Breakout Session: Energy, Water, and Materials Management for Sustainable Manufacturing

Focus Question #1: VISION AND GOALS

- Develop <u>technologies</u> that reduce life cycle energy, water, materials and carbon intensity by an order of magnitude, that can lead to:

  - 1% or greater impact on US energy consumption

  - associated GHG emissions reductions

  - reduction of U.S. water <u>consumption</u> by 20%

- Develop technologies/processes to significantly increase material reuse and recoverability

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Focus Question #2: CHALLENGES

- Lack of <u>data analytic approaches</u> for use of sensing/information

- Lack of expert systems to analyze and process data

- Disparity—across industry—in data and associated tools

- Lack of <u>cost effective manufacturing processes</u> to allow for optimized design to minimize material use

- Lack of adaptive, reactive technologies

- Lack of understanding the coupling among materials, energy, and water uses

- Balancing trade offs between lifecycle material and energy use

- Principal agent problem → manufacturer may not care about down-stream materials and energy use issues

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Focus Question #3: R&D NEEDS

Process innovation

- Modular, feasible, distributed manufacturing approaches for sustainable manufacturing
- Innovative material synthesis technologies to reduce water, energy, and waste simultaneously

Product Innovation

- Recycle friendly alloys (and other materials like polymers, composites, etc.)
- Methods to better utilize/enable use of post consumer materials

Data & Analytics

- Develop metrics and functional relationships among water, energy and materials attributes
- "Big data" approaches for accessing/analyzing data across the life cycle – connecting each step of the supply chain

Sustainable manufacturing design tools

- Integrated life cycle design tools and databases with decision-support systems
- Design tools that consider sustainability parameters

Worksheet: R&D Focus Areas

- Design concepts and tools for sustainable manufacturing
- Innovative Processes and Products to support sustainable manufacturing (incl. appropriate data)