

# The Limits to Growth and the Future of Humanity

Presentation at Amerika Haus  
On behalf of the Carson Center

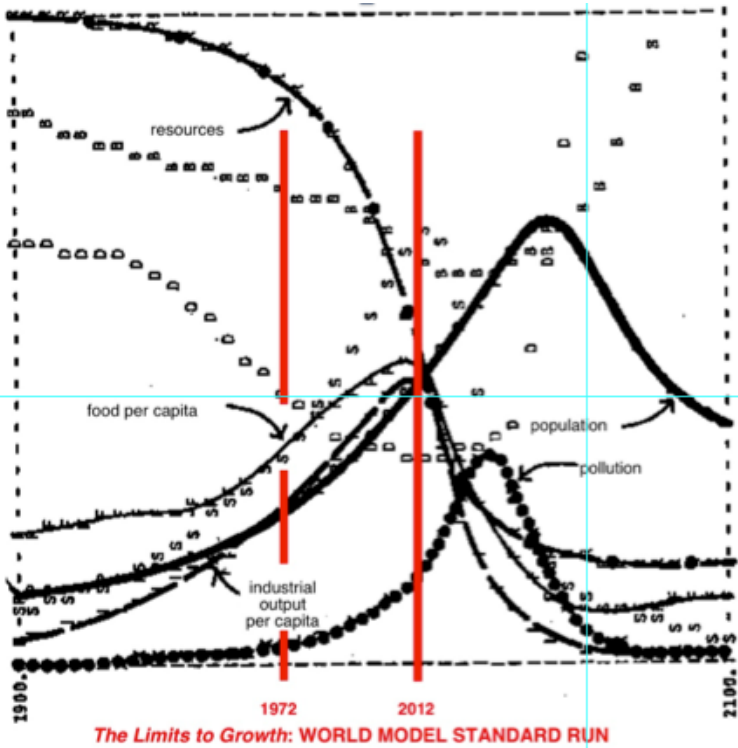
Dennis Meadows

München

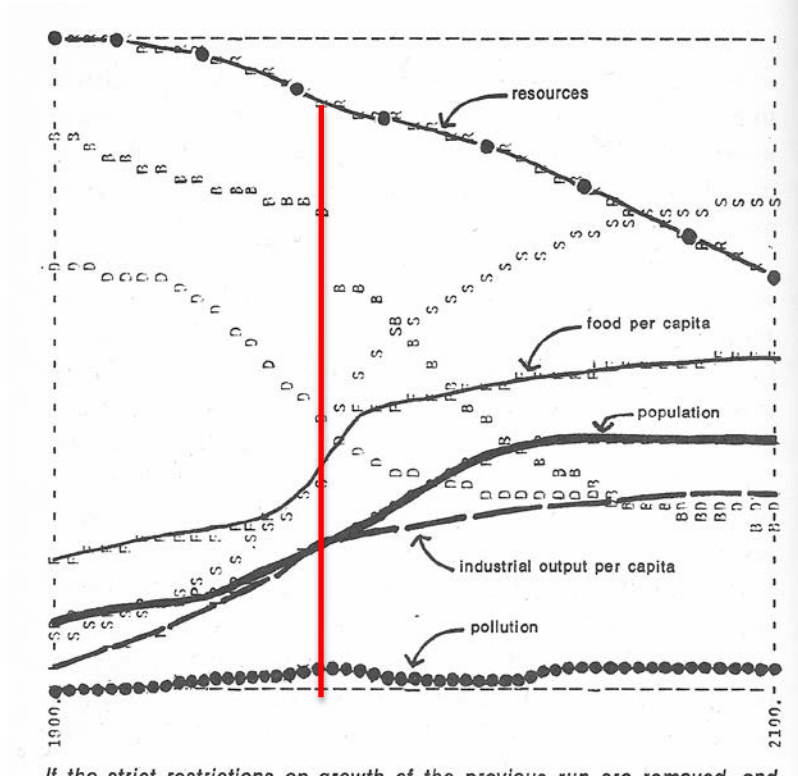
4. December, 2012

# Main Ideas for this Session

- In 1972 there were two future paths for global society – overshoot and sustainable development.
- We followed the overshoot path, so now the old definition of sustainable development is no longer useful.
- We must change our focus in four ways.
  - #1: Focus on universal, not global problems.
  - #2: Focus on cultural and social changes.
  - #3: Focus on the resilience of our systems.
  - #4: Shift from talking to acting

