Alternative Energy and Energy Efficiency Trends, Issues, & Technology Futures

2nd National Standards System Conference
Charting the Course

Allan Amey
Climate Change Central
Suite 100, 999 - 8th St. SW
Calgary, Alberta, Canada
Telephone: 517-2700
e-mail: aamey@climatechangecentral.com
www.climatechangecentral.com
www.energysolutionsalberta.com

November 2004

Climate Change Central

Climate Change Central

Climate Change Central

“Focused on taking action to reduce air emissions”

- A not-for-profit company
- A private-public partnership.
- Core staff of 18 individuals
- Offices in Calgary & Edmonton.

Emission reductions are closely related to energy development, energy use, land use, and water use.

Currently, the world's energy use is about 12 trillion watts.

This is 120 billion 100-watt light bulbs and 85% comes from fossil fuels.

If we want to reduce the impacts of energy demand on the environment, the challenge is immense

Source: M.I. Hoffert, et al, Advanced Technology Paths to Global Climate Change Stability, Science, November 2002

Energy challenges and opportunities

- **Energy supply challenges are global challenges – not all within our locus of control**
- **Energy demand challenges require strong leadership - to change the way we live.**

This is not business-as-usual!

North American energy supply challenges - high energy prices a long term signal?

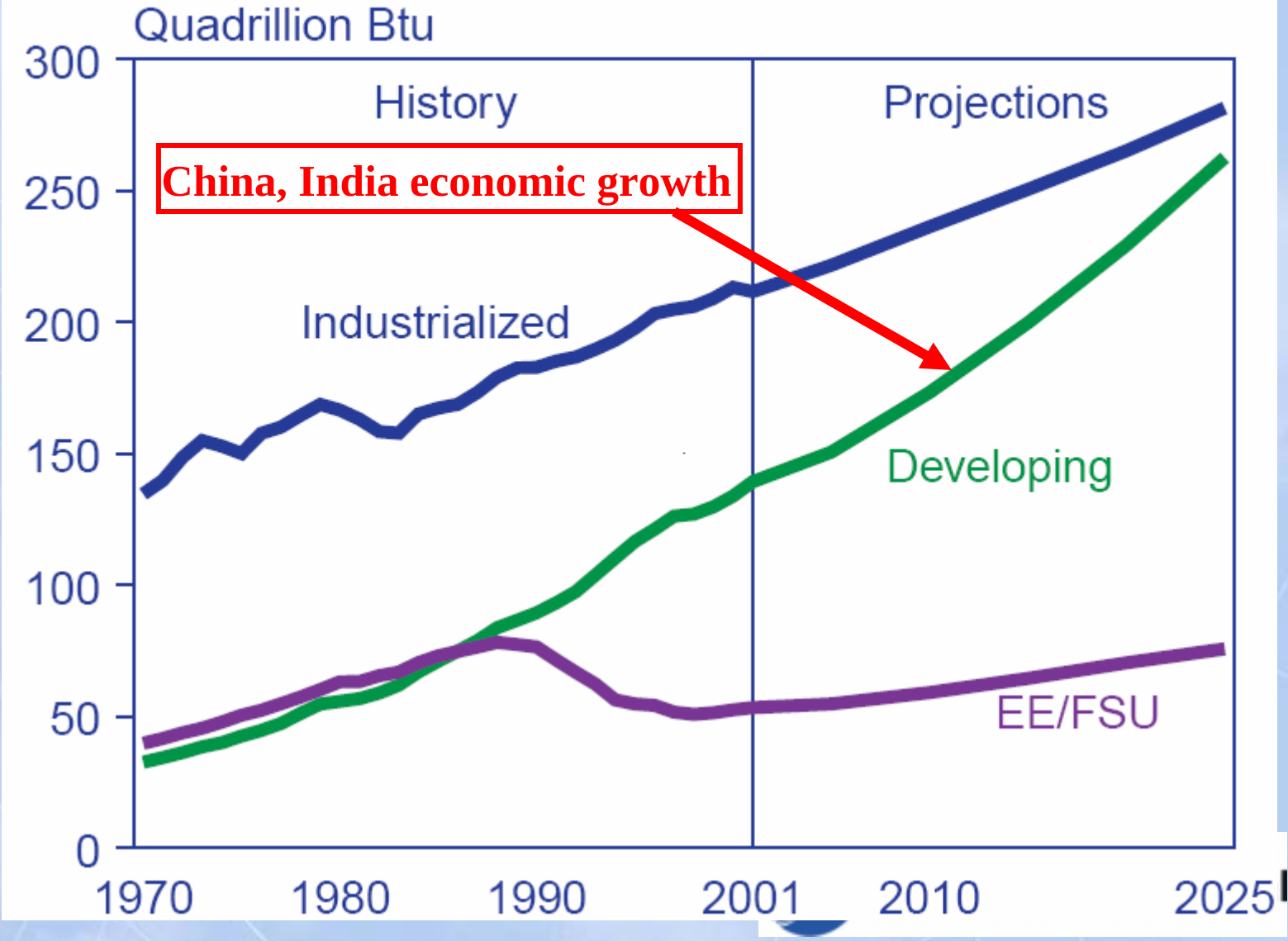
- Huge increases in demand in the Far East (China, India)
- Vulnerability of supply disruptions (Iraq, Saudi Arabia, Russia, Nigeria, Venezuela)
- Concerns about supply capacities from existing reservoirs
- Bigger reservoirs are becoming harder to find and more expensive to develop

