



Clean Energy Venture Capital Investing
in Massachusetts



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- **Fund Overview**
- **General Clean Energy Industry Overview**
- **Clean Energy Investing in MA**
- **Portfolio Companies**



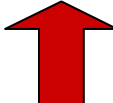
Massachusetts Green Energy Fund: Overview

- **\$17mm VC fund investing in early-stage clean energy companies**
 - State, accredited individual investors, foundations as LPs
 - 3 General Partners
- **Fund focus**
 - Venture IRRs
 - Early-stage clean and renewable energy opportunities
 - Companies based in or doing business in MA
- **Objective**
 - Portfolio of 10-12 companies
 - Early stage investments & build syndicates
 - 4-6 year exit

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Clean Energy Market Drivers

Increasing Problems

- Global energy demand 
- Energy price volatility 
- Environmental degradation 

Increasing Solutions




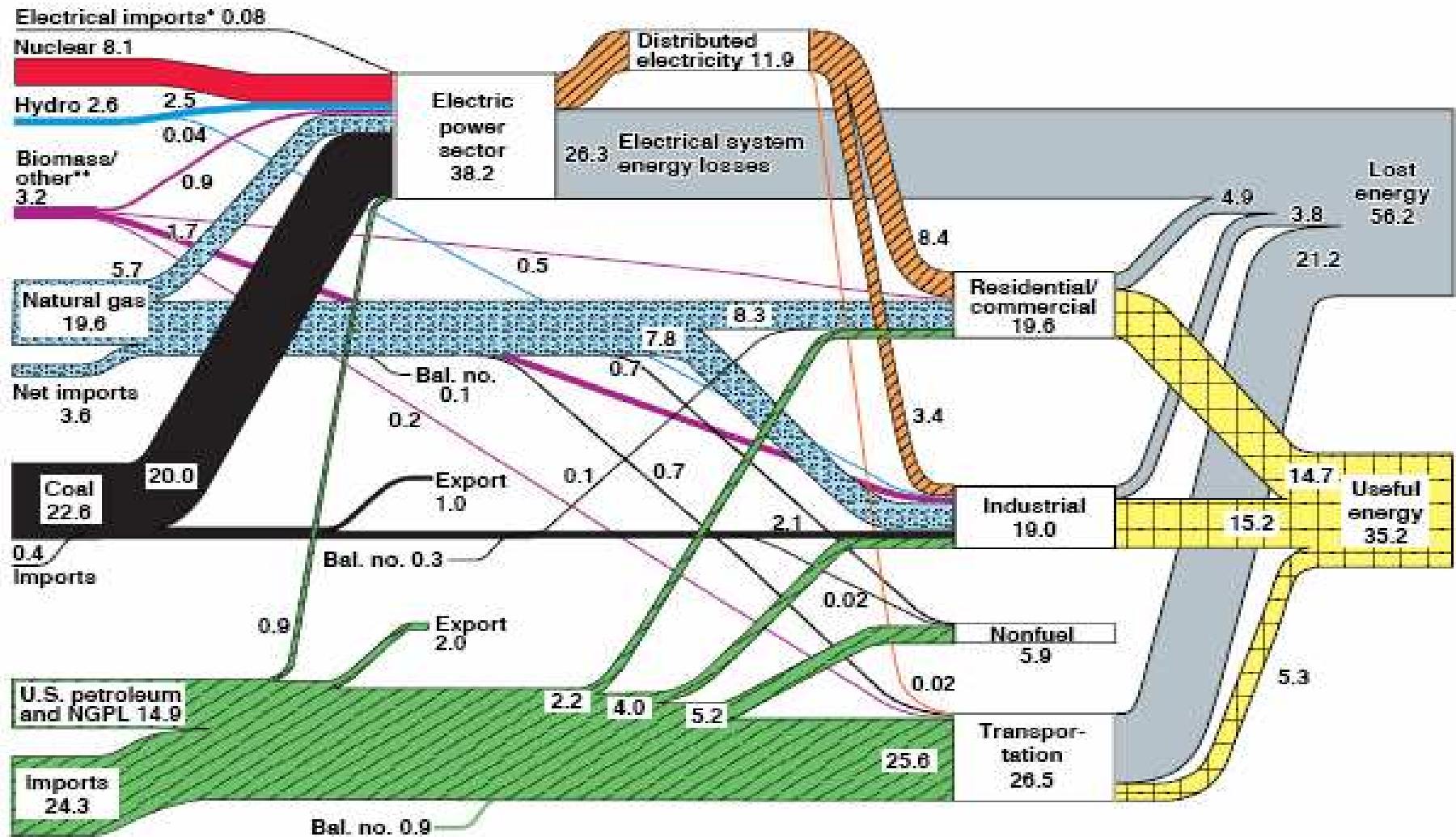
- Clean energy tech innovation 
- Government policy 
 - Global warming & national security
 - Long term incentives
- Capital availability 

Figure 1. U.S. Energy Flow Trends – 2002 Net Primary Resource Consumption ~97 Quads



Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2002*.

