LISTEN. THINK. SOLVE.®

Challenges for automation

HOW can we make tomorrow's smart system technologies safe, secure, reliable, and robust?

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Director Advanced Technology
13 March 2012

Allen-Bradley • Rockwell Software

Rockwell Automation

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Smart manufacturing is a knowledge-enabled industrial enterprise that is,

- *Optimized*
- *Demand-driven*
- *Sustainable*

Today
- Smart Manufacturing 1.0: Islands of Efficiency

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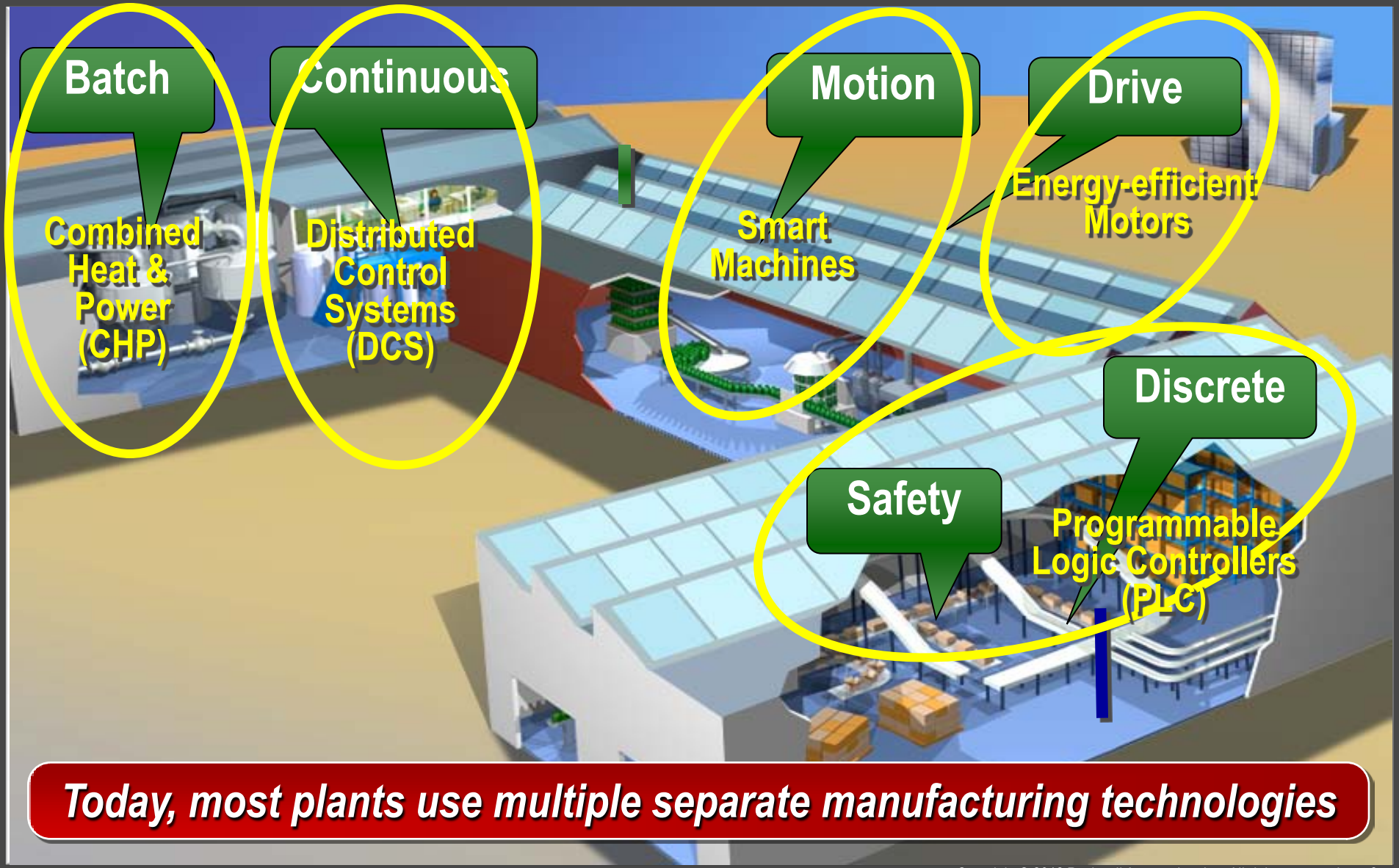

