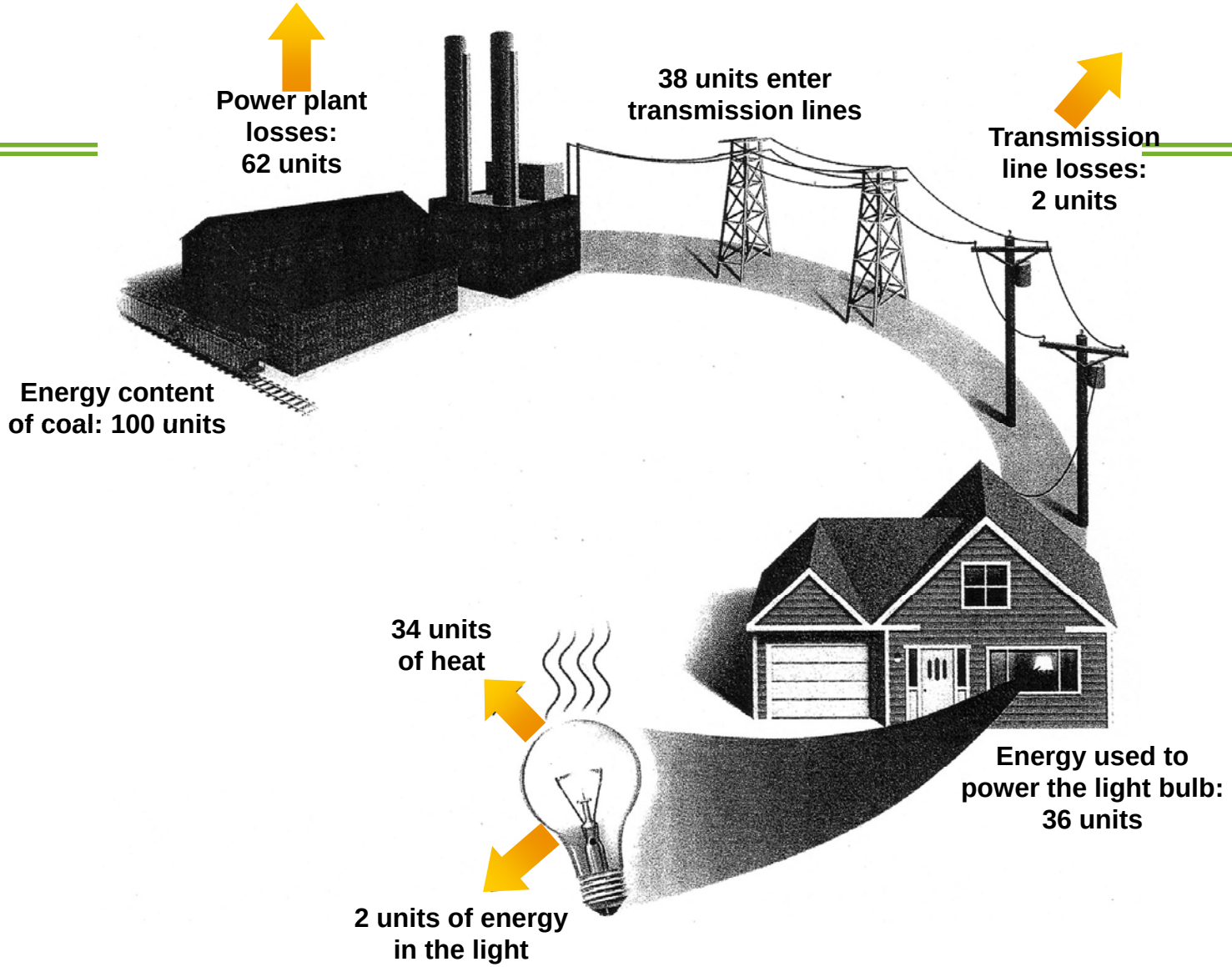
www.galvinpower.org



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Today's grids are the equivalent of dirt horse trails.

"If I had asked people what they wanted, they would have said faster horses"

Henry Ford

Value Lost to the U.S. Economy
($ billion per year)

- **Unreliability — 150**
- **Inefficiency — 100**
- **Productivity Penalty — 1,000+**

Annual Cost to Correct — 50 (Ten Years)