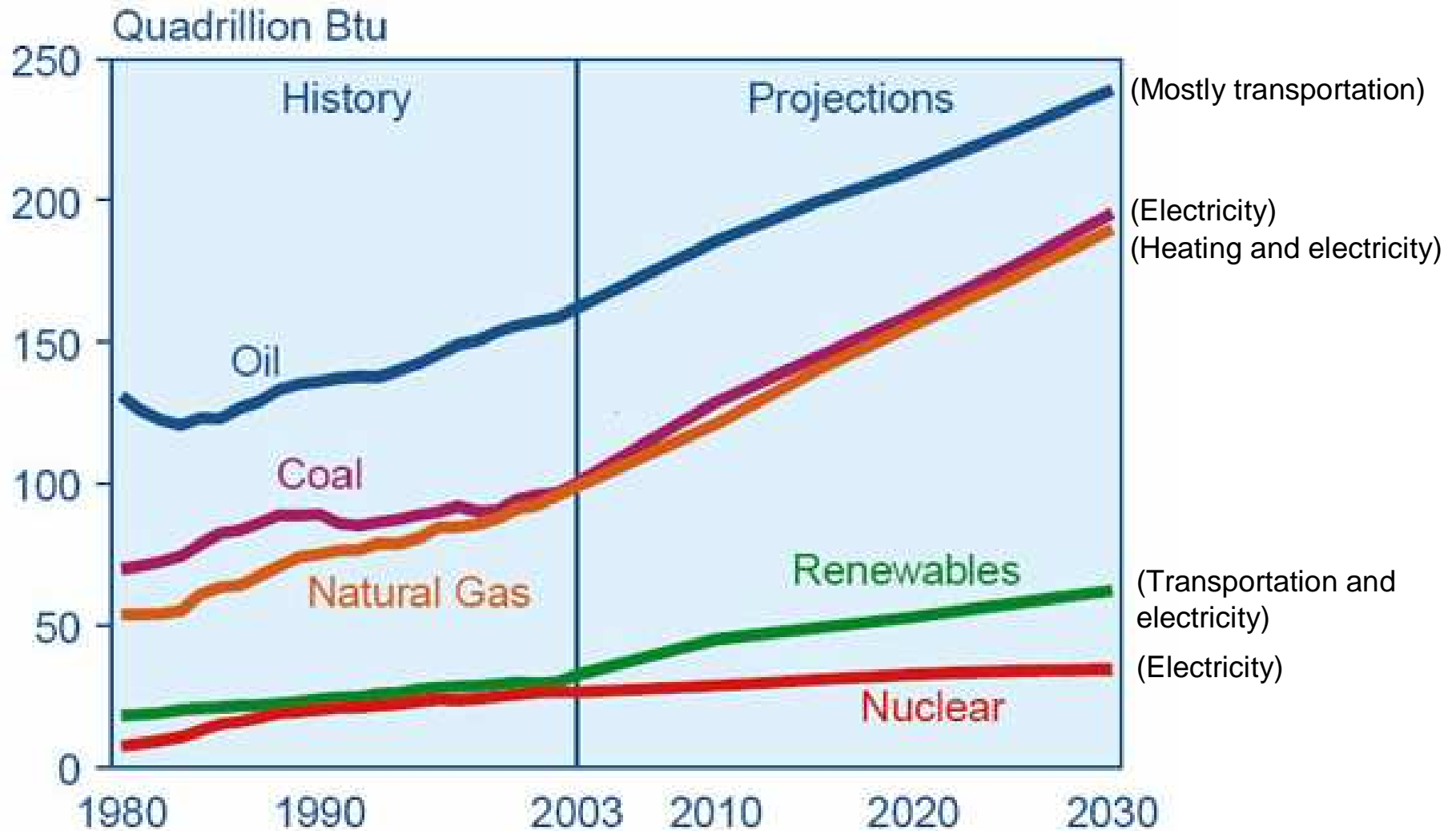
*Net fossil-fuel electrical imports.

**Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

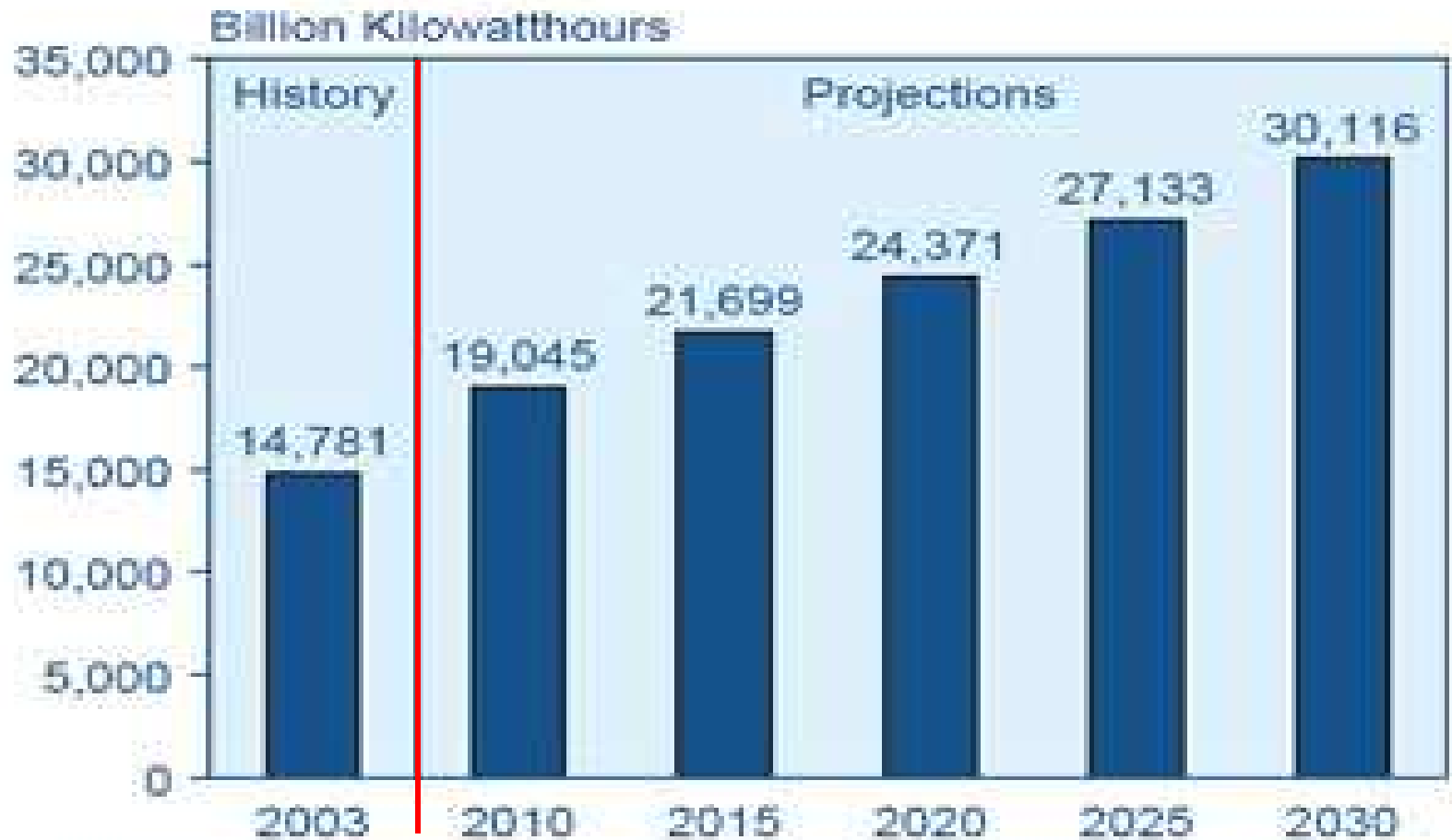
June 2004

Lawrence Livermore
National Laboratory
<http://eed.llnl.gov/flow>

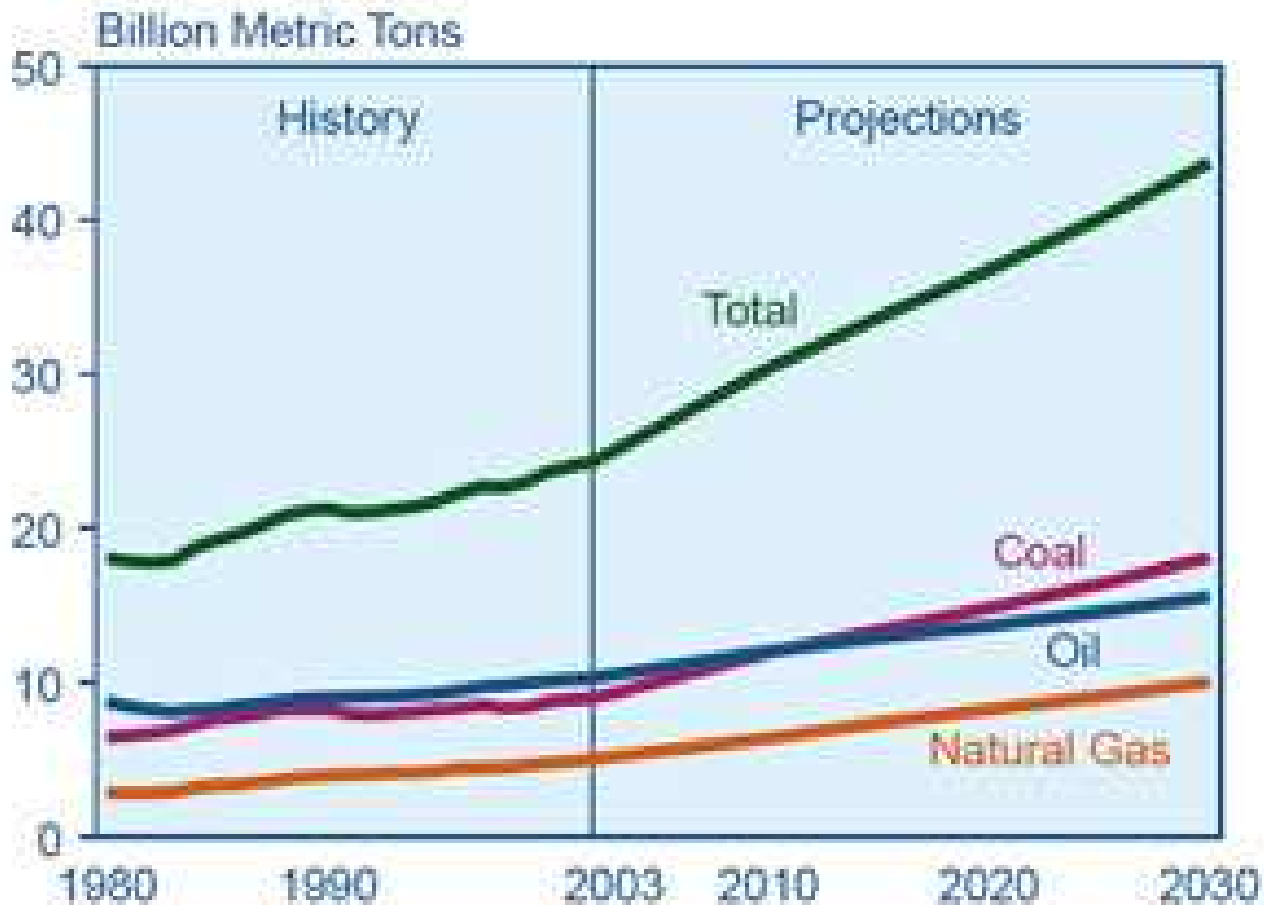