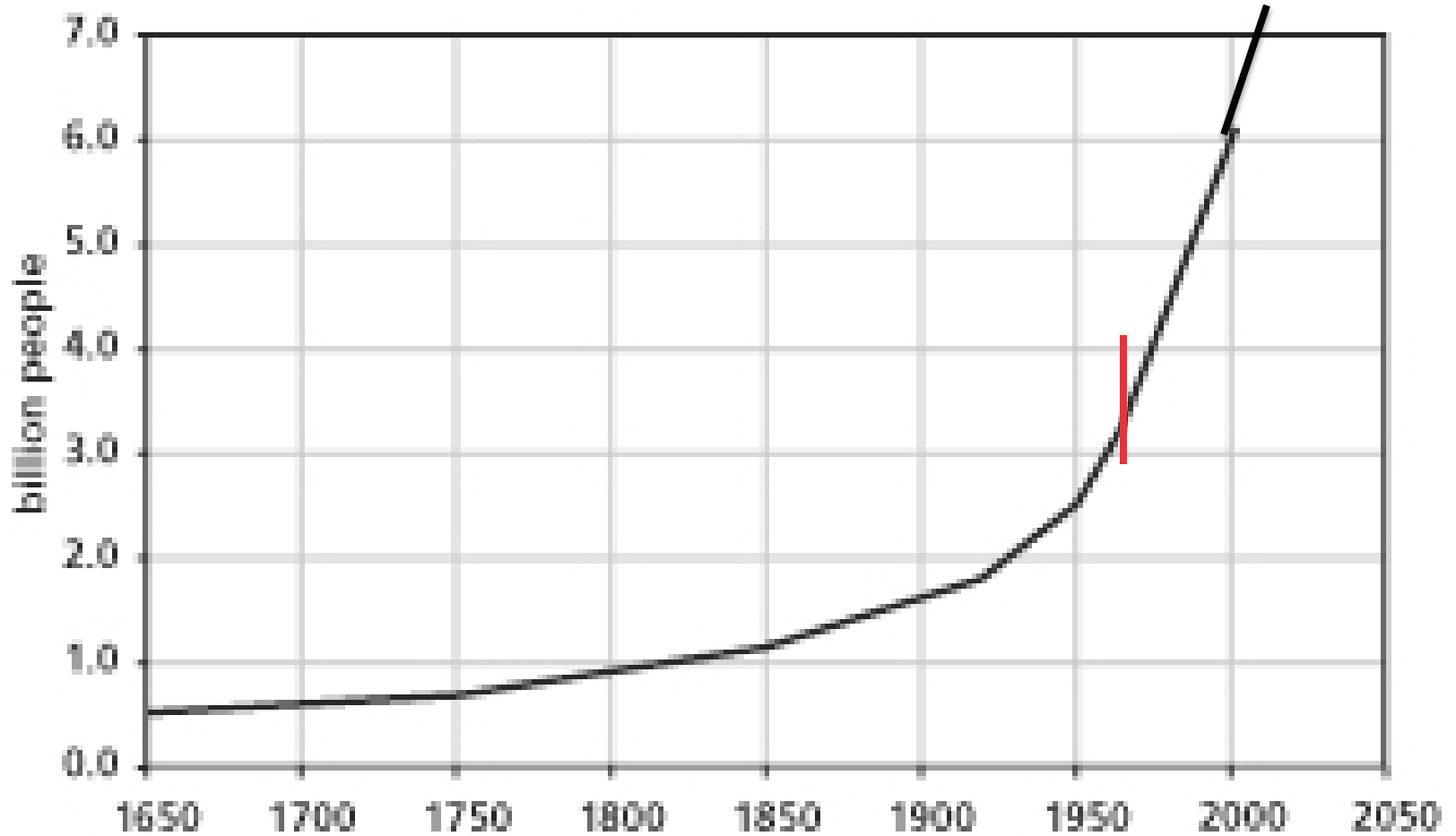


World3: Overshoot Path

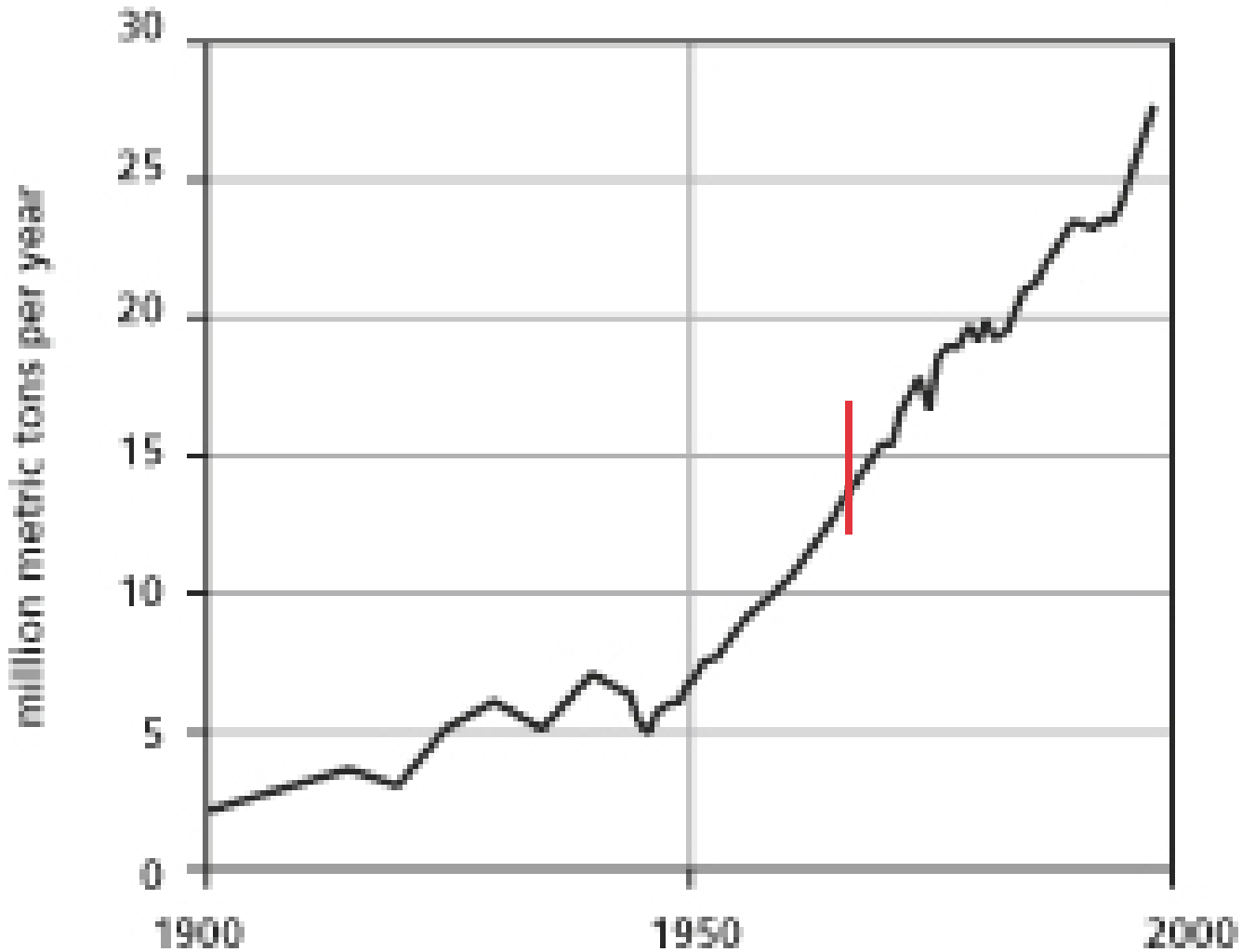


World3: Sustainable Development Path

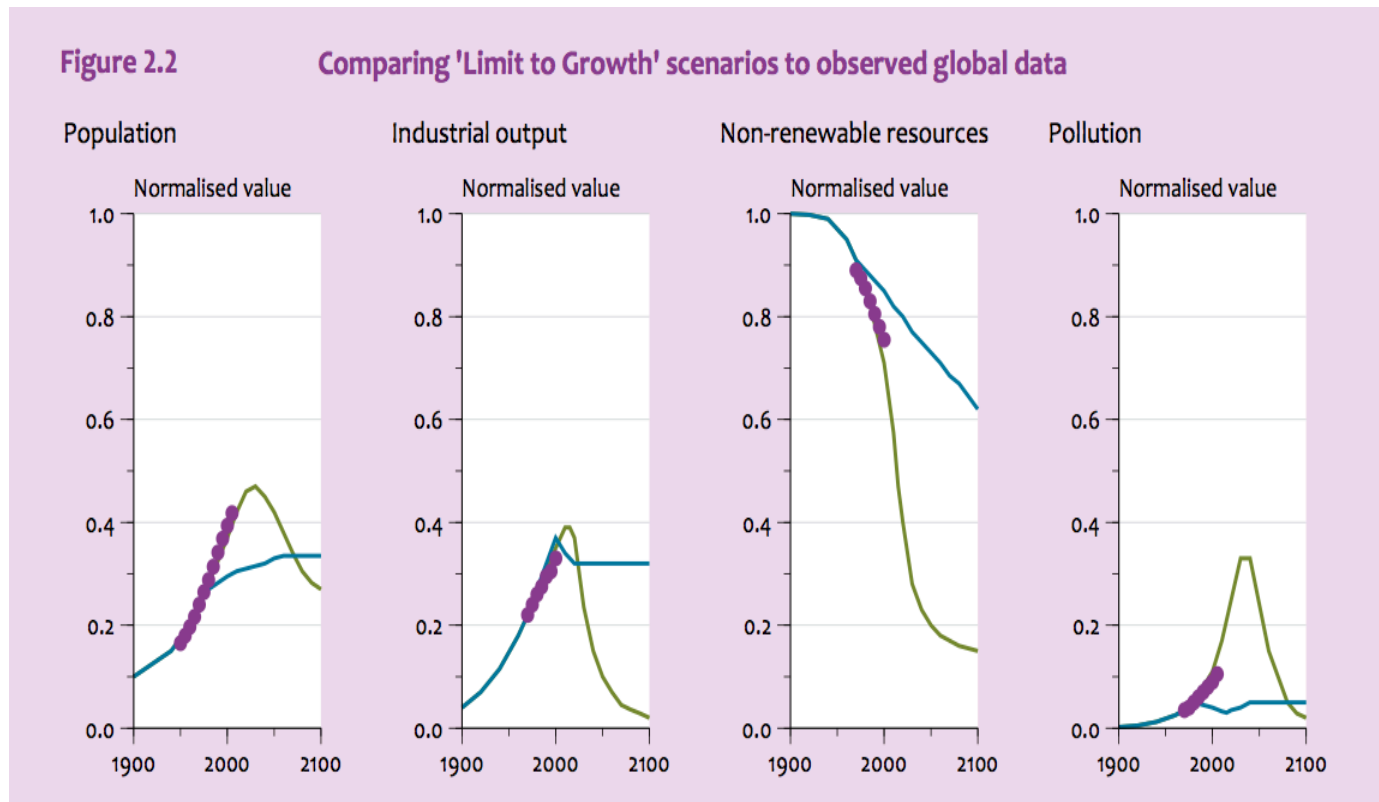
# World Population



# Index of World Metals Use



# Global society