The Road Ahead: 
*Mid-Term Fuels...Delivering Value*

‘The Customer Always Wins!’

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Caterpillar Inc.

- AGENDA
  - Caterpillar Business Drivers
  - Energy Outlook
  - Selected Alternative Fuels
  - ‘Global’ Diesel
  - Questions

ERC Symposium 
June 2011
Caterpillar Powers World Progress

We help build roads, power engines, turn on lights, transport goods and provide financing to create lasting change.
Who We Are

- A Fortune 50 global enterprise
- 2010 sales and revenues of $42.5B
- Global team of more than 225,000 Caterpillar and Cat Dealer® employees
- Nearly 500 locations in 50 countries (manufacturing, marketing, logistics, service, R&D and dealer locations)
- Products at work in more than 180 countries around the world
What We Do

World’s largest manufacturer of construction and mining equipment

A leader in diesel and natural gas engines and industrial gas turbines
Investing in innovation

- $7M invested in R&D each working day in 2010
- 620 patents awarded to 750+ inventors in 2010
Caterpillar’s Legacy Platform

What has kept it alive?
Delivering Customer Value

1893 Diesel Patent
1931 Diesel Track Type Tractor
1955 Turbo Diesel
2004 ACERT®
2008+ System Integration
2011 Future
- Sustainability
- Alternative Fuels
- Globalization

Delivering Customer Value
Business Understanding Breeds Customer Value

The product development value stream
Voice of the Business

- Meet customer expectations
- Meet shareholder expectations
- Fulfill demands of growth markets
- Leverage technology and scale
- Meet regulatory requirements

Complex & Dynamic Marketplace

- Customers are global
- Design is regional
- Used equipment flows
- Global fuels
- Complex regulatory approvals

Caterpillar vertical integration is key
Voice of the Customer

- Technology
- Service
- Sustainability
- Versatility
- Cost
- Ease of Use

We Must Think Like our Customers
Voice of the Regulator…. *Today*

Trend: Lesser Regulated → Highly Regulated
Energy & Power Systems
- ‘Mid-Term’ Fuels -
Regulatory Transition to Near Zero NOx and PM

“…reconciles diesel technology with the environment.” (US EPA, March 2005)

Where we have been...
World-Wide Energy Demand Will Grow

- Global energy demand will increase by ~30% by 2030,
- Drives investment in both efficient systems & alternative fuels

Reference: Outlook For Energy: A View to 2030, ExxonMobil 2009
The Business of Sustainability

2020 Goals for Products, Services and Solutions

- Provide leadership in the safety of people in, on and around our products
- Reduce customer greenhouse gas emissions by 20%
- Increase customer energy efficiency by 20%
- Increase customer materials efficiency by 20%

Significant Global Impact.....Environment and Customers

- Hydraulic Excavators account for 50% of total fuel burned in Caterpillar machine business - Typical Customer Fuel Cost: ~$ 100k Per Year
- Mining Applications - Typical Customer Fuel Cost: ~$ 500k Per Year
Technology Trajectory...

ENERGY & SUSTAINABILITY

- Reduction in Carbon Footprint
  - 5 -10%
  - 10 -20%
  - 10 -30%
  - Up to 100%

- Zero Net Carbon Fuels
- Site Integration and Automation
- Machine Efficiency
- Energy
- Mobility
- Materials
- Technology

Caterpillar: Non-Confidential
Cat D7E Electric Drive Track Type Tractor

- 50% less operator noise
- 10% lower lifetime operating costs
- Grade Control Ready: AccuGrade™ from the factory
- Up to 50% longer life for the electric drive train
- 60% fewer moving parts in the electric drive train
- 50% better steering performance
- Easier to operate: No shifting, Low-effort controls
- Less fluids used
- 10% more material moved per hour
- 10% to 30% less fuel consumed per hour
- 25% more material moved per gallon of fuel
- Less down time: No engine belts
- 35% more visibility
- 50% less operator noise

Caterpillar: Non-Confidential
Technology Trajectory…

ENERGY & SUSTAINABILITY

Reduction in Carbon Footprint

Energy

Mobility

Materials

Development

Up to 100%

10 -30%

10 -20%

5 -10%

Zero Net Carbon Fuels

Site Integration and Automation

Machine Efficiency

Engine Efficiency

Energy

Mobility

Materials

Development
The Business Case for Alternative Fuels

Creates customer value
- Fuel usage per site is large
- Fuel burn per machine is high

Supports business objectives
- Machinery is used in a stable or only a few locations
- Alternative Fuel infrastructure can be implemented

Research Focus:
- Understand fuel characteristics
- Tailor reciprocating engines to burn different fuels
- Ensure the resultant products meet customer expectations and our commitment to sustainability.
We Must Match Technologies to Customer Value

...Around the World...

Challenge of the Future: Developing engines to meet global market needs

*Note: Cat Engines Compatible with B20 Biodiesel
Natural Gas Growth

Environmental pressures – lower GHG emissions
Economics – 2X to 8X advantage over diesel

2030 Forecast:
Natural Gas displaces coal as #2 source of energy worldwide

EIA Annual Energy Outlook - 2011

Price Ratio of Diesel to Natural Gas

Year


high oil prices
baseline
low oil prices
LNG Fueling

Current Diesel Fueling Model

- Diesel tank on truck
- On site storage
- Transport
- Crude Oil
- Refinery
- On site refueling

Future LNG Fueling Model

- LNG tanks with small diesel tank on truck
- On site storage
- Transport
- Natural Gas
- LNG Liquification
- On site refueling
Synthetic Gas Opportunity

Business Driver

- Fastest growing market
  - Low carbon energy
  - Renewable

- Increasing focus on green energy (dealer, customer, and competitor)

- Well-aligned with Caterpillar Gas Engine Products

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010-2015</th>
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<tr>
<td>MW Demand</td>
<td>39</td>
<td>800+</td>
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Variable Syngas Composition –
optimize engine design for fuels

Gas composition %

Sample

[Graph showing gas composition for different samples]
Tremendous Growth – Developing & Growth Markets

![Industry Growth Chart]

**Implications –**
- Developing & Growth Markets have widely varying fuels

- Engine design needs to consider fuels
  - Injector design
  - Injection strategies
  - Engine manufacturing strategies
  - Example: Cooled EGR does not work with ‘high sulfur’ fuels

![Worldwide Fuel Sulfur Regulations – 2017]

Fuel variation drives robust ‘global’ engine design
Mid and Future-term Fuels… Key Considerations

Do we really understand our customers’ future needs?

What is YOUR Role?

How do we select alternative fuel opportunities?

How can we better collaborate…..academia, government, industry?

Will the Alternative Fuels Infrastructure Be There?

How do we meet global drivers in engine in power systems?

How do we best integrate the ‘right’ level of business needs & technology understanding at the University level?

Some questions
Message Points

• Caterpillar is focused on sustainability, meeting customer and shareholder value, & reducing customer lifecycle costs
• Investments can be made in technology to drive customer value at the engine, the machine system, the site, or alternative fuels
• Alternative fuels investments require selecting the ‘right’ opportunities to maximize customer value
• Bio-diesel alternatives available…..LNG & SynGas market opportunities may grow.
• Global growth – ‘World Fuels’ drive engine design challenges
Mid-Term Fuels...Delivering Value

‘The Customer Always Wins!’

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