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Energy Security Climate Change

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Hubbert's Peak

- Shape of oil production in the US lower 48
- Predicting the peak made Hubbert famous

Ref: Hirsch 2005

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OIL AND GAS LIQUIDS 2004 Scenario

Uppsala Hydrocarbon Depletion Study Group

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Production vs Discovery

THE GROWING GAP

Past discovery based on ExxonMobil (2002).
Revisions backdated.

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Where is the Oil?

Amount Discovered in 2006
Thousand trillion barrels

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Enhanced oil recovery

- Technology helps get oil out faster, and to get more (increases to 50%+ recovery)
- Increasing cost makes hard oil worth it
- The impact of enhanced oil recovery
 - Water and gas injection, heating, etc
- Delay peak followed by fast decay

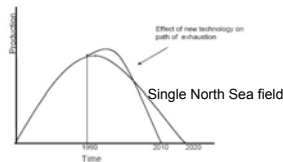


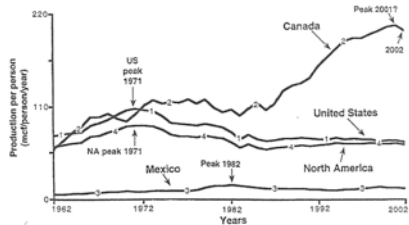
Fig. 2. Technological advance masks impending production declines

So will we "run out"?

- We will always have expensive oil
- "The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil."
 - Zaki Yamani, Saudi Oil Minister 1962-1985
- As oil gets more expensive, we will develop substitutes
 - Natural Gas gets expensive too
 - coal, biofuel, wind, solar

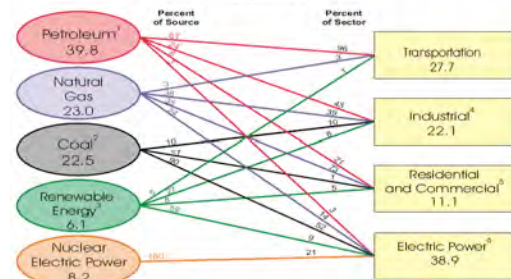
Natural Gas

- Tight supply – likely past peak



U.S. Primary Energy Consumption by Source and Sector, 2004

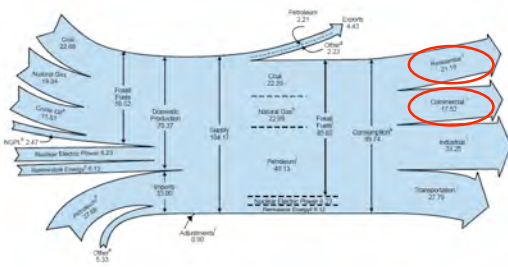
(Quadrillion Btu)



Total Energy

Domestic Sources Supply 70% of Total Energy
40% of Total Supply is Petroleum
23% of Total Supply is Natural Gas
Buildings are #1 Use of Energy in the US (40%)

