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# *Phasor Technology Research Roadmap for The Grid of The Future*

**Presented to EIPP Executive Steering Group**

**February 7, 2006**

# Context

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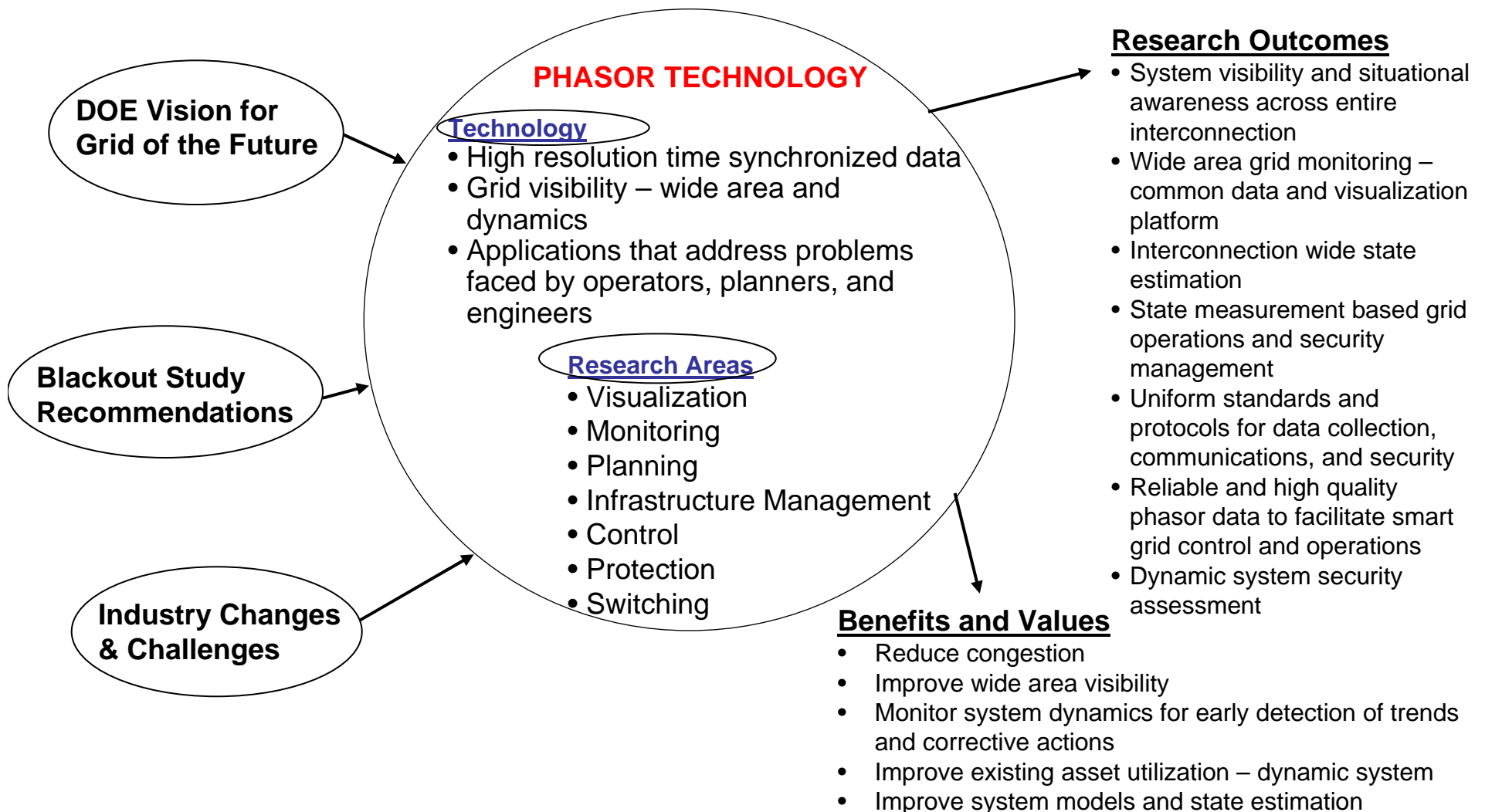
- July ESG meeting discussed status, issues and vision for EIPP
- Issues discussed included:
  - DOE and industry roles
  - Funding
  - Research roadmap
  - Transitioning project management from DOE to industry
  - Impact of EPACT 2005 and the transition to the ERO
- CERTs prepared Research Roadmap draft with input from EIPP Task Team Leaders
- ESG commented on interim draft on October 31<sup>st</sup>
- EIPP Task Team leaders provided final comments in January
- Today's focus is to present Research Roadmap for ESG approval and transmittal to Secretary Bodman to ensure continued and sustained DOE funding for Phasor technology research and in collaboration with industry



