



THE END OF GROWTH

Planning Opportunities for a Resource-Constrained World

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CONTACT INFORMATION

- Presented to FPA National Retreat
 - Palm Springs, CA
 - May 6, 2013
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GETTING STARTED

- Aren't limits "over"?
- The importance of Worldview



HOW WILL THIS SESSION BE USEFUL?

- Different perspective on the economy
- Surprising facts about energy and growth
- Learning about options
 - What can clients do
 - How can we talk to them



INTRODUCTION

1. What is the current situation?
2. What may happen if current trends continue?
3. How did this situation happen?
4. Is the client ready to deal with it?
5. What financial planning perspectives are useful here?
6. What can we recommend?
7. How do we present it to the client, and help them make changes?



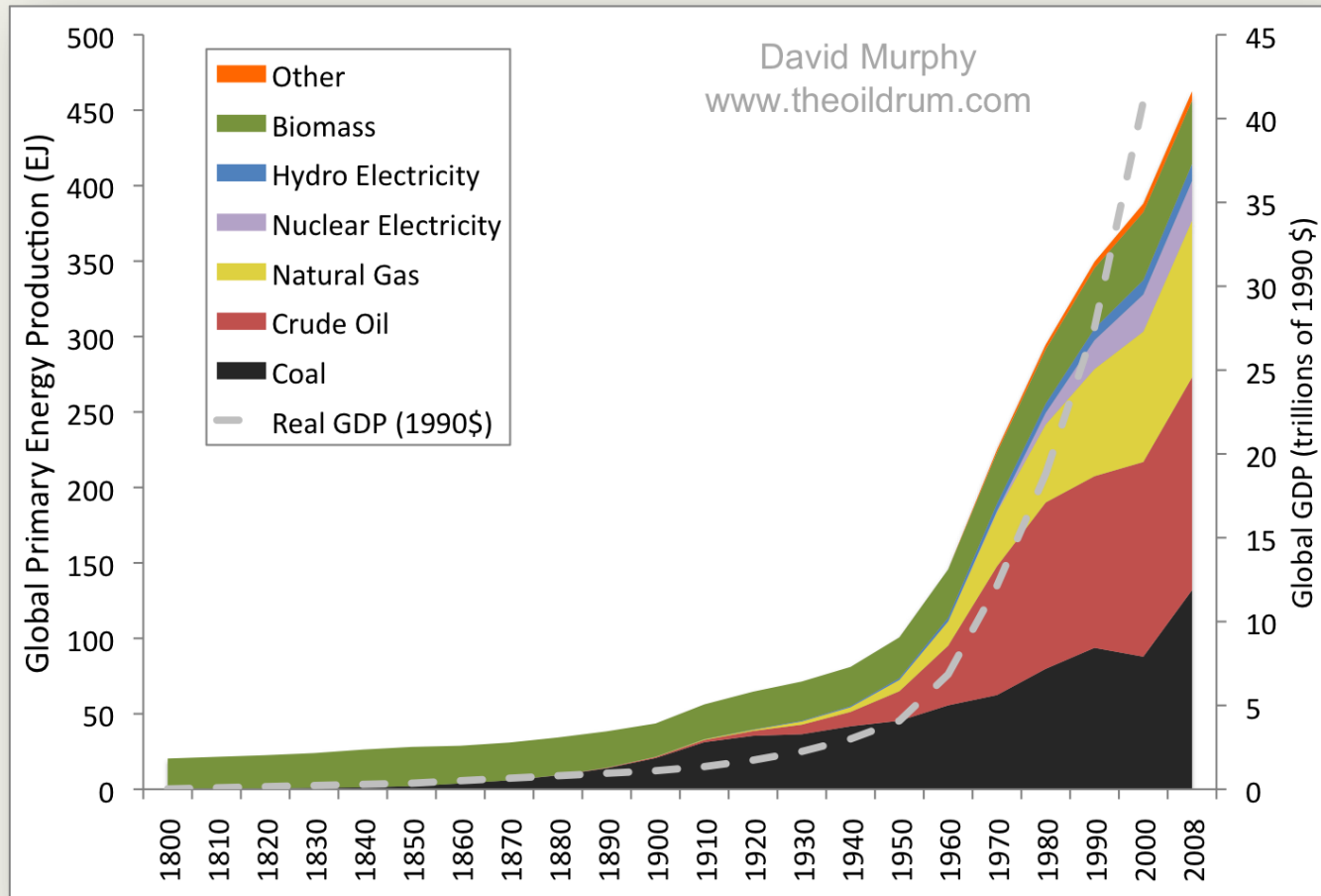
PART ONE

*THINGS CAN BECOME
COMPLICATED
WHEN YOU ACTUALLY TRY TO
UNDERSTAND THEM*



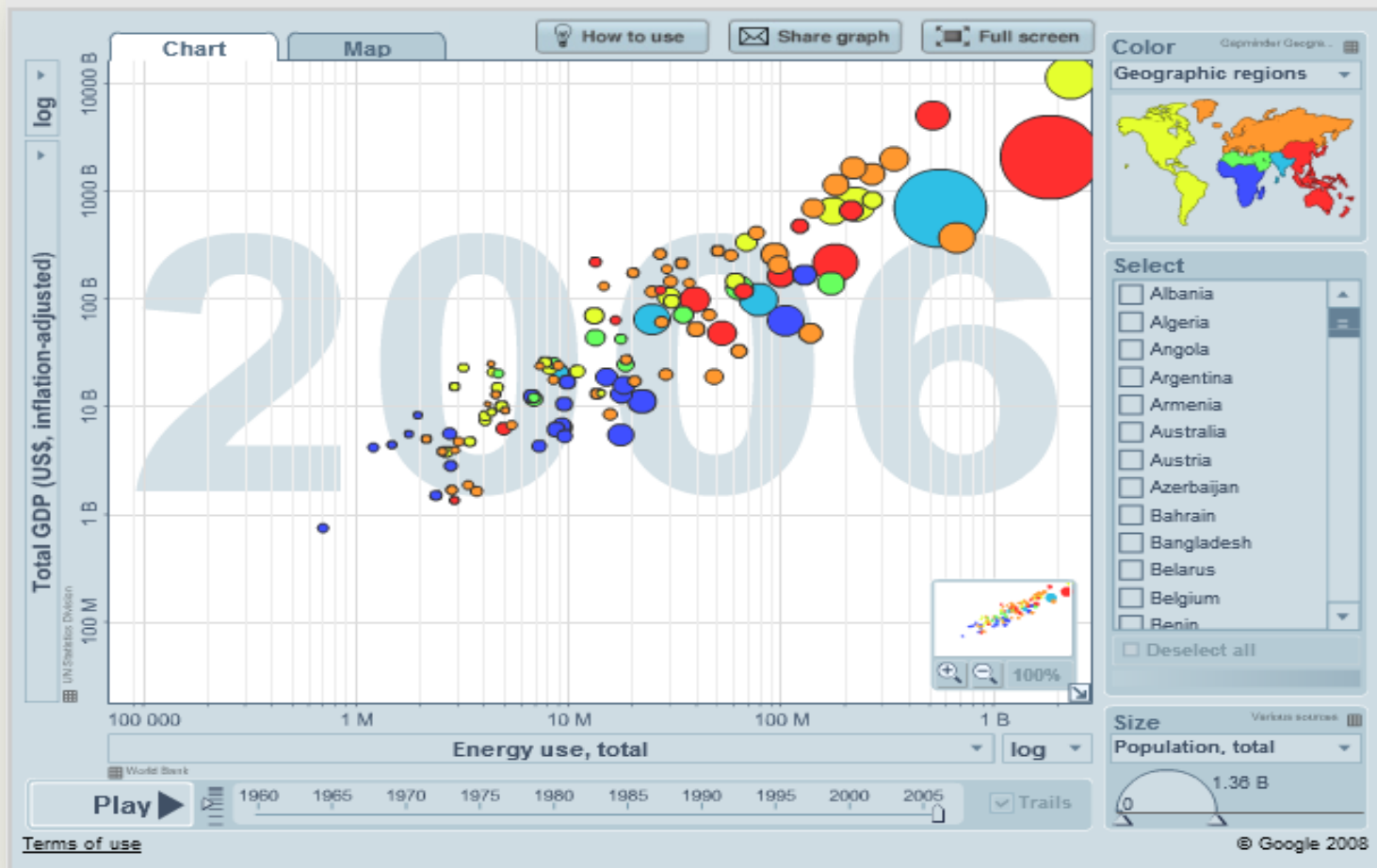
AN OVERVIEW OF ENERGY

