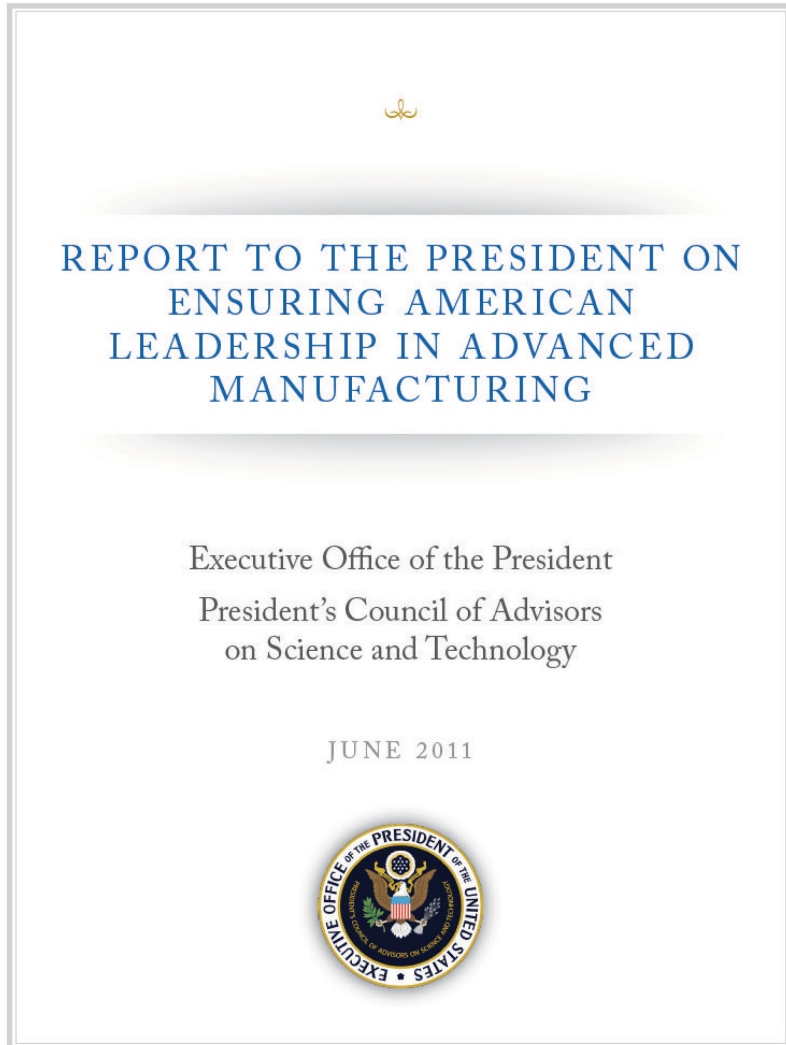


Capturing Domestic Competitive Advantage in Advanced Manufacturing

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Martin Schmidt-MIT

Why Should We Care?



U.S. should strive to revitalize advanced manufacturing because:

- **Jobs:** Manufacturing provides high-quality, good-paying jobs for American workers.
- **Innovation:** By keeping manufacturing local, design, engineering, scale-up, and production processes feed back on the conception and innovation sectors to generate new ideas and novel second- and third-generation products.
- **Security:** *Domestic manufacturing capabilities using advanced technologies and techniques are vital to maintaining national security and critical resources.*

Advanced Manufacturing: What is it?

Advanced Manufacturing involves the manufacture of conventional or novel products through processes that depend on the coordination of information, automation, computation, software, sensing, and networking, and/or make use of cutting edge materials and emerging scientific capabilities.

– From PCAST REPORT

Advanced Manufacturing

AMP Mission Statement

The Advanced Manufacturing Partnership identifies collaborative opportunities between industry, academia and government that will catalyze development and investment in emerging technologies, policies, and partnerships with the potential to transform and reinvigorate advanced manufacturing in the U.S.



