



Cleantech Context

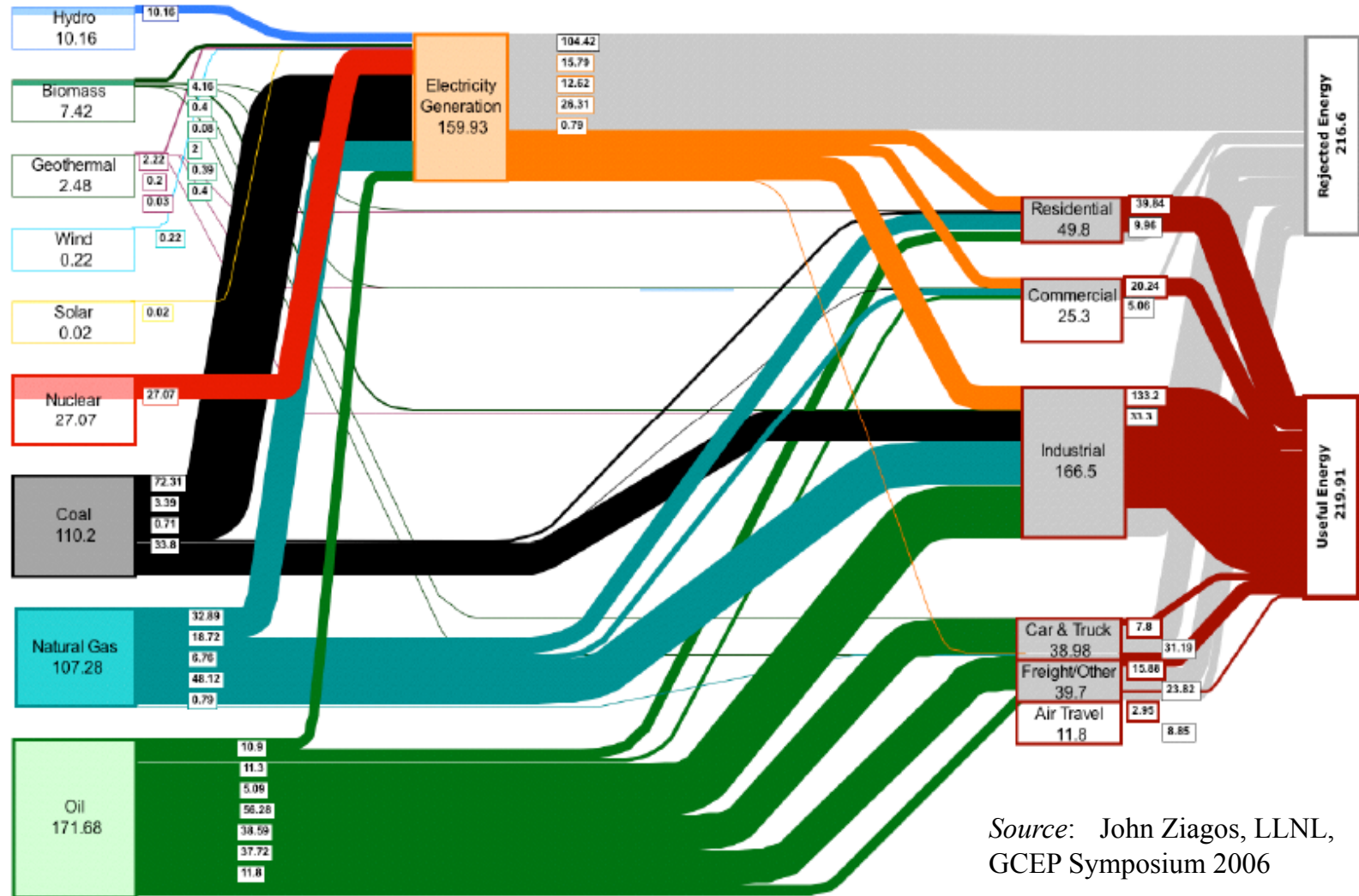
- Demand for energy and natural resources is surging, in part due to rapid development in China and India, as well as steady growth in developed markets
- Supply of fossil fuels is finite and in many cases, controlled by insecure sources
- Energy price inflation and volatility
- Climate Change is a global issue