Energy = Population = GDP





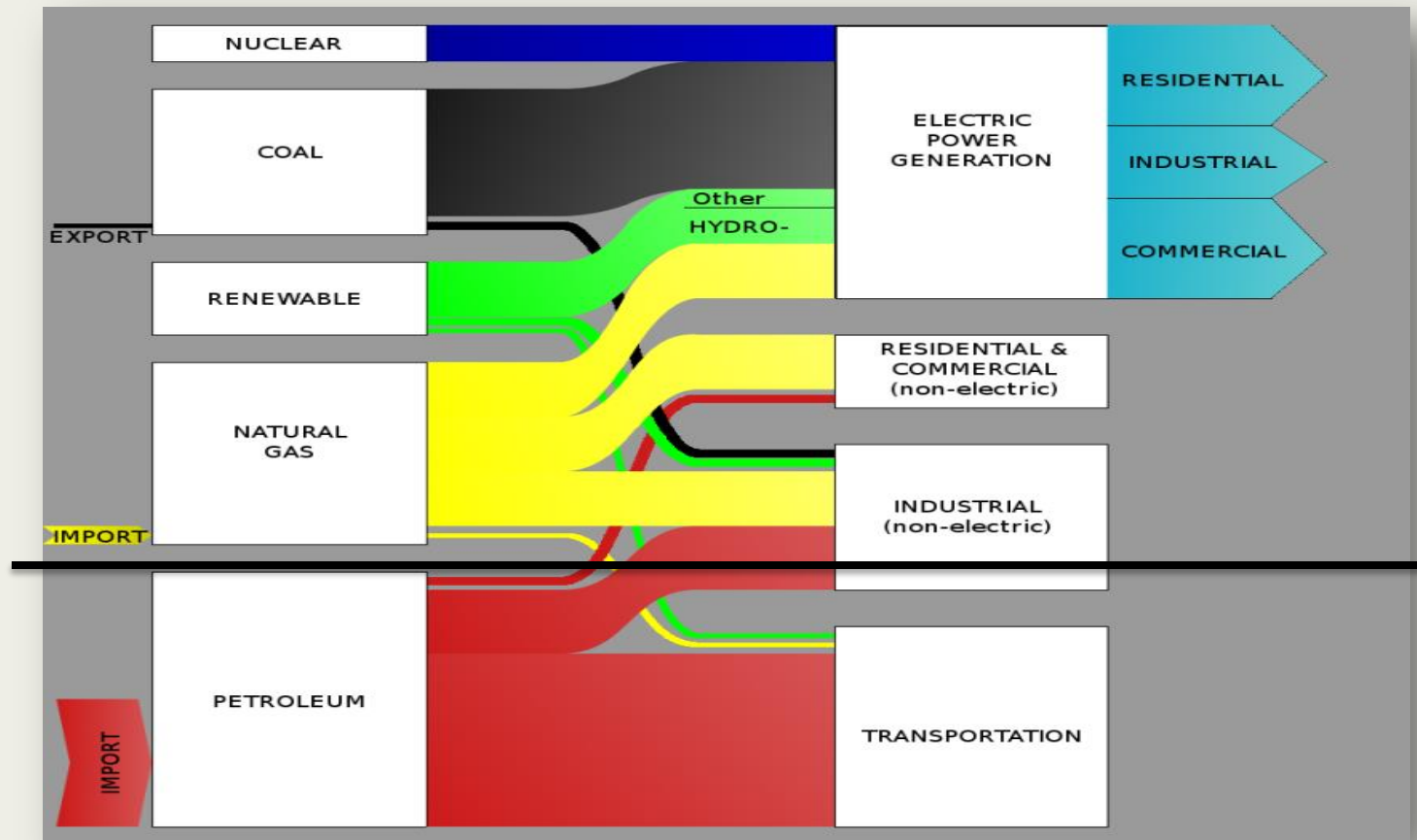
AN OVERVIEW OF ENERGY





AN OVERVIEW OF ENERGY

We have TWO parallel energy systems





WORLD TRANSPORTATION FUELS

- Oil based
- Methane based
- Green based

– *Or, more easily remembered...*



“WTF OMG”



AN OVERVIEW OF ENERGY

“Energy” = Power Available to Increase
What We Can Do

- Historical – wood, water, animals, wind, slaves
- Modern – coal, oil, natural gas, hydro, nuclear, electricity from these
- Energy systems are physical, not “technology”



