Assessing Resource Consumption Flows Through Manufacturing Process Chains

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Industry Drivers
- Cost reduction
- Operational efficiency
- Corporate responsibility
- Stakeholder expectations
- Market competitiveness

Potential for Improvement
A considerable part of the energy and resource demand in manufacturing is determined during the production planning process.

Greatest influence and savings potential is located in the early phases of the production planning process (Schems 2011)

Process Chain Selection
- Production costs
- Cycle times
- Quality
- Efficiency
- Customer Demand & Capacity
- Appropriate Technology

Process Chain Analysis
- Energy
- Water
- Consumables
- Materials
- Waste
- Emissions
- Resource Consumption & Cost

Environmental & Economic Impacts
- Resource Consumption
  - Energy use (kWh)
  - Water use (gal)
  - Tooling & Consumables (kg, ft, or m)
  - Waste generated (kg)
  - Air Emissions (g)
- Impacts
  - Global warming potential (CO2eq)
  - Energy cost ($)
  - Water cost ($)
  - Consumables ($) (5)
  - Disposal fees ($)
  - Landfill
  - Recycling

Summary & Future Work
Summary
- Track (all flows) EVERYTHING!!!
- Ability to characterize the resource consumption and environmental impacts of fabrication process chains
- Can be integrated into other models/tools to help provide decision making support for selecting fabrication process chains based on resource consumption and environmental and economic impacts

Future Work
- Further refinement of the model -- data!
- Integrating interdependencies -- upstream/downstream effects
- Automated vs. manual labor
- Expanding model to include additional processes