is following the overshoot scenario



Overshoot Path 

Sustainable Dev. Path 

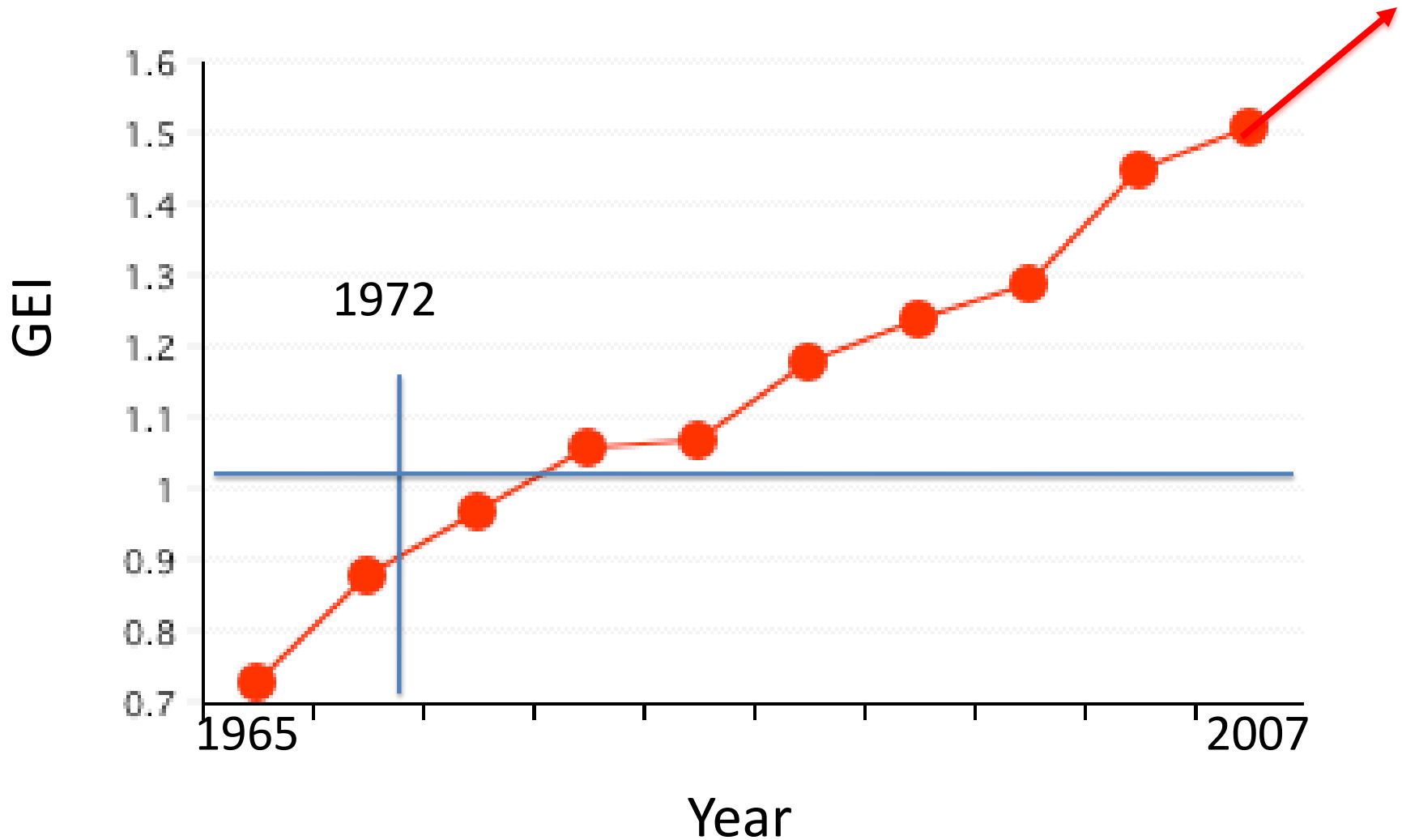
Historical Data 

Our previous comparison of global data with the LtG modelled scenarios has been updated here to cover the 40-year period 1970 to 2010....

