Leading Technologies for the 21st Century

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GE Global Research

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General Electric Overview

A 125-year old, $300B High-Tech Growth Company

Founded by Thomas Edison

Technology is Key to Growth
General Electric Overview

A diversified technology, manufacturing and services company with a commitment to achieving world leadership in each of its key businesses

- Aircraft Engines
- Appliances
- Capital Services
- Industrial Systems
- Information Services
- Lighting
- Medical Systems
- Plastics
- Power Systems
- Transportation Systems
- NBC

Global Research Overview

Founded in 1900 in Schenectady, NY by Charles Steinmetz

One of the world’s largest and most diversified industrial laboratories

Cornerstone of GE’s commitment to technology
Global Research Innovations

Innovations:
- Digital X-Ray
- High-Field MR
- Lexan
- Fan beam CT
- Man-Made Diamonds
- Many More…

Global Research Locations

Niskayuna, NY – World Headquarters

Bangalore, India
Shanghai, China

Global Research Organization
Global Research Overview

GE Global Research Staff

- 2,100 people worldwide (750+ Ph.D.s)
- 12% of GE’s total R&D population
- 30% of GE’s patents

Technical Disciplines

- Chemistry 18%
- Mechanical 17%
- Physics 9%
- Electrical 18%
- Computer Science 17%
- All Other 21%

Global Development & Engineering

- $2.3B RD&E in '01
- 10,000 US
- 5,000 Global

- Canada: Hydro Generators, Protective Relays
- Great Britain: Lighting Systems
- Spain: Power Controls, Plastics
- The Netherlands: Engineering Plastics (AKU)
- France: Aircraft Engines (NECMA)
- Italy: Gas Turbines (Novo Prione)
- Hungary: Lighting Systems
- Russia: Aircraft Engines, Turbines (GEVRA, GBNLP)
- Japan: Engineering Plastics, Medical Systems (YMS), Silicon Products (Ishihara)
- China: Aircraft Engines, GEDAN, GUO Medical Systems (GEW, BMKE, KACAS)
- China: Technology Center
- Ukraine: Aircraft Engines, Gas Turbines
- India: GEKLI, Medical Systems
- Japan: Toyoko Technology Centre

United States:
- Aircraft Engines, Lynn, MA
- Aircraft Engines, Evendale, OH
- Medical Systems, Waukesha, WI
- Appliance, Louisville, KY
- Communications, Raleigh, N.C.
- GE Global Research, Schenectady, NY
- Electrical Distribution Equipment, Elmhurst, IL
- GE Global Research, Niskayuna, NY
- Engineering Plastics, Pittsfield, MA
- Lighting Systems, Hendersonville, NC
- Nuclear Energy, Salina, KS
- Silicon Products, Wheatfield, N.Y.
- Superabrasives, Washington, OH
- Transportation Systems, Erie, PA
- Turbines, Schenectady, N.Y.
- Traffic & Automation, Lynchburg, Information Systems, Rockville, MD
Ceramic Matrix Composites
Solid Oxide Fuel Cells
High Performance Polymers
Digital Underwriting
Advanced Engine Technology
Solid State Ultrasound

Changing the Game for GE Businesses

Ceramic Matrix Composites
(F-Class Combined Cycle Machines)

CMCs
4 years
500° F

Base

12% increase in power output and 2% increase in efficiency
Solid Oxide Fuel Cells

- Efficient
- Environmentally Friendly
- Scalable
- Modular

Changing How Electricity is Generated

High Performance Polymers

- Higher Heat Resistance
- Metal Adhesion

Leadership in Glass & Metal Replacement
Game Changer

Advanced Engine Technology

High Efficiency, Low Noise Turbomachinery

Game Changer

Solid State Ultrasound

Redefining Ultrasonic Imaging
Global Research Technical Charter

Short Term  Long Term

Business Driven  Technology Driven

10%  70%  20%

Ready to Serve  Multi-Generation Product Plans  CEO Projects  Advanced Technology

Advanced Technology Programs

- Nanotechnology
- Photonics
- **Hydrogen**
- Advanced Propulsion
- Light/Energy Conversion
- Biotechnology

Technology Leadership in GE
Global Trends = Global Drivers

- Population Growth & Urbanization
- Economic Development = Energy Demand
  - Electrification
  - Personal Transportation
- Energy Independence ↓
- Greenhouse Gas Emissions ↑
- Urban Air Quality ↓

Resume: Hydrogen Energy
- Combustion product = H₂O in Fuel Cell
- Energy/kg= 3x Natural Gas or Gasoline
- Most abundant

Hydrogen: The Sustainable Energy Carrier

Long Term Business Opportunities ...and Threats
Leading Technology is the Answer
Fuel Production
- Need: Scalable, Efficient
- GE
  - Market Leader Energy Equipment & Services
  - World-Class Polymer Mfg & Chemical Processes

On-Board Storage
- Need: Cost & Volume Effective Storage Materials
- GE
  - World-Class Ceramics, Polymers & Solid-State
  - Original Material Discovery & Design Processes

Creating GE's Energy Future

Imagine 2015
Global Transportation Scenario:
- 8 MM Fuel Cell vehicles
- Hydrogen at 5% refueling stations
- 50% Hydrogen from "central" plants

Low Cost/Available Hydrogen
- $3 B in hydrogen fuel sales
- 25 K refueling stations
- 100-1000 miles delivery pipeline

On-Board Storage
- 8 MM “gas” tanks
- $320 MM storage systems

PEM Fuel Cell Vehicles
- 8 MM FC stacks: Membrane
- 6.5 MM lbs/polymer

Creating GE’s Energy Future