AN OVERVIEW OF ENERGY

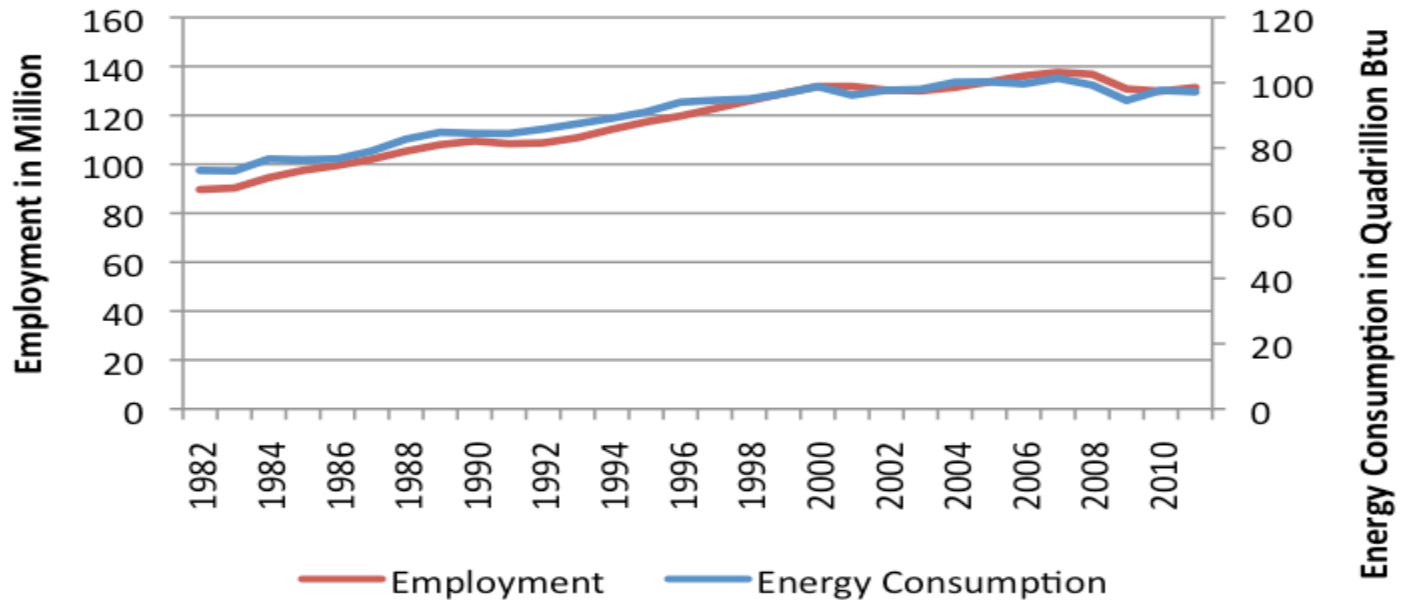
Energy inputs make modern life possible

- Agriculture and diet
- Health
- Cities
- Transport
- Leisure, education, and mass culture
- Communications



ENERGY AND GROWTH

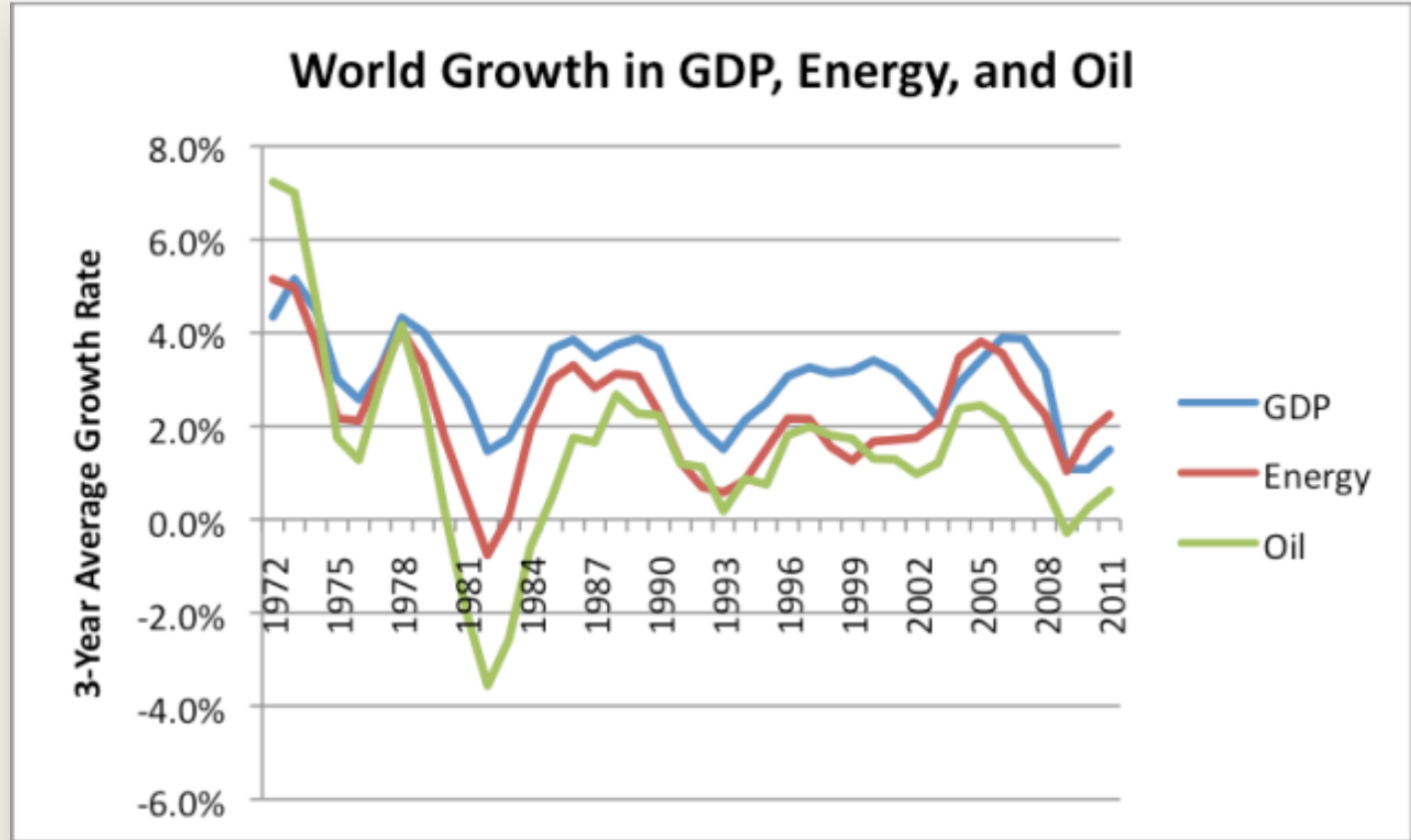
**US Number Employed vs Energy Consumption
 1982 - 2011**



- OurFiniteWorld.com



ENERGY AND GROWTH





PEAK OIL DEFINED

- The point when the amount of net energy from oil stops growing on a daily, monthly, or annual basis.
 - Can refer to a region, nation, or the whole world.
- It does not mean we are “running out” of oil.



