Scientists
The world needs your help to solve its energy crisis

Energy research -
truth, lies and priorities

Yossi Hollander; May 18, 2008 lecture at WIS

The Manhattan Project

- In 1942 General Leslie R. Groves asked **Oppenheimer** to head The Manhattan Project
- 130,000 people participated in the project at a cost of $23 billions (in today's prices)
- The top US scientists left their academic halls and careers and went to live in the desert
- For years they worked on one applied science project
- They knew what will happen if Germany will win the Atomic race

Scientist

Imagine that you are Oppenheimer of 2008

The world needs your help to win the war

WAR?

Are we in a War? Define War

War = people die unnaturally

Death Toll

- Deaths as result of oil related wars (last 35 years): 6-6.7 million
- Deaths as result of global warming (last 35 years): Unknown but under 1 million (WHO estimates 150,000 a year starting in 2000)
- Possible deaths as result of oil related wars (next 30 years): **100 million**
- Deaths as result of global warming (next 30 years): 4.5 million (WHO estimate)

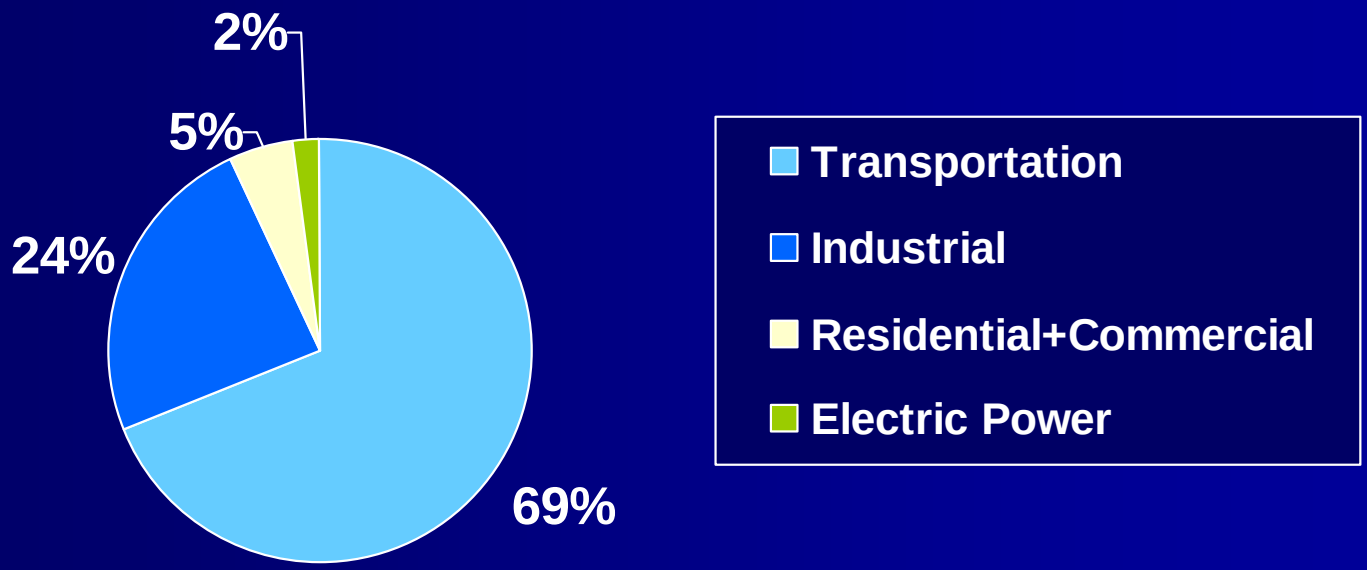
The War Against Oil

- At 120-150$ a barrel the US will transfer its annual budget to oil producers in the first term of the new president
- At 120$ a barrel Opec receives $1.1 trillion a year
- The largest wealth transfer in history to the least democratic governments of the world
- A significant portion of petro-dollars is financing the expansion of radical Islam. We are funding both sides of the war

My Shopping List
Priorities

- Immediate priority – **urgent** war to achieve oil independence (5-15 years)
  - US
  - Rest of the world
- Secondary priority – The global warming war (20-50 years)
- Zero priority – please don't waste your valuable brain on it

Oil Use in the US



US consumes 24% of world oil

Imports 13 million barrels a day, 2.5 million from the Persian golf

Source: www.eia.doe.gov- annual energy review 2006

Transportation Solutions

DO	DON'T
Battery	Hydrogen
Ethanol	Save (or Improve Efficiency)
Methanol/DME	
Bio-diesel	
Buthanol/Gasoline	
Other?	