Today, most plants use multiple separate manufacturing technologies

Today
- Smart Manufacturing 1.0: Connecting the Silos

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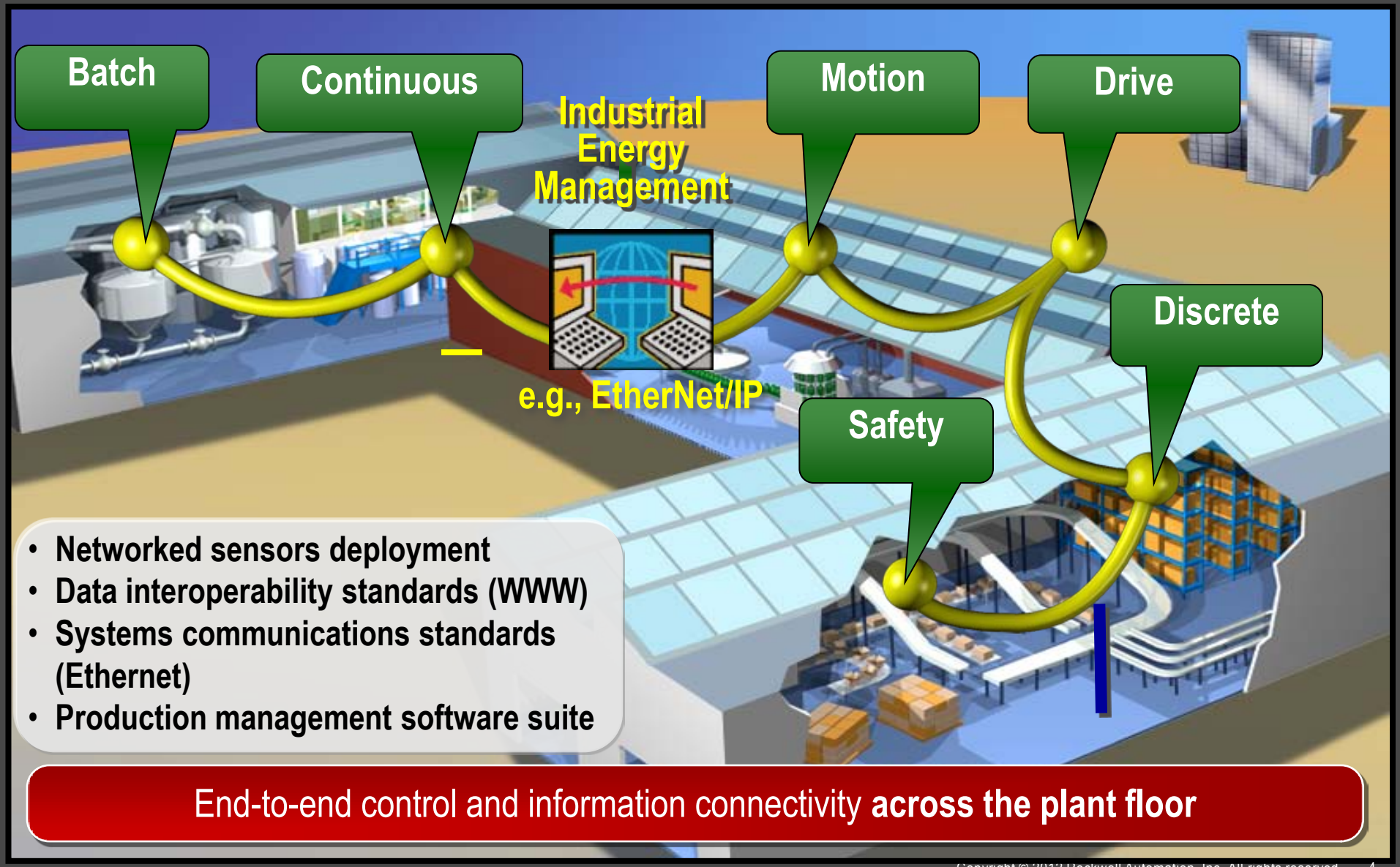

- Networked sensors deployment
- Data interoperability standards (WWW)
- Systems communications standards (Ethernet)
- Production management software suite