Projected World Primary Energy Demand



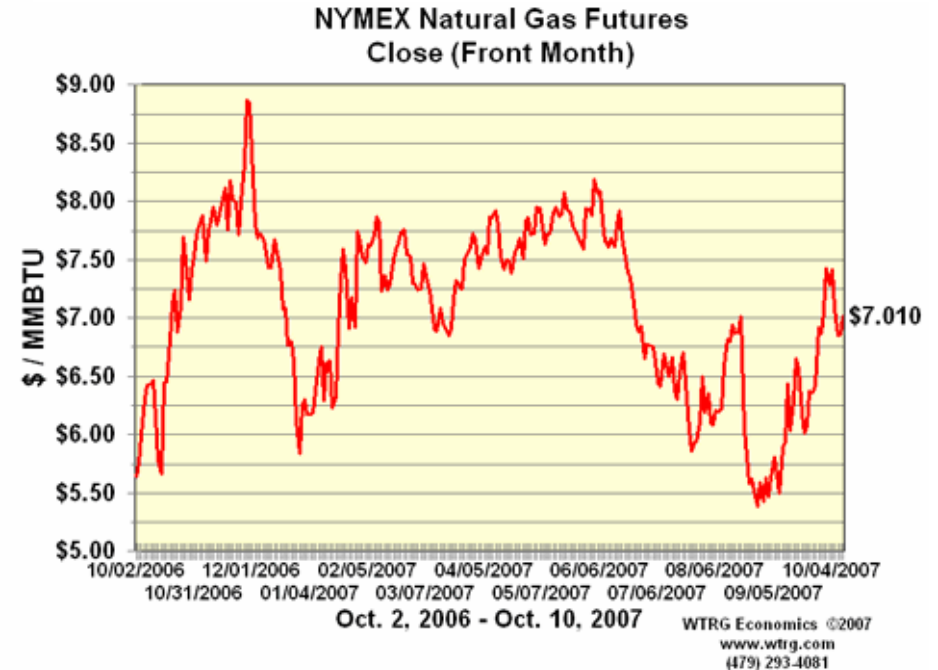
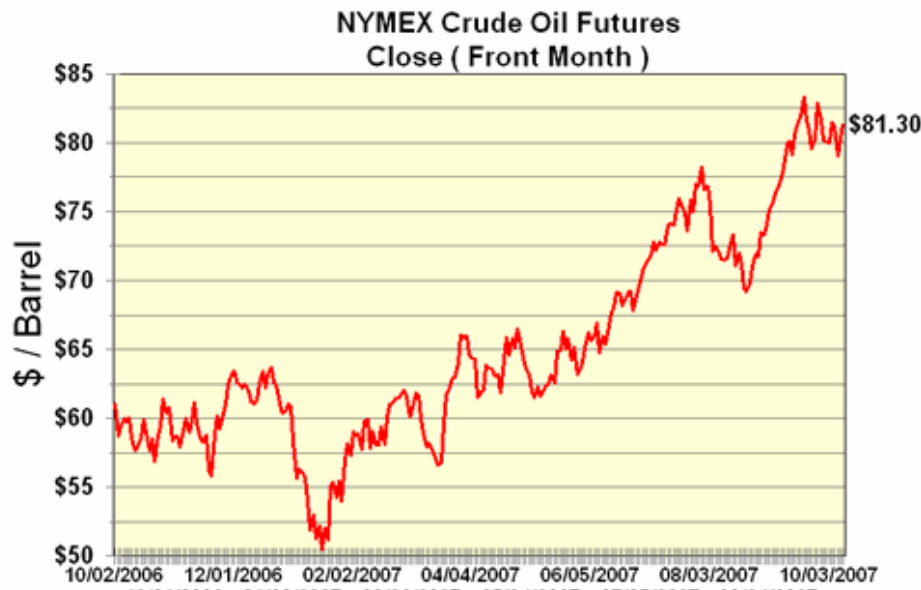
Annual Electricity World Demand is Projected to Double by 2030



