

# ecomagination<sup>SM</sup>

market driven,  
technology enabled

Kate Brass  
Ecomagination Program Manager  
GE Energy



We are taking a new approach to solving some of our customers' toughest environmental problems.

We call it  
**ecomagination**<sup>SM</sup>



# e•co•mag•i•na•tion *(ē'kō-măj'ə-nā'shən)*

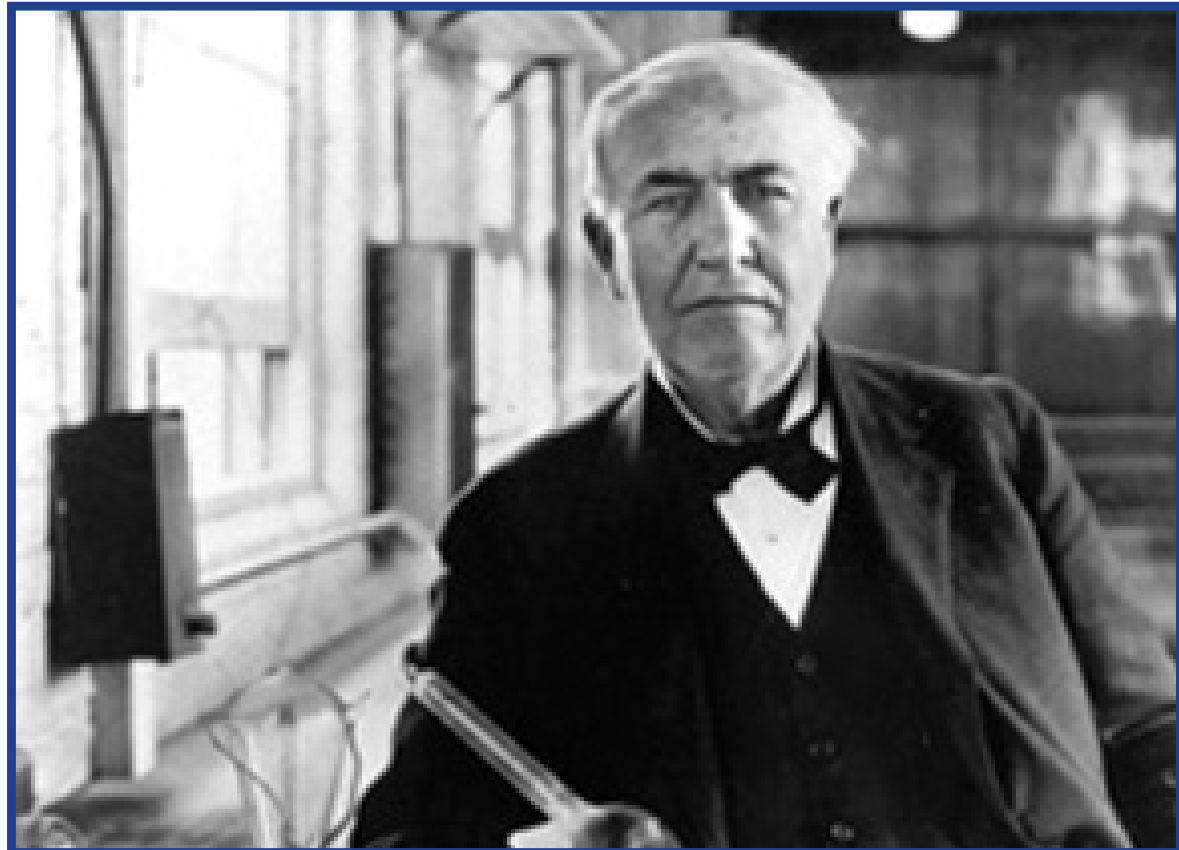
(n.) GE's commitment to imagine and build innovative solutions that benefit our customers and society at large.

It is:

- 1) A goal and a methodology
- 2) A business strategy and a solutions platform
- 3) What we will do and how we will do it

“I never perfected an invention that I did not think about in terms of the service it might give others... I find out what the world needs, then I proceed to invent.”