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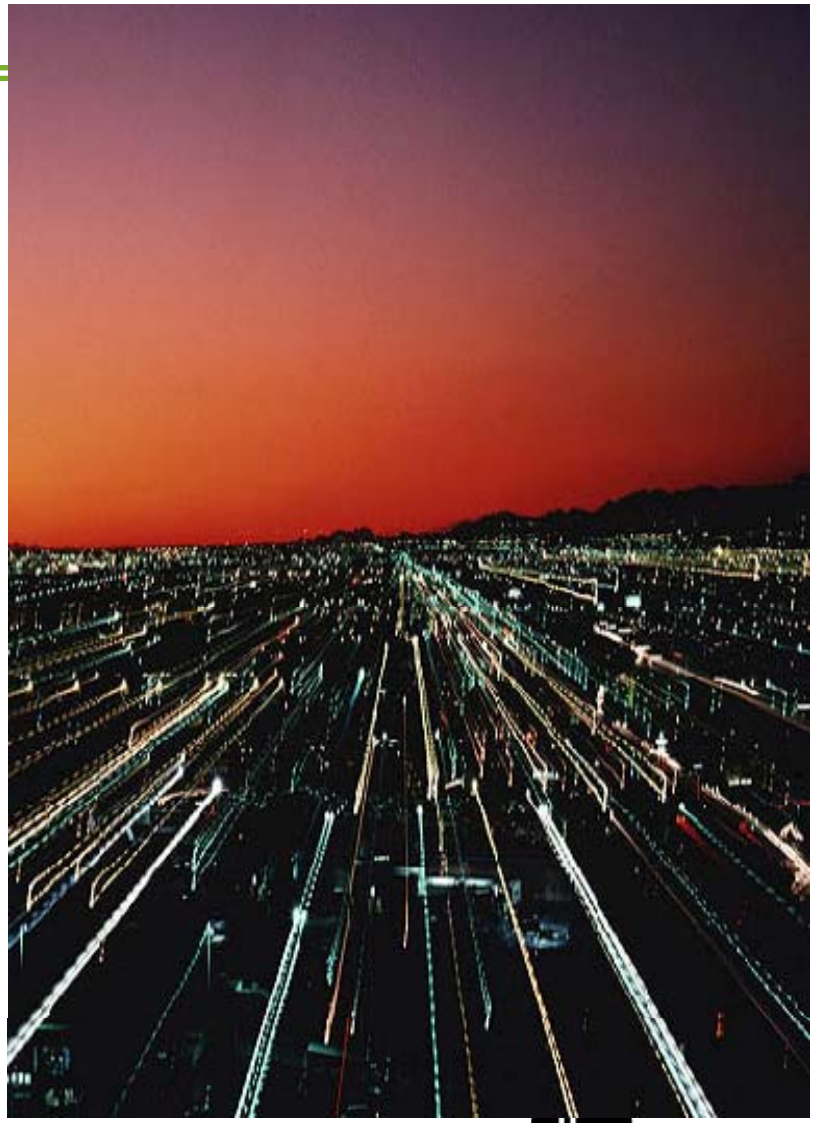
Forward to Fundamentals

Electricity is the engine of prosperity and quality of life

Electricity is a consumer service- based enterprise

Technology can relieve cost pressures through elevation of electricity service value

Realizing these opportunities requires transformation of the electricity infrastructure



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Meet Sad Socket

You'd be sad, too, if you had to power **digital-age** businesses on **1950s technology**

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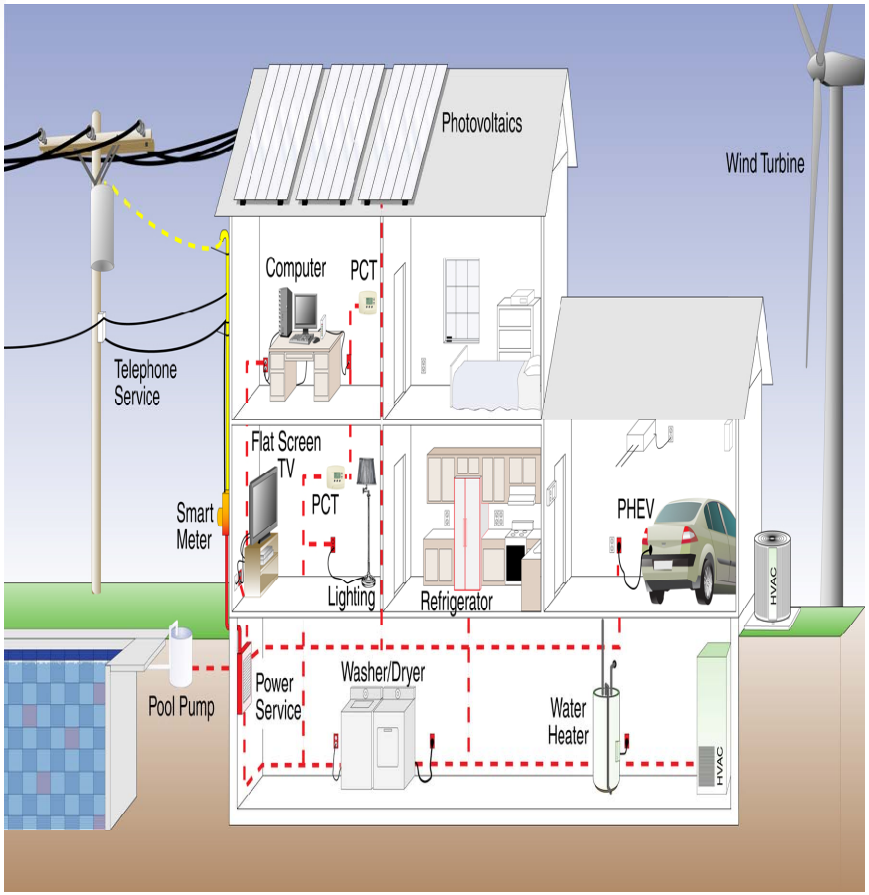
GOAL

"The perfect power system will ensure absolute and universal availability of energy in the quantity and quality necessary to meet every consumer's needs. It is a system that never fails.