AMP Outcomes

1. Develop a permanent model for evaluating, prioritizing, and recommending federal investments in advanced manufacturing technologies
2. Recommend a set of 'partnership projects', focused on advancing high-impact technologies and creating models for collaboration that encompass technology development, innovation infrastructure, and workforce development
3. Provide recommendations to the Administration on the actions required to support investment in advanced manufacturing in the U.S.

AMP Steering Team

Industry	University	Government
Allegheny Technologies	University of California, Berkeley	OSTP
Caterpillar	Carnegie Mellon	Department of Commerce
Corning Glass	Georgia Tech	Department of Defense
Dow Chemical	MIT	Department of Education
Ford	University of Michigan	Department of Energy
Honeywell	Stanford	Department of Labor
Intel		National Economic Council
Johnson & Johnson		National Science Foundation
Northrop Grumman		
P&G		
Stryker		
United Technologies		

Advanced Manufacturing Work Stream Objectives

Work Stream	Objectives
<i>Technology Development</i>	<ul style="list-style-type: none">• Determine a permanent mechanism to be used for identifying and developing key manufacturing technologies• Determine a set of top technology areas that would ensure U.S. manufacturing competitiveness
<i>Shared Infrastructure & Facilities</i>	<ul style="list-style-type: none">• Assess opportunities to de-risk, scale-up and lower the cost of accelerating technology from research to production through unique capabilities and facilities that serve all U.S. based manufacturers, in particular small and medium sized manufacturers
<i>Education & Workforce Development</i>	<ul style="list-style-type: none">• Identify tangible actions that AMP can implement to support a robust supply of talented individuals to provide human capital to companies interested in investing in advanced manufacturing activities in the U.S.
<i>Policy</i>	<ul style="list-style-type: none">• Make recommendations to the Administration on economic and innovation policies that can directly impact the overall climate and the ability to improve research collaboration and the pathway to commercialization in support of U.S. based manufacturing and jobs
<i>Outreach</i>	<ul style="list-style-type: none">• Conduct stakeholder outreach and reviews• Conduct & consolidate findings of regional meetings

AMP in Action

- **Four Regional Meetings**
 - ~ 1200 attendees
- **Work Stream Outreach**
 - Surveys through NAM, NCMS, MAPI and APLU
 - Interviews with leaders at Department of Labor, SBA, Veterans Associations, Community Colleges, Manufacturing Institutes, and Technical, Education, Labor & Policy Subject Matter Experts
- **Targeted Outreach**
 - Trade Groups: NAM, Sematech, US Chamber of Commerce, NCMS
 - Capitol Hill: Ryan & Manzullo of House Manufacturing Caucus, House & Senate Committee Staffs
 - Agencies: DOE, DOD, NSF, DOL

AMP 'Top Line' Recommendations

<http://www.whitehouse.gov/administration/eop/ostp/pcast>

- **Enabling Innovation**

- Establish a National Advanced Manufacturing Strategy
- Increase R&D Funding in Top Cross-Cutting Technologies
- Establish a National Network of Manufacturing Innovation Institutes
- Enhance Industry/University Collaboration in Advanced Manufacturing Research
- Foster a Robust Environment for Commercialization of Advanced Manufacturing Technologies
- Establish a National Advanced Manufacturing Portal

- **Securing the Talent Pipeline**

- Correct Public Misconceptions about Manufacturing
- Tap the Talent Pool of Returning Veterans
- Invest in Community College Level Education
- Develop Partnerships to Provide Skills Certifications and Accreditation
- Enhance Advanced Manufacturing University Programs
- Launch Advanced Manufacturing Leadership Fellowships & Internships

- **Improving the Business Climate**

- Enact Tax Reform, Streamline Regulatory Policy, Improve Trade Policy; Energy Strategy