Annual Global CO2 Emissions Are Projected to Rise Significantly



World Energy Prices Are High and Getting More Volatile



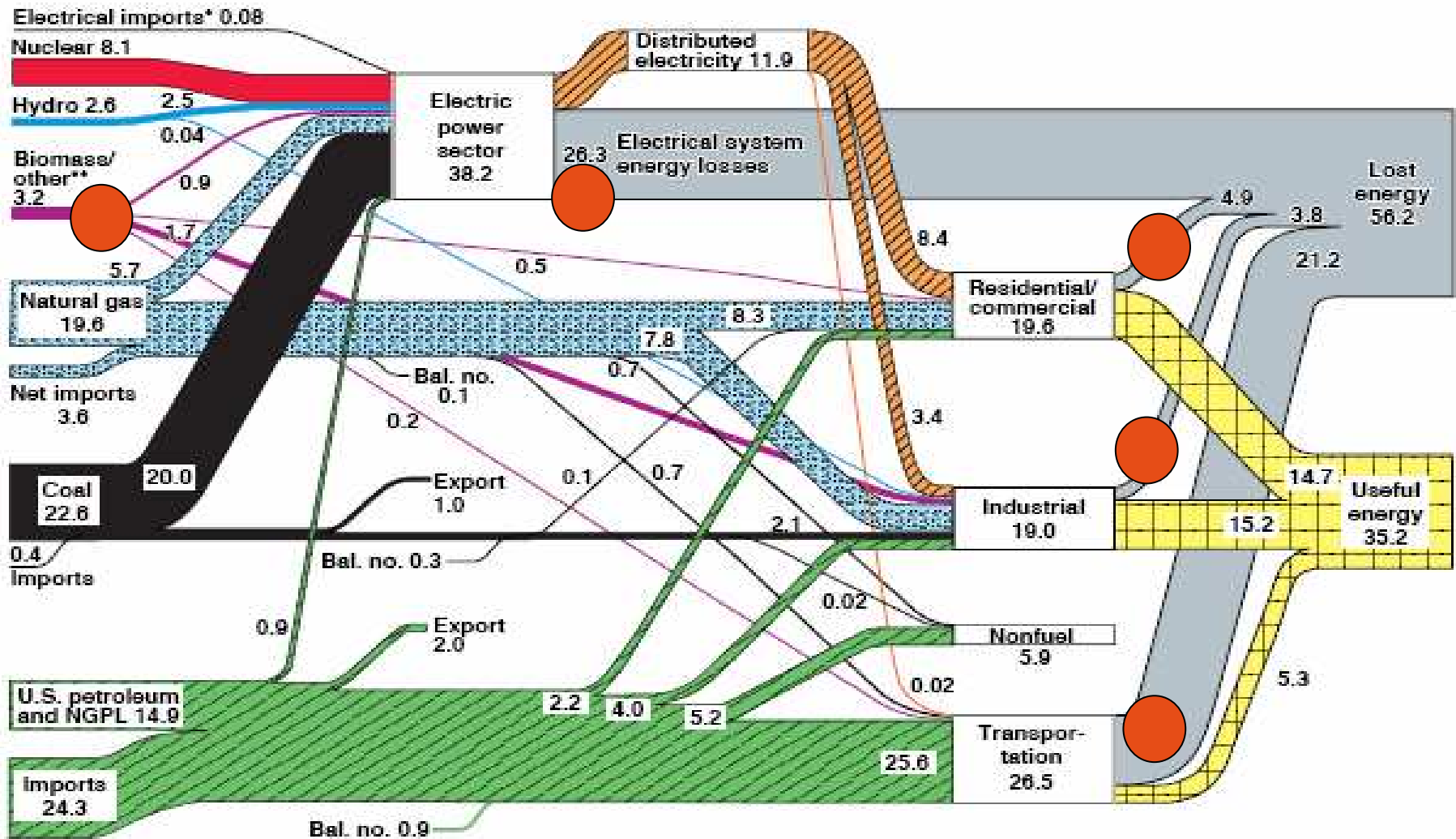
2002 avg price = \$25/barrel

2002-today multiple = 3.3x

2002 avg price = \$3/MMBTU

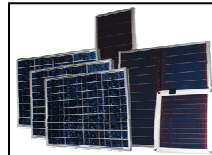
2002-today multiple = 2.3x

Figure 1. U.S. Energy Flow Trends – 2002 Net Primary Resource Consumption ~97 Quads



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 *Net fossil-fuel electrical imports.
 **Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

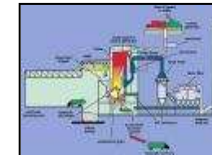
“Cleantech” includes a broad range of technologies



Solar



Hydrogen Generation



Waste Conversion



Wind



Energy Storage



Power Control



Fuel Cells



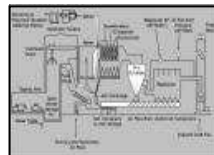
Biodiesel



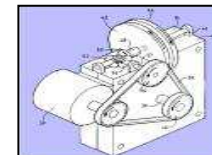
Batteries



Hydro



Biomass



Engine Design



Wave & Tidal



Ethanol



Intelligent Grid Software



Efficient Lighting



Efficient Vehicles



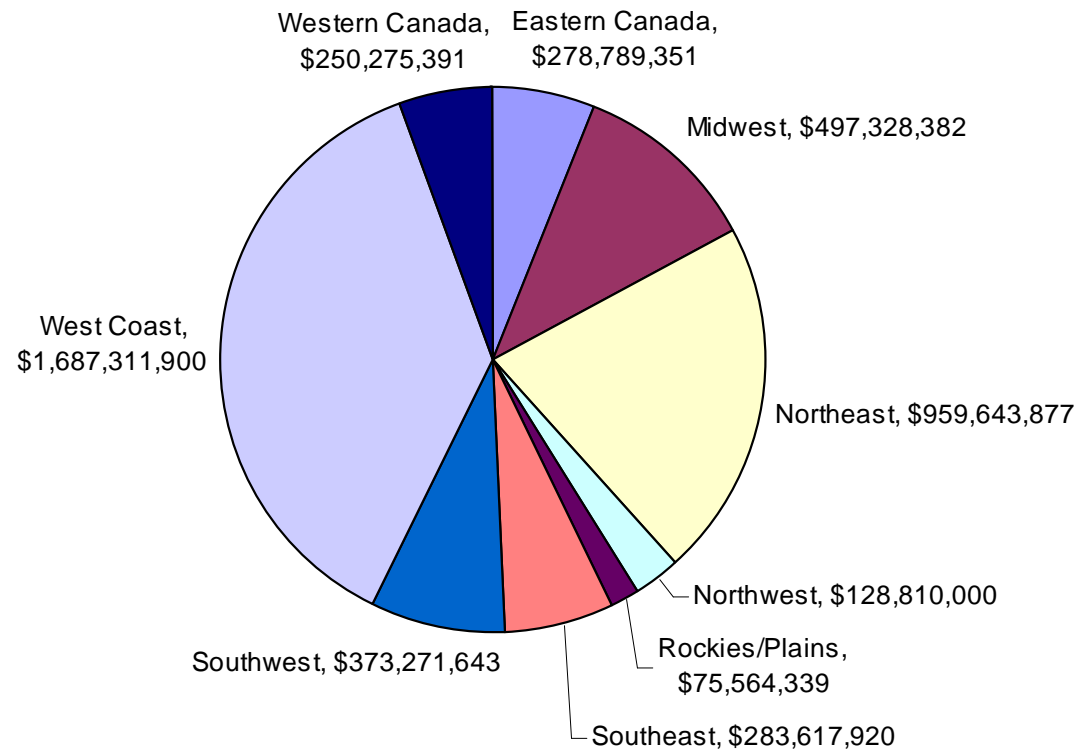
Process Efficiency

and many more...