Bob Galvin

New technology opportunities abound

Set it, and forget it homes



Hyper-Efficient Technologies

Residential

Heat Pumps

Ductless Cooling

Appliances

Commercial

VFC Cooling

VFC Cooling

Data Centers

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Unlocking Smart Grid Benefits Requires

- **Smart Technology**
- **Smart Policy**
- **Empowered Consumers**

SMART = the ability to understand and deal successfully with new situations

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Transforming the Electricity Grid for the 21st Century

Electronically monitor & control the power system

Integrate electricity & communications

Transform meter into a two-way consumer services gateway

Incorporate Renewable & Distributed Resources

Reintroduce Direct Current (DC) Circuits / Microgrids

Enable smart, efficient end uses

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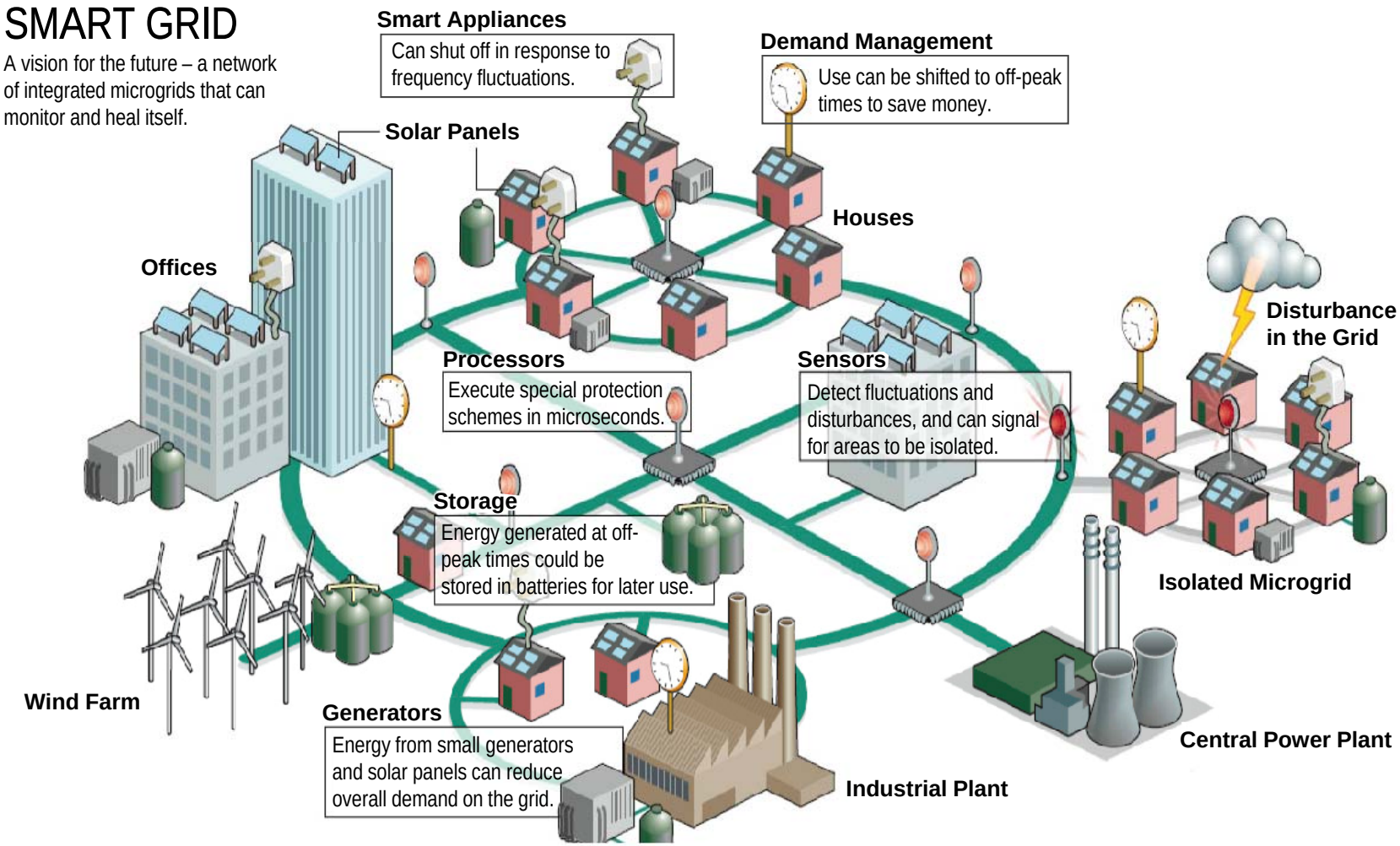
Enable the Future

Integrate microgrids, diverse generation and storage resources into a smart self-healing grid system



Source: Interview with Massoud Amin, "Upgrading the grid," *Nature*, vol. 454, pp. 570-573, 30 July 2008

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N.M. Demonstration Leadership

- Build out **smart, green microgrids** with secure controls integrated with distributed energy generation and storage tied to grid with utility-scale renewables.

