

# Alternative Fuels: Friend or Foe to Global Warming?

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# Introduction

- Civilization runs on liquid fuels
- Can we create alternatives?
- Are those alternatives viable from a CC Perspective?
- Some Digressions...

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- Computer Scientist, Political Scientist, Technology Entrepreneur
- Consultant to Governments and International NGOs
  - ◆ OECD
  - ◆ IEA
  - ◆ IADB
  - ◆ IMF
  - ◆ International Agricultural Council
  - ◆ Governments of Canada, Barbados, Suriname among others...

# Useful Publication

- “Opportunities and Barriers for Renewable Energy,” RIEL Project, CEC Paper, 2005, November 2005 – available on internet, first 50 pages are a synopsis of *all* current alternative energy technologies with *sources*.

# Possibly Useful:

- “WTO Disciplines and Biofuels: Opportunities and Constraints in the Creation of a Global Marketplace,” International Food and Agricultural Trade Policy Council, IPC Discussion Paper, IPC and Renewable Energy and International Law, October 2006 – available on the internet

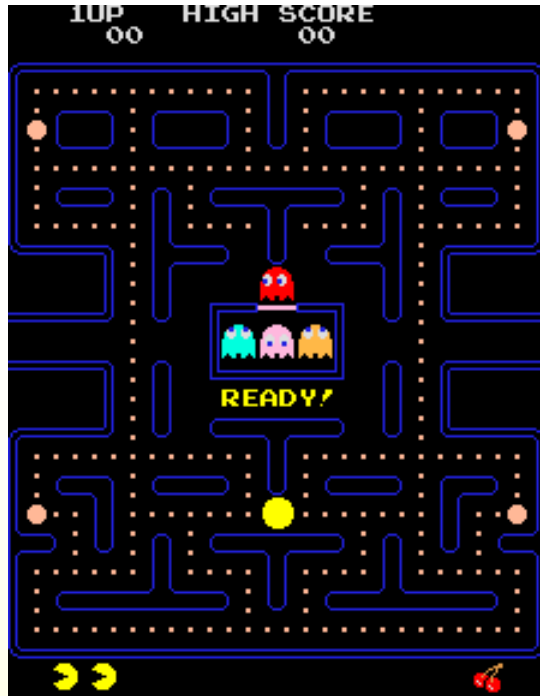
# Topics of Discussion

- Tinker-toy, Ms. Pacman and Dinosaurs in Bikinis: Science Redux
- But it doesn't *mix!* Biofuels
- Risks, Rewards, Caribbean Resources
- Combined Cycle Carbon/Fuel Caribbean Proposal
- Pandora's Box



# Carbon: Nature's Tinker Toy

- What is Carbon? My Favourites:
  - ◆ Diamond & Soot – pure carbon
  - ◆ Carbon: Nature's tinkertoy/backbone of Life.
  - ◆ Carbohydrates = carbon + hydrogen + other “stuff”- all living and once living things = steak!
  - ◆ “Carbs” = people fuel & car fuel



# Ms. Pacman

- Oxygen: Mother Nature's Ms. Pacman.
- Plants *make* carbohydrates, exhale oxygen
- Burn Baby Burn! Creatures, Cars, Fire, Rust *break* carbs = Oxidation



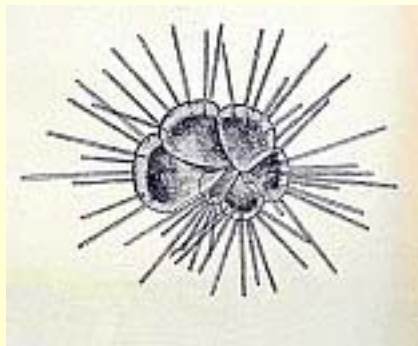


# Dinosaurs in Bikinis

- John Vidal, 5 am, February 26 2008, alleges beach dinosaur sighting...
- ...Petrus Looks for Proof...



# Dino Beach II



- Dinosaurs lived in Caribbean like (shallow tropical seas with islands) conditions for many tens of millions of years.
- These seas were teeming with life
- All of that sea life died and sank.
- Sea-life was covered with sediment
- Mother Nature added heat and pressure + time = oil, gas, coal

# Nature's Carbon Bank



- Carbon is an “elbow in the yeast growth curve.”
- Nature has been ‘banking’ ie sequestering carbon since the dawn of life on this planet
- Withdrawals from the bank: oil, gas & coal = carbon withdrawal/recycling
- Dinosaur Ethics

# Carbon: New, Recycled & Tip Points.

- Only two sources of carbon can change climate system tip points
  - ◆ Recycled carbon – ie: coal, oil, gas
  - ◆ “New” carbon – primarily from geologic action esp. volcanoes. Huge volumes but intermittent

# Relief!

- That was the end of the background material.
- You now know more than many journalists, practically speaking.

# Sunday Supplement Sci.

- Cultivate Scientific Sources & *Protect Credibility* by:
  - ◆ Listening for – and *to* – qualifiers
  - ◆ Scientists *hate* reports that turn *qualified* statements into ‘fact’ or “factoids.”
  - ◆ Check sources
  - ◆ Don’t jump to conclusions
  - ◆ Science is about debate *not* consensus ex. Hurricanes in Carib.



# Bjorn's Warning...

- Bjorn Lomborg Left-wing Danish Statistics Professor and Environmentalist (..and GreenPeace member...) discovered GreenPeace completely misrepresenting facts on its website and elsewhere – wrote “The Skeptical Environmentalist”
- Result: Huge Credibility Problem!
- Be Warned - Advocacy Journalism is not a justification to distort, ignore or change the truth because the truth is inconvenient!