This is the biggest engineering challenge ever faced by mankind

World Energy Flows

Estimated Future Energy Flows (≈ 436.5 Quads/Year)

World
2005



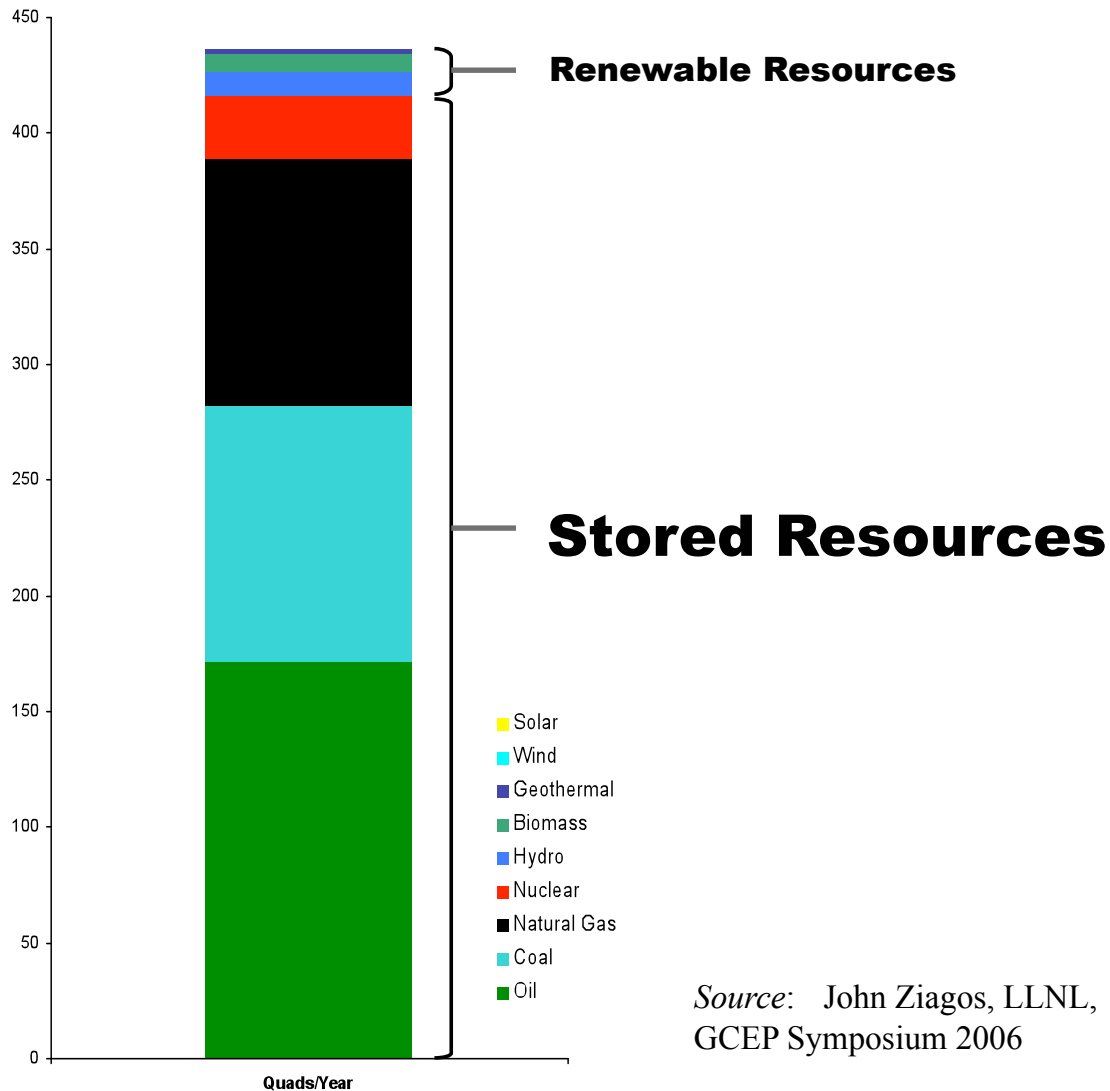
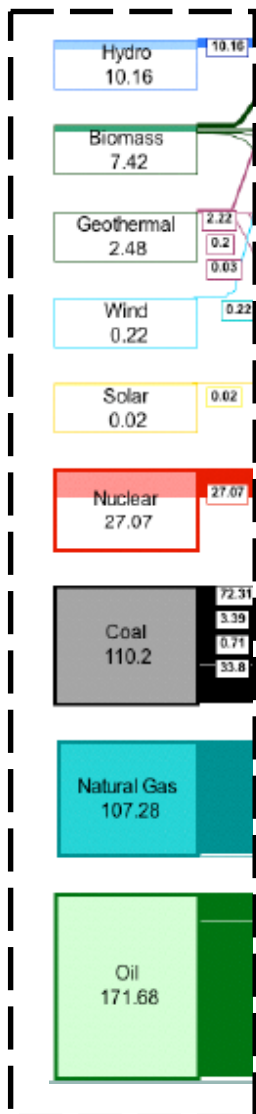
Source: John Ziegler, LLNL, GCEP Symposium 2006