- Build out **community** at substation level (~5 MW) with:
  - Smart energy management substation system w storage
  - Smart two-way metering of buildings
  - Distributed energy generation (rooftop solar PV) w storage
  - Time of day pricing
  - Smart, energy efficient buildings and appliances
  - Full monitoring and control w simulation and modeling
  - Integrated with renewable energy sources on the NM grid

Key Characteristics of Smart Microgrids

- **Self-healing.** Grid Rapidly Detects, Analyzes, Responds and Restores.
- **Empowers and Incorporates the Consumer.** Ability to Incorporate Consumer Equipment and Behavior in Grid Design and Operation.
- **Tolerant of Attack.** Grid Mitigates and Resilient to Physical and Cyber Attacks.
- **Provides Power Quality Needed by 21st Century Users.** Grid Provides Quality Power Consistent with Consumer and Industry Needs.
- **Accommodates Wide Variety of Supply and Demand.** Grid Accommodates Variety of Resources (Including DR, CHP, Wind, PV).
- **Fully Enables Maturing Electricity Markets.** Allows for and is Supported by Competitive Markets.

SMART GRID POLICY IMPLICATIONS

Focus on Consumer-Societal Benefits

- Seamless Supply/Demand Interconnect
- Consumer Empowerment
- Reliability Transformation

Help Utilities Deal with the Inevitable

- Universal Real Time Pricing
- Distributed Generation Microgrids

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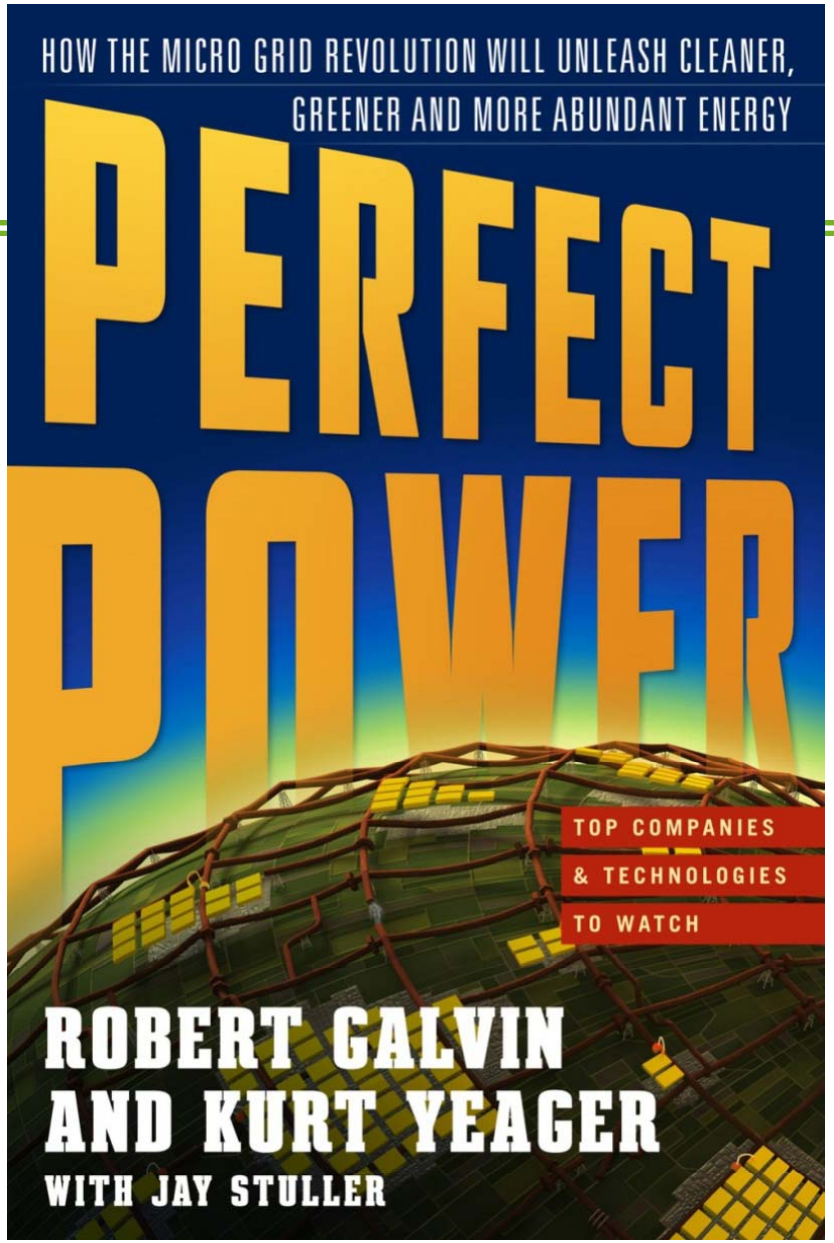

