



PULP LIMITED PARTNERSHIP

# Climate Change: Energy and Potential Impacts on Pulp & Paper

International Pulp Week  
Montreal  
May 8, 2007

# ● Introduction

- 1. Energy and Economic Growth: Are there enough non-renewables to keep world turning?**
- 2. Climate Change, is not new, is not the problem**
- 3. Oil and Gas in the Past  $S > D$**
- 4. Peak Oil and Gas in the Future  $D > S$**
- 5. Energy Content of Wood**
- 6. Life Cycle Assessment (LCA)**
- 7. Conclusions**

# ● Economy, Energy and Growth

## **World Consumption of Primary Energy 1820-2001**

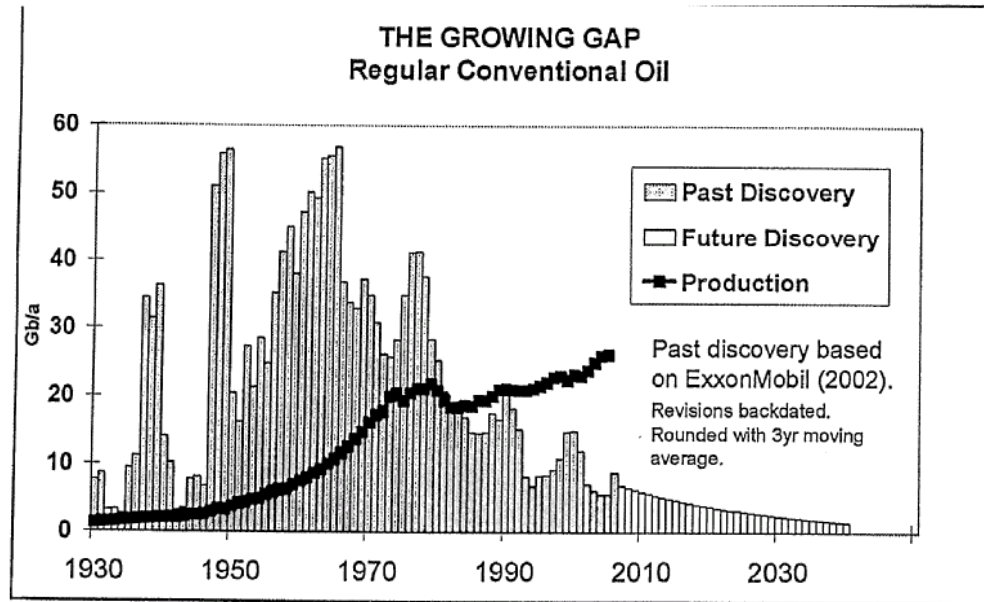
*(In Million Metric Tons of Oil Equivalent)*

	Population in Bn	<b>Energy Consumption in Tons of Oil Equivalent [toe]</b>			
		Modern Sources	Biomass	Total	Per Capita
1820	1.0	13	208	221	0.21
1870	1.3	135	254	389	0.31
1913	1.8	735	358	1093	0.61
1950	2.5	1625	505	2130	0.84
<b>1973</b>	3.9	5369	674	6043	1.54
2001	6.1	9072	1094	10165	1.65
180 yrs	x 6	x 703	x 5	x 46	x 8

Source: Angus Maddison -

*Contours of the World Economy and the Art of Macro-Measurement 1500-2001*

# Oil Supply & Demand



The energy crisis we face is a classic case of exponential growth against a finite source, whereby price was not based on replacement cost but on free-for-all depletion.

Energy too cheap for too long

# ● On Peak Oil & Gas

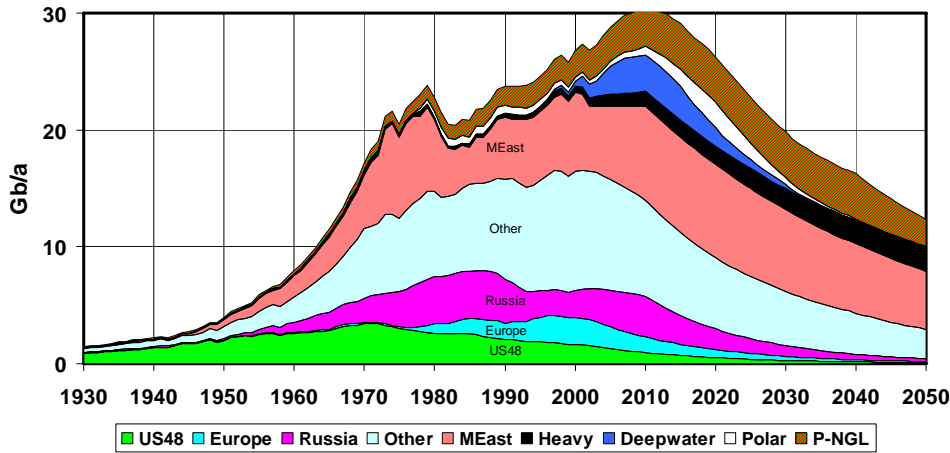
Peaking means: production of oil and gas can no longer grow.