Permanent Mechanism: The Technology Lifecycle Process

Create National Strategy & Objectives

- Prioritized list of strategic needs and required technologies

Create Technology Roadmaps

- Technology roadmaps for each of the prioritized technologies

Create and Manage Programs

- Technology programs established & executed

Review Progress and Correct Course

- Periodic review of program portfolio by key stakeholders

Framework for Identifying, Prioritizing, and Developing US Advanced Manufacturing Technologies

Recommended Criteria for Assessing & Prioritizing

➤ National Strategic Needs

- Defense Security
- Energy Security
- Food Security
- Health Security
- Homeland Security
- Economic Security

The significance of national need, size of global market opportunity & state of technology readiness determines the scale & role of Industry-Academia-Government partnerships

➤ Global Market Demand

➤ US Industry Competitiveness

➤ Technology Readiness

Framework for Nurturing and Developing Technologies

USA National Strategic Needs	Global Market Demand	USA Industry Maturity/Competitiveness	Global Tech Readiness	Implication	Technology Required to Drive USA Competitiveness	Role of USA Government	Role of Industry	Role of University
High	High	Low	Low	Greenfield opportunities. New technology & infrastructure required. Need to forecast economic competitiveness.	Basic Research	Government demand drives fundamental research & infrastructure build	Partner with national labs & universities to conduct basic & applied R&D & establish required infrastructure	Conduct basic research
High	High	Low	High	Situation only exists if US not global leader, e.g., energy storage & power electronics.	Applied R&D; Breakthrough Technologies	Government demand drives infrastructure build & incentives	Establish globally competitive infrastructure. Conduct breakthrough R&D to establish global leadership.	Develop breakthrough technologies
High	High	High	Low	Consortium lead roadmapping	Basic Research	Government demand drives research & incentives, e.g., energy efficiency	Industry defines roadmaps, develops technologies and establishes infrastructure.	Conduct basic research
High	High	High	High	Research is driven by industry based on government demand	Applied R&D	Government demand drives future requirements	Leads research & infrastructure build	Participate in applied research
High	Low	Low	Low	Government roadmap drives research and infrastructure investment	Basic Research Required	Government demand drives research	Establish infrastructure to demonstrate technology & meet national demand	Conduct basic research
High	Low	Low	High	Not Applicable				
High	Low	High	Low	Government roadmap drives research and infrastructure investment	Basic Research Required	Government demand drives infrastructure build & incentives	Establish infrastructure to meet national demand	Conduct basic research
High	Low	High	High	Government roadmap drives future infrastructure investment	Infrastructure Investment	Government demand drives infrastructure build & incentives	Establish infrastructure to meet national demand	

National Advanced Manufacturing Strategy

Need:

- Establish US as global advanced manufacturing leader

Recommendation:

- Establish 5 year National Advanced Manufacturing Strategic Plan
- Utilize to prioritize technologies, programs & public-private partnership investments

Who:

- Advanced Manufacturing National Program Office coordinates and aligns interagency programs
- Industry+University+Government Agency partner to develop, manage & execute the plan