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World Energy Flows – Supply

Estimated Future Energy Flows (≈ 436.5 Quads/Year)

World
2005



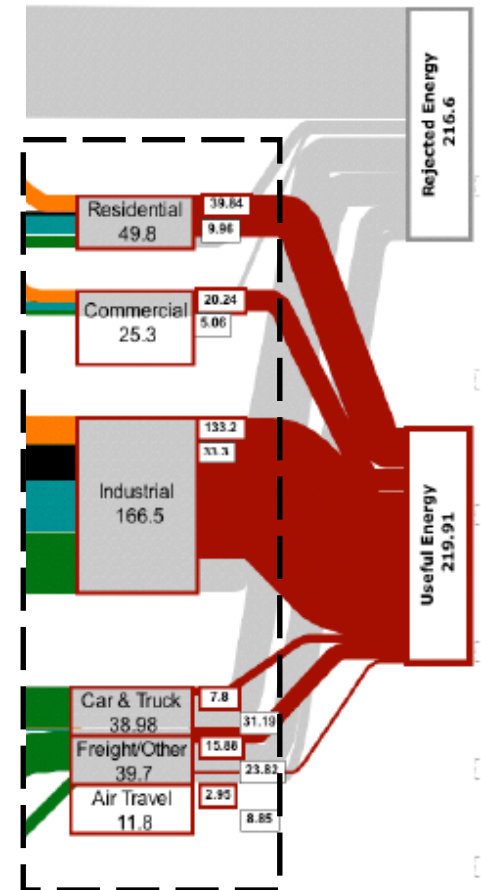
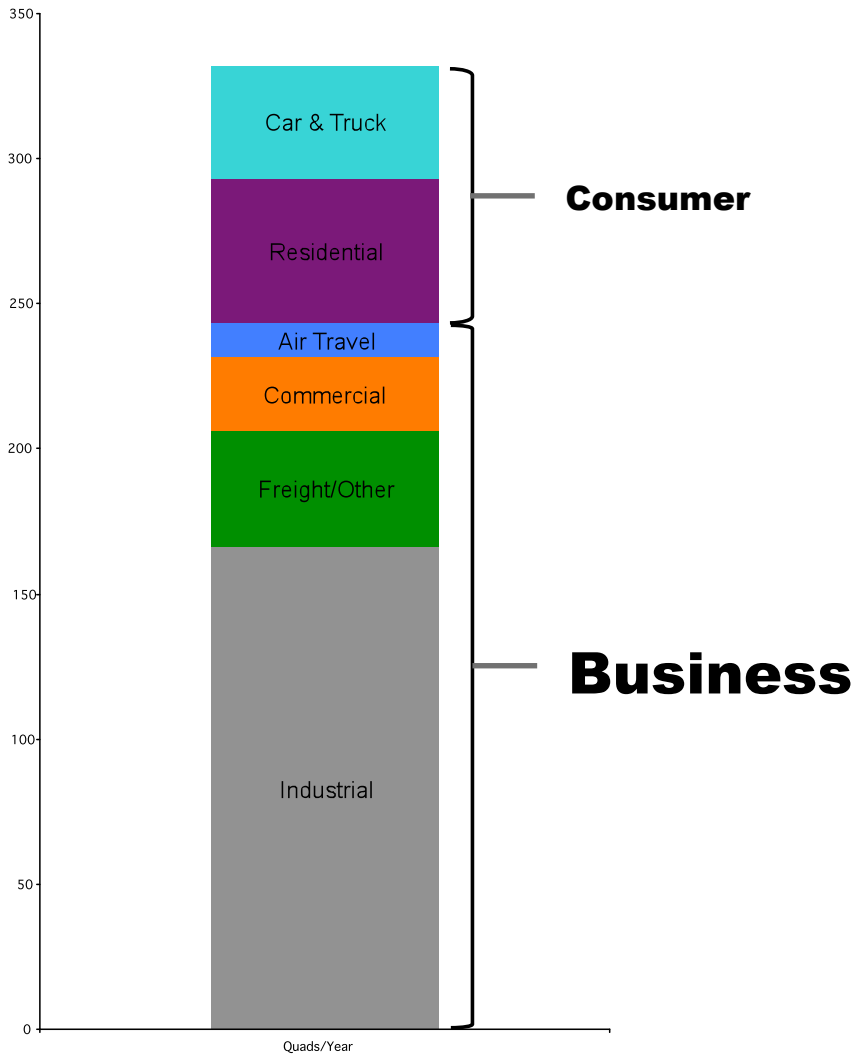
Source: John Ziagos, LLNL, GCEP Symposium 2006

World Energy Flows – Demand

Estimated Future Energy Flows (≈ 436.5 Quads/Year)