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Principles of a New Electricity Constitution

- **Eliminate Utility Restrictions on Smart Microgrids**
- **Enable Municipalities to Access & Invest in Their Electricity Distribution Infrastructure**
- **Require Fundamentally Higher Distribution Reliability Standards**
- **Provide all Consumers with Time-of-Use Electricity Rates & Incentives**
- **Compensate Utilities Based on their Reliability, Efficiency and Customer Service Quality**
- **Provide Consumers Competitive Choice in Electricity Management Services**

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New Mexico Green Grid: a Unified Vision

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GRIDWISE

Leverage Markets & Buildings as Virtual Power Plants to benefit consumers of all sizes

How will we keep the lights on in the future?

Existing Grid +

New Mexico Green Grid

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New Mexico & Galvin Electricity Initiative …great partners

- The purpose of the Galvin Initiative is to catalyze the transformation of the electricity system to one that best serves & adapts to changing needs of consumers
- Formed in 2005 by Bob Galvin, former CEO of Motorola, to leverage continuous quality improvement methods and establish governance that focuses on consumer empowerment and reliability www.galvinpower.org
- The Purpose in New Mexico is constructive technical, policy and education outreach to support New Mexico's Green Grid and Consumers

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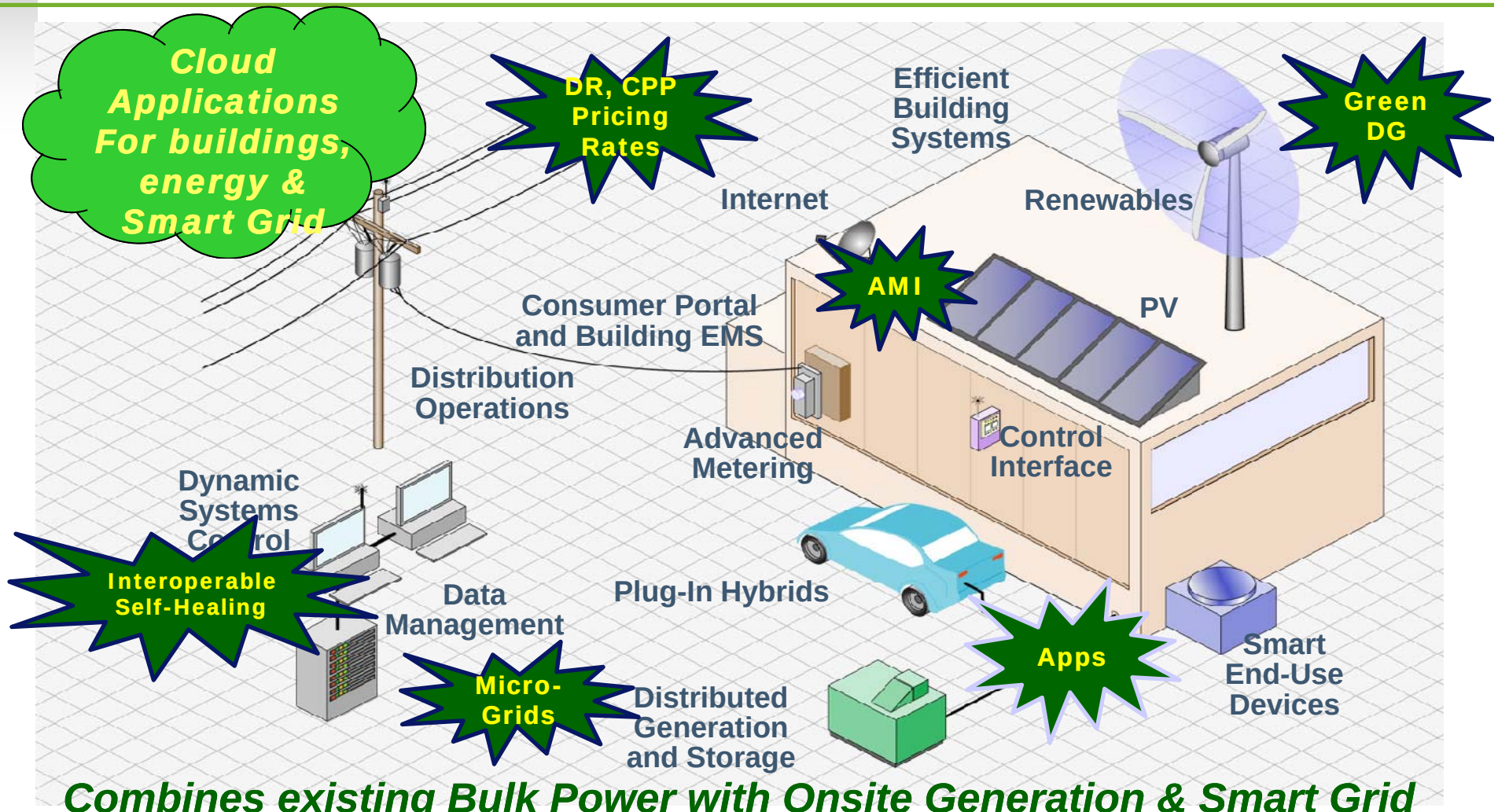
New Mexico Green Grid &
Galvin Electricity Initiative & Galvin NM Team