The problem:

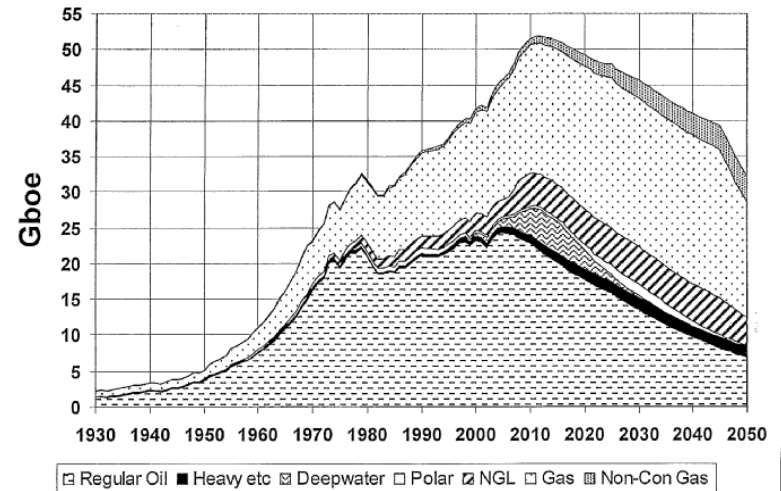
- 95% of the world's proven oil & gas reserves are unaudited,
- We have hardly any data on decline rates and imprecise production data
- Gas is even more problematic as statistics are fewer and even fuzzier.
- The situation on the gas side is said to be even more dramatic than with oil. Gas is a vapour, declines faster and less noticed than oil.

# Peak Oil

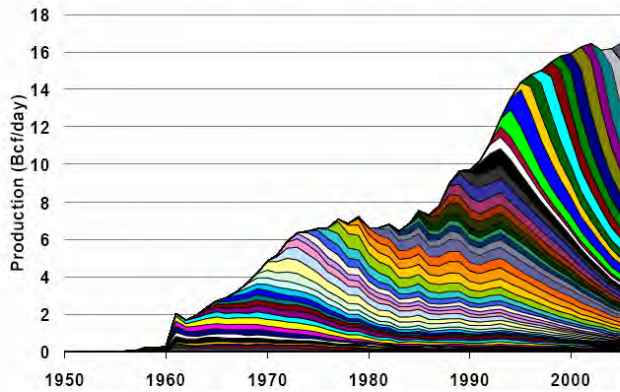
Regular Oil & Natural Gas Liquids  
2003 Base Case Scenario



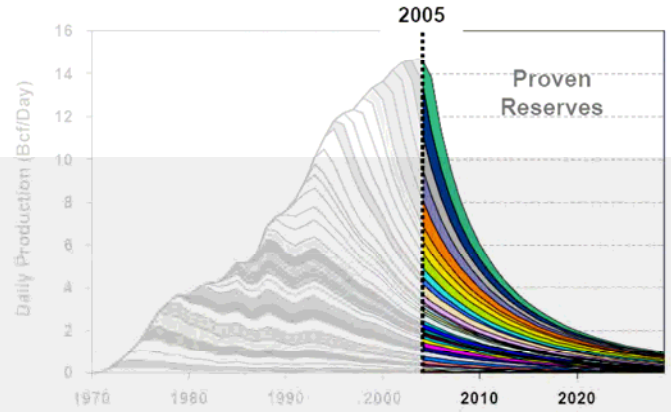
OIL & GAS PRODUCTION PROFILES  
2006 Base Case