—Thomas Edison



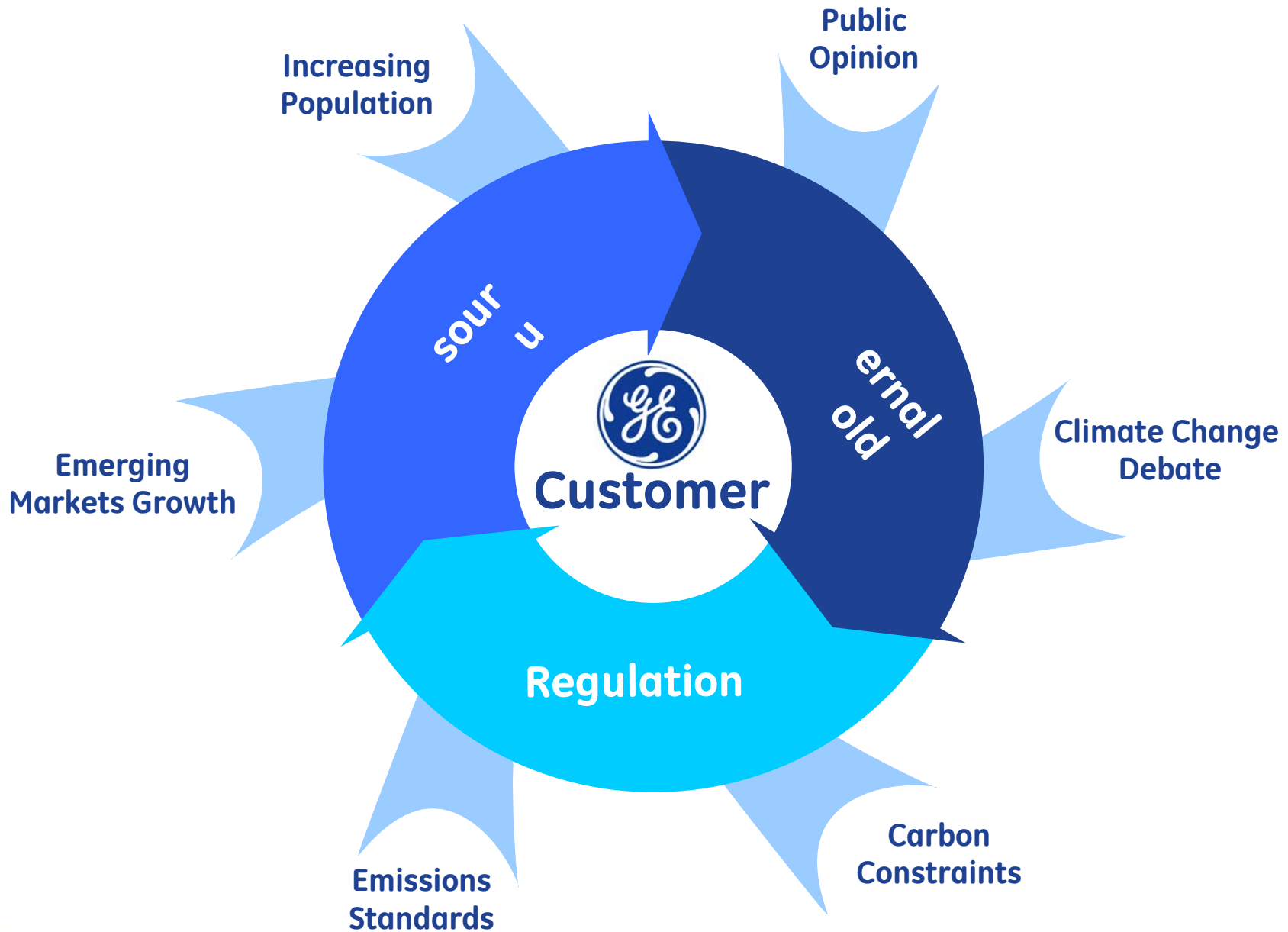
# Informed by customers



# Informed by governments and NGOs



# Pressure on GE customers



# ecomagination<sup>SM</sup>

Environmental  
performance



Operating  
performance

Double R&D...  
\$1.5 Billion

Grow Revenues...  
\$20 Billion

Reduce  
Emissions

Report  
Progress



# ecomagination commitment

1

## Deliver on aggressive GE goals

- R&D spend... double research spend on ecomagination technologies from \$700M to \$1.5B by 2010.
- ecomagination revenue... increase from ~\$10B to \$20B by 2010.
- GHG emissions... reduce intensity 30% by 2008 and at least a 1% absolute reduction by 2012 (both compared to 2004 baseline).
- GHG reduction from the installed base of GE ecomagination products will more than offset all GE GHG emissions every year, starting in 2005.
- Improve the energy-efficiency of GE's operations 30% by 2012 (as measured in BTUs/\$ revenue).



# Consumer & Industrial ecomagination showcase sites

3



19 plants converted

## Green benefits – \$

- 26+MM KWH reduced
- \$2MM annual savings
- 2+ year payback

## Green benefits – eco

- 18,200 tons of CO<sub>2</sub> ↓
- = 3,500 cars ↓
- = 5,400 acres of trees

# ecomagination commitment

## 2

### **Make customers true partners**

- Develop technologies that significantly and measurably improve operating and environmental performance.
- Provide a full range of technology offerings to meet customer and end-user needs.
- Demonstrate the economics/value proposition of ecomagination offerings.
- Provide financing to support development and application of new technologies at the customer.

# The value of a GE partnership



Differentiated technology and services

Full suite of solutions for breadth of industries



Technology partnerships

Product development and co-development



Stakeholder engagement

Convening power, relationships and lobbying



Best practices

Environmental, Health & Safety and Public Relations

ecomagination™

Marketing partnerships

Commercialization, co-branding, events and PR

# Customer Activations ... a good start



BMW



BP



British Airways



BHP Billiton



Cargolux



DHL



Dow



Google



Johnson & Johnson



KLM



Limited Brands



Lowe's



Mervyn's



Motorola



Statoil



Wal-Mart



Australia - ZCP



China – NDRC



Hawaii



India – US Aid



UAE – Abu Dhabi



imagination at work

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GE ecomagination  
October 2006

# ecomagination commitment

## 3 Embrace balanced energy policy that:

- Promotes fuel diversity -- natural gas, petroleum, renewables, cleaner coal, hydrogen and nuclear -- to achieve reliable supply and stable pricing.
- Provides clarity and certainty for return on investment.
- Promotes technology and policies that reduce emissions and help achieve sensible CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub>, and Hg targets.
- Encourage a constructive dialogue around carbon constraints/caps in an appropriate timeframe.
- Encourages energy-efficiency and conservation.
- Creates an environment in which U.S. industry can lead in environmental and energy technology.