Combines existing Bulk Power with Onsite Generation & Smart Grid

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A Promising Solution: Smart Grid … but what is different?

The Technical Answer

- Decentralized supply and control; the existing bulk power supply remains essential to the system
- Two-way power flow
- Two-way information flow

The Benefits Answer

- Jobs, Economic Development and Recovery
- Electric Reliability and Security
- Efficiency, Cost Savings and hedge capital investment
- Environment

The Policy Answer

- New Mexico is in one of the most progressive states
- Will require Legislative & Regulatory Policy changes
- Goes hand in hand with efficiency and renewables

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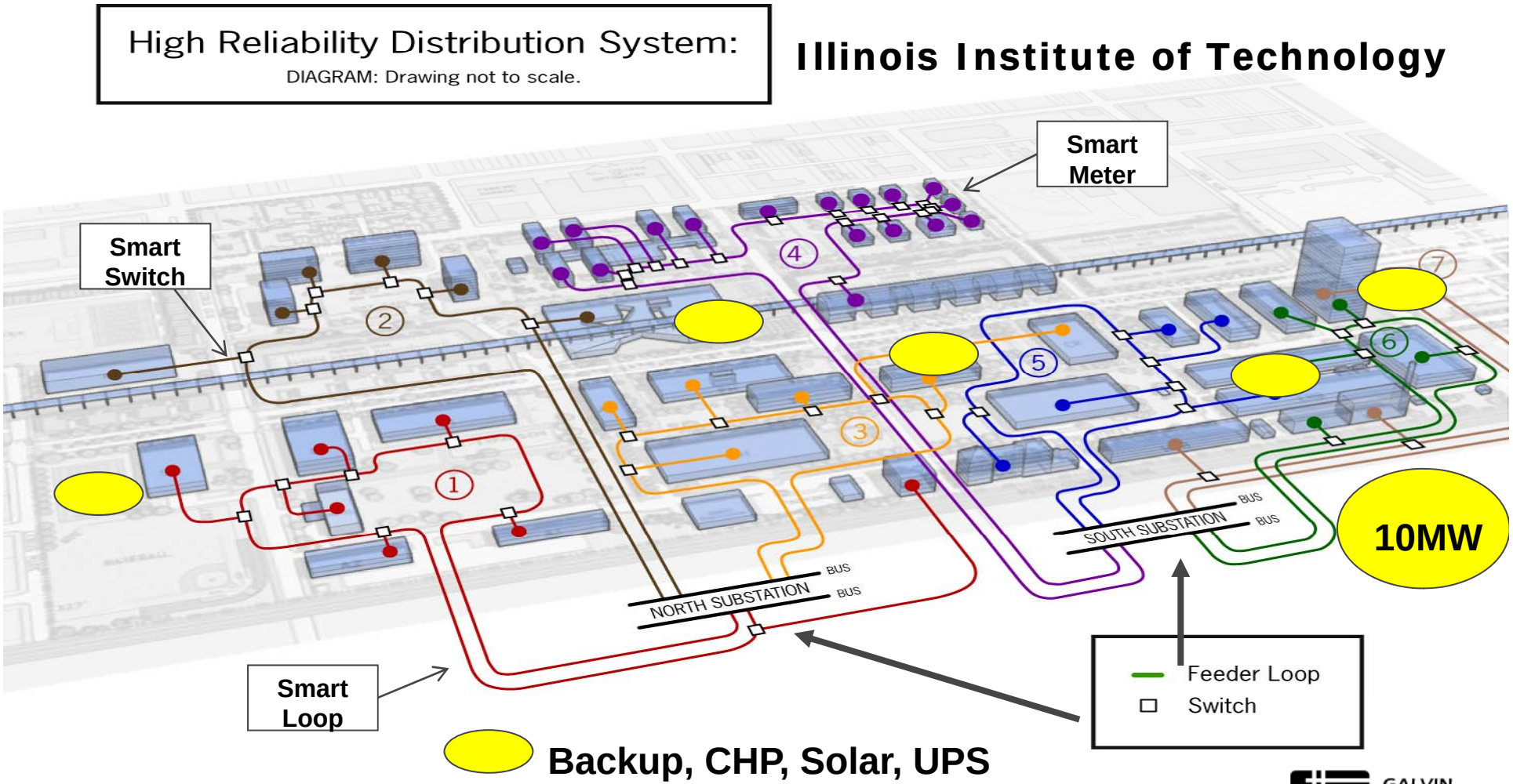
The Technology: What does it look like? Green & Web-enabled Microgrids



