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# **DOE Sensors & Automation 2007 Annual Portfolio Review**

## **INDUSTRIAL WIRELESS IS HERE:**

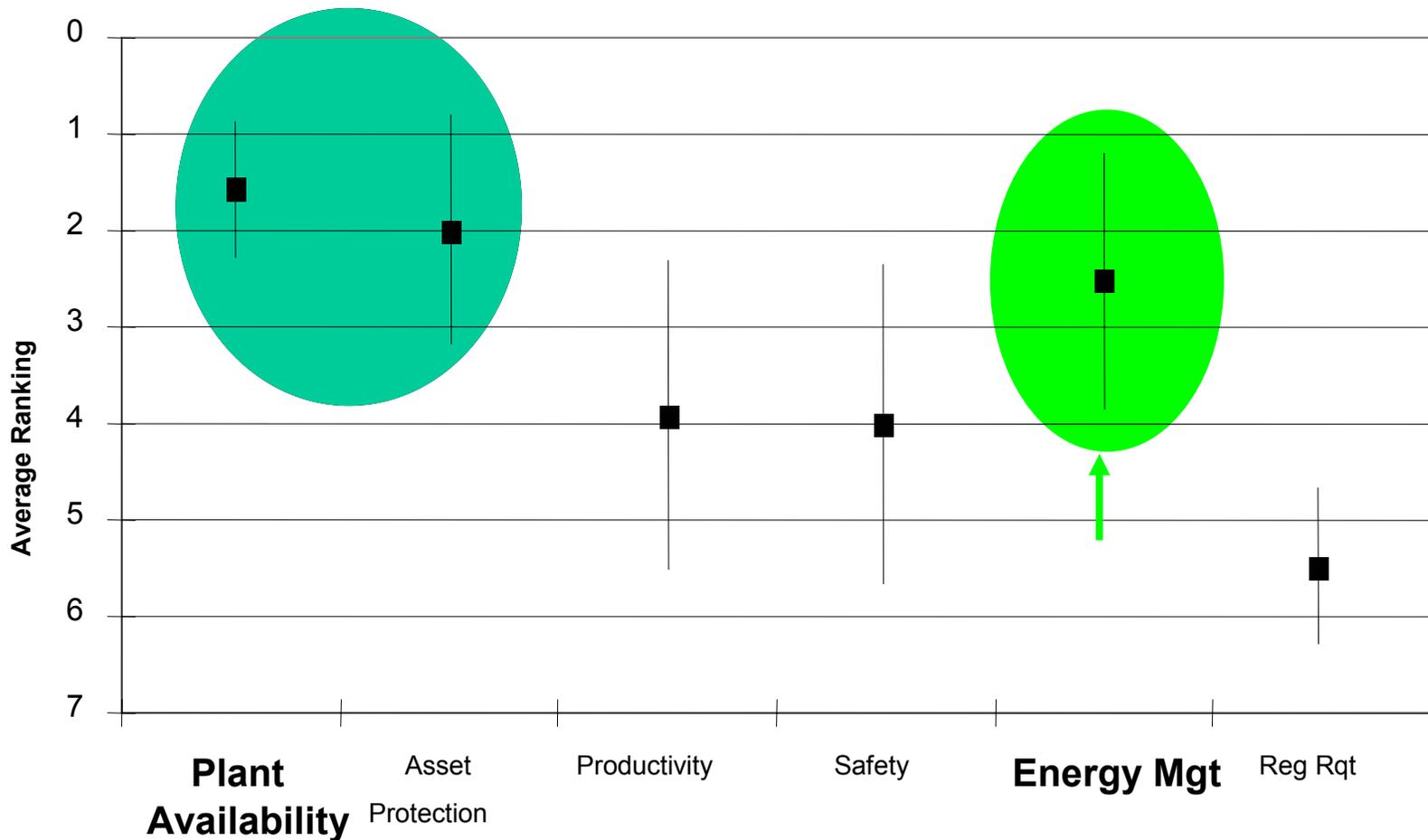
**Eaton Wireless Sensor Network for Advanced  
Energy Management Solutions Phase 2:  
Advanced Pervasive Wireless Energy Sensing**

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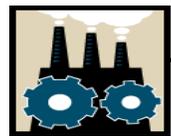
# Goal: Enable significant energy savings for Advanced Energy Management Solutions (AEMS) in the Industries of the Future (IOF)