The Electric Battery

Electric battery technology improves 10% a year. It is already "just about" good enough for Pluggable Hybrids

The Magic of Pluggable Hybrids

- 80% of the cars in the US travel less than 20 miles per day
- If they are charged at night, until 70% of the cars are pluggable hybrids, there is no need for new power stations
- Can be implemented immediately – no infrastructure issue
- The drawback – initial cost per car ($3k-5k)
- The drawback – Except the US, most cars don't park in a garage at night

Priority One

The world needs a 5-20 fold electric battery breakthrough

Range and/or charge speed
and/or price and/or weight

It will completely change the economic equation and is also the best solution for global warming

Ethanol

- High yield “energy vegetation” (for different climates) – for current fermentation methods
- Improved production process
- Cellulose Ethanol – the "holy grail" of Ethanol future
- "Decomposing" plants
- Local production facilities (for developing countries)

The Case for Ethanol

- Proven success - Brazil
- The key is cost differential (vs. Gas)
- Main benefit – source of income for the poorest countries in the world

Methanol from Coal

- Improve the 100 year old process
- Make it "Carbon Clean"
- Make it NO_X clean

The Case for Methanol from Coal

- Worldwide abundance of cheap coal
- At current prices – the most price efficient ($2 a gallon)
- The Chinese are going big on it:
  - 2007 – 3.7 billion gallons
  - 2015 – 10 billion gallons

Other Sources for Methanol Examples

- Methanol from waste wood
  - US potential 40 billion gallons
- Methanol from black liquor (by product of paper pulping)
  - Paper mills potential – 9.3 billion gallons

More Ideas on Methanol

- Cellulose Methanol
- Methanol from Methane flares
- Methanol to DME (better process)

Methanol and Ethanol - Making It Happen

- Needed – a GEM Flexible Fuel Car mandate
- 50 million cars in the US in a few years – will release the market forces
- Needed – blending mandate

Bio-diesel

- High yield "bio-diesel" plants (vs. use of food plants)
- Organic "bio-diesel" makers

The Case for Bio-diesel

- US - 30% of transportation and growing
- Europe - 64% of transportation
- No infrastructure changes
- Price advantage = increase use of diesel

Butanol or Gasoline

- Find a cheap (and clean) way to produce Butanol (or Gasoline)
- Could be in connection to all the above mentioned bio-fuels or not
- The main advantage – it can be used by the current car fleet
- The main disadvantage – it can be used by the current car fleet (not a complete alternative to Opec)

Hydrogen – Don't

- Fuel cells cars are (and will be) too expensive to make
- No way to store safely (liquid or gas)
- No way to distribute safely
- Need new energy-efficient hydrogen production
- We don't have enough Platinum for electrolysis
- Too expensive for developing countries

Hydrogen – Don't

The Hydrogen Economy is a hoax designed to keep us dependent on oil, because under the best of circumstances it is 20-30 years away (or never)

It already lost the race to next generation batteries

Don't Save
Don't Improve Car Efficiency

- We do not need science to improve MPG – it will happen anyway
- Cars in the US stay 16.8 years on the road
- If all cars will be 10% better next year – it is 0.7% less oil next year
- OPEC will simply cut production by 0.7% and we have done nothing
- The growth of China and India alone will make any savings a joke

Don't Save
Don't Improve Car Efficiency

- Price, cap, public transportation have minimal effect
- Demand for Gasoline is only minimally price sensitive
- The European proof
  - Higher gas prices (taxes)
  - Better public transportation
  - Consumption has increased

Don't Save
Don't Improve Car Efficiency

Saving gas is like smoking light cigarettes instead of quitting

If You MUST Save…

- Mass production, ultra light car body parts (reduced fuel consumption, improved battery range)
- Variable torque electric motors (improved battery range)