End-to-end control and information connectivity **across the plant floor**

Smart Manufacturing 2.0: Optimized Plant & Supply Network

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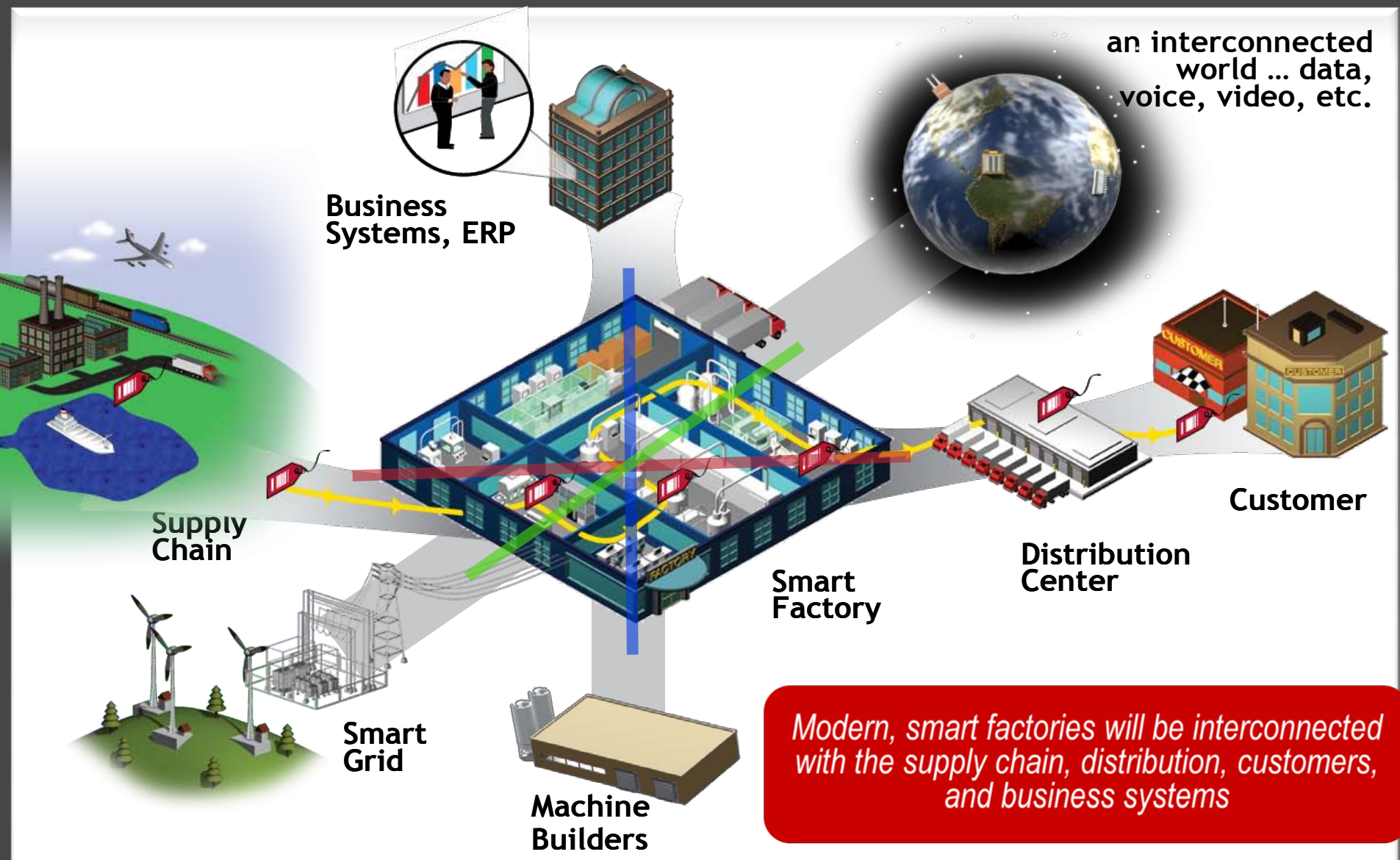

Modern, smart factories will be interconnected with the supply chain, distribution, customers, and business systems