# Products ... growing the portfolio

**Launch**

**17**

- Credibility
- Broad and deep portfolio

**Current**

**38**

- New applications
- New businesses

**2007**

**60+**

- Technical and commercial innovations
- White space developments

# A breadth and depth of solutions

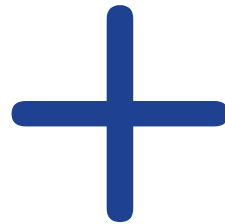




# ecomagination ... customer value

Significantly and measurably improving

**Operating  
performance**

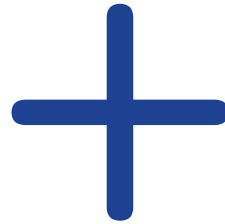


**Environmental  
performance**

# Energy solutions

## Operating performance

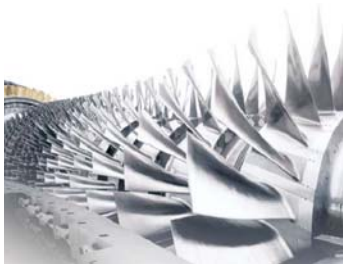
- Increased efficiency
- Fuel diversity
- Energy security



## Environmental performance

- Reduced emissions generation  
– NOx, SOx, Hg and CO2
- Renewable and near zero emission technologies

Gas



Wind



Jenbacher



Solar



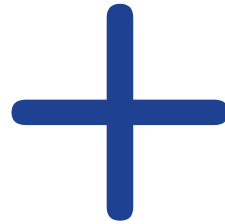
Cleaner Coal



# Water solutions

## Operating performance

- Improved availability
- Reduced consumption
- Economical maintenance
- Improved throughput



## Environmental performance

- Make use of polluted or brackish water
- Reduced waste

### Desalination



### Treatment and Re-use



### Cooling



# Transportation solutions

## Operating performance

- Improved fuel consumption
- Increased efficiency
- Enhanced reliability
- Economical maintenance



## Environmental performance

- Reduced emissions
  - NOx
  - Sox
  - CO2

Rail



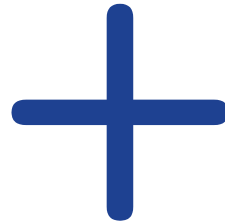
Aviation



# Industrial solutions

## Operating performance

- Lower electricity usage
- Higher efficiency
- Dependability
- Economical maintenance



## Environmental performance

- Reduced emissions
  - NOx, SOx and CO2
- Reduced mercury content

Motors



Lighting

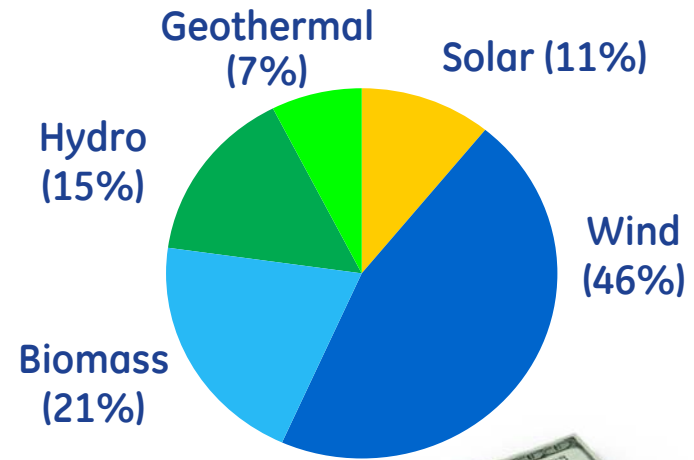


# Energy financial services

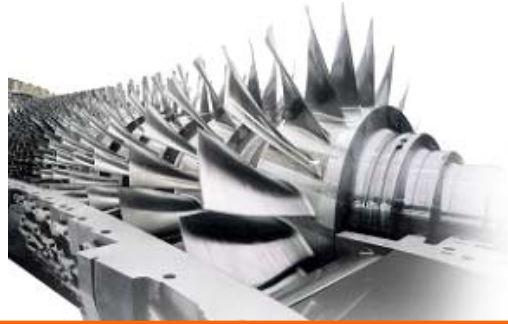
One of industry's biggest renewable portfolios: ~\$1B

## Critical enablement tool

- \$10B to \$12B in assets  
~\$1B renewable portfolio
- 300 energy experts
- AAA rating
- Serving customers from  
“wellhead to wall socket”



# Ecomagination ... at Energy



- Energy will spend \$2.1B on ecomagination technology developments between 2005 and 2010
- Energy ecomagination revenue to grow from \$3.7B to ~ \$10B by 2010

Wind



Cleaner Coal  
IGCC



LMS100®

# Residential and Commercial Solar

## Ladera Ranch Community Los Angeles



- Roof-integrated, aesthetically pleasing, Gecko™ modules for residential applications
- High efficiency and reliability inverters
- GE “system” solutions



- Large Scale Projects Featuring GEPV-165 Modules
- Single Structure or Multiple Facilities
- 10 kW to Multiple MWs