UNDERSTANDING PEAK OIL

The magnitude of the oil problem

- Of all oil used worldwide since 1859:
 - 50% has been used since 1989
 - over 10% just since 2008
- The US will use more oil this year than was used by everyone on earth during the six years of World War II



UNDERSTANDING PEAK OIL

The magnitude of the oil problem, cont'd

- Oil use (and production) is now about 90 million barrels per day, or 33 billion barrels per year
- The world uses 1000 barrels of oil per second
- Over one trillion barrels have been used so far
- The world's remaining supply of liquid oil is estimated to be about one trillion barrels, according to the Association for the Study of Peak Oil and Gas



UNDERSTANDING PEAK OIL

The Peak Oil Concept

- The amount of oil on earth is limited
- We use the easiest-to-get first
- The maximum extraction rate occurs when reserves are about half gone
- The US reached its peak in 1970. Despite the opening of Alaska, the Gulf of Mexico, and now shale oil, no new high has been achieved.
- The key number is the **rate of production**, not the amount of reserves left



Net Energy is the real bottom line

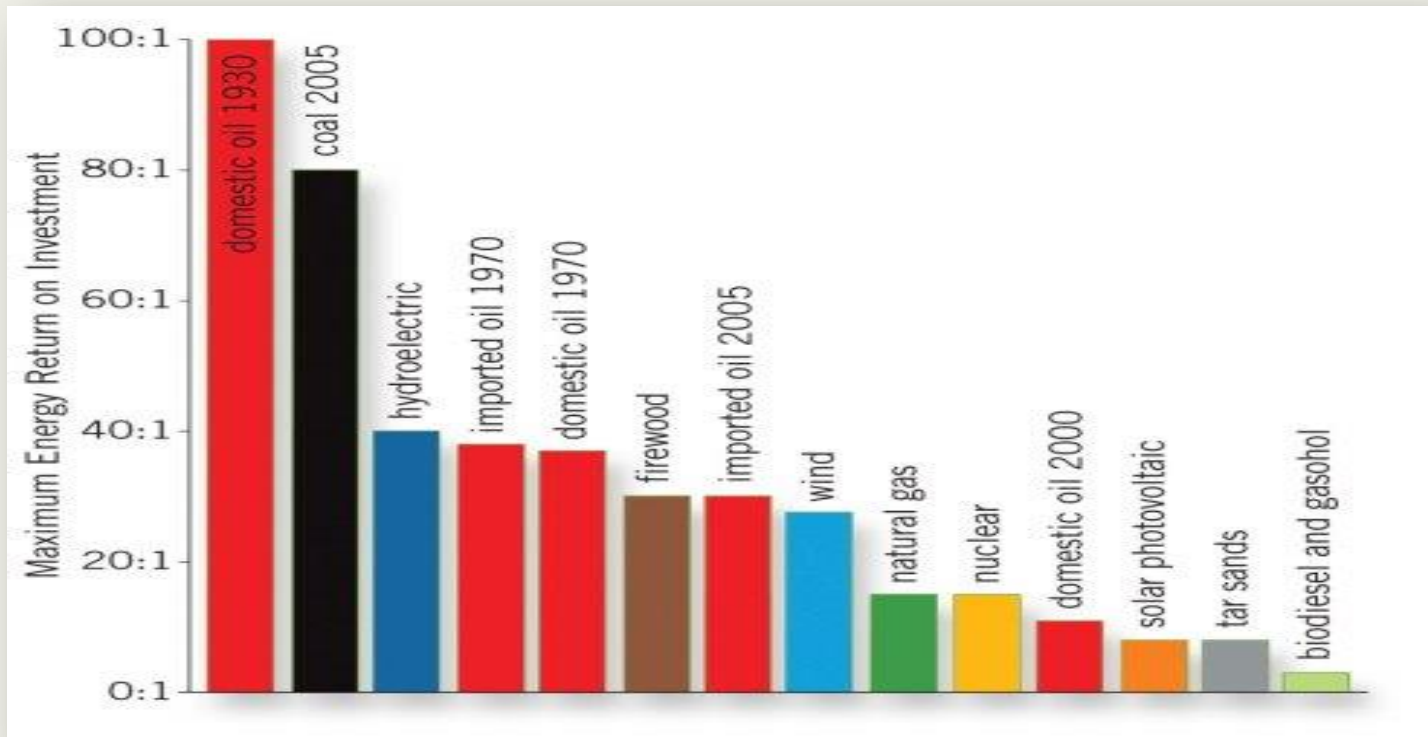
That is the energy available after the energy used in obtaining and processing the total energy produced

- Compare to investment returns net of taxes, expenses, and fees
- Measured by EROEI – Energy Returned on Energy Invested



UNDERSTANDING PEAK OIL

EROEI FOR ENERGY SOURCES





Net Exports and Competition for Oil

- Producing nations use more of their oil, and have less to export
- Growing nations (especially China) can afford to pay more for each barrel of oil – it's worth more to them
- “Our” oil is also priced at world levels



