Low Carbon Manufacturing
A Systematic Energy Approach to making Workspaces "Greenspaces"

Mike Molnar
5 May 2010
Diversified Global Company

Components
- Turbochargers
- Filtration
- Emissions
- Fuel Systems

Engines

Distribution

Power Generation
Global Revenue 2009: $10.8B

- US/Canada: 44%
- EMEA: 24%
- Asia Pacific: 10%
- China: 6%
- India: 5%
- Latin America + Mexico: 11%
- Asia Pacific: 10%
Global Footprint
Over 35,000 employees in 131 countries.
Climate Change??

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF₆)

Carbon Sequestration

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF₆)

80% Reduction by 2050

United Nations Framework Convention on Climate Change

Cradle to Grave

1,428 page US House Bill
923 page US Senate Bill
AB32

Anthropogenic

Global Warming Potential
Low Carbon Energy Efficiency Facilities

- Commit
- Plan
- Manage
- Improve
Our Vision / Mission

Vision

 Making people’s lives better by unleashing the Power of Cummins.

Mission

 Demanding that everything we do leads to a cleaner, healthier, safer environment.

 Motivating people to act like owners working together.

 Exceeding customers expectations by always being the first to market with the best products.

 Partnering with our customers to make sure they succeed.

 Creating wealth for all stakeholders.

 Making people’s lives better by unleashing the Power of Cummins.
Recognition of Environmental Stewardship
GHG Reduction Goal Setting

- Measure what we had already accomplished
  - 2.3% absolute and 20% intensity reduction 2000-2005

- Set competitive goal
  - A goal that is competitive among peers
  - Cummins enjoying strong growth, elected an intensity metric to focus on sustainable growth

- First public commitment
  - 25% intensity reduction from 2005 baseline by 2010
Energy Focus

Cummins Baseline (2005 Footprint)

- Electricity: 58%
- Stationary combustion: 22%
- Fugitive (SF6, CO2): 15%
- Mobile sources: 4%
- All Other: 1%

756,650 tCO2e
Business Case

Climate change initiatives position Cummins for sustainable success

It’s Good Business and the Right Thing to Do
- Business opportunities for Cummins and stakeholders
- Consistent with our commitment to be good environmental stewards

Energy Efficiency Drives Greenhouse Gas Reduction
- Energy efficiency also reduces operational costs
- Employee engagement is a key success factor

Our Customers Can Depend On Us
- Our customers expect innovative energy and environmental solutions
- We integrate with their operations and equipment to maximize efficiency
Low Carbon Energy Efficiency Facilities

- Commit
- Plan
- Manage
- Improve
Cummins Systematic GHG/EE Approach

Planning
1. Scenario
2. Business Case
3. Commitment
4. Baseline
5. Benchmark
6. Assessments

Managing
7. Leaders
8. Teams
9. Methods
10. Portfolio
11. Goals & Targets
12. Reporting

Improving
13. Capital Improvements
14. Operational Improvements
15. Education and Engagement
16. Sustainable Building Standards
Carbon Footprint Pareto

15 US sites account for ~ 2/3rds of total footprint (~ 400 sites)
Make GHG emissions visible – stress linkage to Energy Use

- Large office building - 1%
- Next 10 sites - 18%
- 189 other non dist sites - 14%
- 150 distributor sites - 5%
- Mfg site - 9% of total CMI
- Tech Center - 8% of total CMI
- Data Center - <1%
- Manufacturing
- Tech Center
- Data Center
- Office / Whse

15 US sites account for ~ 2/3rds of total footprint (~ 400 sites)
Assessing Opportunities By Intensity vs Energy Use

Energy Intensity (Use / size) →

High Intensity and Low Energy Use

High Intensity and High Energy Use

Low Intensity and Low Energy Use

Low Intensity and High Energy Use
Assessing Opportunities By Intensity vs Energy Use

- High Intensity and Low Energy Use
- Low Intensity and Low Energy Use
- High Intensity and High Energy Use
- Low Intensity and High Energy Use

25 priority sites for first wave of detailed EE assessments

Energy Intensity (Use/size) vs. Intensity (kW/H ft²)

- Manufacturing
- Tech Center
- Data Center
- Office / Whse
Reduction Opportunities Found

More than 500 technically viable capital projects defined at first 15 US sites

- Heating / Cooling: 36%
- Waste Heat: 23%
- Process Power: 12%
- Lighting: 10%
- Combustion: 8%
- Operations: 4%
- Water: 3%
- Building Envelope: 2%
- Powered Equipment: 2%
Low Carbon Energy Efficiency Facilities

- Commit
- Plan
- Manage
- Improve
Cummins Systematic GHG/EE Approach

**Planning**
1. Scenario
2. Business Case
3. Commitment
4. Baseline
5. Benchmark
6. Assessments

**Managing**
7. Leaders
8. Teams
9. Methods
10. Portfolio
11. Goals & Targets
12. Reporting

**Improving**
13. Capital Improvements
14. Operational Improvements
15. Education and Engagement
16. Sustainable Building Standards
Teamwork for Energy Efficiency

All capital projects are evaluated for energy efficiency and greenhouse gas reduction.