North American energy demand challenges

- China – 40% of the world oil demand growth.
- The White House in 1985 focused on zero imports by 2000. By 2002, imports stood at 12 million barrels per day.
- A disruption in Saudi oil supplies - “one event to which no one has an answer”
- Last year the world used 25 billion barrels of oil and found 8 billion new barrels!

Sources: EIA-DOE, July 2004, J. David Hughes, Geological Survey of Canada, December 2003, Larry Goldstein, Petroleum Industry Research Foundation, August 2004, Paul Roberts, Harper’s, August 2004

Figure 13. World Energy Consumption by Region, 1970-2025



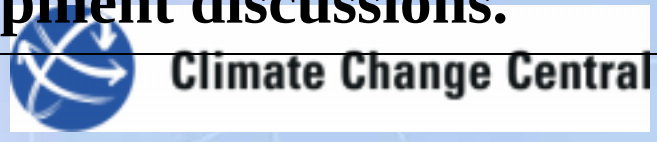
Source: EIA - DOE

North Americans like energy. We like heat and light and power.

How much power do we need and what fuel sources do we want?

- **Motive Power**
  - **Oil, natural gas, ethanol, bio-diesel, hydrogen?**
- **Power Generation**
  - **Oil, natural gas, coal, hydro, nuclear, wind power, solar?**

"*NIMBY*" (not in my backyard) and "*BANANA*" (build absolute nothing anywhere near anything) predominate energy development discussions.



North American energy demand challenges - What impact will high prices have?

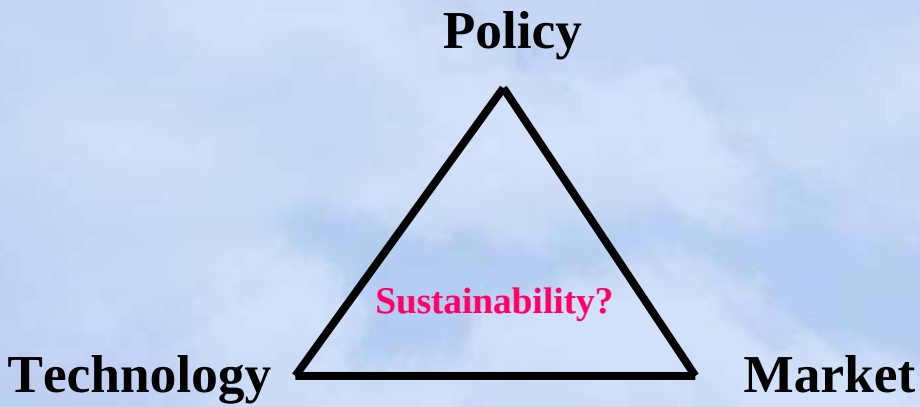
- Increased energy efficiency and conservation
- Increased energy R&D
- Increased development of hydrocarbon sources and frontier areas
- Increased development of renewable energy
- Increased environmental concerns

What priority should be given to these initiatives?

Climate Change Central

Can we move to a sustainable energy future?

What innovative policy, market, and technology approaches are needed?



These elements of societal change are tightly linked.