Optimized Plant & Supply Network: Meaningful Uses / Benefits

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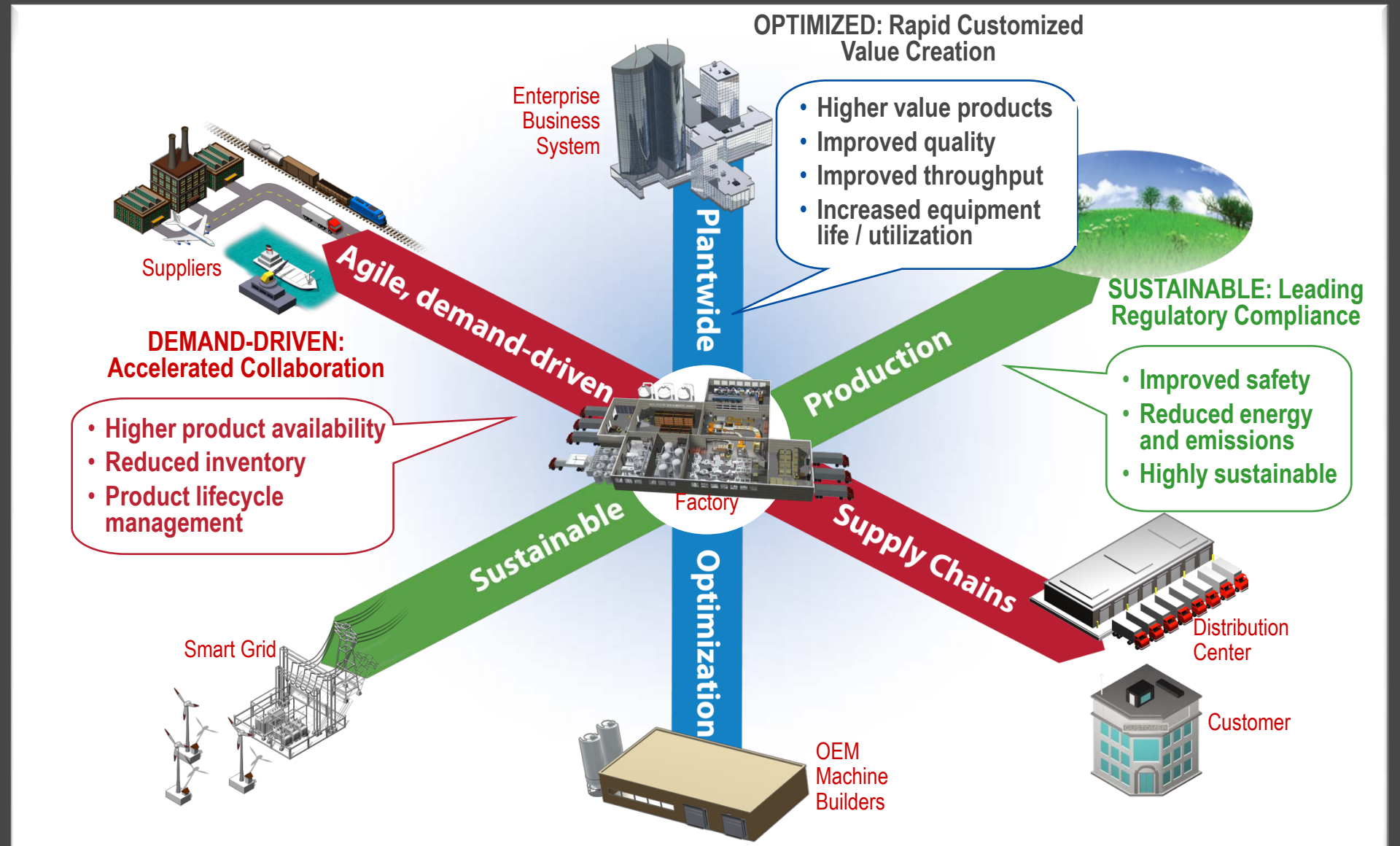