# *EIPP Executive Steering Group*

<b>WILLIAM (BILLY) O. BALL</b> Southern Company	<b>MICHEHL R. GENT</b> NERC	<b>MARTY MENNES</b> Florida Power and Light
<b>PAUL BARBER</b> Barber Energy	<b>DAVID GOULDING</b> Independent Electricity Market Operator	<b>WILLIAM C. PHILLIPS</b> MISO
<b>TERRY BOSTON - Chair</b> Tennessee Valley Authority	<b>HOLLY KOEPEL</b> American Electric Power	<b>ED TYMOFICHUK</b> Manitoba Hydro
<b>VIKRAM S. BUDHRAJA</b> Electric Power Group	<b>KEVIN KOLEVAR</b> Department of Energy	<b>STEVE WHITLEY</b> ISO New England
<b>JOSE DELGADO, P.E.</b> American Transmission Company	<b>MARK LYNCH</b> NYISO	

# Phasor Technology Vision and Roadmap - Overview



# *Phasor Technology Research Framework to Meet Future Grid Needs*

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- Catalogue known problems to be addressed by research
- Define research areas based on above assessment
- Develop research milestones
  - Research target
  - Project definition
  - Research and analysis
  - Development
  - Test and demonstration
  - Deployment and commercialization

# Summary of Research Goals and Milestones

Research Areas	Near-Term(1-2 Years)	Mid-Term (2-5 Years)	Long-Term (5-10 Years)
<ul style="list-style-type: none"> <li>▪ Visualization</li> <li>▪ Monitoring</li> <li>▪ Planning</li> <li>▪ Phasor Infrastructure Management</li> <li>▪ Control</li> <li>▪ Protection</li> <li>▪ Switching</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wide-area visibility with common situational awareness screens</li> <li>▪ Baseline normal operating conditions, limits and alarms for EI</li> <li>▪ Demonstrate improved state estimation with phasor measurements</li> <li>▪ Model validation for better system understanding</li> <li>▪ Identify human factors &amp; visualization needs for phasor based operations tools</li> <li>▪ Define best practices for enhanced grid “forensics”</li> <li>▪ Design next generation data and communications infrastructure</li> <li>▪ Define research and demonstration approach for real-time control</li> <li>▪ Identify research needs for federal investment</li> </ul>	<ul style="list-style-type: none"> <li>▪ Wide-area visibility with full coverage</li> <li>▪ Approaching real-time state measurement for operators</li> <li>▪ Dynamic system security assessment tools</li> <li>▪ Common operator tools deployed</li> <li>▪ Congestion management</li> <li>▪ Dynamic ratings</li> <li>▪ Improved LMP</li> <li>▪ Work with industry to initiate major demonstration of real-time control for dynamic security</li> <li>▪ Work with industry to demonstrate adaptive islanding protection concepts to improve protection from wide-area blackouts</li> <li>▪ Develop strategy for next-generation operational tool concepts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Real-time protection</li> <li>▪ Distributed closed loop control</li> <li>▪ Automatic smart-switchable networks</li> </ul>
	<b>2006 - 2007</b>	<b>2007 - 2010</b>	<b>2010 - 2015</b>

# *How Does Phasor Technology Research Fit With Current Activities?*

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- Blackout focused attention on need for real time wide area visibility, situational awareness, and monitoring
- DOE was the catalyst to get the EIPP started
- EIPP network in place – industry taking on responsibility for hardware installation and infrastructure management
- California and WECC utilities also have a phasor network in place
- With phasor data now becoming available and coverage expanding, research focus shifts to research on utilization of phasor data to address industry problems

