

Cleantech

Just a Phase or ?

Cleantech is more than being green

**Plentiful and low-cost water and electricity
can solve traditional political disputes**

Cleantech includes

- Renewable Energy - need economic solution
- Energy Storage - need increased capacity
- Water - need energy efficient solution

The preliminary information presented includes original material as well as information collected or compiled from numerous sources by R. Helfrich of Alameda Capital LLC. Some forecasts are the opinion of the author without external sources.

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Value Creation Through Combined Technologies

- **Fully Integrated Low-Cost Systems**
- **Creates Barriers to Competition**
- **Large Market Opportunities**
 - **Near Term**
 - **Revolutionize existing markets**
 - **Long Term**
 - **Create whole new markets**



CleanTech Renewable Energy

- **Point of Use Energy**
 - Photovoltaic + Advanced Materials+ Optics
- **Central Power Generation**
 - Solar Thermal + Advanced Materials + Energy Transfer Techniques
- **Biomass**
 - Life Science (GMO) + Solar
- **Niche Markets**
 - Wind - random times and limited locations
 - Wave - complex transmission to users
 - Geothermal - cost of a deep well

Hydro

Fission

Fusion

NOTE: Compare Price at Point of Use

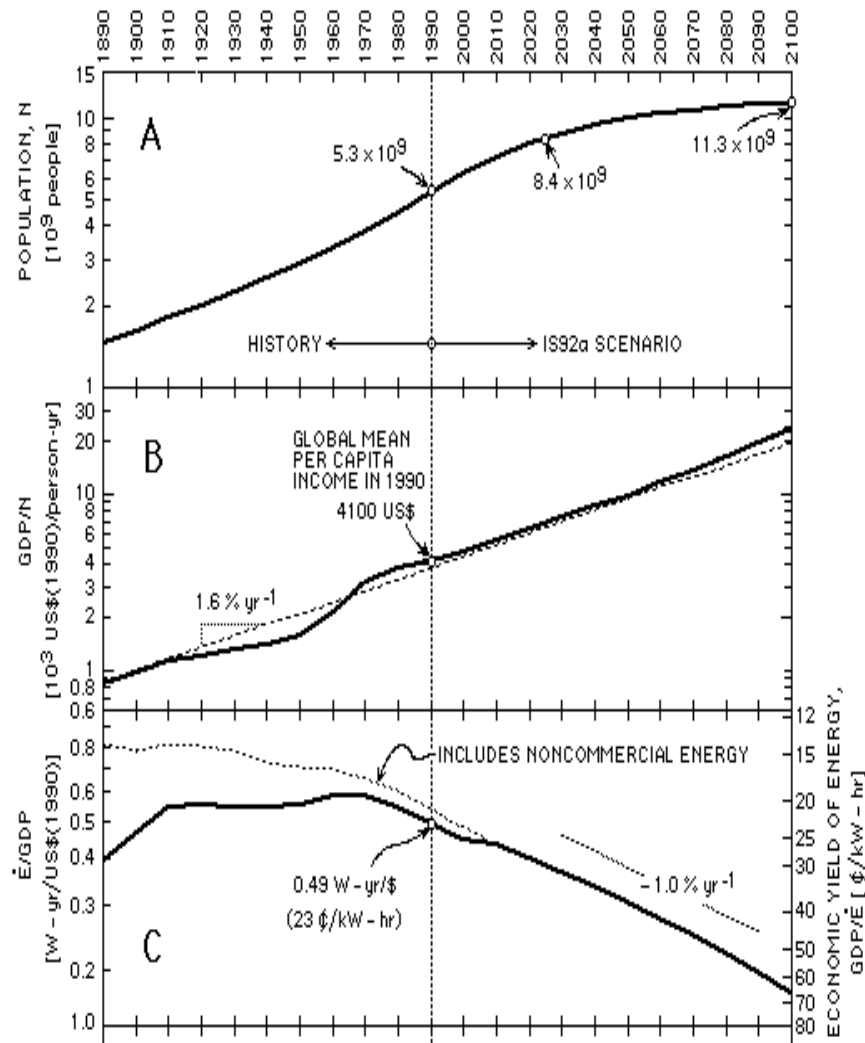


Energy Efficiency Unable to Overcome More People Living Better

Population Growth to **10 - 11 Billion People** in 2050

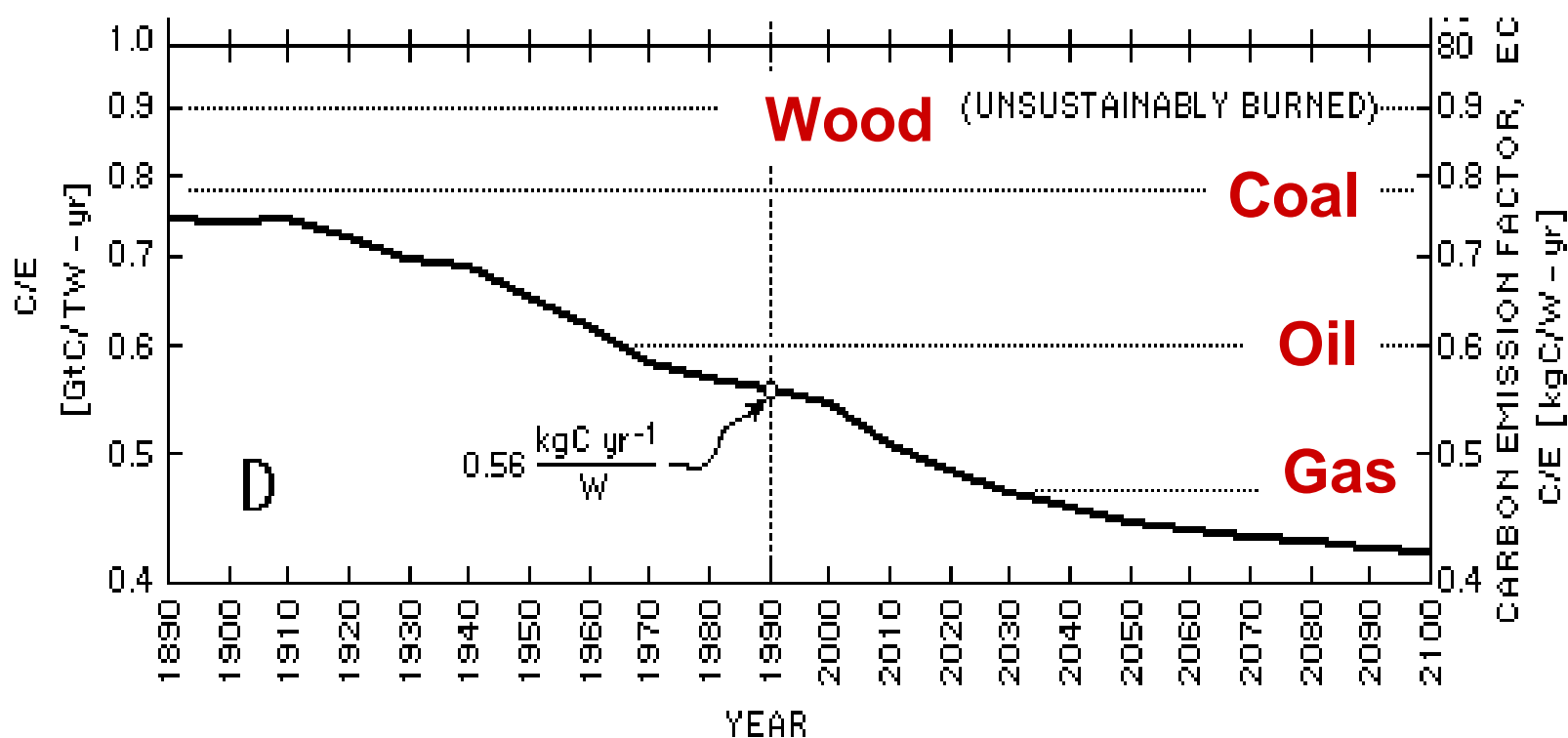
Per Capita **GDP Growth** at **1.6% yr⁻¹**