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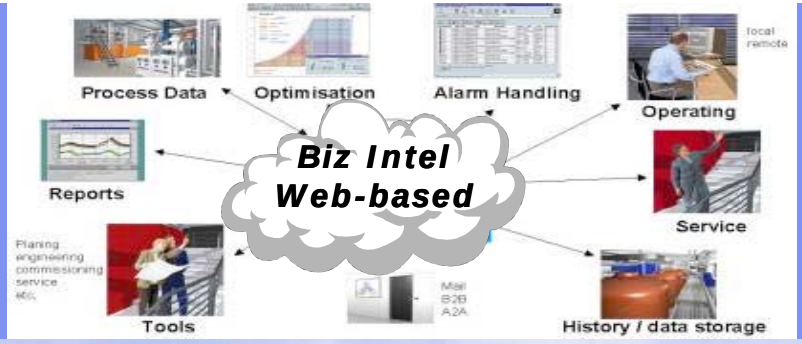
Contracting Business



2009 Best Design/Build Project in US

- *UNM leverages smart buildings, smart meters, thermal Storage, renewable energy and distributed generation with a DOE funded project implemented by ECI and interfaced with PNM to develop Smart Energy strategies*

GRIDWISE

- *IT Interoperability collaboratively controls resources to make the Grid more reliable and efficient while creating new business and market opportunities*

Smart Buildings meet Smart Grid Smart Consumers...

The Smart Grid Benefits = Jobs & Economic Development

Characteristics

- ✓ Enable consumer role
- ✓ Generation & storage
- ✓ New Jobs
  - Products & services
  - markets
- ✓ Power quality for digital economy
- ✓ Optimize asset utilization
- ✓ Operate efficiently
- ✓ Self-healing: Web & controls

Technology

- ✓ Web Services
- ✓ Price Signals
- ✓ Green Microgrids
- ✓ Advanced Control Methods
  - There's an "app" for that! (*e.g.:* Demand Response, on-site generation & automation)
- ✓ Monitoring & Measure Grid
  - Smart sensors & meters
- ✓ Advanced Components (*e.g.*: switches, storage, etc.)
- ✓ Integrate Communications

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The Smart Grid Benefits = More

Consumer Benefits

- ✓ Reliability & efficiency
- ✓ Higher quality service
- ✓ Energy Management
  - ✓ pricing information
  - ✓ power control options
  - ✓ manage electricity use
  - ✓ keep costs down
- ✓ Consumer role in electricity market (Sell generation & demand response to utility $)
- ✓ Hedge utility Cost increases
- ✓ Reduced business losses & prices for goods/services

Utility: Operations

- ✓ Metering & billing
- ✓ Manage Outages
- ✓ Voltage/current stability
- ✓ Workforce management
- ✓ Reduced losses (energy)
- ✓ Asset management
  - ✓ (*e.g.*, system planning, maintenance practices, engineering)
- ✓ Customer satisfaction
- ✓ Reduce O&M
- ✓ Reduce capital costs

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The Smart Grid Benefits = More Societal Benefits

Improved Reliability

- ✓ Reduce consumers' loss of ~$135 billion/yr (DOE)
- ✓ Cleaner Environment
- ✓ Reduce CO2 emissions by renewables & electric cars
- ✓ Less Use /T&D losses = Less future generation

Economic Growth

- ✓ New jobs: R&D, operation maintenance—NM assets
- ✓ Economic development: new Smart Grid products & services for consumers

Energy Independence

- ✓ Reduce US peak loads
- ✓ Reduce total US electric use
  - ✓ Expanded demand response
  - ✓ More efficiency/conservation
  - ✓ Reduced T&D line losses
- ✓ More electric vehicles=less oil imports by 52%(DOE)
- ✓ Enhanced National Security
- ✓ Less vulnerable–supply blend
- ✓ 2-way flow of power and information reduces impact & duration of disturbances

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New Mexico Green Grid: How to get there?

Enterprise Zones (EZ) Electricity

- MOU with NMEDD & Galvin Electricity Initiative
  - Technical consulting
  - Education and Outreach
  - Policy Recommendations

- Drive changes in NM Electricity system to benefit all
- Leverage Japan's role
- Provide new thinking and knowledge through research on **innovative policies and programs**
  - Empower consumers/communities & strengthen utilities
  - Consumer outreach underway
- Address funding need: 0% financing, no fiscal impact
- Work with stakeholders to **develop innovative Perfect Power prototypes** or models
  - Los Alamos, Mesa del Sol, Taos and others