World
2005

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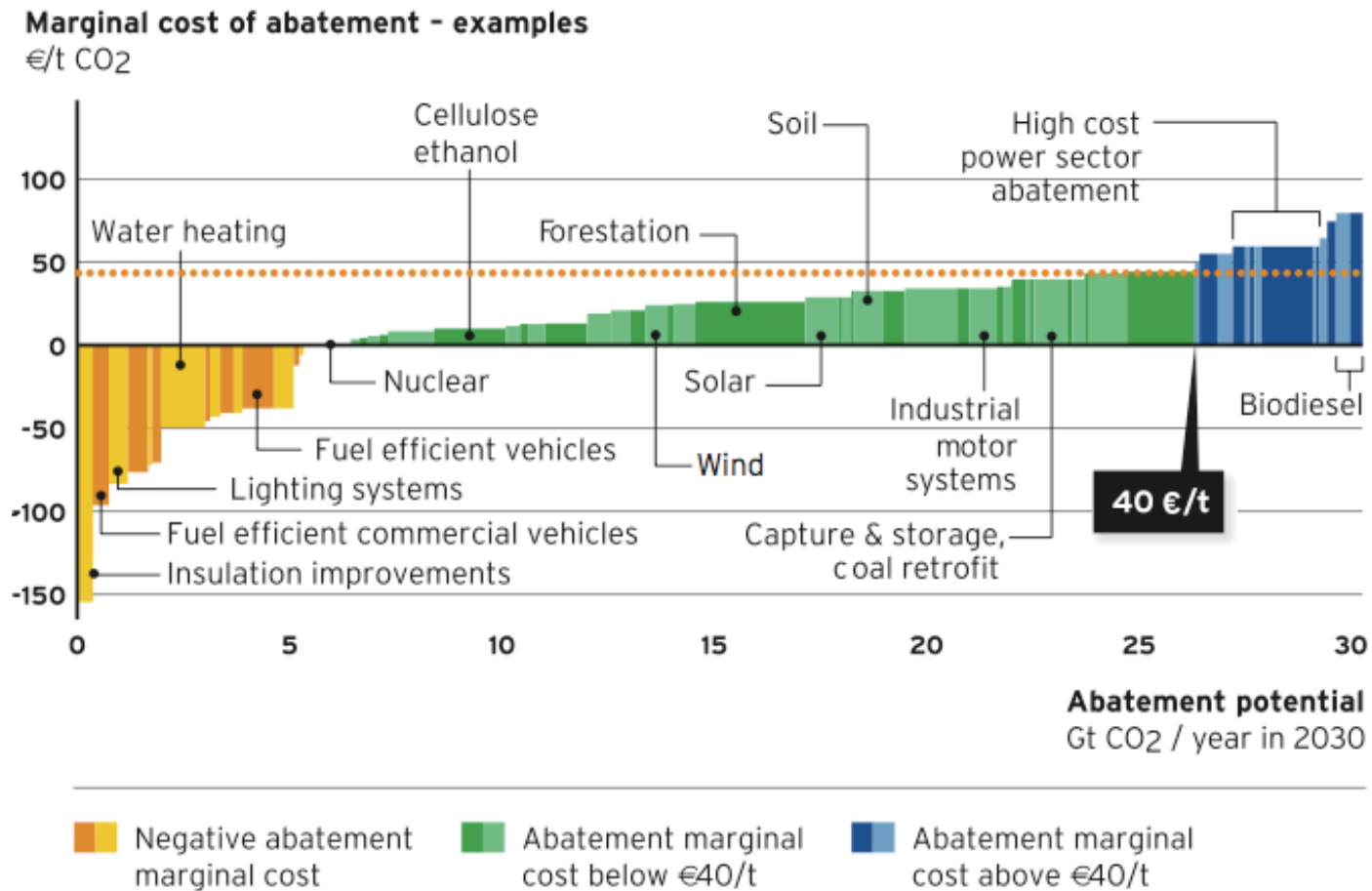
Source: John Ziangos, LLNL, GCEP Symposium 2006

Cleantech Landscape

- **Energy Management & Efficiency**
 - Demand response
 - Smart Grid and advanced metering
 - Behavior modification
- **Energy Generation**
 - Renewable energy
 - Alternative fuels
 - Next-gen Nuclear
 - Clean coal
 - New financing models
- **Energy Storage**
 - Advanced batteries
 - Flywheels, Ultra capacitors
- **Built Environment**
 - Advanced materials and processes
 - Dramatic reductions in embodied energy
 - Lighting
 - LEED
- **Industrial Processes**
 - Water purification & reclamation
 - Food safety
 - Recycling
- **Transportation**
 - Enhance efficiency
- **Emissions Reduction**
 - Monitoring & management
 - Carbon capture & storage

Global Cost Curve

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Source: Vattenfall, McKinsey

Why Invest in Efficiency?

- Typically economic out of the gate – no subsidies required.
- Capital efficient – don't require hundreds of millions of dollars to develop or implement.
- Can be delivered today – we're not waiting on new technologies, materials, or processes.
- Massive upstream impact – 1 Joule of energy conserved means 3 to 5 Joules saved at source.
- Efficiency investments are irreversible – you don't rip out your more efficient infrastructure when the price of oil drops below \$90 a barrel.