## Reasons Energy Management or Wellness is Deployed



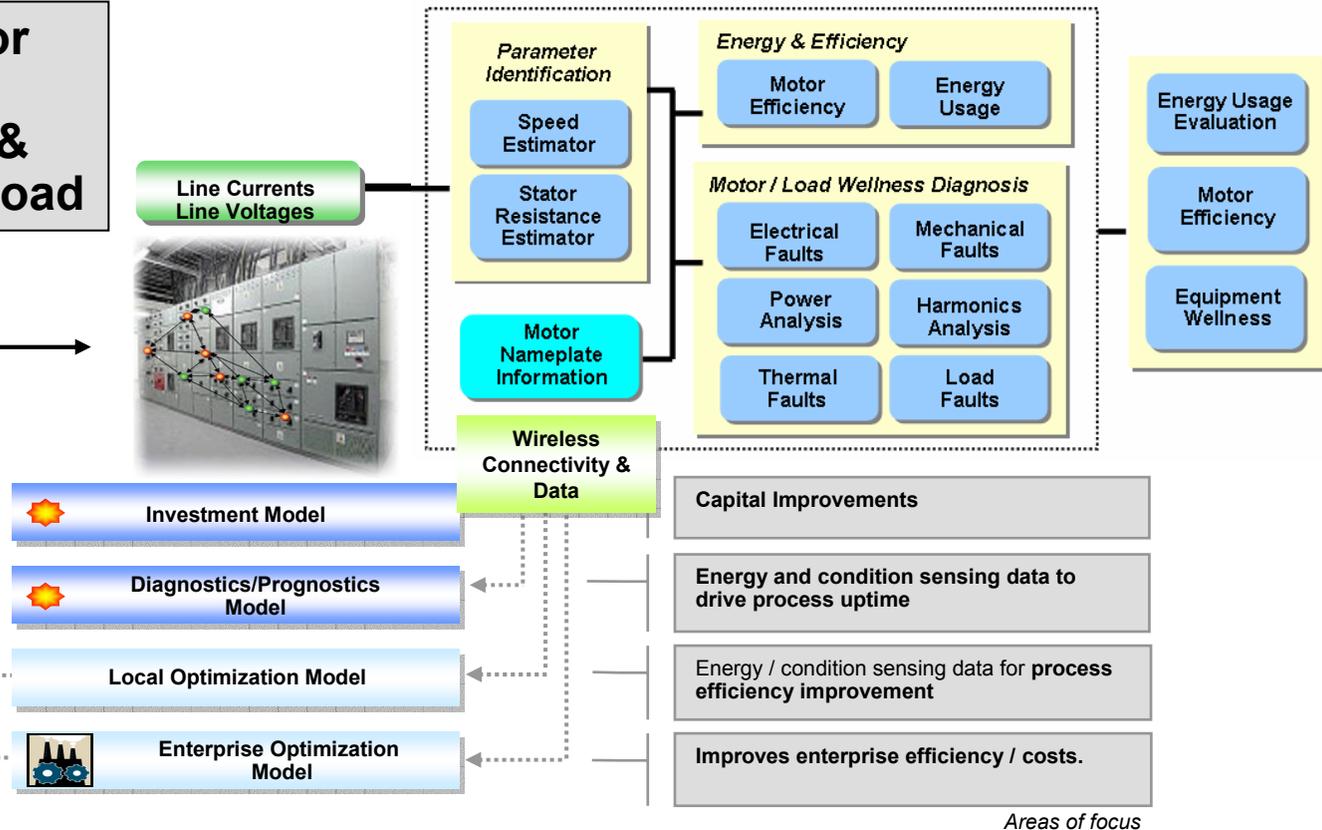
# Technology Description - Energy Saving Vision

**At a wireless sensor price, Monitor the Energy, Efficiency & Wellness of motor & load**



Motor efficiency improves 4.5%

System efficiency improves 9.6%



*Areas of focus*

- **Energy monitoring is straight forward**
  - Price point is key -- Achievable by employing existing sensors and wireless connectivity
- **Efficiency estimation adds additional value**
  - Real time view of system losses
- **Wellness and Health monitoring takes it to real time business results and energy saving; 'Uptime' saves energy**

# Technology Significance

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## Problems

- **Current barriers to broader energy management system usage:**
  - Wiring costs – up to \$1000/foot
  - Sensor cost, installation, Intrusion
  - Information overload
  - Daunting cost / benefit analysis especially for small motors (<200 HP)
- **Lack of robust, secure, and cost-effective communication networks to enable collection of critical monitoring and diagnostic information in energy management solutions**
- **Sensors required to measure speed and torque are difficult to retrofit in existing systems**
- **Lack of standards that promote interoperability**



## Solutions

- **Communication of value proposition to customers – focusing on uptime and ROI.**
- **Development of robust, self-configuring, low cost wireless sensor networks for advanced energy management solutions**
- **No speed and torque sensors needed → Inferential, non-intrusive, low-cost!**
- **Eaton's industry participation in IEEE802, ISA/SP-100, AADL, and the ZigBee Alliance**