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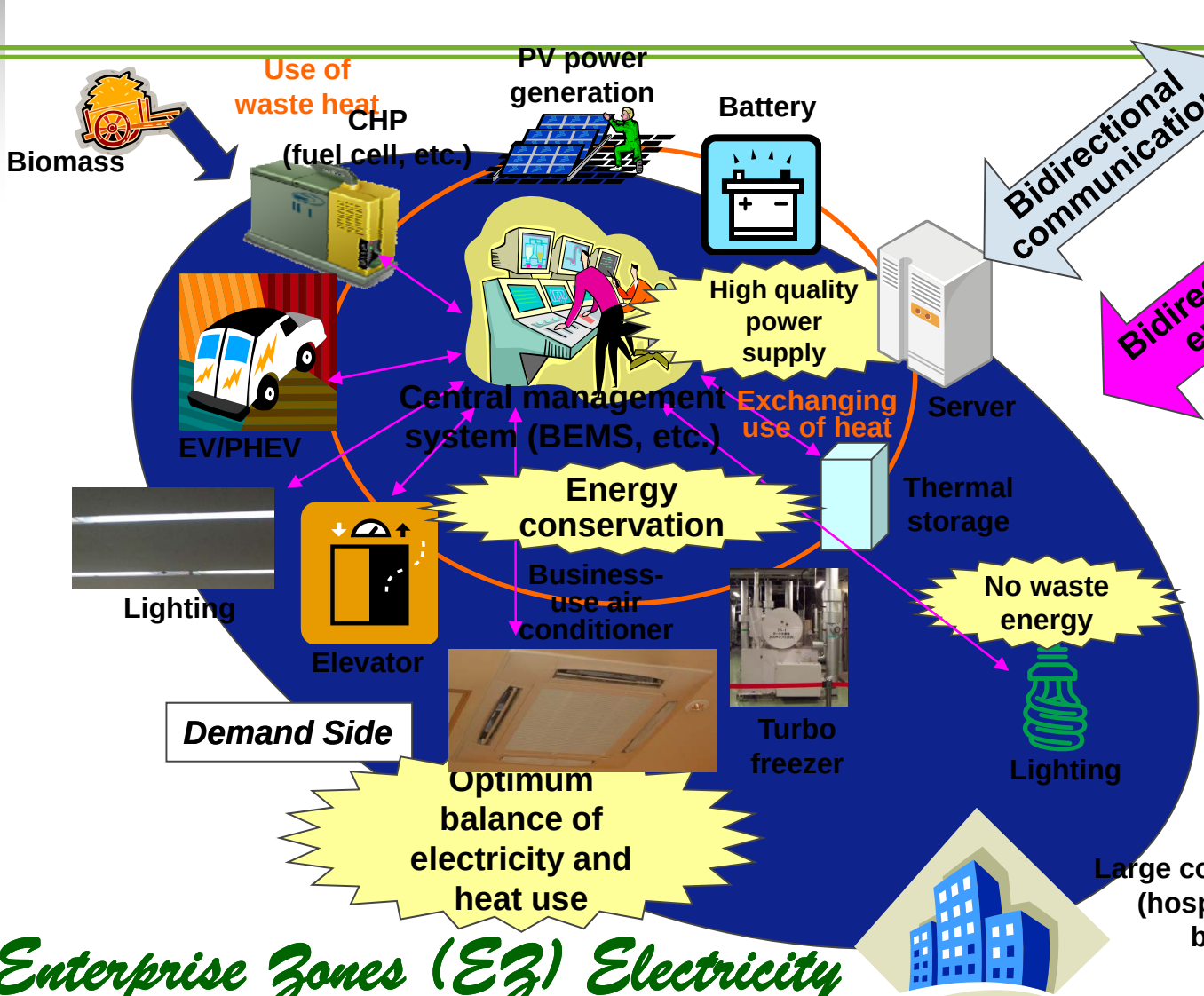
New Mexico, Japanese & Galvin Initiative Green Microgrid Projects



For New Mexico / US
- -New Mexico Green Grid
- -Galvin Electricity Initiative
- -10+ other partners

For Japan: NEDO
- -New Energy and Industrial Technology Development Organization
- - 31 Japanese companies

Enterprise Zones (EZ) Electricity

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New Mexico Near-term Policy Opportunities

- **Green Grid to prove technology & point to needs**
- **Galvin NM: outreach & create NM Policy Review**
- **Constituent outreach & Policy research point to:**
  - ✓ **Public Facility Energy Efficiency Act** [Section6-23-1- NMSA 1978]
    Energy Efficiency & Renewable Bond [Section6-21D-1- NMSA 1978]
    - **Align terms, expand finance vehicles to 0% Fed programs**
    - **Education & Outreach to inform on financing availability**
    - **Financing for efficiency and renewable microgrids**
  - ✓ **Sustainable Development Community Act** [Section71-8-1-NMSA1978]
    - **Focus: Demand Response by consumers in cities/counties**
    - **enabled by Efficient Use of Energy Act** [Section62-17-1- NMSA1978
    - **Consumers get more value and can aggregate energy**

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New Mexico

Green Grid

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GRIDWISE™ Architecture Council

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