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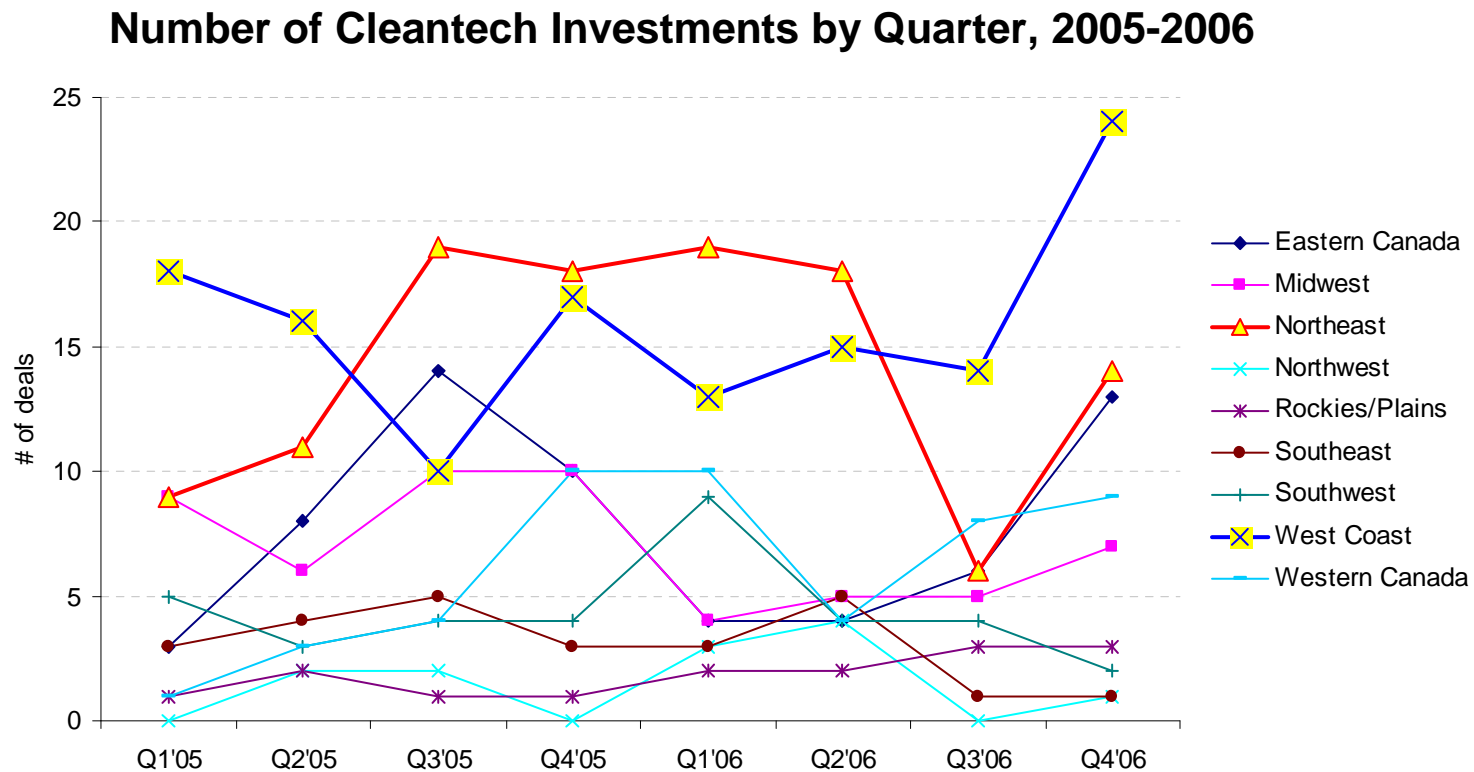
The Northeast and California have led cleantech investment activity

Annual Dollar Volume of Cleantech Investments, 2005-2006



- For all of 2005 + 2006 investments, the Northeast ranked second in total dollars invested