# GE's Solar Technologies

Beijing Olympics – Fengtai Olympic Stadium

12 grid independent, LED, solar street lights

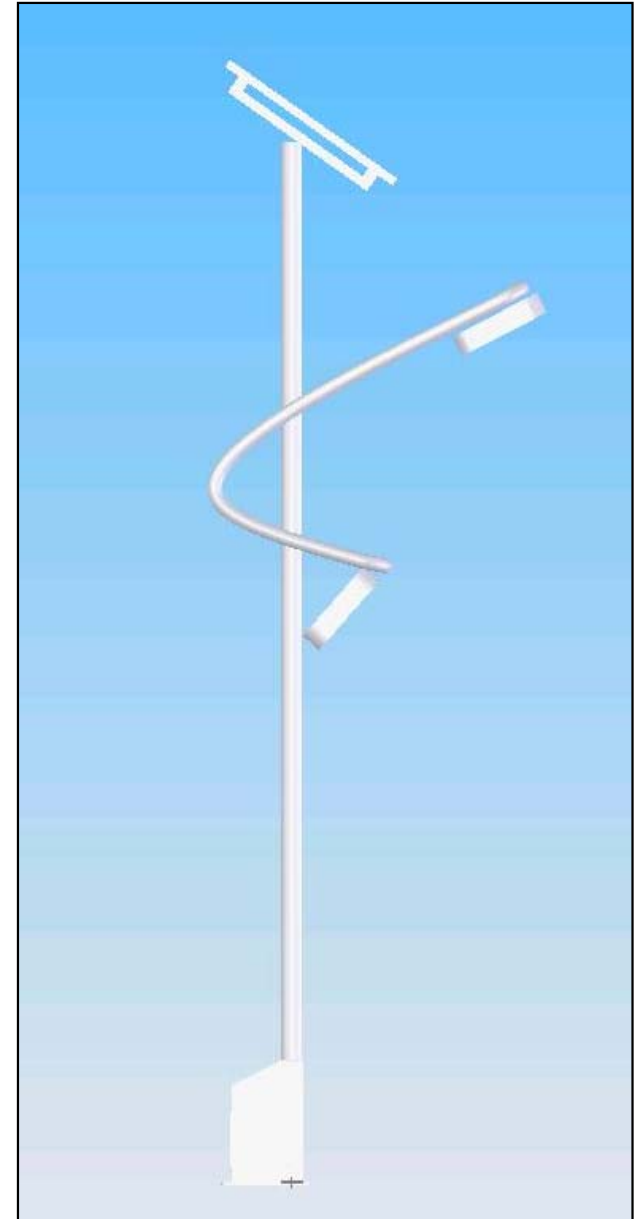
3 separate light sources per pole

2- 40 watt solar modules

3 day battery capacity

3 operating modes

operating time 4 hours or dusk to dawn  
(environmental conditions =>10lx)



# Wind Technology

## Onshore

- Proven technology ... > 3,300 1.5 MW units worldwide
- Full range of products ... up to 3 MW to support global needs
- **Offshore**
- Arklow, Ireland ... GE's technology demonstration
- 7 GE 3.6s offshore wind turbines
- 25MW project capacity
- Expected to generate enough energy for ~16,000 homes
- Largest wind turbines commercially installed at sea



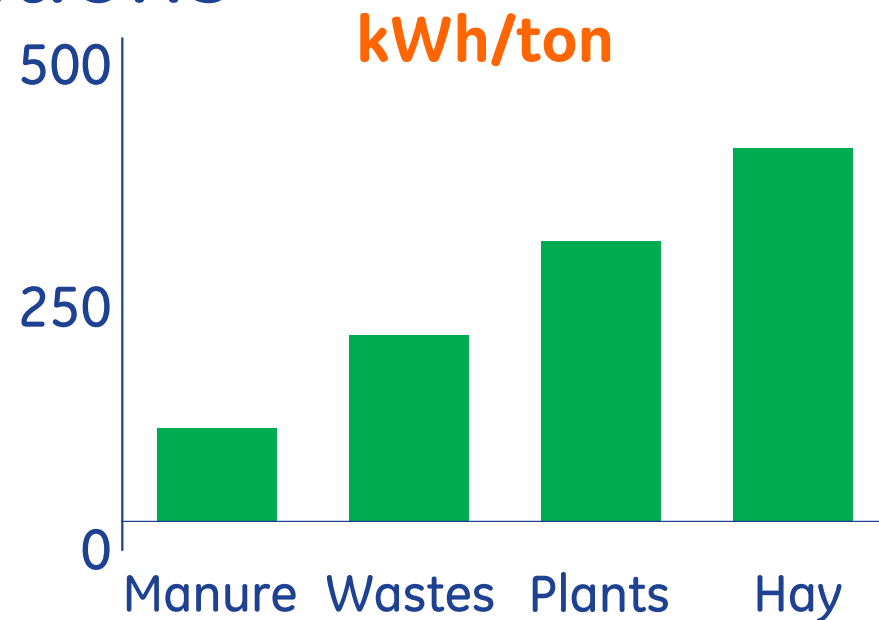
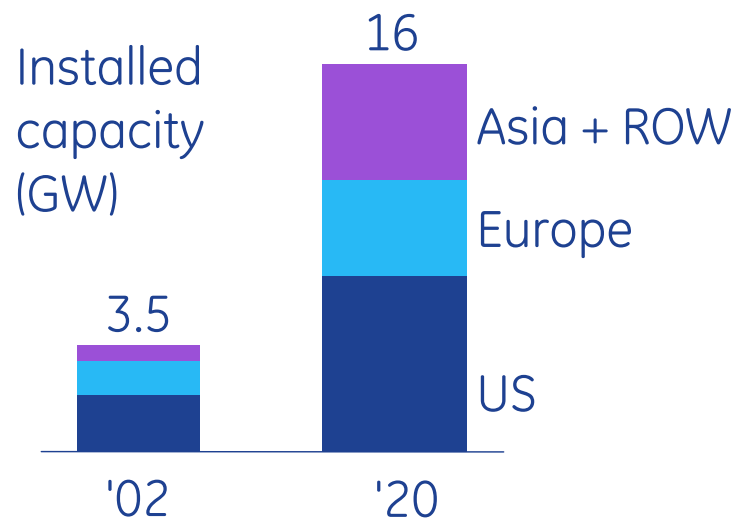
# Jenbacher Reciprocating Engine Technology