The data review continues to confirm that the standard run scenario represents real-world outcomes considerably well.

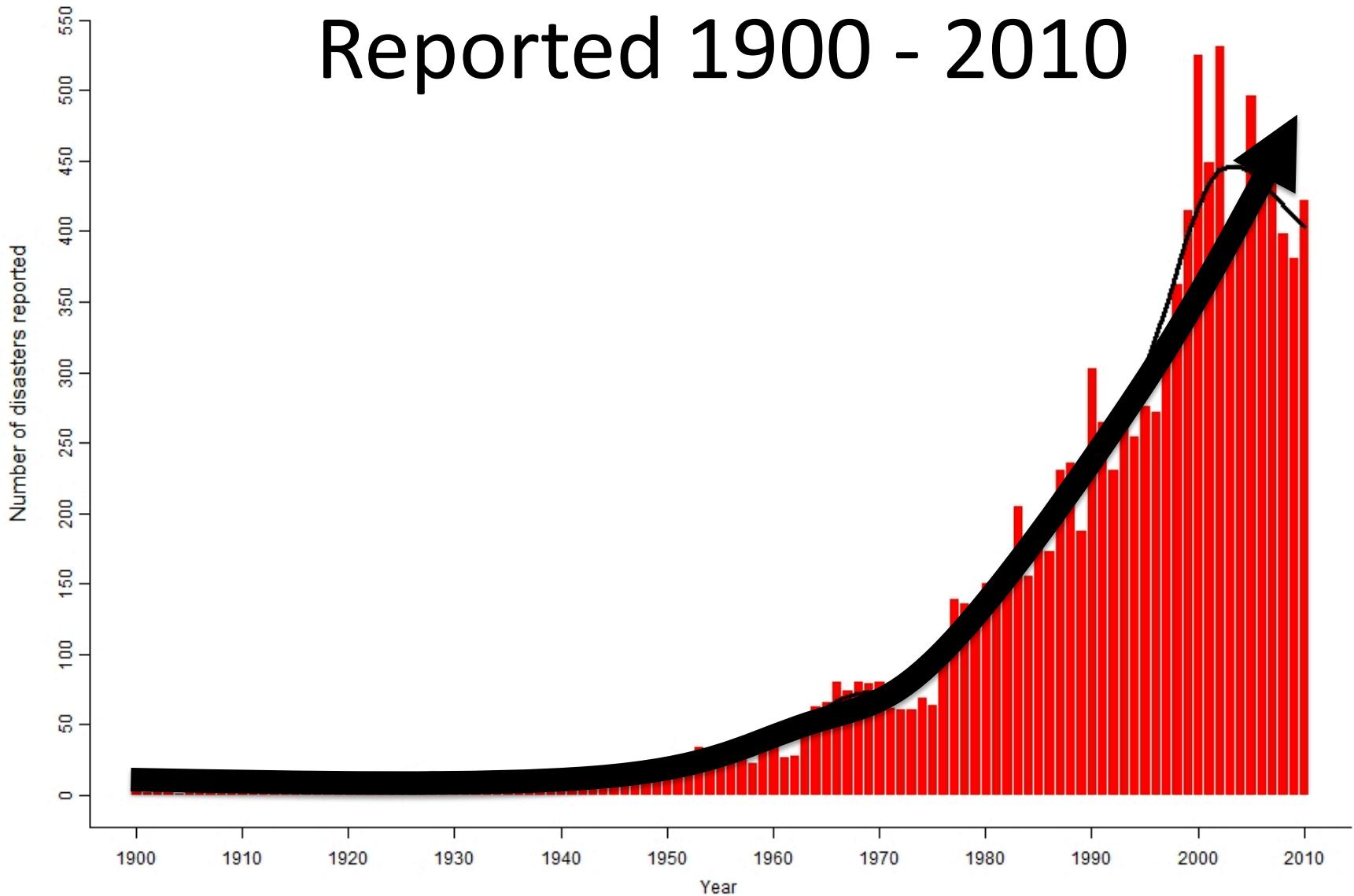
Graham M. Turner, “On the Cusp of Global Collapse?” in *Gaia* 2/2012, P. 123