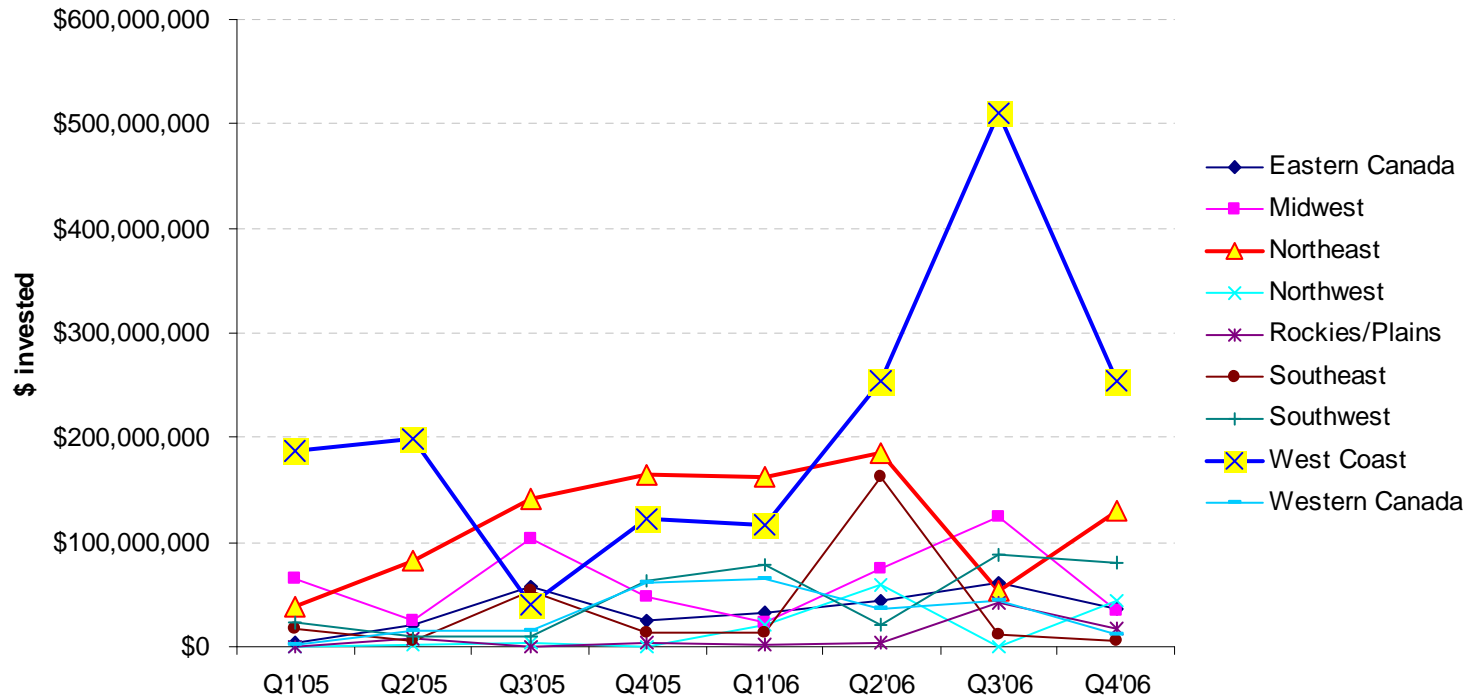
California is becoming the dominant cleantech market



- The Northeast ranked first or second in number of cleantech investments 7 of the 8 quarters across 2005 & 2006
- Boom in solar investments in the Southwest in 2007

California is becoming the dominant cleantech market

Dollar Volume of Cleantech Investments by Quarter, 2005-2006



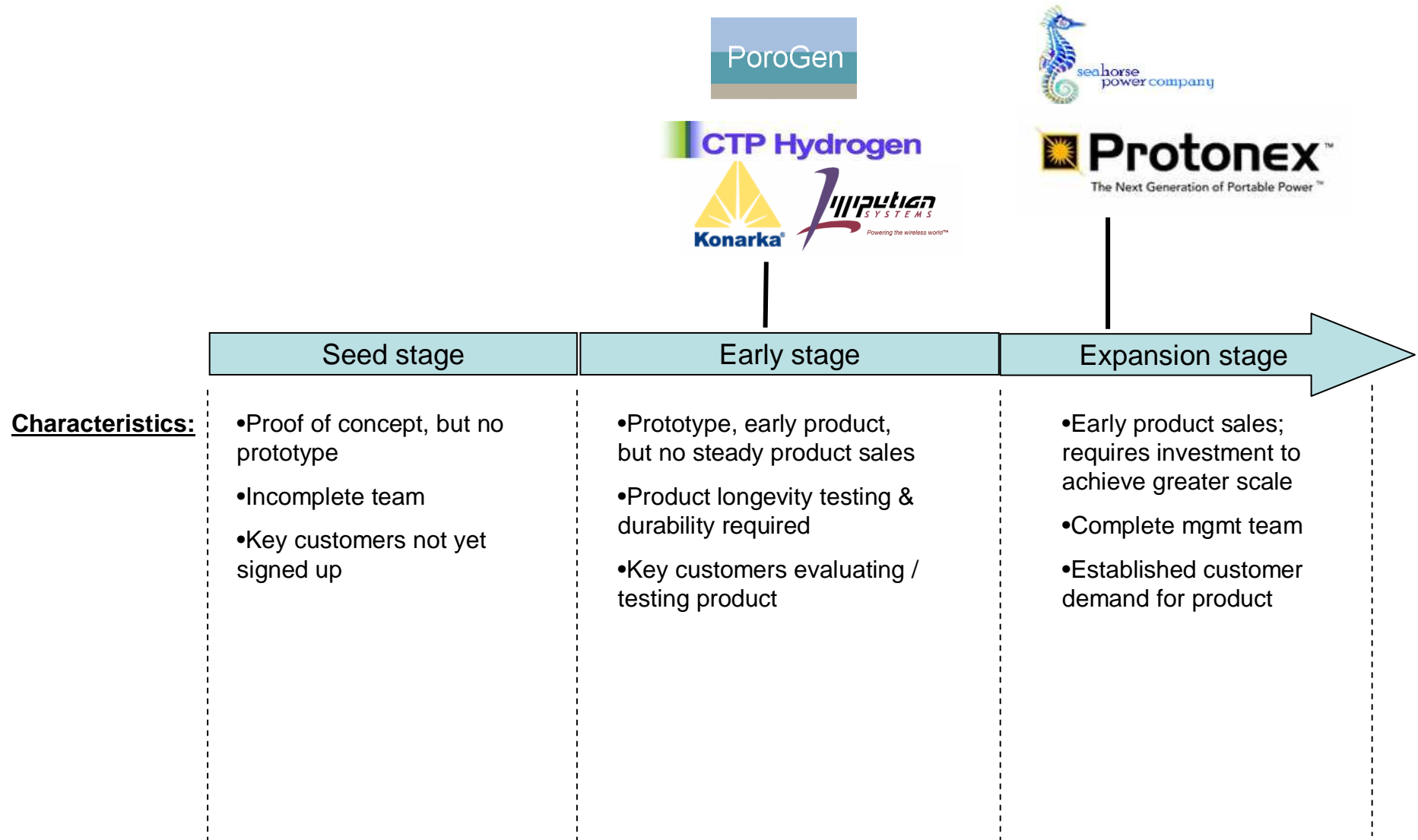
- The Northeast ranked first or second in dollars invested 6 of the 8 quarters across 2005 & 2006
- Large-scale solar investments in the SW have recently pushed the Northeast to 3rd place