- CO<sub>2</sub>e reduction potential of 85%
- electrical engine efficiency up 43%
- engine efficiency up to 90% as CHP plant (combined heat & power)
- reliable operation under fluctuating CH<sub>4</sub> contents & gas pressures
- carbon credit applicable



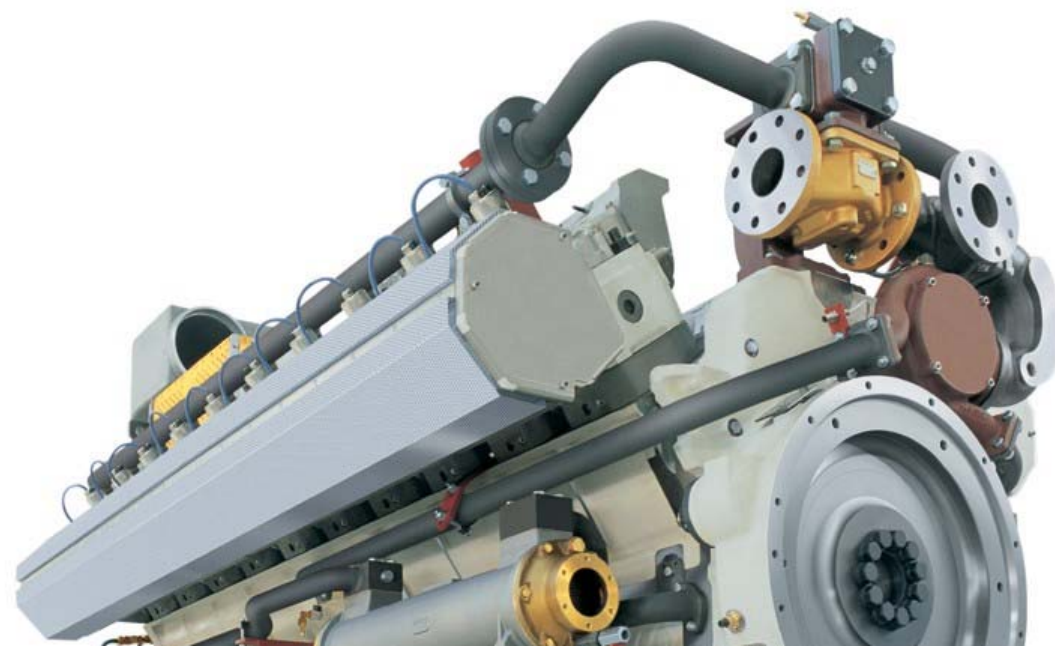
# Reciprocating Technology ... Environmental Applications

