Advanced Manufacturing Office

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Advanced Sensors, Controls and Platforms for Manufacturing (ASCPM)

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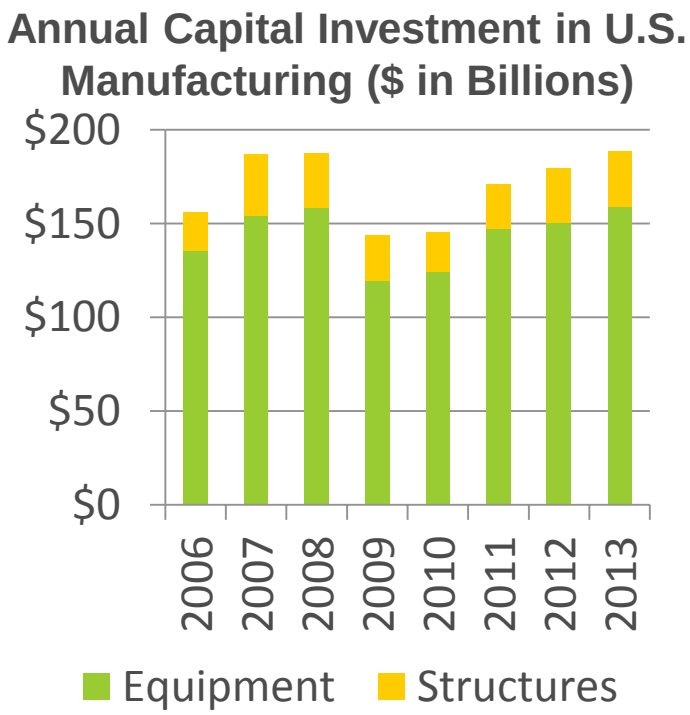
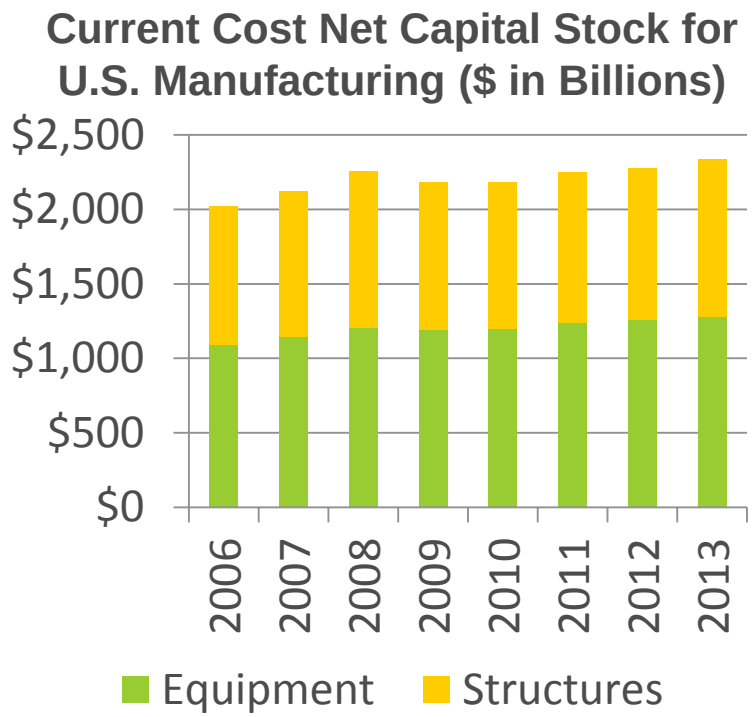
U.S. Manufacturing Represents a Huge Asset Base

A tremendous amount of investment has already been made and continues to be made in the U.S. manufacturing sector:

- Annual investment in capital equipment currently exceeds $150 billion
- Current cost value of existing capital equipment and structures exceeds $2 trillion
- Planned capital investments in the chemical industry alone due to expanding shale gas production are estimated to be over $100 billion





Sources: U.S. Bureau of Economic Analysis.
Fixed Asset Account Tables 3.1E and 3.1S. http://www.bea.gov/iTable/index_FA.cfm
American Chemistry Council press release, February 20, 2014.

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Manufacturing Requires Significant Capital Investments

Large greenfield manufacturing plants and major plant expansions are expensive. Recent and planned investments include:

Firm	Purpose	Cost
ExxonMobil	1.5 million tonne/year ethylene plant expansion, Baytown, TX	~$2 billion
Nucor	2.5 million tonne/year direct reduced iron plant, Convent, LA (with expansion potential to 5.5 million tonne/year)	~$750 million (~$3 billion)
Mesabi Nugget	0.45 million tonne/year iron nugget plant, Hoyt Lakes, MN	~$265 million
Dyno Nobel	0.8 million tonne/year ammonia plant, Waggaman, LA	~$850 million
Dow Chemical	0.75 million tonne/year propylene plant, Freeport, TX	~$2 billion
Holcim	4 million tonne/year cement plant, Ste. Genevieve, MO	~$1 billion
Intel	Chip fabrication plant, Hillsboro, OR	~$3 billion
Tesla Motors	Advanced battery “Gigifactory,” Carson City, NV	~$5 billion

Once operational, these plants become iconic landmarks for decades

Opportunity to Optimize Manufacturing Efficiency and Competitiveness Through Advanced IT and Smart Use of Data

THE SITUATION

- Existing plants: relatively slow to turn over major equipment due to large investments in physical production facilities.
- New plants: likely to deploy state of the art process technology but may lack the common IT infrastructure for optimal design and interconnectivity.