# ...and FINALLY

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The Main Topic of Today's Talk

Alternate Fuels: Friend or Foe of  
Global Warming



# Civilization Runs on Liquid Fuels

- Replacement cost of U.S. liquid fuel infrastructure - \$2 – 3 TRILLION.
- Key Cause of Pearl Harbour: Oil
- Try to fill your gas tank with:
  - ◆ Wind
  - ◆ Solar
  - ◆ Geothermal
  - ◆ Tidal

# Why?

- Greatest Technology Failure of 20<sup>th</sup> Century was? ...

<free drink for anyone with correct answer>

# Answer

- No good energy storage device developed – still SF (Robert A. Heinlein “shipstones,” E.E. “Doc” Smith, Ph.D, “accumulators.” etc...
- Very low energy density in energy storage devices
  - ◆ High cost
  - ◆ Short life
  - ◆ Great Bulk

# Mother Nature's Answer:

- Bind energy (hydrogen) to carbon
- High Tech. Analog: Fuel Cells
- Fuel Cells are NOT batteries
  - ◆ They require a 'fuel' (even sugar)
  - ◆ Oxidize (ie "burn") fuel to create electricity – much like your own body. Ballard Power and many other companies involved.

# ...and Petrochemicals

- Wind, Solar, Geothermal can not be used as feed-stocks for chemical plants.
- “Go into plastics, young man.”
- Plastics and chemicals sine qua non of modern civilization.



# Can We Create Alternatives?

- Biofuels:
- Bio-diesel
  - ◆ Diesel made from biomass, esp. from:
  - ◆ U.S/E.U. : Soy and Rapeseed.
  - ◆ Carib: palm oil, jatropha, algae, coconuts

# Ethanol

## ■ Various Alcohols

### ◆ Ethanol, Methanol, Octanol

#### ★ Ethanol:

- We drink it
- We use it for gas line anti-freeze
- Other hygrophilic (water binding) activities
- We use it as FUEL
- High Octane
- Lower energy density than gasoline

# Methanol

- “Wood” Alcohol
  - ◆ Toxic. Ex. causes blindness
  - ◆ Low energy density
  - ◆ Not currently popular, anymore



# Octanol

- ..and other more specialized alcohols...
- Dupont is working with Octanol
- Why?
- Doesn't separate from gasoline in pipelines or tanks
  - ◆ Transport & Storage = cost.

# Sounds Great....*but*...

- Increasingly fierce debate about issues surrounding bio-fuels. Key Issues:
- Land use (ex. Farmland, virgin pampas or forest)
- Carbon emissions in production cycle
- Water issues where irrigation used.

# More *But...*

- Biodiversity loss
- Fertilizer competition with food production

# Cellulosic Ethanol Etc...

- Ethanol & kin made from simple sugars what about complex sugars like: cellulose, lignin etc. (woody fibers)?
- If a Cow needs four stomachs to digest grass, it *isn't easy*.
- Canada – yes, Canada is a world leader in developing these processes

# Cellulosic Continued

- U.S. also hard at work on enzymes needed for process (remember the cows!).
- U.S. Congress mandated 250 m/gallon cellulosic production (about 6-10 plants) by 2013
  - ◆ Legislation has accidental huge loophole. [Title XV, Section 1501 ]

# Cellulosic Again...

- Cellulosic ethanol (or octanol etc.) can be produced from any woody fibre – trees, bushes fast-growing grasses, bamboos etc.
- GREAT! Problem Solved! Err..No.

# Cellulosic Cost

- Cost. It is still expensive to manufacture the special enzymes that break down complex sugars (woody fibres) into simple sugars that can then be fermented/converted into alcohol based fuels.

# Cellulosic & Environment

- This is great – we can turn agricultural waste (stalks, stubble etc.) into fuel.
- Soil is made up of mineral components and organic components, those organic components make it into “good, rich soil” – if there are enough.
- Take the waste, take the soil!
- Solar driven ecology built soil, question:
- How much can be withdrawn, without damage?



# Caribbean Perspective

- Lots of warm sun means high-energy ecology = fast growth = easily produced biomass.
- Warm countries at competitive advantage in growing biofuels and in balancing soil needs.
- Caribbean has lots of (sea) water too – big advantage.
- Caribbean has energy substitution needs so is motivated

# Huge Challenges Need Bold Visions

- Huge challenges can cause audiences to feel paralysis.
- Bold visions give hope. People sign on to the vision.
- Caribbean has unique potential to make lemonade from the lemons it has been handed!

# Carbon Tourism

- Caribbean Declares itself Global Carbon Sink
- A levy from each traveler goes to tourism authority.
- Authority runs – and advertises – carbon sink program
- Each traveler offsets “x” times carbon usage while in Caribbean
- Each traveler can even buy MORE carbon credits from authority -> guilt tourists

# Caribbean Carbon Trap

- Large fabric/plastic floating 'pipes'
- Pipes contain sea-water and algae
  - ◆ Some algae produce biodiesel (current strains about 30% by mass)
  - ◆ Some algae optimized for rapid growth only for use as carbon sink
  - ◆ Some organisms grown as fish food.
  - ◆ Fish production in tubes
  - ◆ Fresh water production in tubes.
  - ◆ All run by tourism authority = credibility = lots of tours of the facility too!

# Last Out was...

Hope



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