## Bio Power Growth



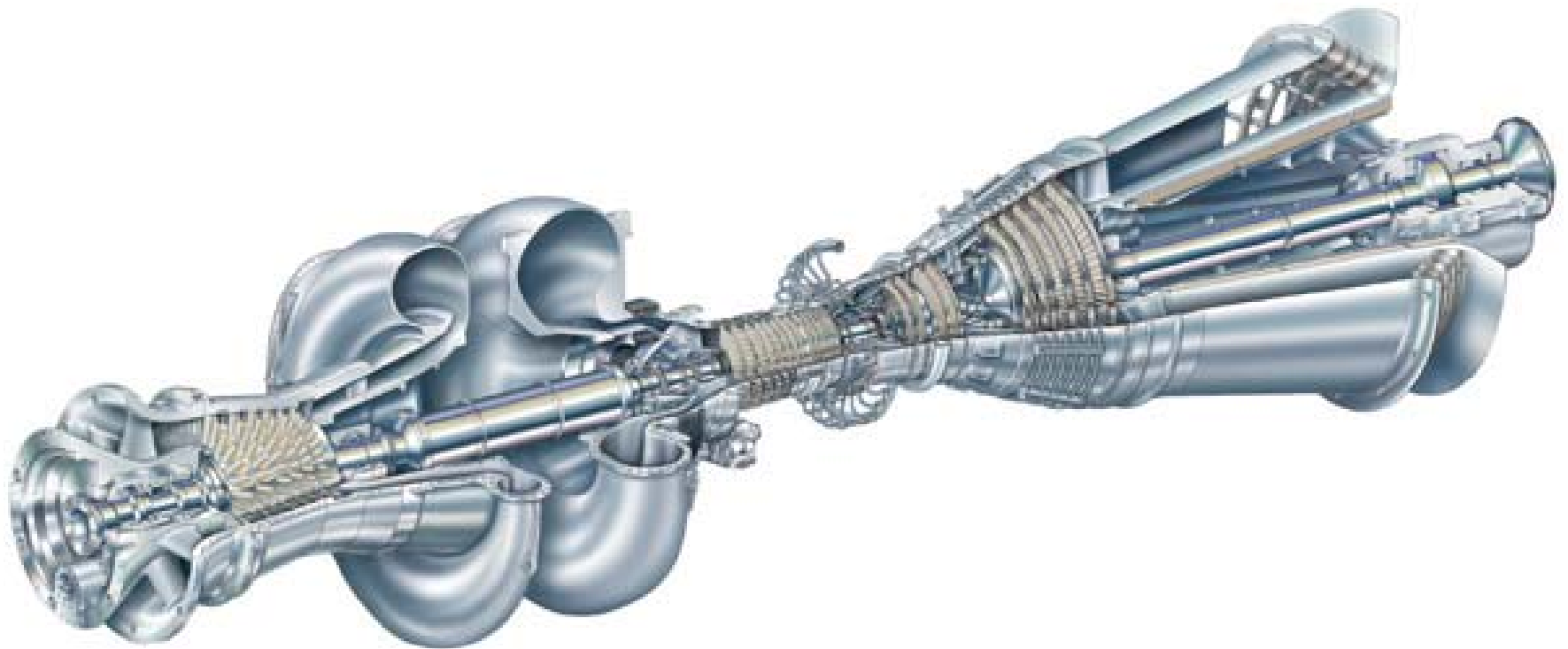
## Non-Natural Gas

- Using gas that would otherwise be vented or flared ...
  - Landfill
  - Coal mine gas
  - Biogas



# LMS 100

- Highest simple cycle efficiency gas turbine available today
- 100 MW at 46% thermal efficiency - best in class by 10%
- Significant reduction in GHG (CO<sub>2</sub>) emissions
- Operating flexibility for peaking, mid-range and base-load operations
- Lower startup emissions with 10 minute starts



# H System™

- GE's highest combined cycle efficiency ... 60%
- Advanced steam cooling and integrated control system

109H 50 Hz - 520 MW

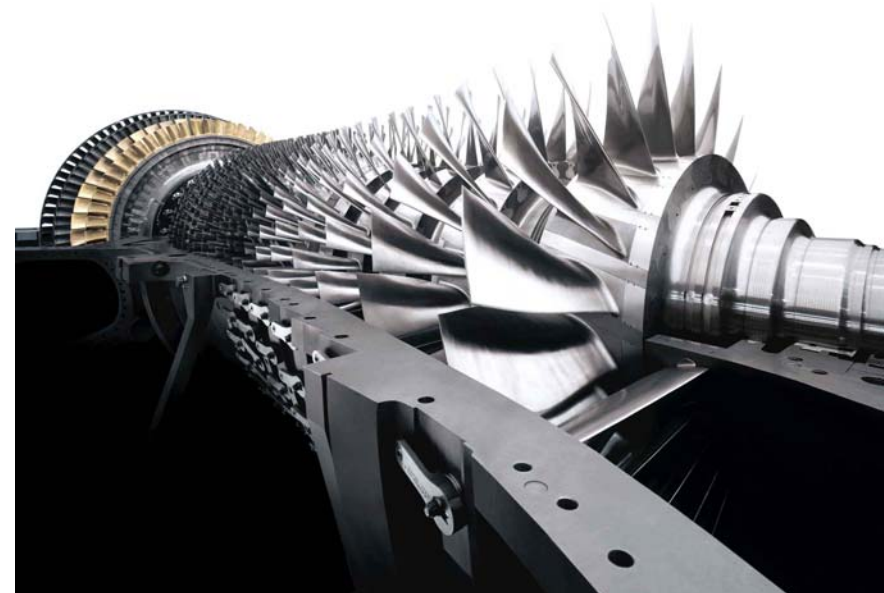
- <15ppm NO<sub>x</sub> emissions to 50% load
- CO<sub>2</sub> – 3- 5% improvement vs. F Class
- Baglan Bay - 11,600+ fired hours

107H 60 Hz – 400 MW

- Enough power for 300,000 U.S. homes
- CO<sub>2</sub> vs. F Class = 73,000 tons / yr. improvement
- NO<sub>x</sub> vs. F Class ~ 20 tons / yr. improvement