THE CHALLENGE

- Existing plants: How do we optimize performance given the predominance of long-life, multi-generation, legacy equipment?
- New plants: How can we impact efficiency and performance of newer plants going forward?

THE OPPORTUNITY

- Advancements in information technologies, data analytics, and HPC modeling to provide unprecedented capabilities at an economical level.

The White House Advanced Manufacturing Partnership (AMP) Addresses the Need for Manufacturing Efficiency

- Building on White House-led efforts initiated in 2011, AMP "2.0" is a renewed, cross-sector, national effort to secure US leadership in emerging technologies that will create high-quality manufacturing jobs and enhance America's global competitiveness.
- The AMP 2.0 Steering Committee includes CEO's from leading manufacturing firms, university and college presidents, and labor leaders.
- ***Advanced Sensing, Controls & Platforms for Manufacturing (ASCPM) was established as a high priority AMP Manufacturing Technology Area.***
- An ASCPM work team was formed, with the following objectives:
  - Identify technical gaps and implementation barriers that limit development, scale-up, and adoption of ASCPM technologies
  - Provide recommendations for addressing the gaps and barriers (summary report forthcoming)
- The ASCPM work team included subject matter experts from industry, academia, and government

ENSURING AMERICAN LEADERSHIP IN ADVANCED MANUFACTURING

For more information about AMP, visit http://www.manufacturing.gov/amp.html

What is ASCPM?

Advanced networked systems that combine sensors, data, models, and algorithms to improve efficiency, process flows, and product quality across interconnected new and legacy equipment – highly interoperable, smart systems for manufacturing.

Visionary Goals*

- Seamless interoperation of manufacturing automation equipment from different vendors allowing plug-and-play configurations
- Energy use and waste streams per unit output from manufacturing plants are reduced by 20% to 50%
- Deployment cost of sensors fall by an order of magnitude
- Real-time optimization and control to adapt to changes in feedstock, market demands and plant performance

* Based on AMP work team report

Essential Technologies & Key Features

- Affordable Industrial Data Collection & Management System
  - Resilient Wireless Sensors, Low Cost Networked Sensors
  - Noninvasive Real-time Measurement Solutions
- Standardized IT Platform
  - Data Interoperability
  - Multi-scale Dynamic Modeling & Simulation
- Enterprise Wide Integration: Business Systems, Manufacturing Plants & Suppliers
  - Open Standards
  - Standard Interface
  - Process Models

AMP ASCPM Work Team Recommendations (Partial List*)

- Form a coordinating committee to:
  - Develop and implement interoperability standards and protocols for key systems with vendor support
  - Develop new methods for addressing industry standards
- Support public-private cost-shared R&D to:
  - Accelerate the development and implementation of ASCPM technologies, including scalable market-driven models for decision-making
- Enable demonstration and implementation capabilities to:
  - Focus on ASCPM needs and demands of individual sectors
  - Reduce implementation risk of available technologies by providing physical and user centers virtual test beds
  - Provide ASCPM technology evaluation, development, demonstration, and customization services, in collaboration with vendors
  - Demonstrate use of and offer 'platform' services such as Manufacturing Software Cloud

* Based on AMP work team report

Session Purpose: Obtain Input for ASCPM PPP

Workshop Session Purpose:

- Identify challenges associated with ASCPM technology which may be overcome via a Clean Energy Manufacturing Innovation Institute concept, or other means

Clean Energy Manufacturing Innovation Institute Concept:

- Support shared RD&D infrastructure with affordable access to reduce cost, risk and technical challenges of scale-up
- Provide capabilities for collaborations in open, pre-competitive work
- Define structures and strategies for a wide range of stakeholder participation, particularly small and medium sized enterprises
- Establish a technical education and workforce development plan to support technology expansion
- Leverage existing private and public sector resources to maximize benefits and speed commercialization
- Become a financially self-sustaining , world-leading innovation hub

Facilitated Breakout Session Specifics

Specific Discussions to Focus on:

- Technology Needs, Barriers, & Challenges
- Implementation & Deployment Challenges
- Goals and Metrics
  - E.g, Measurement for operational and cost benefits, energy reduction, productivity, economic/GDP impacts
- R&D Priorities
  - E.g., IT infrastructure, sensors, HiFi modeling & simulation, data security
- Vision for an ASCPM Institute under a Public-Private-Partnership (PPP) framework
- R&D opportunities best addressed by other means (e.g. traditional R&D PPP)

While keeping in mind DOE/EERE guiding questions

- **Impact**: Will the developed technologies make material contributions toward national energy goals?
- **Additionality**: Will EERE funding make a significant difference relative to private sector investment?
- **Openness**: Is the focus on the broad problem with openness to new ideas?
- **Enduring Economic Benefit**: Will the developed technologies result in long-term economic benefits?
- **Proper Role of Government**: Is this a proper role for government?