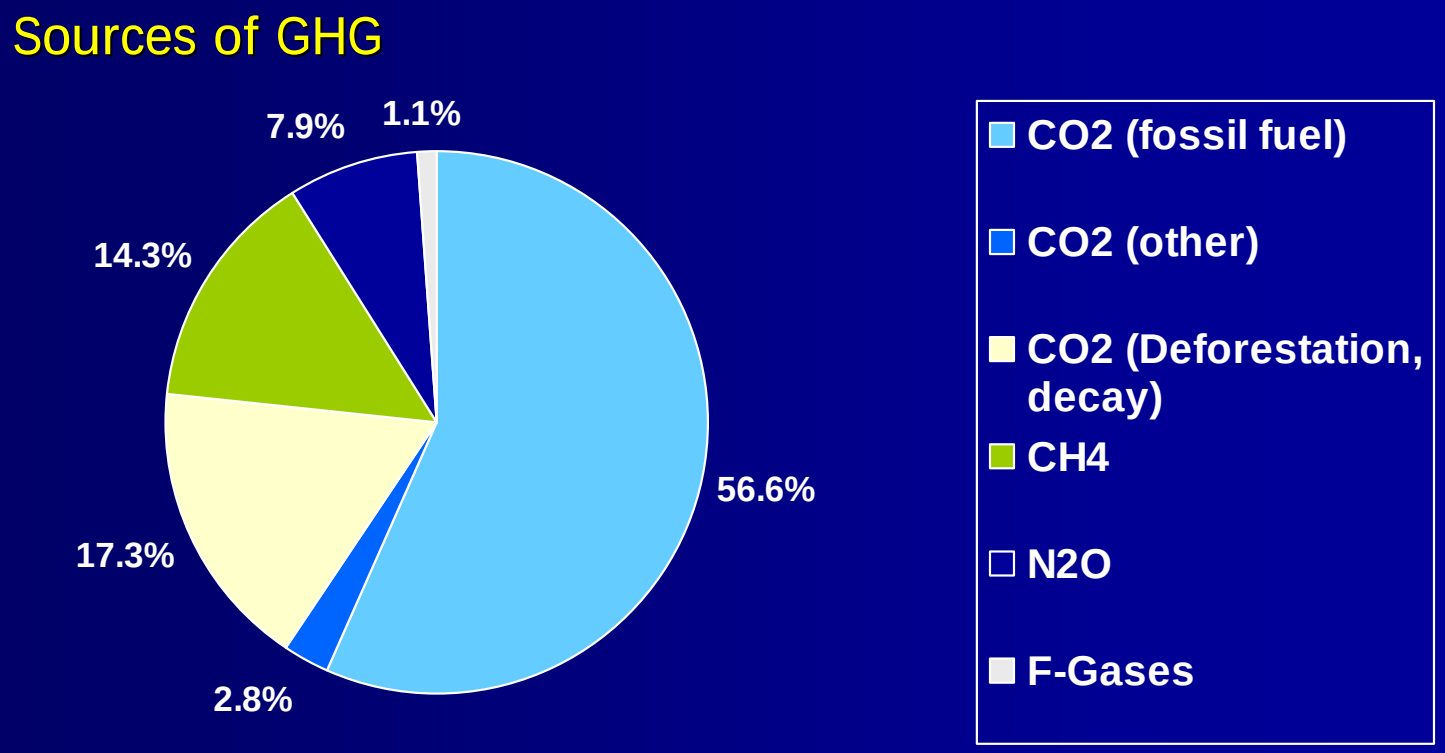
Other Transportation Solutions: Requirements

- Significant price advantage
- Can be implemented within the current infrastructure

War on Oil - Summary

- Current technology and correct government policies can reduce US oil imports from OPEC to 0 within 12-15 years
- Science can
  - Speed the process up
  - Make it more economical
  - Reduce world dependency on OPEC to 0

The War on Global Warming



Global Warming - Priorities

- Priority 1 – Transportation (double impact)
- Priority 2 – Cheap Coal-CO_2 reuse (or absorption)
- Priority 3 – Meat production

Some Coal Facts

- China alone builds 1-2 coal power stations a week (how many are closed in a year?)
- Kyoto was supposed to save 1.2 billion tons of CO_2 until 2012 (135 MT saved by 2008)
- CO_2 emissions for China and India could double to 14.7 billion tones by 2030, about fifty five percent of the current global emissions (source: IEA)

World Electric Power Sources

Source	Market Share (%)	Cents/KW-Hour
Coal	40	4
Natural Gas	19	5
Oil	7	6
Nuclear	16	5
Hydroelectric	16	2
Geothermal	0.65	6
Biomass	1	6
Wind	0.31	7
Solar	0.004	15-50

Source: www.eia.doe.gov

Coal is Here to Stay

- The rest of the world wants the Western standard of living (and energy consumption that comes with it) and Coal is the only available solution for the foreseeable future. Developing countries will not slow their progress because of CO_2 emissions from coal
- Even **if** we find a great alternative to Coal **today**, it will take 40-50 years to retire all the coal plants

You Want to Fight Global Warming?