# Global Ecological Footprint: 1965 - 2007

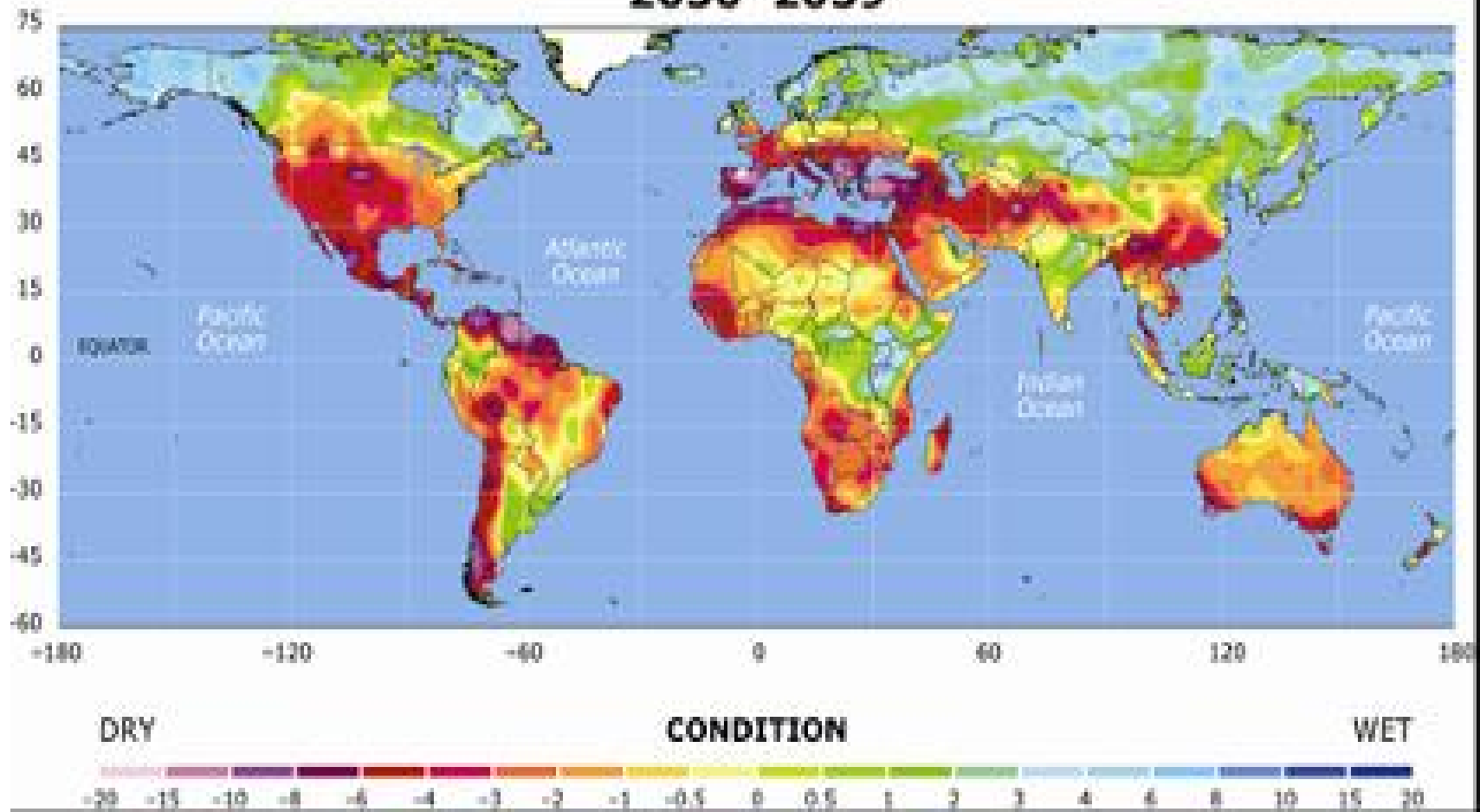




# “Natural” Disasters Reported 1900 - 2010



# 2030-2039



Think again, teacher: Myths from neuroscience are creating confusion in the classroom **C**



# REVIEW



For the gift-giving season, books on Proust, suburban wild life, Jewish jocks and the history of Christmas trees **C5**

BOOKS | CULTURE | SCIENCE | COMMERCE | HUMOR | POLITICS | LANGUAGE | TECHNOLOGY | ART | IDEAS

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THE WALL STREET JOURNAL.

Saturday/Sunday, November 17 - 18, 2012 | **C1**



## LEARNING TO LOVE VOLATILITY



# Brundtland Commission Definition

Sustainable Development is: development that meets the needs of the present without compromising the ability of future generations to meet their own needs

*Our Common Future*, Report of the World Commission on Environment And Development, United Nations, 11 December 1987

# The common assumptions about sustainable development

- The rich can keep what they have (preferably get even more)
- while the poor rise to the standards of the rich
- this will be achieved keeping our current system (markets and politics)
- by developing new technologies that 'decouple' GDP growth in the use of energy and materials.
- Growth will give us the resources we need to accomplish all this.

# Exercise about habits

# To make our future more attractive

- Focus on universal problems
- Focus on cultural and social changes
- Focus on making our systems more resilient
- Shift from talking to acting

