

# **Pilot Research Study**

## **Product Lifecycle Management in Support of Green Manufacturing: Addressing the Challenges of Global Climate Change**

### **Module 16**

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# Introduction

- Rapid consumption of natural resources and growing interest in global warming [15] have motivated companies to change manufacturing strategies.
- The result is a desire to move from traditional manufacturing to green manufacturing.
- This research focuses on how PLM supports green manufacturing.

# Research Questions

- Why green manufacturing processes are beneficial and which green activities are in place
- Summary of financial impacts, sustainability practices and regulations and policies
- Argument of how PLM can support green manufacturing and offers examples of how green manufacturing can be integrated into PLM processes

# Methodology of Study

- Six companies were selected from the Global Round Table on Climate Change (GRTCC):
  - Florida Power and Light (FPL) Group
  - DuPont
  - General Electric (GE)
  - Toyota
  - Bayer
  - The Dow Chemical Company

# Background Information

- Green Manufacturing
  - Methods that minimize waste and pollution during product design and production
- Environmental Regulations
  - Standards adopted by sampled companies
  - Their influence on production and business practices
- Product Lifecycle Management (PLM)
  - It's role as a key component in reducing the use of materials and energy

# Financial Impact

- Competition is crucial in the globalized market of consumers' products [16].
- Two of the biggest benefits for a company to pursue green manufacturing:
  - Cost Savings
  - Production Increase
  - Time, Energy and Materials

# Current Sustainable Practices

An analysis of our companies' current sustainability practices was performed and includes the following elements:

- Recycling and Disposal
- Energy Consumption
- Water and Air Management
- Products and Processes

# Recycling and Disposal

Companies	Recycling			Disposal
	Fuel	Plastics	Copper	
FPL	X			
DuPont		X	X	
GE				
Toyota	X			X
Bayer				hazardous waste
Dow		X		chemicals

*Table 1. Recycling and Disposal. This table indicates the presence of recycling activities and active green disposal practices.*

- Product take-back legislation in Europe and current directives in the U.S. have forced companies to think differently.
- Companies must dispose their products through efficient recycling, disassembly, and reuse.

# Energy Consumption

- The electricity industry is the single largest source of industrial pollution in the world, and one of the largest sources of greenhouse gas emissions [20].
- As a result, energy consumption is clearly important in green manufacturing.

# Energy Consumption

Companies	Energy			
	Wind generator	Landfill Gas	Conserv.	Reduction in Use
FPL	X	X	X	X
DuPont				
GE		X		
Toyota				
Bayer			X	
Dow				X

*Table 2. Energy Consumption. This table indicates energy sources used and green practices are active.*

- Half of the energy FLP produces comes from natural gas and only 10% comes from oil
- GE has developed engines that use alternative energy from landfill gases
- Bayer has developed a project that extracts bio-gas from sludge for energy generation
- Dow Chemical's current goal is a 20% reduction in the energy needed to fabricate a pound of product

# Water and Air Management

Companies	Water			Air
	Conserv.	Reuse	Recycle/ Treat	Lower emissions
FPL				X
DuPont	X			X
GE		X		
Toyota	X			X
Bayer	X			lower green house gases
Dow	reduce waste water		X	lower green house gases

*Table 3. Water and Air Management. This table indicates green activities in water/air management.*

- DuPont is committed to reduce water by at least 30% over the next ten years at global sites
- GE's improved membrane configurations have revitalized its water reuse and purification system
- Toyota's "green" complex conserves more than 11 million gallons of drinking water annually

# Products and Processes

Companies	Product/Processes		
	Energy efficient	Fuel efficient	Operational Efficient
FPL			
DuPont	X	X	
GE	X	X	X
Toyota		X	X
Bayer	X		X (info availability)
Dow	X		

*Table 4. Products and Processes. This table indicates which companies have active green products and operational processes.*

- Companies have products and processes with environmentally friendly characteristics.
- Converting to more climate-friendly technologies.

# Regulations and Policies

- Companies are seeking to improve environmental performance in order to join consortia, associations, and projects and to comply with environmental regulations [7].
- Internal and external factors influence companies to follow environmentally friendly standards.
- Examples include: SOX, RoHS, WEEE, ELV, ISO

# Product Lifecycle Management

- Green manufacturing requires changing entire process.
- The PLM information core supports green manufacturing strategic initiatives.
- PLM and green manufacturing both work to conserve time, money, and energy.
- Information on product design and material make-up is vital for the recycle and disposal phase.



- Data and design accessibility
- Library of green directives and legal issues
- Facility-layouts
- Knowledge of existing equipment
- Warranty information
- Hiring practices
- Product performance
- Distribution

# Observations and Conclusions

- Green manufacturing changes are not easy and they may not represent an economic benefit in the beginning.
- However our research shows they do represent a good long-term investment
  - Cost Savings
  - Increase in Production
  - Competitive advantage

# Observations and Conclusions

- From the study, the following observations about studied companies and PLM were made:
  - **FLP** is engaged in substantial green energy efforts
  - **DuPont** has committed to increase revenues with energy efficient processes by 2015
  - **GE's** Ecomagination program has led to the development of green products and processes
  - Many of **Toyota's** goals have been reached due to their global earth charter.
  - **Dow** implemented energy efficient processes, recycling and waste water reduction programs, and lowered green house gas emissions.
  - **Bayer's** goals include efficient resource management and future-oriented climate protection activities.

# Observations and Conclusions

- Similarities between green manufacturing and PLM affirm the relationship and support the trend towards green manufacturing.
  - PLM and green manufacturing look for the conservation of resources and reduction of waste.
- Environmentally-friendly practices seen in the studied companies indicate green manufacturing is already very actively pursued.
- To compete in a global world *and* to comply with environmental protection regulations and standards is not easy.
- Information core of PLM cycle helps to lessen this burden by capturing information and storing it for use by all stages of a product's life.

# Limitations and Future Work

- Data comes only from published material.
- Next step, interview company representatives for additional details.
- More companies should be considered and divided according to production methods, ecological practices, and/or products.

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