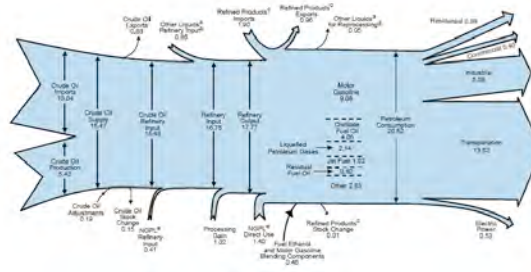
Quadrillion Btu

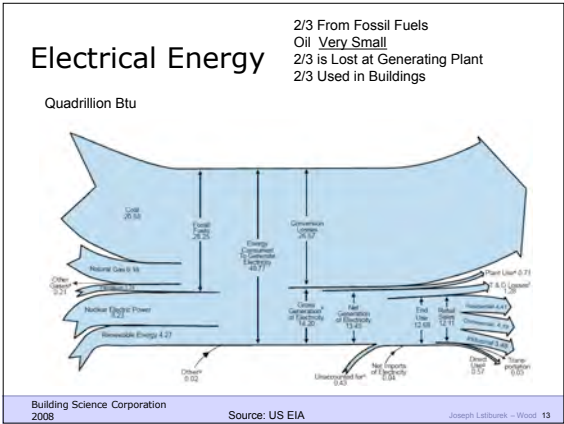


Petroleum Energy

2/3 of Oil is Imported
2/3 is Used in Transportation
Building Use is Very Small

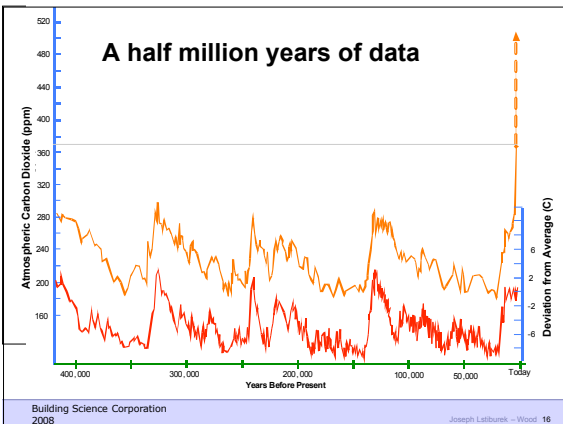
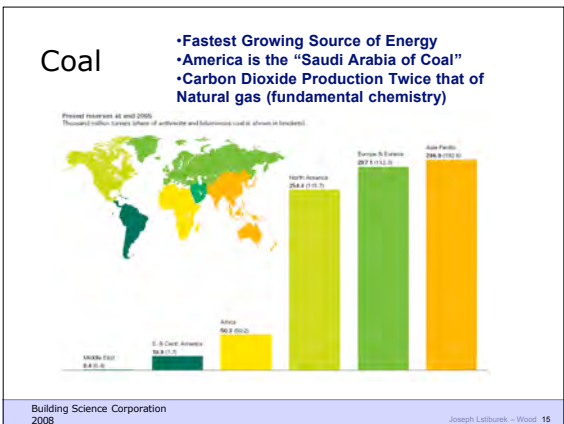
Millions barrels per day



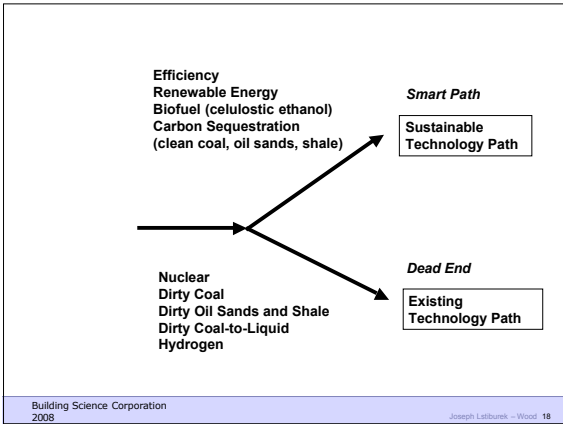


Transportation Sector Will Compete With The Building Sector For The Same Energy

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- There is No Question that Climate Change is Happening
 - The Questions are When, How Bad, Did We do it and Can We do Anything About it?
 - Looks Like Sooner Than Expected
 - Could be Pretty Bad, But then Again Maybe Not
 - Looks Like We Did Do it, But Not Completely Sure
 - We Can Fix It - But is it Worth it?
 - One Solution - Reduce CO2 Through Efficiency & Renewables
 - Energy Security is a Decoupled Issue
 - Solution - Efficiency and New Energy Sources (coal?)
 - Solving Energy Security the Wrong Way Will Worsen Climate Change
 - Solving Climate Change also Solves Energy Security
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It's The Energy Stupid

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Typical Family Carbon Footprint
50 % House
50% Transportation

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Buildings Are The Key To Energy Security
And Climate Change

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Transition From A Hydrocarbon Based
Economy to a Carbohydrate Based
Economy

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We Are The Saudia Arabia of Carbohydrates

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It's Never A Good Idea To Trade Food For
Fuel

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Celluloistic Ethanol

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Wood Is A Battery For Energy From The Sun

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Carbon + Water + Sunlight = Wood
(photosynthesis)

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The Ultimate Carbon Sequestration Is A
Wood Building That Is Energy Efficient

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Wood Is The Ultimate Building Material

When We Are Done It Turns Back To
Carbon and Water and Releases The
Energy

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Plants Do A Better Job Of Converting Solar
Energy Than Rocks

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Let The Trees Do It

Keep The Money Here