Smart Manufacturing 2.0 - Challenges for Automation

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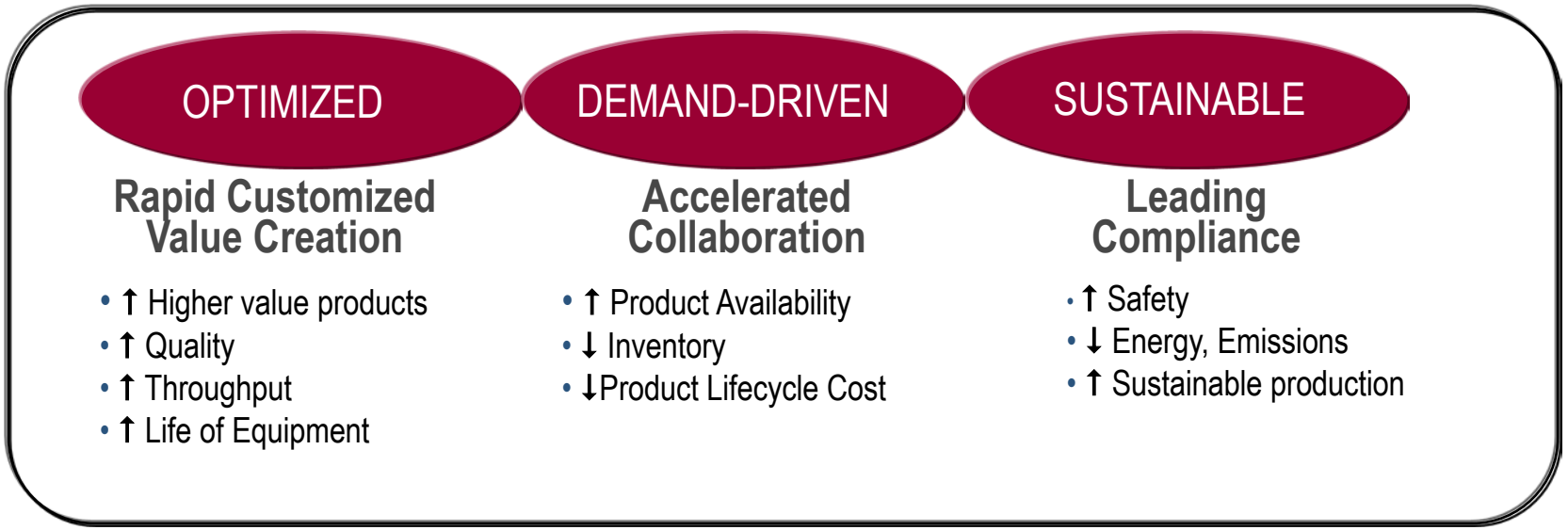
- *Data to knowledge*
- *Knowledge to operating models*
- *Operating models as key plant assets*
- *Models as key plant assets*



OPTIMIZED Production Costs, Quality, Efficiency
Challenges for Automation

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- ***Data to Knowledge***
  - *Standard, secure communications network(s) and data interoperability* standards for plant data, product life cycle / ERP data, and supply chain data <Wired / wireless infrastructure, interoperability standards>
  - **Networked sensors** in large numbers throughout manufacturing plants and surrounding environments to provide detailed production data <Novel sensors, low-cost, secure networking>
  - **Model-based systems** for data transformation to information <Large scale data translation / transformation>

- ***Knowledge to Operating Models***
  - **Process models** for advanced process control and optimization <Process models>
  - **Production Software** for long- and short-term planning, predictive control, flexible automation, environmental health and safety management, and other intelligence about manufacturing operations <Manufacturing intelligence, Flexible production>

<Red Text>: Technical advances

DEMAND-DRIVEN: Maximize Collaboration With Supply Chain *Challenges for Automation*

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- ***Operating Models as Key Plant Assets***
  - **Develop multi-scale dynamic modeling, simulation, and large-scale optimization**
    - Large-scale cross-company, cross-industry and supply chain integration at strategic, tactical, and operational levels
    - Business planning and scheduling fully integrated with operational optimization so that decisions and actions are made within an operational time window that can have proactive impact

<Life cycle modeling, simulation, optimization>

<Red Text>: Technical advances

SUSTAINABLE: Safe, Energy-Efficient, Environmentally Friendly
Challenges for Automation

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- ***Models as Key Plant Assets***
  - **Develop and implement active energy management**
    - Model, measure, control, and optimize energy consumption <Active energy optimization, low energy processes>
  - **Provide enhanced safety and security** <Safety, security>
  - **"Certified" environmentally friendly processes and materials / chemicals / substances**
    - Closed-loop eco-management <Product lifecycle management>