Climate Change Central

Climate Change Central

An Integrated North American Clean Energy Strategy is needed

- **Energy infrastructure technology breakthroughs are needed**
  - **CO2 separation, transportation, and storage**
  - **Clean coal**
  - **Transmission line optimization**
- **Alternative energy commercialization initiatives need to be stimulated**
  - **Distributed generation, combined heat & power**
  - **Continued wind power development**
  - **Alternative transportation fuels**
  - **Sustainable buildings**
- **Policy incentives and rules are needed**
  - **Energy efficiency and conservation programs**

Alberta's Energy Mix for Electricity Generation

	COAL	NG	HYDRO	WIND	BIOMASS	TOTAL
Capacity (%)	51	41	7	1	0.5	11200 MW
Generation (%)	66	39	3	0.5	0.5	64 TWh

- **Demand growing by 400 MW/yr**
- **GHGs from electricity generation:**
- **40 Mt in 1990 → 47 Mt in 2000 → 57 Mt in 2010**

Climate Change Central

Climate Change Central

Large Centralized Electricity Generation Challenges

- Capital costs for large centralized facilities
- Long lead-times & approval process
- Transmission constraints
- Line losses
- Wasted heat energy
- GHG & non-GHG emissions
- Matching supply with demand

Distributed Generation as an energy alternative

- Small-scale power generation close to the end-user
- Not fuel-specific or technology-specific
- Can be off-grid or grid-connected
- Offers potential cost savings and greater efficiencies
- A rational response to:
  - Re-structuring
  - Convergence of power & natural gas
  - Advances in enabling technologies
  - Environmental concerns

Types of Distributed Generation

Distributed Generation

Distributed Generation is a power delivery system or "platform" that integrates different technologies and fuels. This allows the most cost-effective combination of fuel and technology to be used.

Advantages of Distributed Generation

- No long lead-times
- Scalable to power needs
- Easier site approvals
- Fuels & generation technologies
- Improved power quality & reliability
- No transmission losses or costs
- Higher efficiencies (CHP)
- Reduced emissions & impact
- More stable power prices
- Revenues

"Using a variety of power sources should bring greater price stability while reducing emissions of pollutants and GHGs. DG could change the way we buy and sell electricity" - EPRI President, Kurt Yeager

Alberta alternative and renewable energy initiatives

- **By 2005, the Alberta government will be utilizing 90% green power at its facilities.**
- **Over the past 5 years, renewable energy sources have increased 600% in Alberta**
- **52% of wind production in Canada is generated in Alberta.**
- **Combined heat and power, solar, and biomass projects are underway in a number of locations in Alberta**

A portfolio of energy production sources makes good business sense to producers and consumers

What Can Businesses Do?

- **Short-term measures**

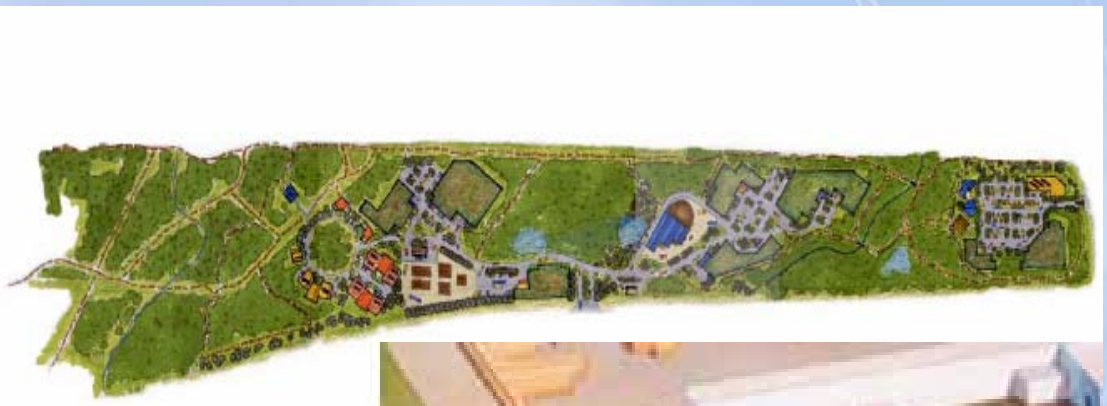
Climate Change Central

What Can Businesses Do?

- **Medium-term measures**

What Can Businesses Do?

- **Longer-term measures**



Never underestimate the power to conserve and use energy wisely

- **In the 2000-2001 energy “crisis”, Californians cut their peak electricity demand by 14% in six months.**
- **After the Iran crisis, GDP grew in the U.S. by 20% between 1979 and 1986 and energy use decreased by 5%.**

Sources: Lovins & Wyatt, February 2003, Lovins & Lovins, February 2002

Climate Change Central

A Final Thought

Tough fuel economy standards for new vehicles could save 67 billion barrels of oil over the next 40 years - 10-20 times greater than the potential oil supply from the Arctic National Wildlife Refuge.

Source: ACEEE

Reducing energy use, reduces energy development, air emissions, frontier land use, and wildlife disturbance

Allan Amey

Climate Change Central

Suite 100, 999 - 8th St. SW

Calgary, Alberta, Canada

Telephone: 517-2700

e-mail: aamey@climatechangecentral.com

www.climatechangecentral.com

www.energysolutionsalberta.com