Summary:

- Cleantech continues to be one of the top categories for VC investment
- Energy deals dominate the cleantech category
- Photovoltaics and biofuels represent two of the biggest sectors for energy investments
- The Northeast (primarily MA) led cleantech activity in 2005 and 2006, but has recently fallen behind other geographies

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The Fund has 6 portfolio companies





- Top technical team – 2 Nobel Laureates
- Low cost flexible PV power < \$1/W
- High speed, low cost reel/reel manufacturing
- Prototypes being tested by military and commercial customers

Flexible solar strip from Konarka



Reel-to-reel manufacturing equipment



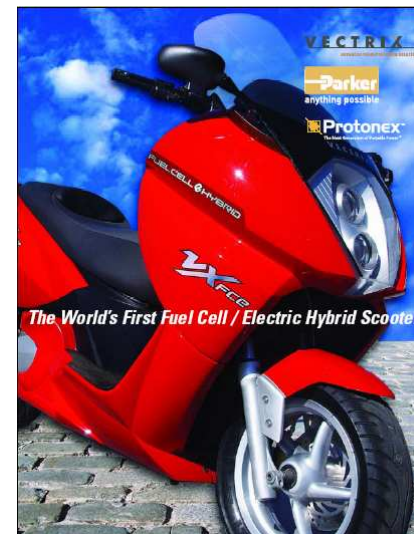


- Fuel cell stacks and systems for the sub-500W portable power market
- 3-5x stack cost advantage
- Portable power system prototypes in tests by military
- June 2006 IPO on London Stock Exchange

500W fuel cell genset made with Protonex stack



Prototype electric “maxi-scooter” with Protonex fuel cell



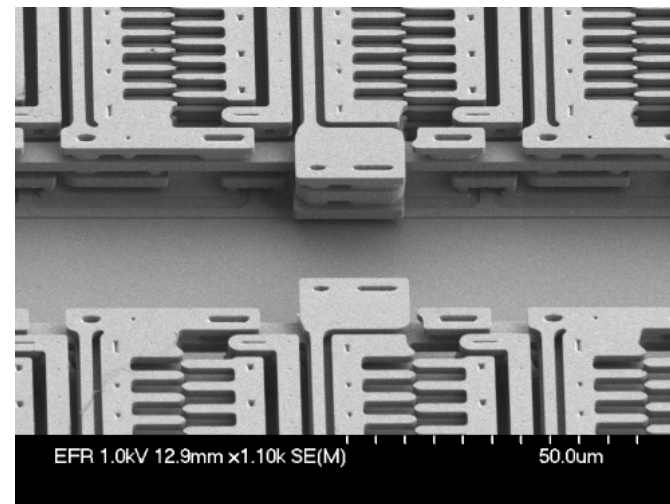


- MEMS semiconductor-based solid oxide fuel cells fueled by liquid fuel for long-duration portable consumer electronics
- Significant performance advantage over Li-Ion batteries
- First markets: smartphone chargers and industrial PDA battery replacement

Developing partnerships in portable electronics



Close-up of micro-fabricated MEMS device





- Integrated photovoltaic technology for remote power applications
- Primary markets are municipal, park, and recreational areas

Big Belly 2



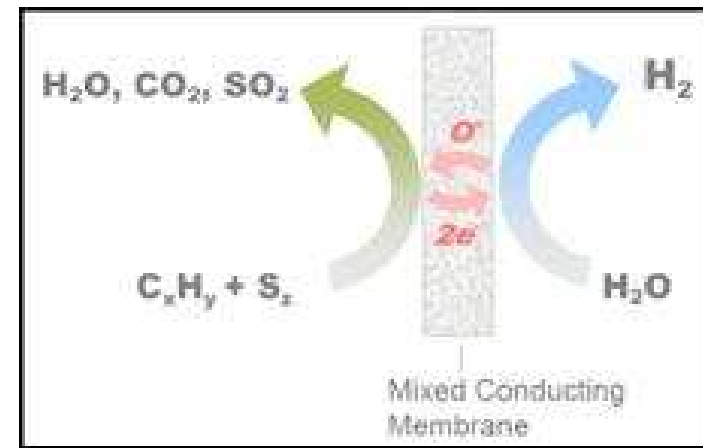
Big Belly 3



CTP Hydrogen

- Inexpensive, efficient technology to extract hydrogen from hydrocarbon fuels (gasoline, propane, diesel, etc.)
- Significantly lower cost for portable and distributed hydrogen generation
- Primary markets are portable generation and uninterruptible power supply (UPS) applications

Patented conducting membrane





- **Key technology: proprietary high-performance porous membrane for separation applications which other membranes cannot address**
- **Novel membrane technology used to significantly reduce cost of producing bioethanol, biobutanol**
- **Platform technology applies to natural gas processing, too**

Membrane cartridge assembly for processing of gas and/or liquids