<Red Text>: Technical advances

Smart Manufacturing 2.0 Is Enabled by Internet 2.0

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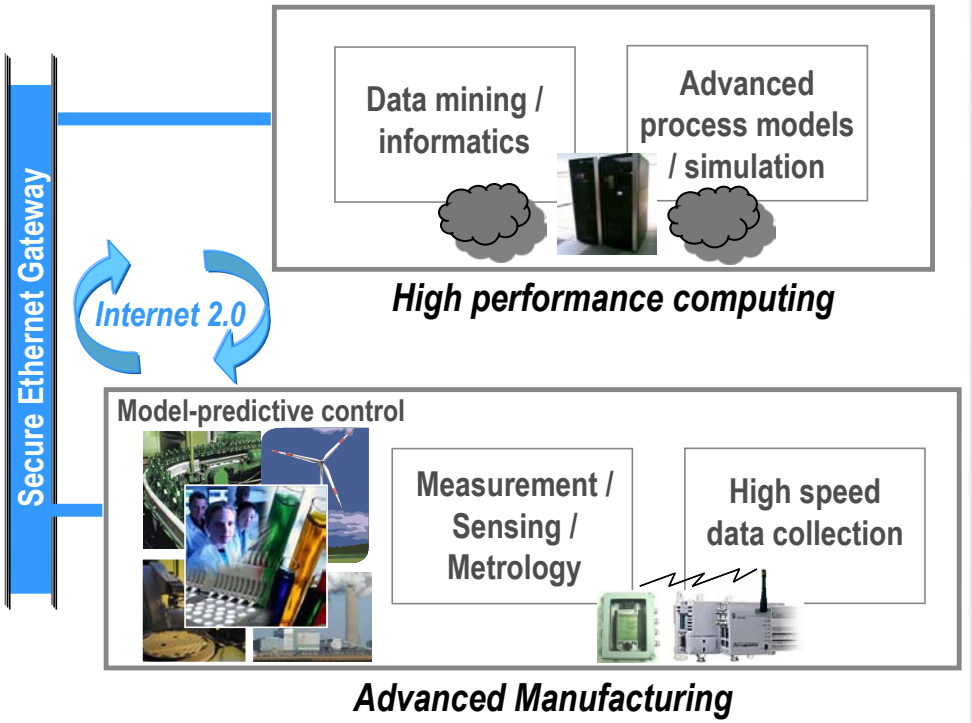
- IT-enabled, next generation manufacturing systems will utilize Internet 2.0 for optimization and control
  - High speed data collection, secure transmission, data mining
  - Advanced process models and simulation to optimize yield, sustainability (e.g., energy consumption)
- High performance computing platforms (e.g., cloud computing) connected to manufacturing enable use of advanced models and simulation for process control and scale-up of next generation nano / bio manufacturing systems



Internet 2.0 **links data** to Smart Manufacturing

Smart Grid Enables "Active" Industrial Energy Management

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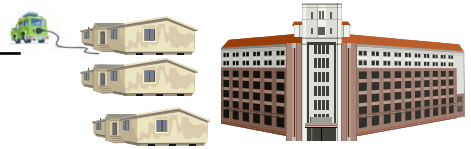
Generation | **Transmission** | **Distribution** | **Utilization**

Conventional: Coal, Nuclear, Oil / Gas, Hydro

Renewable: Solar, Wind

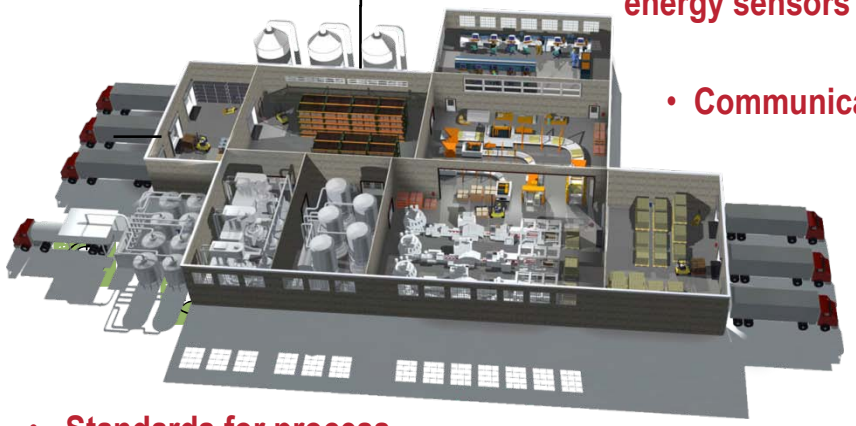
Smart Grid

Substation



Residential/Commercial

- **Econometric models**
- **Low-cost "embedded" energy sensors**
- **Communications**



- **Standards for process equipment energy**
- **Integrated control & energy mgmt.**

- **ACEEE estimates +2x energy savings**
- **Able to measure and manage carbon footprint per product line**

Transform factories from passive to active energy management

Summary – Challenges for Automation

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- Modern, smart factories will be interconnected with the supply chain, distribution, customers, and business systems
- Safety, security, reliability and robustness will become increasing important to ensure flexibility in a highly integrated environment
- Challenges:
  - Data to knowledge
  - Knowledge to operating models
  - Operating models as key plant assets
  - Models as key plant assets