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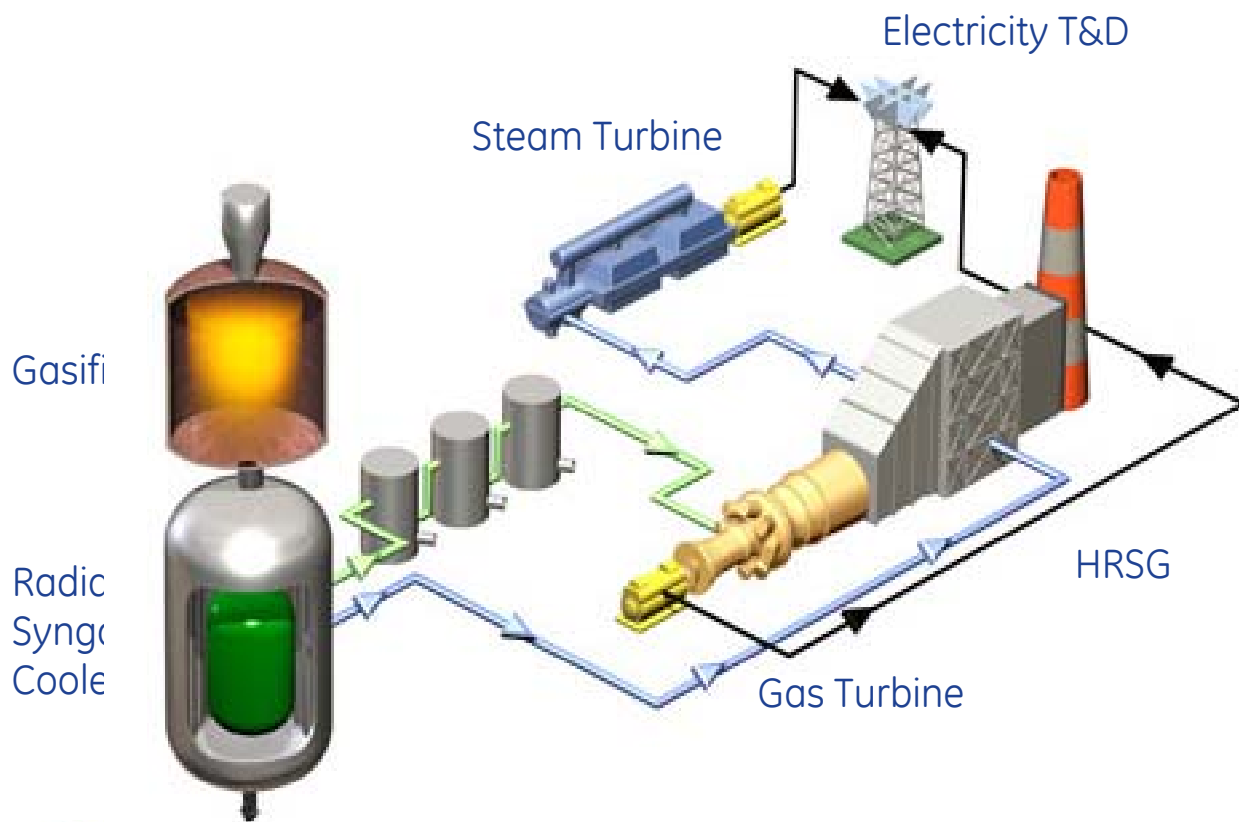


GE ecomagination  
October 2006

# Cleaner Coal Technology ... It's Time Is Now

## Abundant and Inexpensive Fuel Source

- COE parity with pulverized coal
- Integrating proven technology
- Generates maximum value from coal



## Environmental Impact

### Reduction vs PC

NO <sub>x</sub>	~33%
SO <sub>x</sub>	~75%
Particulate	~50%

Achieve 90% mercury removal at a fraction of the cost

# Water ... Implications and Solutions

## Left unresolved water scarcity will:

- Slow/stop economic expansion (industrial, commercial and residential)
- Reduce agricultural output and food independence
- Degrade public health and quality of life

## GE Water Scarcity Solutions

Sustainable fresh water supply via desalination



Water conservation via reuse and reclamation



Surge capacity or emergency water production

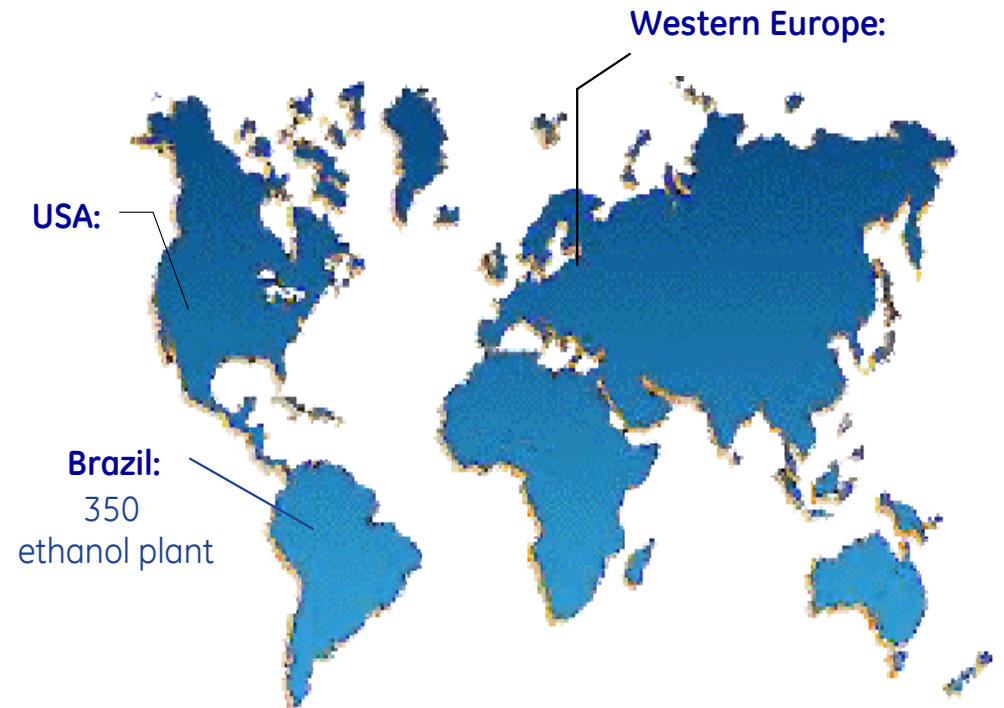




# Waste to Energy

## Food & Beverage facilities with organic waste > 4000 lbs/day

- ✓ Dairy, Beverage, Ethanol, Distilleries, Fruits and Wineries.
- ✓ Approximately 850 existing opportunities and more than 200 new facilities being built in the ethanol market by 2010.
- ✓ Focused Regions USA, Mexico, Brazil and Western Europe