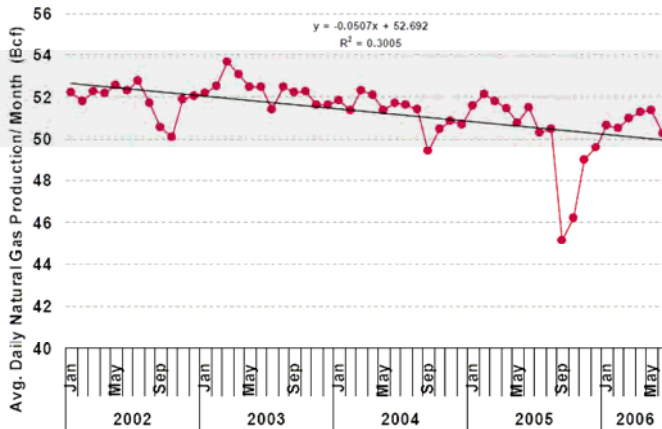
**ARC** Vintage Canadian Gas Production  
All Depths 1950 - 2005



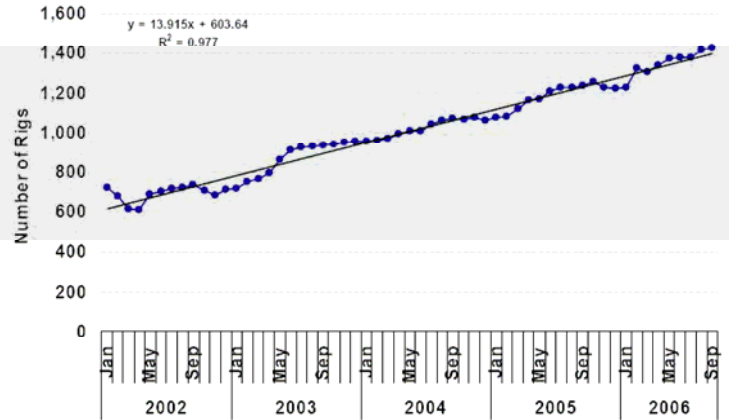
**ARC** Produced and Proven Reserves  
WCSB Natural Gas 1950 to 2004



**ARC** US Monthly Natural Gas Production  
2002 to Present



**ARC** US Monthly Average Rig Count  
2002 to Present



# ● Energy Content of selected Carbons

	Kcal/kg	Pellets = 100
Nat Gas Liquids	10750	225
Heating oil	10025	210
Coal	6200-7400	140
Wood pellets	4800	100
Pulp/Paper	4600	95
Air dry wood	4700-5000	100
Dry split wood	3225	70

# ● Pulp, paper and Wood

## INPUTS:

trees are cut with feller-bunchers, transported by truck to the sawmill

energy of 3 tons sawmill residues equals one tonne of oil - transported to pulp mill, mostly by truck

a modern pulp mill is energy self-sufficient and uses 2.2 tons wood or 0.7 toe to end up with one ton of pulp that contains roughly 0.33 toe

pulp then is shipped all over the globe by ship, train or truck

a paper mill consumes huge amounts of energy in its process and all raw materials have high energy contents

And a lot of other raw materials like latex and chemicals, all oil and gas based

## ● A modern UC WF paper machine

Using 66% HW, 9% SW and 19% filler, the remaining 6% are water

All pulps used are produced in a modern mill, using no fossil fuel

SW chips travelled 300 km in 50 tons trucks to the pulp mill, 200 km for HW chips (45% yield/50% moisture)