PLEASE….

Find a CHEAP way to significantly reduce CO_2 emissions from EXISTING Coal power plants

Or from newly built plants

Where is the Beef?

- WW meat production (million tons):
  - 1950 - 44
  - 2007 - 284
- Meat consumption per capita - developed countries: 70-123 kg
- World meat consumption per capita: 36 kg
- By 2050 world meat production will double
- By 2050 Methane emissions will double

You Want to Fight Global Warming?

Find a way that cows will not produce Methane

or

Find a way to efficiently capture that Methane

Things NOT To Do

- CO_2 trading system? The consumer pays. It has not and will not reduce CO_2
- Saving energy? It will never catch up with the growth of the developing world

If You Really Want to Save Electricity

The fastest way to save up to 20% of electricity is to improve the electricity transportation grid

- It is 50-80 years old
- Over production to maintain availability
- It is key to transformation to electric transportation and renewable energy
- A fascinating mathematical, physical and engineering challenge

Wind, Solar, etc.

What is the major problem with renewable energy?

Energy Storage

Renewable Energy Needs

- 1 MW "energy" battery
- Very light storage (for transportation)

Other Solutions

- CO_2 sequestration from the atmosphere (e.g., “artificial plants") - science
- Geothermal – needs government push
- Other?

Nuclear Fission

- World should increase use as much as possible
- In its current form will never be used by the developing world (bomb…)
- Challenge - Improve Uranium utilization from 3%
- Challenge - Improved reprocessing
- Use of Thorium (3 times the amount of Uranium)
- Nuclear fission technology that does not facilitate the creation of a bomb
- The problem - requires super power financial resources

Cold Fusion

- The "Holy Grail"
- All super powers work on it

When it will be commercially available, you will be able to shred this presentation

But until then……

It's All About Priorities

- Priority 1 – Transportation (double impact) – if we are to survive as a free world
- Priority 2 – Cheap Coal-CO_2 reuse (or absorption) – the only realistic way to go

Summary

Science has a real opportunity to help the world

and you (unlike Oppenheimer) don't have to go to the New Mexico desert……

Guess Who Said It?

"Ethanol and other biofuels do not meet environmental and energy security goals" and that "their cultivation eats into the human food supply, reduces the absorption of carbon dioxide as forests are cut down, has not improved the security of energy supply and has not reduced petrol prices."

Guess Who Said It?

"we have to look beyond biofuels… and concentrate instead on truly renewable sources of energy," he said, flagging solar energy as "perhaps the best source"

Saudi Minister of Petroleum and Mineral Resources Ali Al-Naimi at the International Oil Summit

But....

What the Saudis omit is that the US no longer produces electricity from oil so solar power is no threat. This cannot be said about alcohols which directly displace oil and snatch petrodollars from the Saudi coffers.

Merrill Lynch analyst Francisco Blanch: Without biofuels, the price of oil would be about 15% higher than it now is. This means at least $13 higher. This year the US will import 5 billion barrels. At $13 saving for each barrel, that adds up to US saving of $65 billion in foreign oil payments due to current biofuel programs.

The Food vs. Fuel Fallacy

	2002	2006	2007	2015 (projected)
Harvested corn acres & yield (bu/A)	69.3M (129.3)	70.6M (149.1)	86.5M (151.1)	85m (180)
Total Corn Supply Available (Mbu)	10,573	12,512	14,393	17,232
Ethanol per Acre (gal/A)	350	404	435	575
Ethanol produced (B gal)	2.96	5.8	8.3	15.3
Corn used for Ethanol (Mbu)	1,093 (10%)	2,129 (17%)	3,010 (21%)	4,695 (27%)
Corn Supply (- Ethanol)	9,480	10,383	11,383	12,537
DDG disp	189	515	792	1,452
Total (Mbu)	**9,669**	**10,898**	**12,175**	**13,989**