Energy Champions and the Health, Safety, Environment Council promote efficiency at site level.

EET provides program management, goal setting, activity tracking, and accountability to progress.

Cummins Facilities Council established to drive improvements and share best practices.
Financial Valuation and Prioritization

- Cummins pioneers “sustainable capital planning”
  - Standard capital evaluation tool has “Energy & Environment” section added
  - Calculates energy use, costs, and GHG footprint for every investment
  - Includes financial valuation for CO₂ impact

- Tool enables our prioritization of energy efficiency investments
  - Prioritize by IRR and GHG cost/benefit
  - Investment rule for % return, initial $ per annual CO₂
Data Mining Assessments for best environmental and financial results

- Tremendous opportunities for improvement found in energy efficiency
- “Balanced Scorecard” financial model with GHG metric produces clear total value return
- Prioritization based on both environmental and financial benefits – two minimum hurdles designed to meet our goals

All these projects meet our environmental and financial investment criteria

All these projects are priorities – offering superior environmental and financial benefits – do these first!
Example Site Energy Efficiency Assessment/Prioritization

- Identified energy efficiency capital projects by assessment team
- After further study, technically viable projects
- Meets corporate investment rule
- Reviewed and selected by plant for implementation wave

Positive financial return, meeting 25% reduction goal
Low Carbon Energy Efficiency Facilities

- Commit
- Plan
- Manage

- Improve
  - Capital Improvements
  - Operational Improvements via “Energy Champions”
  - New Building Standards for Sustainable Future Growth
Cummins Systematic GHG/EE Approach

Planning
1. Scenario
2. Business Case
3. Commitment
4. Baseline
5. Benchmark
6. Assessments

Managing
7. Leaders
8. Teams
9. Methods
10. Portfolio
11. Goals & Targets
12. Reporting

Improving
13. Capital Improvements
14. Operational Improvements
15. Education and Engagement
16. Sustainable Building Standards
Capital Project Example
High Efficiency Lighting

Fuel Systems Plant - Columbus Indiana

Former MH lighting replaced

New high efficiency lighting installed

Capital: $535k                      Annual Savings $343k            GHG avoided: 3,372t

Lighting is higher quality and brighter, uses “smart sensor”
Project replicated at 32 other sites
Example EE Projects

**Power Management**

**CFBU-Wautoma Filtration Plant, WI**

“Power Down” – natural gas oven usage optimization by employee awareness and change of start-up procedures

- Capital: $0
- Annual Savings: $38k
- NPV (n/m)
- IRR (n/m)
- GHG: 189t

**Lighting**

**FSBU-Fuel Systems Plant, IN**

“Shop Lighting Upgrade” - High efficiency fluorescent lighting with occupancy and daylight harvesting sensors

- Capital: $535k
- Annual Savings: $343k
- NPV: $907k
- IRR: 44%
- GHG: 3,372t

**Building Envelope**

**EBU-Darlington Engine Plant, UK**

“Airlock Doors” - high speed doors at Vantec gates to reduce heat loss at delivery times

- Capital: $44k
- Annual Savings: $16k
- NPV: $39k
- IRR: 39%
- GHG: 22t
Example EE Projects

**Building Envelope**

**CEP/LDD – Columbus IN**
“Ceiling Thermal Insulation” – Replace leaking single pane skylights with high efficiency double pane, first 100 of 800
Capital: $42k  Annual Savings $25k  NPV $97k  IRR 81%  GHG: 144t

**Machinery & Equipment**

**CFBU-Eastern Distribution Center, TN**
“Recirculation Fans” – Install massive low speed fans to equalize temperatures for reduced energy use
Capital: $111k  Annual Savings $129k  NPV $156k  IRR 86%  GHG: 413t

**CTT-Huddersfield, UK**
“Voltage Optimisation” – New technology power supplies reduces electrical consumption by 15-20% by balancing 3Φ load, filtering harmonics, and extending equipment life.
Capital: $498k  Annual Savings $262k  NPV $692k  IRR 41%  GHG: 758t
Example EE Projects

**Machinery & Equipment**

**CTT-Dewas, India**

“Compressor Booster unit” – Replacement of air compressor in QA lab with booster unit, eliminating the lab’s high pressure compressor. December 2008

Capital: $36k  Annual Savings $33k  NPV $90k  IRR 63%  GHG: 2,679t

**EBU-Columbus Engine Plant, IN**

“LDD Distributed Boilers” – Replace site main boiler with two small high efficiency boilers, infrastructure for LDD, February 2008

Capital: $420k  Annual Savings $370k  NPV $402k  IRR 27%  GHG: 2,120t

**CES-Mineral Point, WI**

“Welding Ventilation Improvement” – Central collection, filtering, and energy recovery from exhaust air, June 2008

Capital: $428k  Annual Savings $175k  NPV $288k  IRR 26%  GHG: 984t

**Fuel Usage**

**Energy Recovery**
Energy Efficiency Capital Project Results

GHG reductions 2006 through 2009
202 capital projects implemented
25 in process
Reduction of 219,812 tCO2e annually
$11M in annual savings