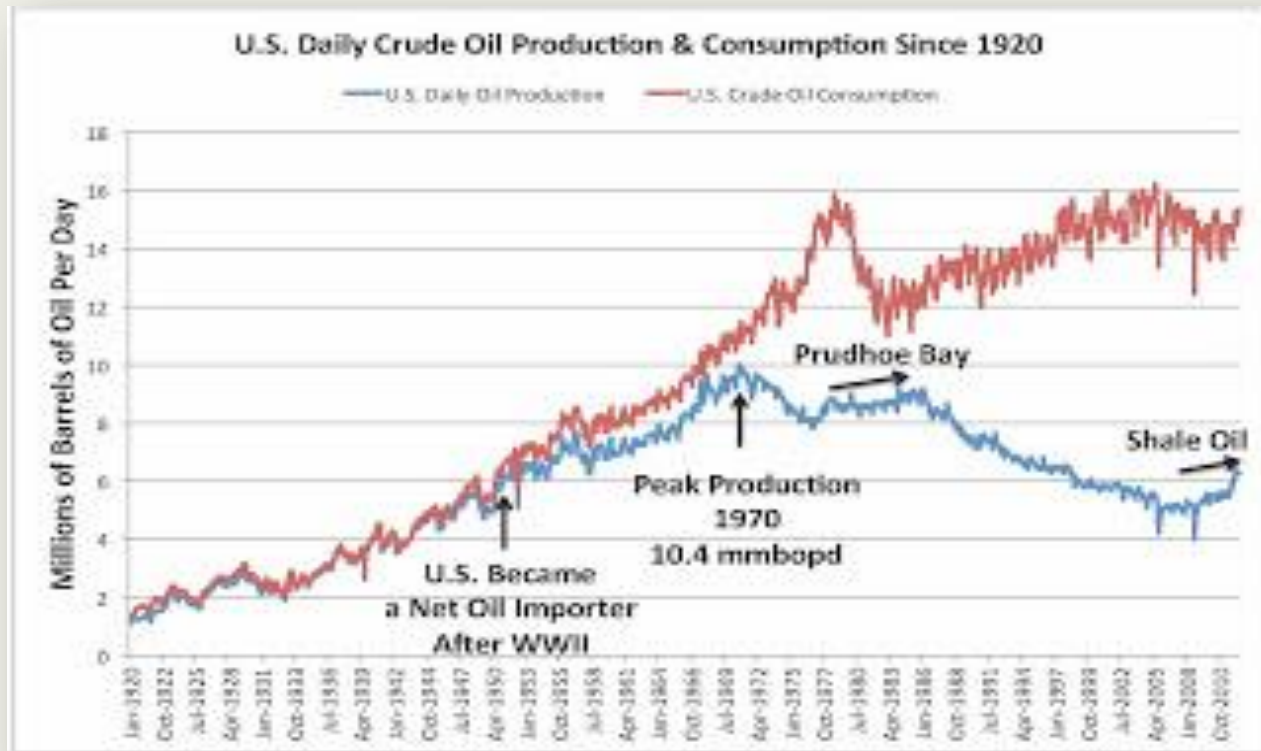
When will the global peak occur?

- Discoveries peaked in 1960's
- Production has been in narrow band since 2005
- Many experts say peak date will be (or was) between 2005 and 2014
- Peak production will probably be between 88 and 91 million barrels per day.