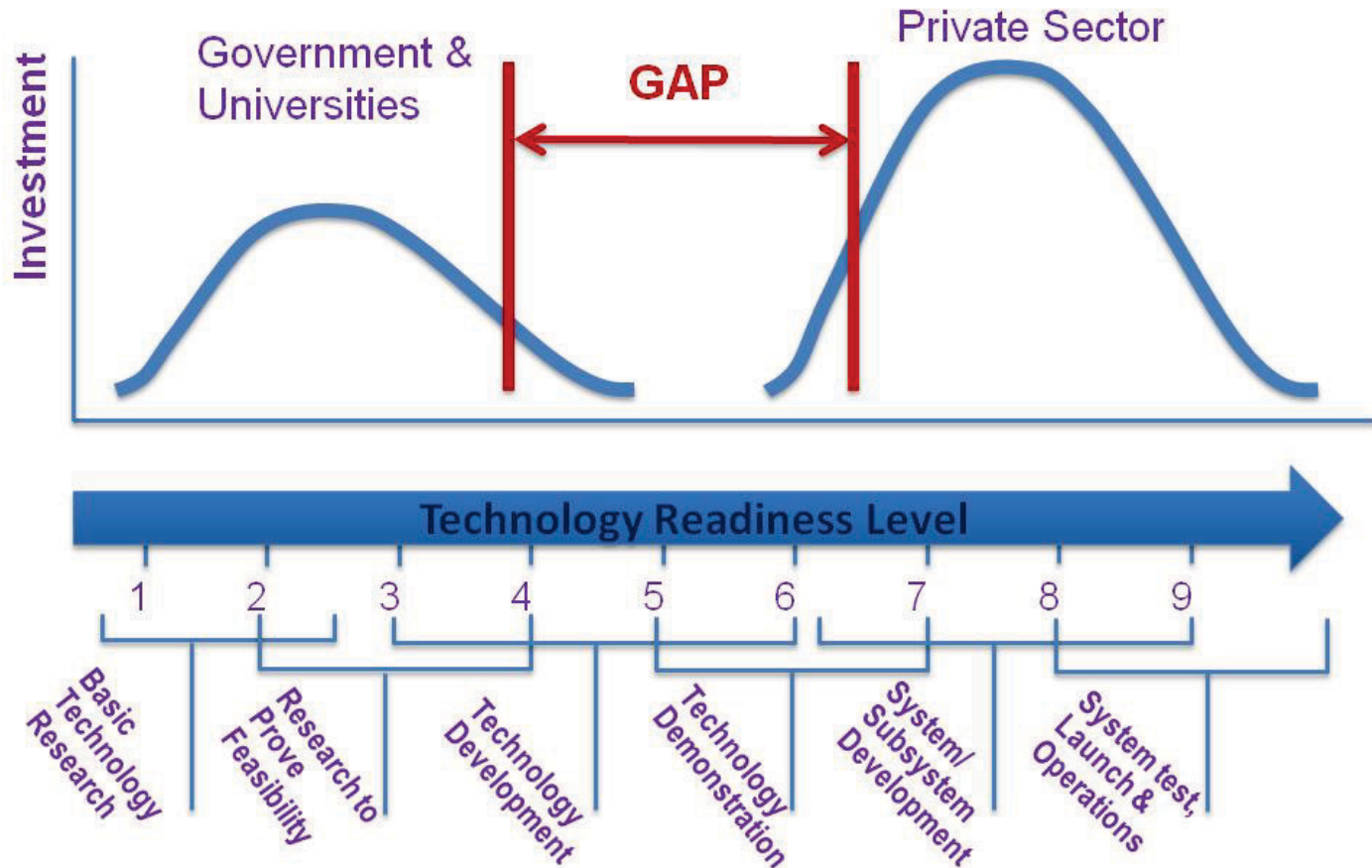
Top Cross-Cutting Technologies

Establish partnerships in top cross-cutting technologies:

- Additive Manufacturing
- Advanced Forming and Joining Technologies
- Advanced Materials Design, Synthesis and Processing
- Advanced Sensing, Measurement, & Process Control
- Visualization, Informatics and Digital Manufacturing Technologies
- Sustainable Manufacturing
- Nano-Manufacturing
- Flexible Electronics Manufacturing
- Bio Manufacturing and Bioinformatics
- Advanced Manufacturing & Testing Equipment
- Industrial Robotics

Filling the Gap

Gap in Manufacturing Innovation



Manufacturing Innovation Institutes

Need:

- Expedite filling existing technology and workforce development gaps through network of shared facilities

Recommendation:

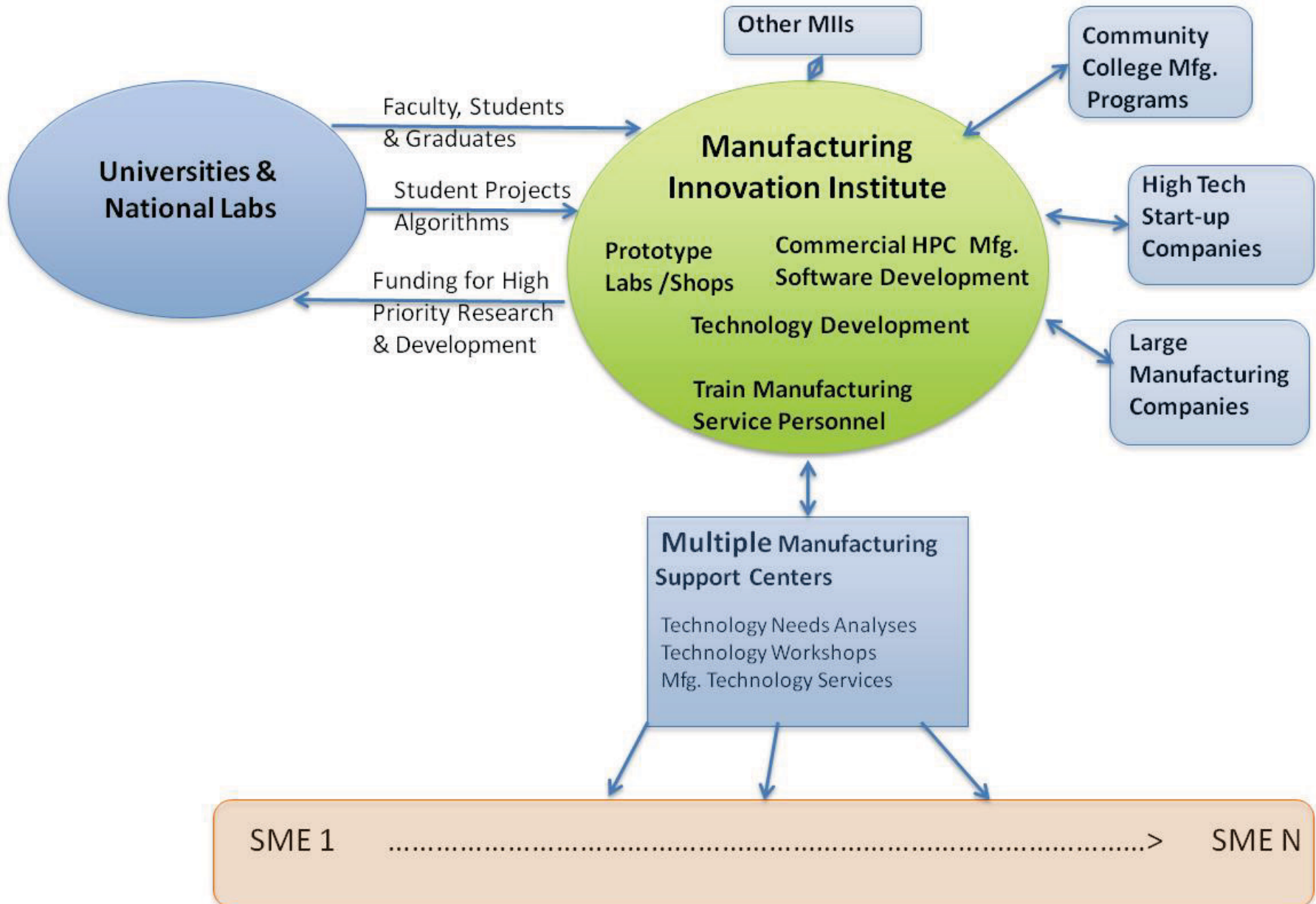
- Establish a network of Manufacturing Innovation Institutes

Who:

- Federal, State and Regional Agencies Sponsor
- Industry-University- Community Colleges Manage & Lead
- Advanced Manufacturing National Program Office coordinates