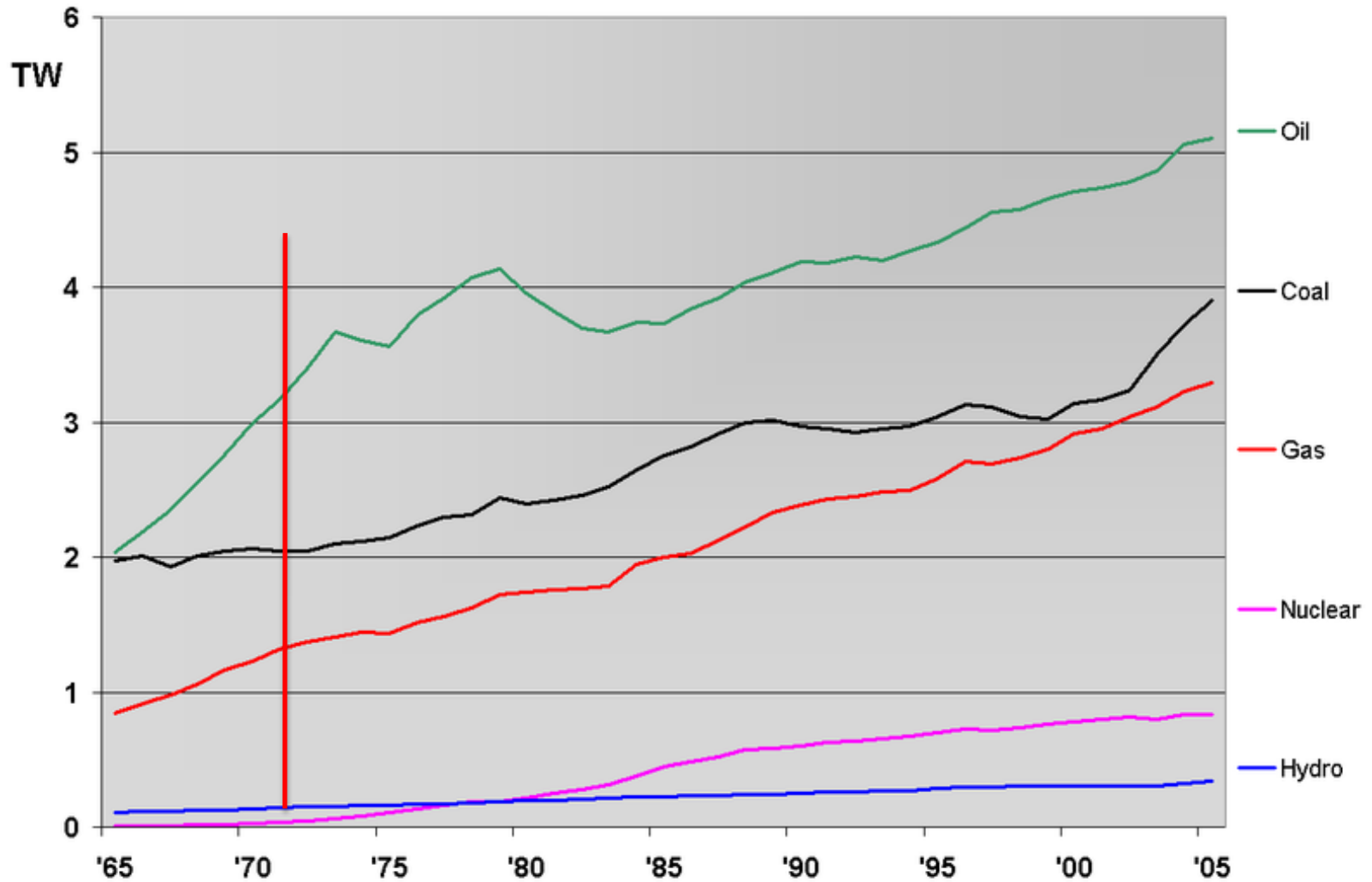
# #1: Focus on Universal Problems

- Global problems affect everyone (climate change, spread of nuclear weapons, epidemics, etc.). Solving them requires everyone to agree and act. Costs here and now give benefits there and later.
- Universal problems affect everyone (city air pollution, soil erosion, flooding, etc.). Solving them requires only a small group to agree and act. Costs here and now give benefits here and soon.



## #2: Focus on cultural and social changes

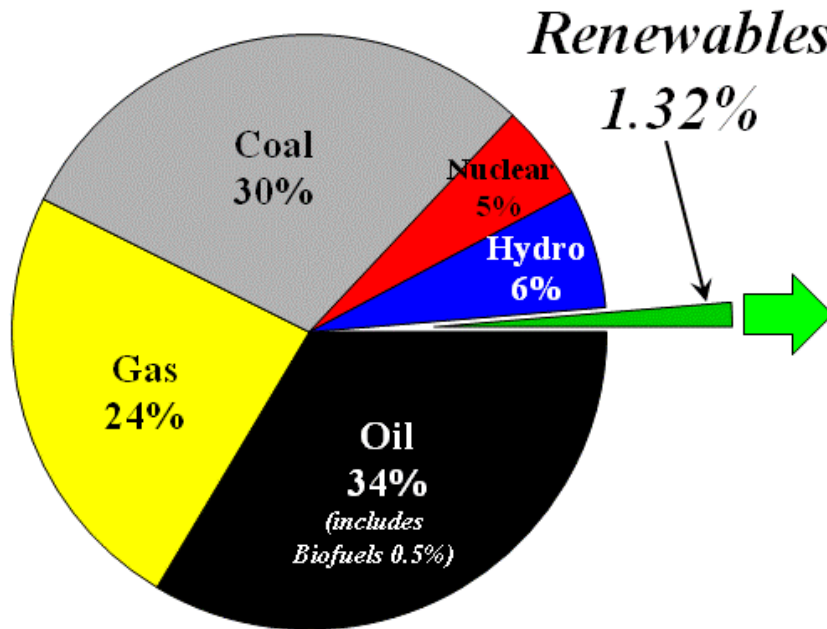
# World Energy Consumption



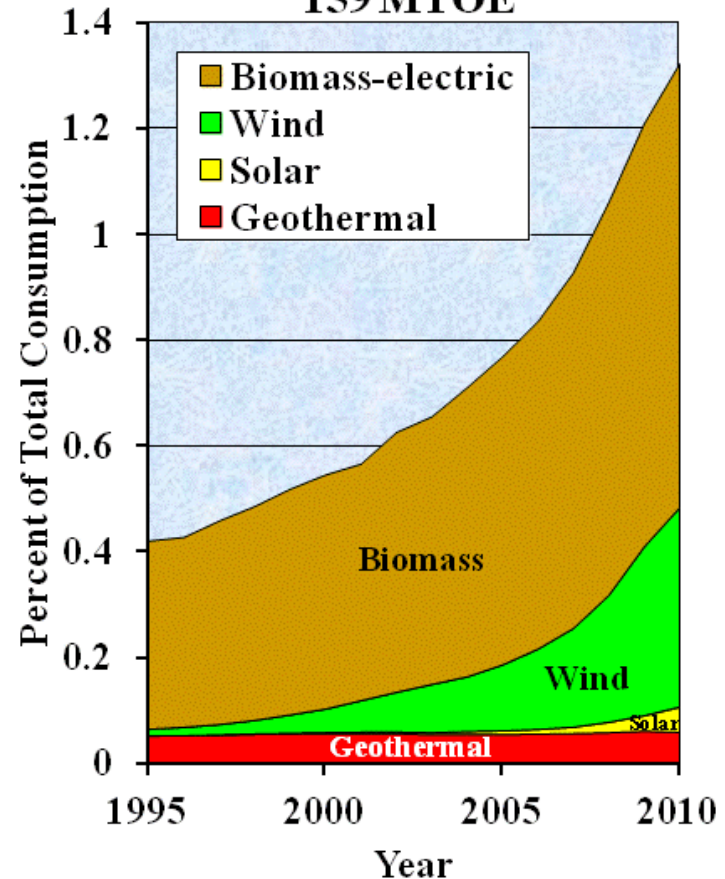
# Global Primary Energy Consumption by Source in 2010