My conclusion – we're there now, especially in net oil available in world trade



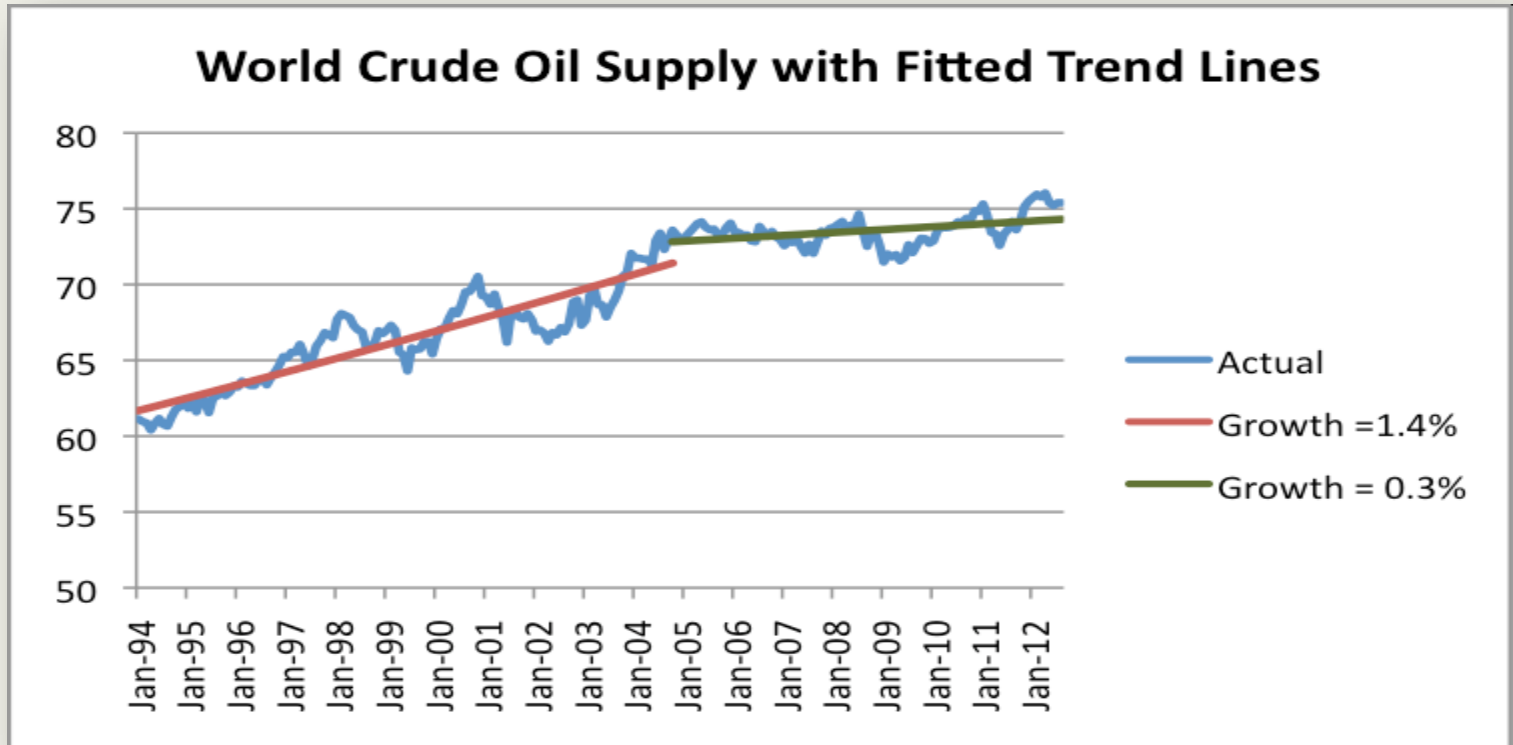
WHAT PEAK OIL LOOKS LIKE - USA



source: US EIA

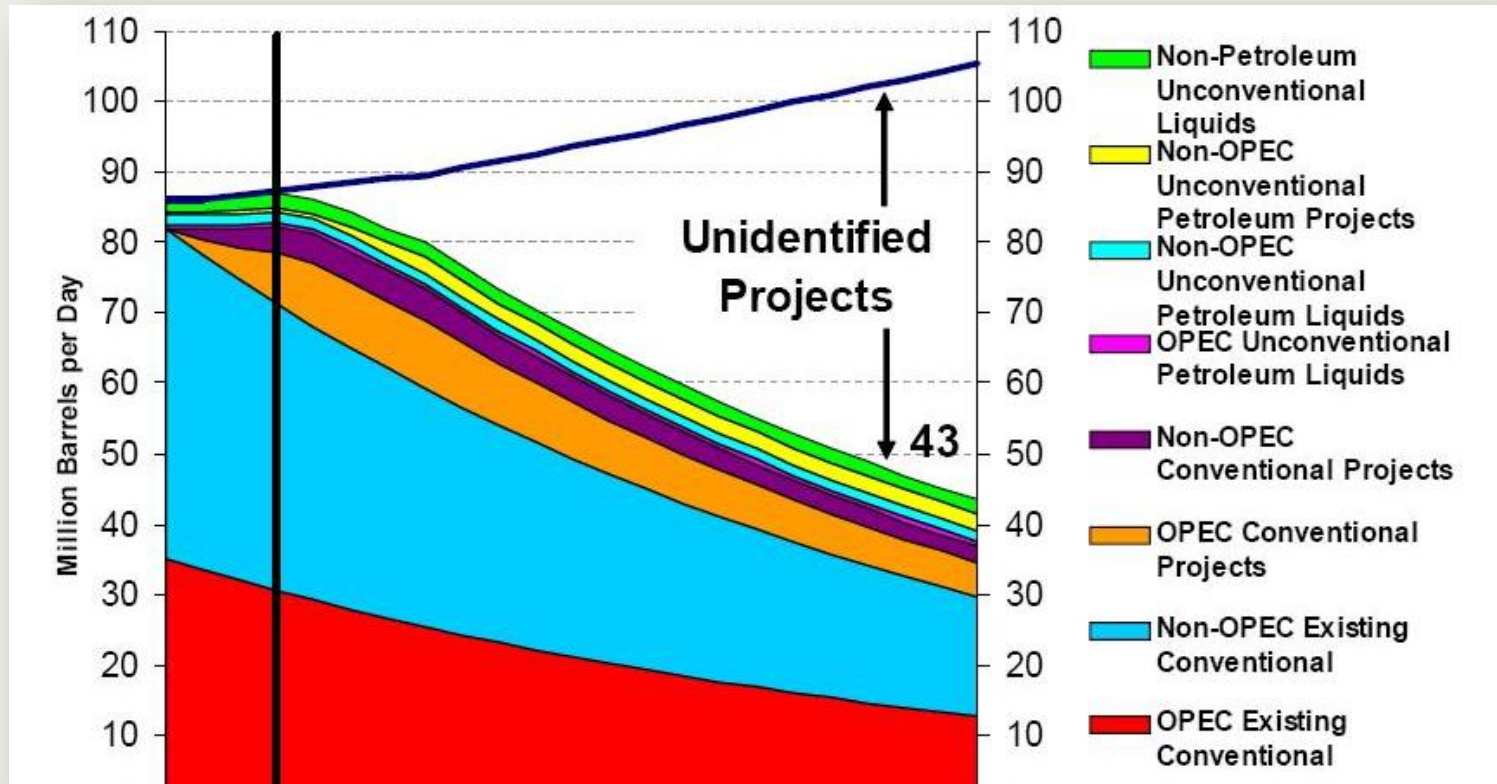