# Energy Savings

## Conservative Estimates

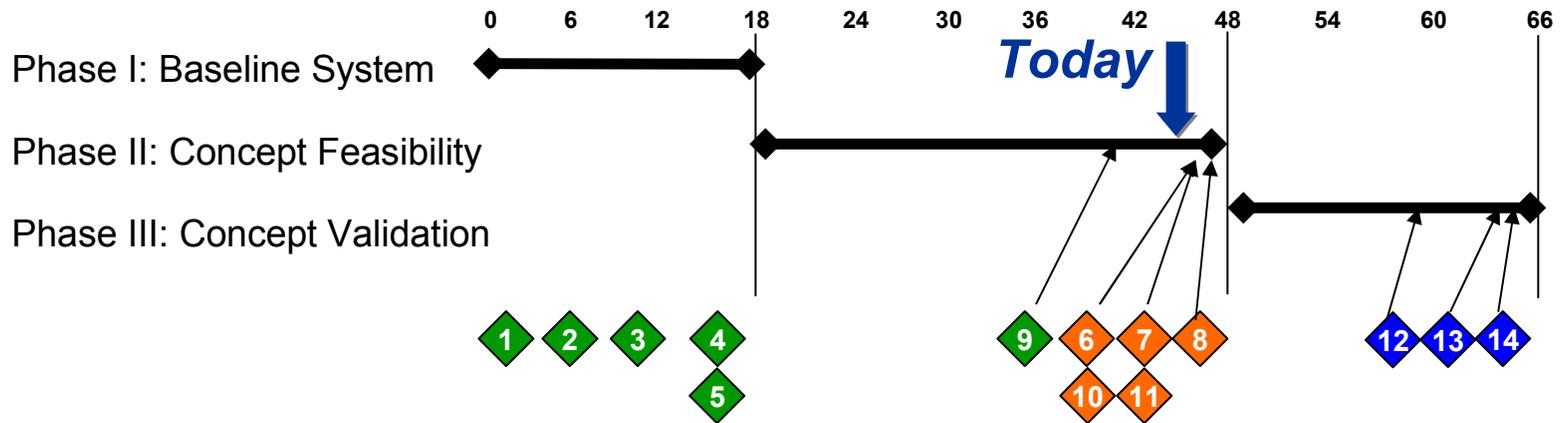
- **Savings related to electrical management only**
- **Based on 10% energy savings (vs. 11% to 18% est)**
- **Realized savings based on capitalization schedule**
  - Assume 6 to 10 yr motor life
  - 100% R&R by 2020
- **DOE OIT report based data**
  - Fuel Consumption tables per industry segment (SIC)
  - Industry segment growth rates

	Energy & Environmental Benefit in 2020								
	Petroleum	Aluminum	Chemical	Forest Products	Glass	Casting	Mining	Steel	2020 Total Impact
Electrical energy savings (trillion Btu's)	29.8	14.9	78.7	33.5	7.7	4.4	99.0	10.9	279.0
Pollutant Reduction (million lbs)	12.4	6.2	32.7	14.0	3.2	1.8	41.2	4.5	116.1

Benefits (est.)	2020
Energy Savings	>279 trillion Btu
Cost Savings	\$1300 millions
Pollutant Reduction	116 Million lbs

 **Using conservative DOE-based data yields significant electrical energy savings of 279 Trillion Btu's year!**

# Current Status



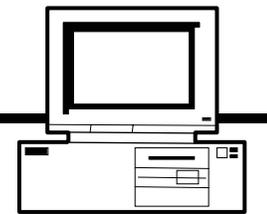
1	Wireless Sensor Network (WSN) requirements	Accomplished!
2	Investigate, assess, and document alternative solutions	Accomplished!
3	Develop design specifications	Accomplished!
4	Build the wireless system testbed	Accomplished!
5	Develop and perform baseline tests	Accomplished!
6	Evaluate concepts for ultra-low power wireless nodes	Near Completion
7	Increase robustness of routing algorithms	Near Completion
8	Address packaging for robust RF transmission	Near Completion
9	Implement enhanced security	Accomplished!
10	Update the demonstration testbed	Near Completion
11	WSN performance testing	Near Completion
12	Create alpha site demonstrations to include diagnostics / prognostics	Phase III
13	Implement additional system design improvements	Phase III
14	Develop and implement product introduction plan	In Process

# Next Steps

- Continue aggressive testing and customer evaluation of inferential algorithms and communications performance
- Implement industrial wireless network enhancements based on the results of Phase II R&D efforts
- Complete build of Gen II hardware → Wireless - Energy - Uptime
- Continue active participation in standards efforts, to maximize the benefits from interoperability
- Continue refinement / integration of commercialization plan



Web Portal



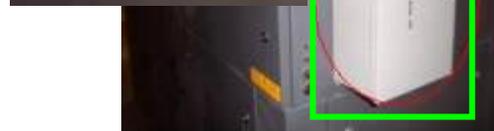
Remote Data Server



Gateway



Wellness Unit



Industrial Plant

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