SW pulp moved 17000 km by ocean vessel to the paper mill, and 5000 km for HW

# ● LCA based Chemical energy numbers

11 GJ total process energy, i.e. the energy used up to produce the products and get them to the mill gate;

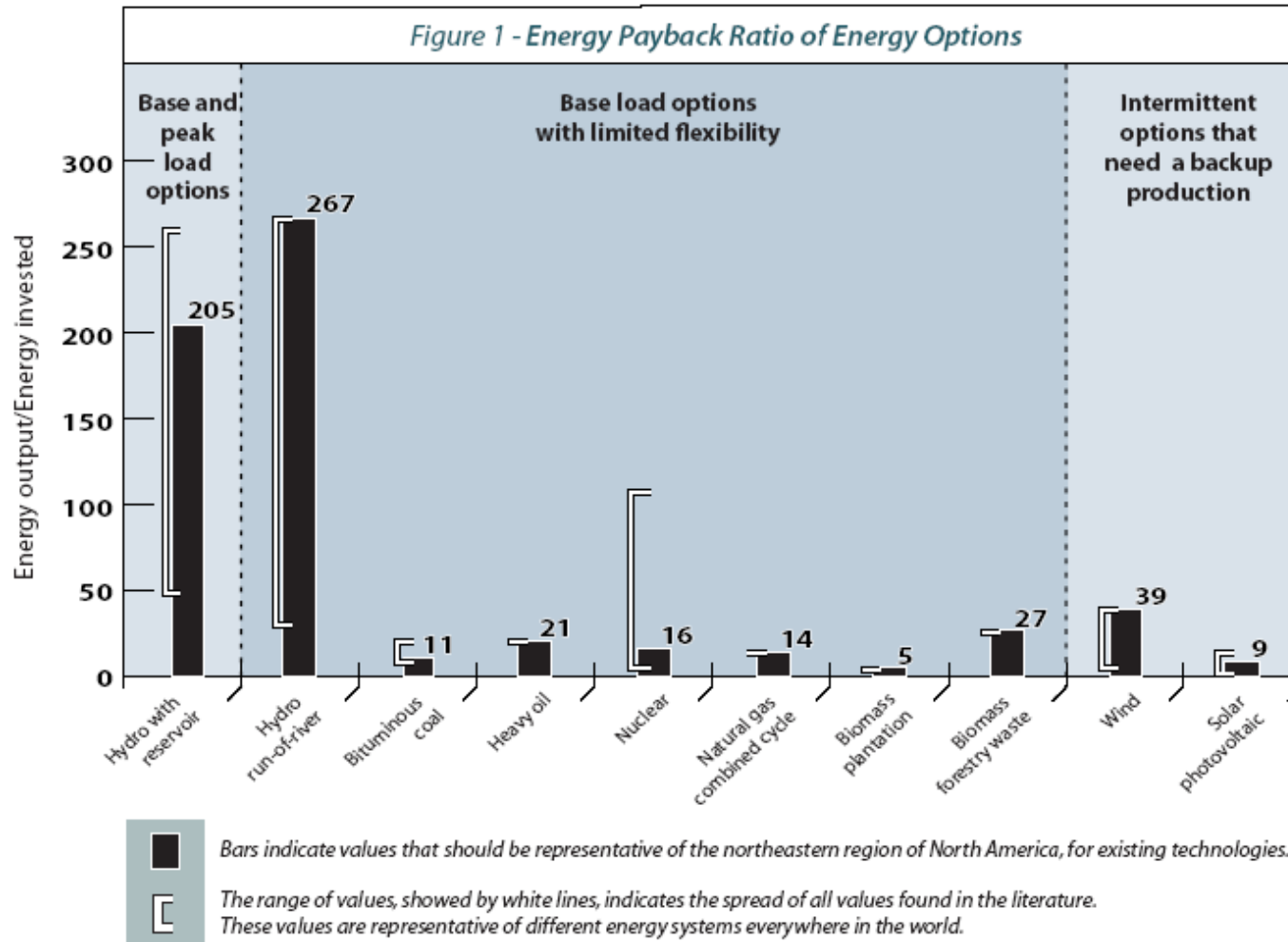
2.8 GJ of these 11GJ was energy in the wood chips for a fossil free value use of 8.2 GJ;

38 GJ total extracted energy, i.e. energy that was depleted (or 35.2 GJ fossil free)

27 GJ or 76% of the original energy content that were available on earth, were irreplaceably lost in the process

Full LCA study conducted by Stora Enso, Axel Springer Verlag, Mike J. Bradley/Canfor downloadable at [www.temap.com](http://www.temap.com)

# Energy Payback Ratio of Energy Options



## **Sweden**

is the only country that has made up its mind.

The Swedish Commission on Oil Independence wants to turn Sweden into an oil-free society by 2020 and its conclusions are:

- No oil for residential & commercial buildings
- Increase efficiency of energy use by 20%
- All transport to cut petrol/diesel usage by 45-50%
- Industry reduces oil by 25-40%

## ● European Union

The vigilance with which the EU are pushing through their Bio-energy policies and Biomass Action Plan (in which forest biomass plays a key role) makes the wood-pulp-paper industry problems irrelevant and trivial in the face of the overall problems.

*“First priority is policies that do not disturb the market and that the paper industry has access to its valuable fibers with affordable prices, without having to face biased competition of subsidized energy generators”. “Local authorities need clear guidance on how to organise the paper collection in the most sustainable way”.*

Mr Henri Vermeulen – Chairman CEPI Recycling and Product Committee

## Core messages on bioenergy



**Efficiency of the energy production from biomass should be a priority and should be monitored in order to avoid wasting the resource.**

## ● Conclusions

It is time to wake up to the new and harsh realities: we have depleted nearly all the non-renewable carbons

Climate change is a critical issue and will significantly impact future pulp & paper operations

Future will not be business as usual

Need to turn challenges into opportunities