Enabling Innovation

Manufacturing Innovation Institutes



Additive Manufacturing Innovation Institute



Energy Department's Assistant Secretary David Danielson announcing the selection of the National Institute for Additive Manufacturing in Youngstown, Ohio. *Photo credit: Advanced Manufacturing National Program Office (AMNPO)*

\$30 MM Federal + \$40 MM Partners

- 40 Companies
- 9 Universities
- 5 Community Colleges
- 11 Non-Profits

Waiver or Exception to Revenue Procedure 2007-47

Need:

- To modify tax policies which prohibit greater industry investment & partnership with nations top universities

Recommendation:

- Create Waiver or Exception to Revenue Procedure 2007-47 to remove the cap on private use activities in buildings constructed with tax exempt bonds for activities specifically related to industry research collaborations and supporting dynamic research partnerships between industry and university startups.

Who:

- Department of Commerce
- Department of Treasury

Policy to Enhance University-Industry Partnerships

Need:

- Foster more robust environment for access to capital & commercialization of Advanced Manufacturing Technologies

Recommendation:

- Create new section of SBA Small Business Innovation Research Program to support early stage funding activities
- Extend nation-wide work of NSF created 501(c)3 Innovation Accelerator to support startups emerging from federal advanced manufacturing programs
- Clear pathway from startup to pilot scale production by greater interagency coordination & procurement
- Incorporate manufacturing impact measures into annual performance reports issued by Association of University Technical Managers

Who:

- Small Business Administration
- NSF and Advanced Manufacturing Interagency Representatives
- University Tech Transfer Offices

National Manufacturing Portal

Need:

- Easy, user friendly portal connecting SME's to national network of Advanced Manufacturing resources

Recommendation:

- Create National Manufacturing On-Line Portal

Who:

- NIST or MEP coordinate
- Agencies & Public Funded Laboratories & Universities populate

Securing the Talent Pipeline

- **Image of Manufacturing: Ad Council Campaign**
 - A national campaign with local flavor to correct public's misconceptions from "Dull, Dirty & Dangerous" to "Exciting, Engaging, Essential & Environmentally Sustainable"
- **Tap the Talent Pool of Returning Veterans**
 - Use the TAP program to educate veterans about the career possibilities
- **Invest in Community Colleges**
 - Standardized national curricula with project-based learning, internships and apprenticeships. Use partnerships with industry to achieve maximum results
- **Adopt Stackable Credentials**
 - Adapted to life-long learning, these credentials give employers a sense of the candidates' competencies & are recognized nationally.
- **Improve University Programs**
 - Engage ABET & Universities to add manufacturing content to engineering programs and create new degrees at BS, MS, and PhD levels
- **National Manufacturing Fellowships & Interns**
 - Establish coordinated interagency fellowship program

Improving the Business Climate

1. Tax Reform

- Strengthen & Make Permanent R&D Tax Credits
- Lower corporate tax rate to bring it line with other advanced economies
- Create an internationally competitive corporate tax system

2. Smarter Regulations

- Early Engagement & Better Cost-Benefit Analyses using Best Available Science & International Best Practice

3. Trade Policy

- Focus on non-tariff barriers and export control standardization

4. Energy Policy

- Focus on energy efficiency & conservation
- Increase and diversify domestic supplies
- Speed the development of cost competitive, renewable sources of energy
- Transition to low carbon economy

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Advanced Manufacturing Summary

- AMP recommendations aim to re-invent manufacturing in a way that ensures our competitiveness, feeds our innovation economy & grows a robust domestic manufacturing base.
- The recommendations focus on our future & the opportunity to lead the world in new disruptive advanced manufacturing technologies which are changing the face of manufacturing and in which the inherent strengths of US's innovation economy can be brought to bear to create new opportunities for making things in America.
- We—industry, academia, communities and Federal, State & Local governments—must unite to ignite our ingenuity to make it in America.