## A Comparison to Total Non-Hydro Renewable\* Energy

**Total Energy by Source**  
12002 MTOE



**Renewable Energy by Source**  
159 MTOE

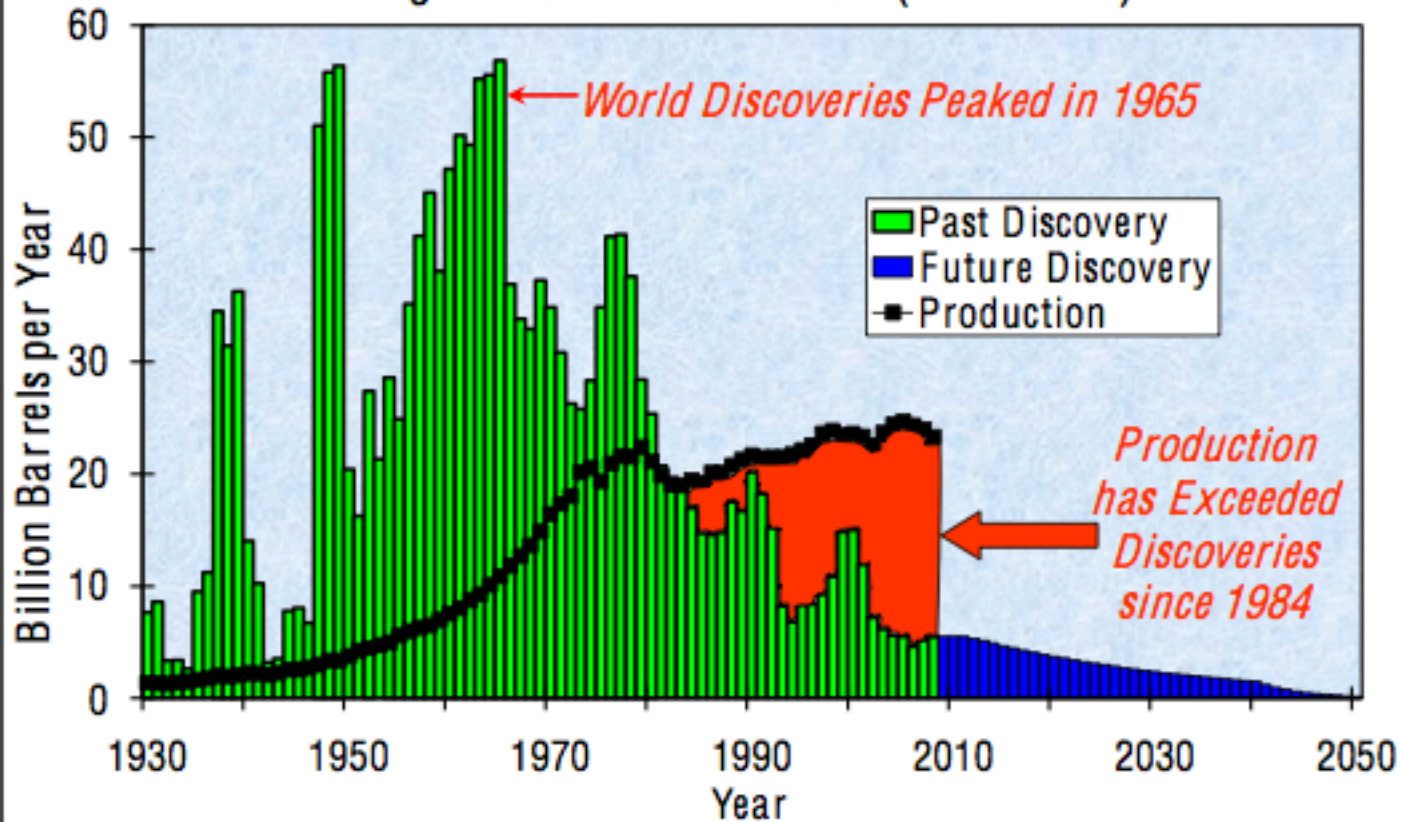


*\*excluding biomass burned for non-electric uses*

© Hughes GSR Inc, 2011

*(data from BP Statistical Review of World Energy, 2011)*

# The Growing Gap between Production and Discovery of Regular Conventional Oil (1930-2050)



Past discoveries have been backdated with revisions to reflect **“Reserve Growth”**

© Hughes GSR Inc, 2009

(data from Campbell, personal communication, October, 2009)

# Global Oil Production is Nearing the End of its Plateau

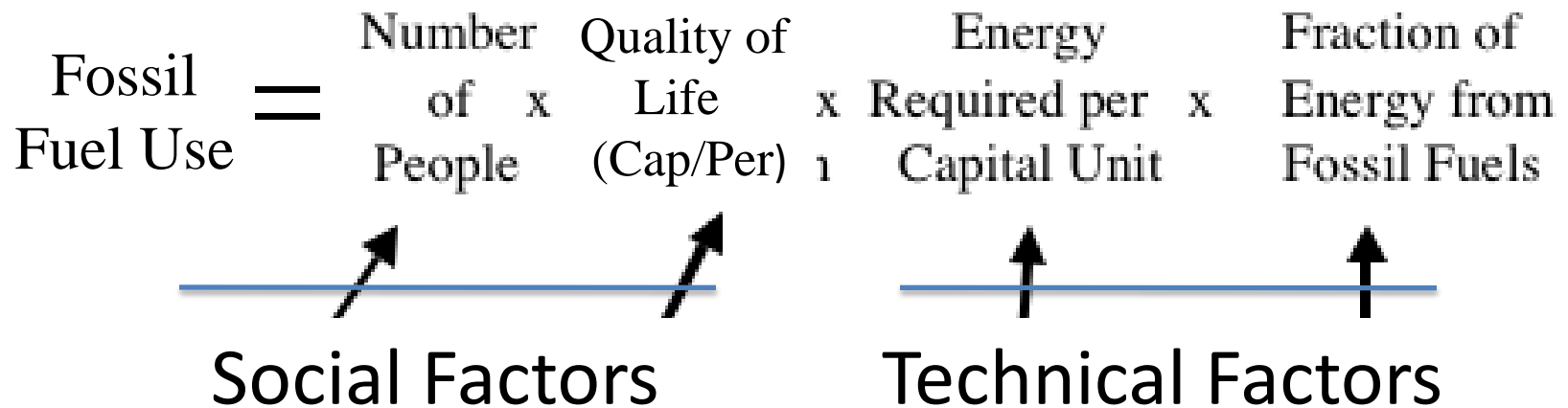
- 1995 - 1999 + 5.5%
- 2000 - 2004 + 7.9 %
- 2005 - 2009 + 0.4 %

- data from the *International Statistical Supplement – 2010 edition*, International Energy Agency, p. 18

- 2010 - 2030 – 50%\*

\* Projection from *Crude Oil – The Supply Outlook*, Energy Watch Group, Feb 2008, p. 12.