Energy consumption per Unit of GDP **declines** at **1.0% yr⁻¹**



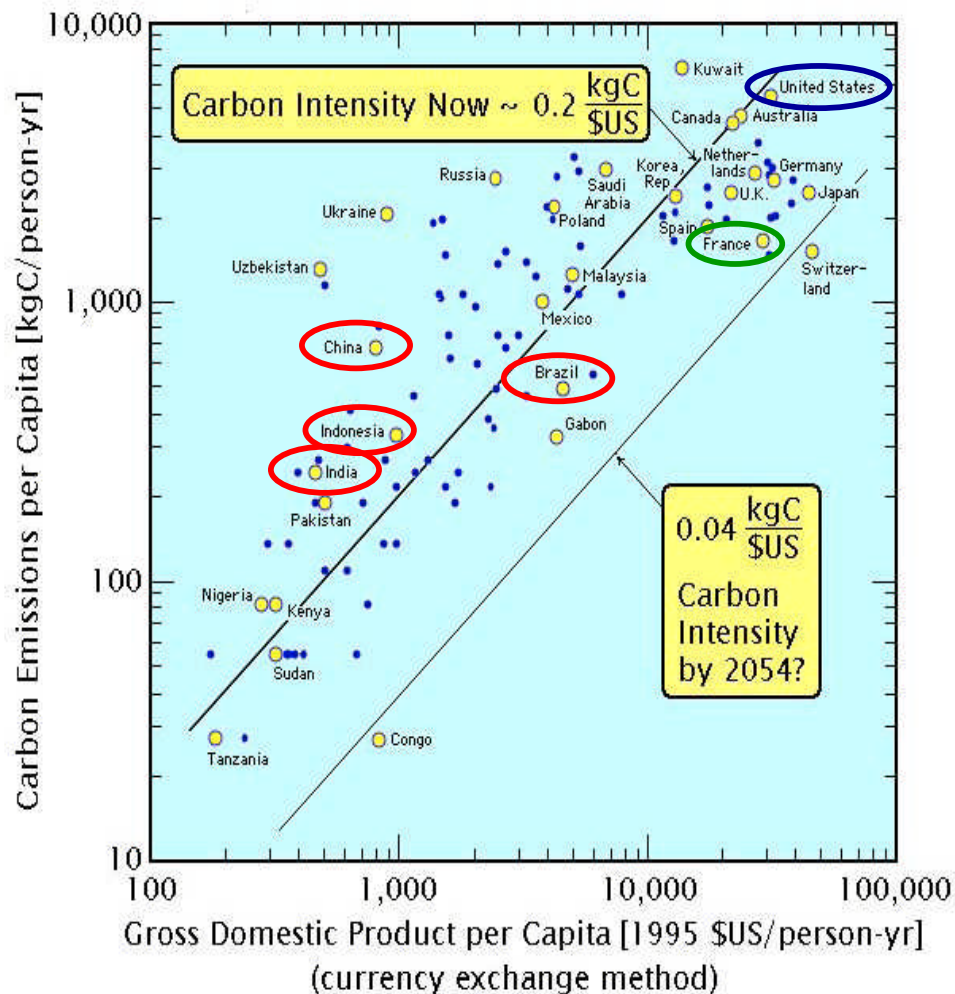
Carbon Intensity of Energy Mix

Easy transport or storage of energy creates value
 - Electric and oil are better than others



M. I. Hoffert et al., Nature, 1998, 395, 881

Carbon Intensity vs GDP



Concern

3 of 4 countries with the world's largest population in 2050 along with high GDP growth are carbon intense users in 2006 and likely to remain so

Alternative

France's nuclear provides advantage



Renewable Conclusion

- Abundant, Inexpensive Resource Base of Fossil Fuels (always 40 years oil left + 200+ years coal)
- Renewables will not play a large role in primary power generation

unless/until:

- technological/**cost breakthroughs** are achieved, or
- unpriced externalities are introduced (e.g., environmentally-driven carbon taxes)
 - [or politically created supply restrictions]

Source: Professor Lewis of Caltech

<<http://nsl.caltech.edu/energy.html>>



Other CleanTech

- **Energy Storage** (TW-Hr.)
 - Batteries + Advanced Material
 - Advanced Materials + UltraCaps
- **Energy Efficiency - Opportunities**
 - Lighting and Semiconductors (> 85% @120V AC)
 - Solid Oxide Fuel Cells (> 50% natural gas joules)
 - Others - Dynamic HVACs - Pumps - etc.
- **Municipal Water / Waste Treatment**
 - Advanced Materials + Molecular Separation



Entrepreneur Opportunities

This Startup Cycle is Different

- Very early stage capital tighter than late
- Investors expect to see tech demo
- **Global market** longer and more expensive to penetrate
- **Total capital required** to reach exits (M&A or IPO) growing faster than PPI or CPI
- **Global competition - Intense**
 - Smart and educated people everywhere
 - Capital less expensive than US in some countries
 - IP - more difficult path to achieve value
 - Method IP frequently copied without recourse



Focus on US/CA Startup Strengths - Minimize Weaknesses

Strengths

- Science/ Engineering multidisciplinary skills
- Workforce with diverse thinking
- Partnership opportunities for effective sales channels
- Specialized skill sets available on demand
- Established startup service infrastructure

Weaknesses

- High cost of capital
- Difficult capital market for seed companies
- Extensive local competition
- Complex government regulations
- High cost of labor