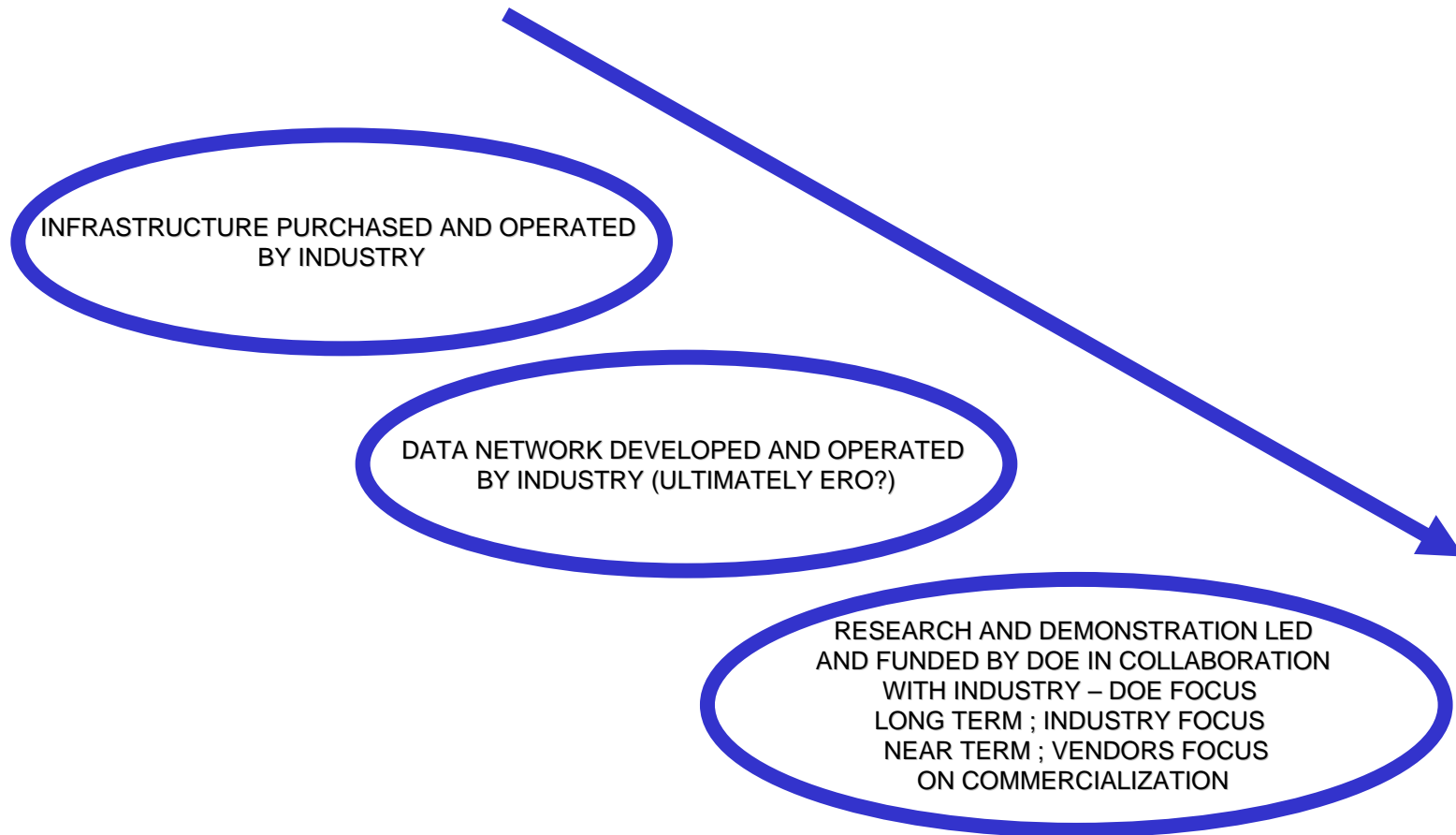
# *Expected Outcomes From Phasor Technology Research?*

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- System visibility and situational awareness across entire interconnection
  - Wide area grid monitoring – common data and visualization platform
  - Interconnection wide state estimation
  - State measurement based grid operations and security management
  - Uniform standards and protocols for data collection, communications, and security
  - Reliable and high quality phasor data to facilitate smart grid control and operations
  - Dynamic system security assessment
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# Key Roles in Delivering the EIPP

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# January Leadership Meeting Highlights

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- Eventual transition from CERTS project leadership to industry leadership
  - ERO a logical home (transition time frame mid-2007)
  - DOE's future phasor role stresses research, collaborating with ERO in the national interest for all the interconnections
- PMU deployment
  - Ease new member entry (selection, training, best practices, test and certification)
  - Status tracking (operation, in progress, in queue, forecast targets, ...)
    - Note, ESG can help in targeted marketing (Where do we have holes?)
- Production level phasor exchange network
  - Network beyond present superconcentrator
  - Architectural requirements, design, plan transition
  - Eventual funding, hosting model (ERO decisions important)
  - Bullet dodged: TVA's commitment to support superconcentrator thru 2010
- Research level information access agreement needed

# *Request for Continued DOE Investment in Phasor Core Technology Program*

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- DOE investment in EIPP has been \$3M since 2002.
- Industry investment in EIPP infrastructure and staff time has run at 5:1 ration (industry to DOE) ..... Ratio will grow in near-term.
- DOE role will transition to long-term R&D to maximize economic and security benefit of the emerging new class of monitoring data.
- Recommend DOE commit to \$5M/year for five years for core Phasor Tools R&D Program
  - **Monitoring** investments to ensure full coverage of NA interconnections and appropriate visualization tools to enable use by operators
  - **Planning** use of the phasor data to improve system models to improve reliability management
  - Develop necessary security protocols so that the industry-managed **networks** are robust
  - Invest in demonstration of **visualization and control concepts** to leverage phasor data for improved control and protection to mitigate major blackouts