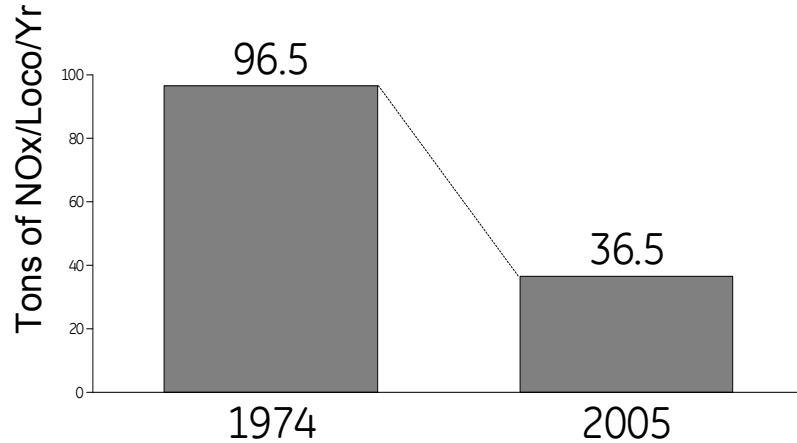
# Evolution series locomotive

- First locomotive to meet new EPA standards
- Cuts key emissions up to 40%
- Increased fuel efficiency by 5%
- 16 cylinders' worth of horsepower with just 12 cylinders
- 10% lower lifecycle costs
- '05 - 687 units
- 1100 Backlog

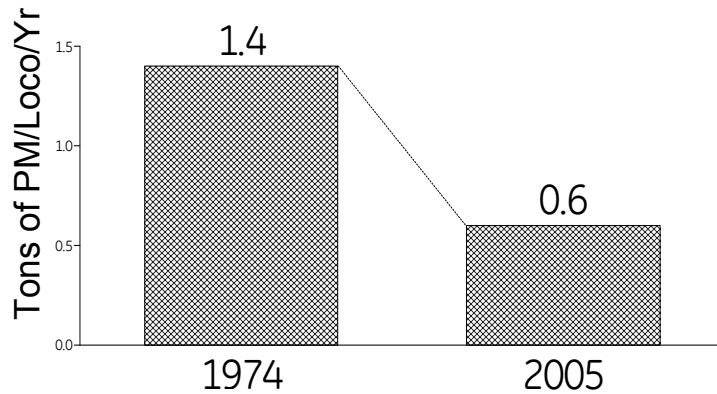


# Technology's impact on the rails

60% less smog producing pollutants...



83% fewer asthma causing particulates...



=  
315,000 gal of fuel saved  
*in a locomotive lifetime*

# Waste Disposal

## Landfills



### Advantages

- Low cost solution
- Low tech, simple

### Issues

- Land usage
- Small volume reduction
- Off gas & odor
- Limited ability to handle hazardous materials
- Ground Water Pollution

### Emissions

- Difficult to control off gas

## Incineration



### Advantages

- Volume reduction (80:1)
- Ability to handle some hazardous materials

### Issues

- Higher cost than landfill
- Exhaust emissions
- Potentially hazardous & leachable ash

### Emissions

- Exhaust clean up possible – but at a cost
- Some emissions are very difficult to remove

## Plasma Gasification



### Advantages

- High volume reduction (<200:1)
- Ability to handle most hazardous materials
- Non-leachable vitrified glass by-product
- Easier to clean syngas

### Issues

- Public perception that technology is incineration

### Emissions

- As clean as Natural Gas
- CO2 Neutral
- CO2 Capture Possible

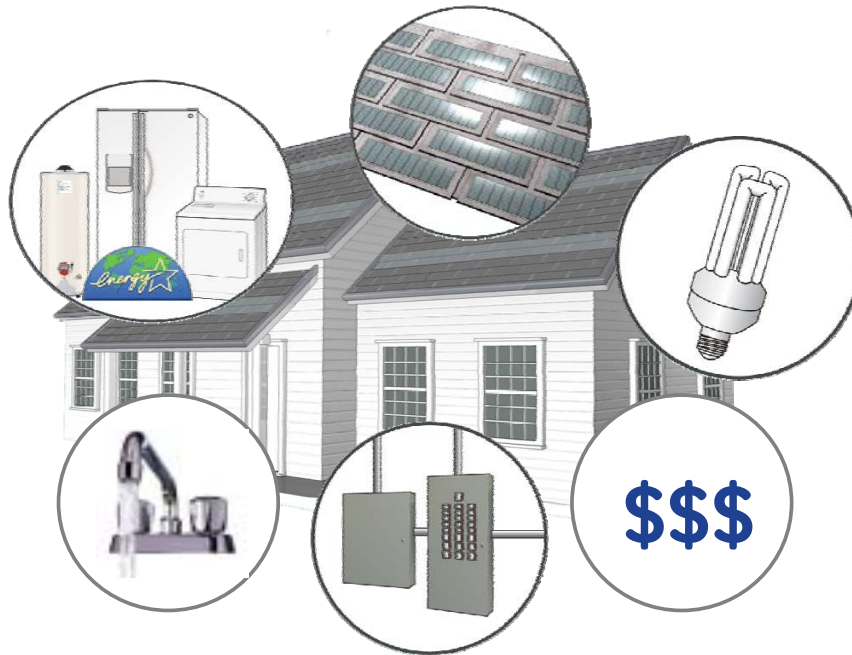
# Ecomagination ... beyond equipment



**Consumer Finance**  
**Green Card**



**Fleet Services**  
**GreenFleet**



**Solution selling**  
**Net Zero Energy**  
**Homes**  
**Green Mortgage**



imagination at work