2010 Goal:
240 Energy Efficiency Capital Projects Completed
$15M+ annual savings in energy

EPA base year is 2005, 1/06 is start of our improvement commitment
Energy Efficiency Team established
Energy Champions Training Program Launched

Cummins Facilities Council established
EPA base year is 2005, 1/06 is start of our improvement commitment
Energy Efficiency Team established
Energy Champions Training Program Launched
2005 to 2009 Footprint by Source

2005
756,650 tCO2e

2009 est
595,948 tCO2e

- Electricity: 58%
- Stationary combustion: 22%
- Mobile sources: 4%
- All Other: 1%
- Fugitive SF6, CO2: 15%

- Electricity: 60%
- Stationary combustion: 30%
- Mobile sources: 9%
- All Other: 0.4%
- Fugitive SF6, CO2: 0.1%
Measurement of outputs - GHG RESULTS

- Actual GHG Emissions
- CMI Revenue (2005 constant $)
- Normalized GHG Emissions (intensity)
- Normalized Emissions Goal

Low Carbon Energy Efficiency Facilities

- Commit
- Plan
- Manage

- Improve
  - Capital Improvements
  - Operational Improvements via “Energy Champions”
  - New Building Standards for Sustainable Future Growth
GHG and Energy Training Strategy
Energy Champions & Leaders

**Energy Champion**
- one per site
  - Training
    - 5 Days – Centralized Group + Web
  - Lead EE at site
  - Coach/mentor ELs in local teams

**Energy Leaders**
- Area/shift based associates, 2-20 per site
  - 10 – one hour local weekly sessions
  - Team “starpoint” resource
  - Generate ideas
  - Implement power down

**Cummins Employees**
- All Cummins employees – info for their benefit at home, and at work
  - 4 Hours – Web
  - Generate Ideas
  - Act

**Commitment**
- Individual Actions-

**Impact $**
- Company Impact $
Energy Champions/Leaders Program
Operating our facilities for Energy Efficiency

One per Site
Coaching and
Project Focus

One in every
area/team at a Site
Operations
Improvement Focus

Every site can save at least 10% with low/no cost actions
~ $10M savings

2010 Goal:
100 Energy Champions trained
At least 20 sites with active Energy Leaders programs

Pilot Graduation Energy Leader Class
CIC/CKEC, January 2010
Building a Network of Energy Champions
Examples – “Make Energy Visible”

- **Lightswitch card**
  - Special Requirements for Shutdown
  - Turn off WITH CARE when not needed
  - Turn off when not needed
  - YES!! Turn it off
    - Left running this equipment has an annual resource footprint of:
      - $_______  ____ tons GHG

- **Printer sticker**
  - Please Consider the Environment Before Printing
  - Every Cummins employee reducing paper usage by just one page per workday saves over $466,000 per year and avoids 169 tons of greenhouse gases.
  - Doing More to Use Less.
Low Carbon Energy Efficiency Facilities

- Commit

- Plan

- Manage

- Improve
  - Capital Improvements
  - Operational Improvements via “Energy Champions”
  - New Building Standards for Sustainable Future Growth
New Building Standards for Sustainable Operations

- Cummins expected to return to significant worldwide growth
  - New facilities
  - Major renovation of existing facilities
- Team developing comprehensive worldwide building standards
  - Emphasis on lifecycle costs
  - “Olympic scorecard” approach
  - New facilities exceeding LEED basic
Example – recipient of inaugural “Chairman’s Award for Sustainable Building Practices”

First site built to new interim building standards with many sustainable and energy efficient features
Power Generation Plant, Ranjangaon, India

Green living roof and skylights over cafeteria

Green features to save additional 1,450 tCO2e, equivalent to removing 266 automobiles each year
## Facilities Standards Categories

<table>
<thead>
<tr>
<th>1) Business &amp; Construction Practices</th>
<th>3) Sustainable Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Selection &amp; Due Diligence</td>
<td>LEED and lifecycle criteria</td>
</tr>
<tr>
<td>Codes &amp; Standards</td>
<td>Energy Efficiency standards</td>
</tr>
<tr>
<td>Construction Site Procedures</td>
<td>Lighting systems</td>
</tr>
<tr>
<td>Documentation Standards and Document Retention</td>
<td>Heating, ventilating and Air Conditioning systems, indoor air quality</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2) Building Standards</th>
<th>4) Site, People, &amp; Equipment Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor and foundation</td>
<td>Sprinkler System</td>
</tr>
<tr>
<td>Roof</td>
<td>Security System</td>
</tr>
<tr>
<td>Wall and building structure</td>
<td>Safety Requirements</td>
</tr>
<tr>
<td>Windows, doors</td>
<td>Accessibility/ADA Requirements</td>
</tr>
<tr>
<td>Plumbing, piping</td>
<td>Water and waste treatment</td>
</tr>
</tbody>
</table>
Thank You!

Questions or Comments welcomed…

Mike Molnar
Director – Environmental Policy & Sustainable Development
mike.molnar@cummins.com