# Four Factors Determine the Amount of Fossil Fuel Use



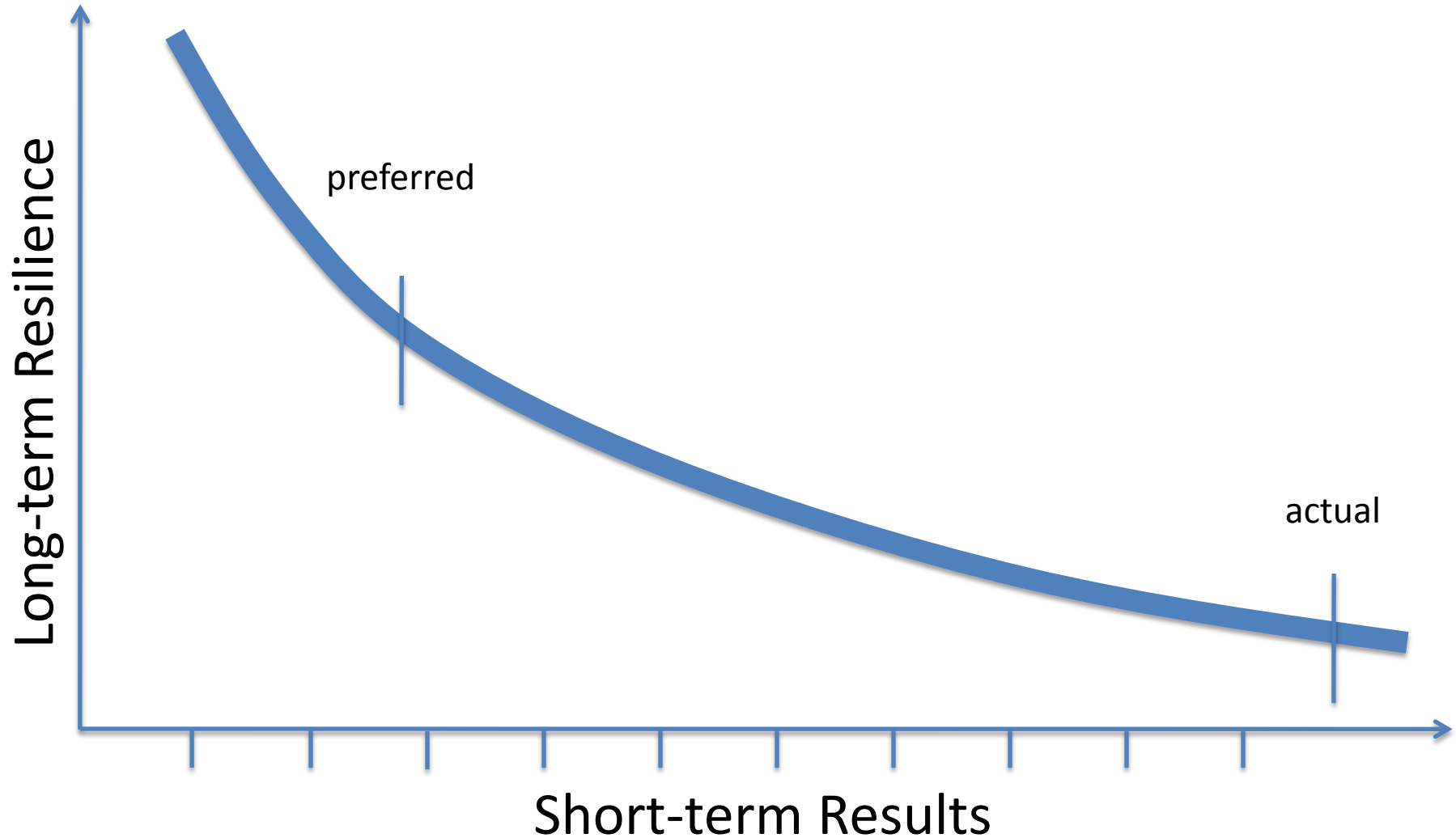
**#3: Focus on making our  
systems more resilient**

# Resilience Vocabulary

- Resilience is the ability to absorb a shock and quickly regain the ability to perform essential functions.
- If a resilient system continues to perform without pause, we say it is **stable**.
- If a resilient system quits performing briefly and then resumes, we say it is **flexible**.
- If a system is not resilient, we say it is **brittle**.



# Actions that Increase Short-term Results Tend to Reduce Long-term Resilience



# Determining the resilience of a system

Essential  
Inputs

energy, information,  
clean water, raw materials,  
manufactured parts, labor,  
Income, food, energy

Individual, Family,  
Home, City,  
Company, State,  
Country, Globe

Essential  
Outputs

wastes, reputation  
Information, products,  
payments,

# Evaluating resilience

- What types of shocks could occur?
  - What is the probability of each type of shock over the lifetime of the structure? (risk assessment)
  - How large might the shocks be?
  - How long would the shock possibly last?
  - Could there be synergies among shocks?
- 
- Would the interruption of essential outputs be :
    - unnoticed, minor irritation, serious problem, or lethal

# Five Ways to Increase Resilience

## #1: Improve Efficiency:

Efficiency is the ratio (output/input) You can increase efficiency by improving the conversion process (technology change) or by preferring different outputs (cultural change)

## #2: Raise the Barrier:

Increase the resistance against shock (stronger or higher barriers)

## #3: Increase Redundancy:

Internally by building alternative technical systems  
Externally by making social networks stronger

# Five Ways to Increase Resilience

## #4: Create more Buffering:

Decouple inputs from outputs (build bigger buffers)

## #5: Develop better Predictions:

Identify new variables to measure.

Reduce the delays in measuring

Reduce the errors in measuring.

# Exercise on Action