WHAT PEAK OIL LOOKS LIKE-WORLD





WHAT PEAK OIL LOOKS LIKE





PART TWO

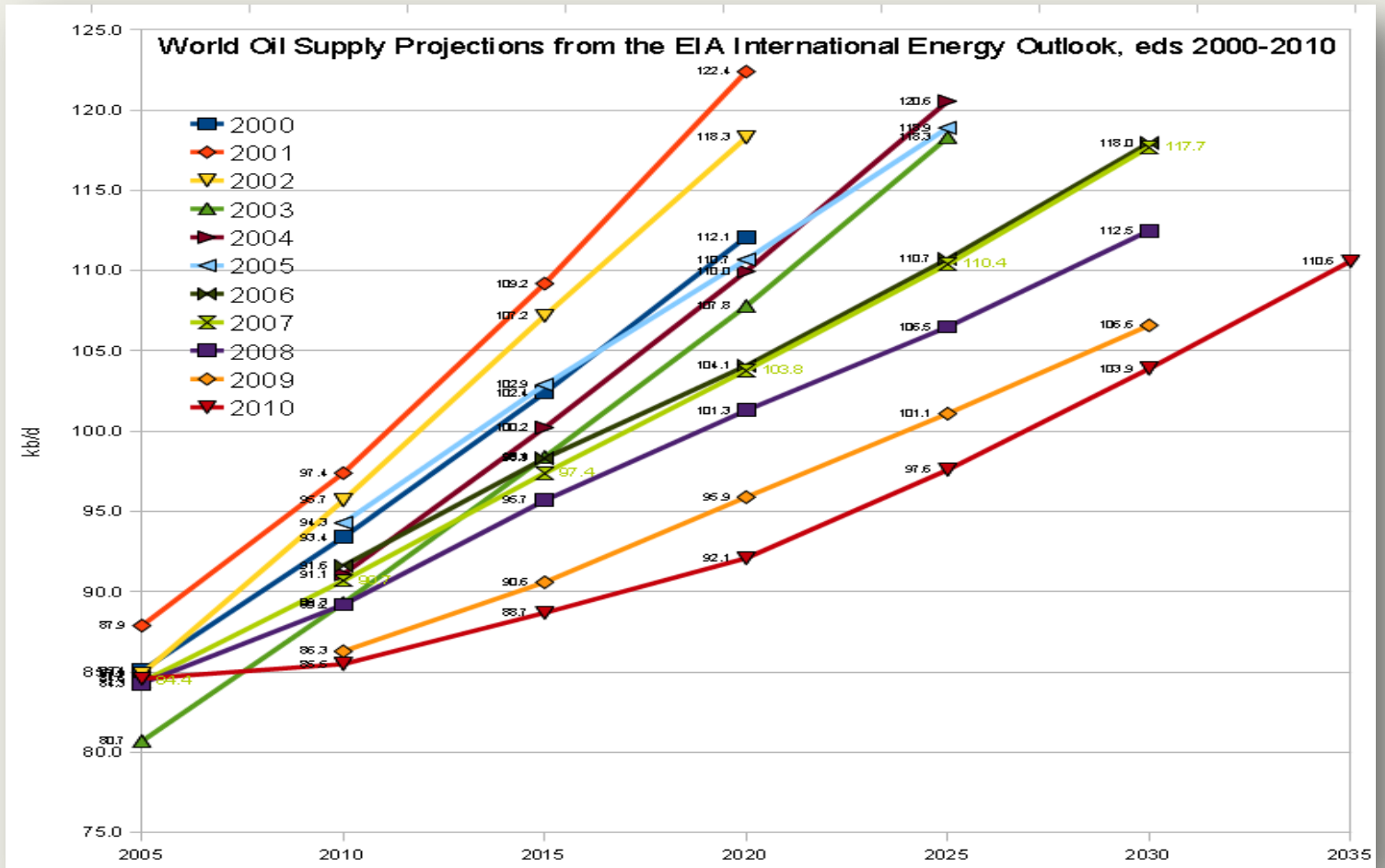
DON'T RELY ON YHPRUM'S LAW

*YHPRUM'S LAW – EVERYTHING
WILL WORK OUT AS PROMISED*

YHPRUM = MURPHY, SPELLED BACKWARDS



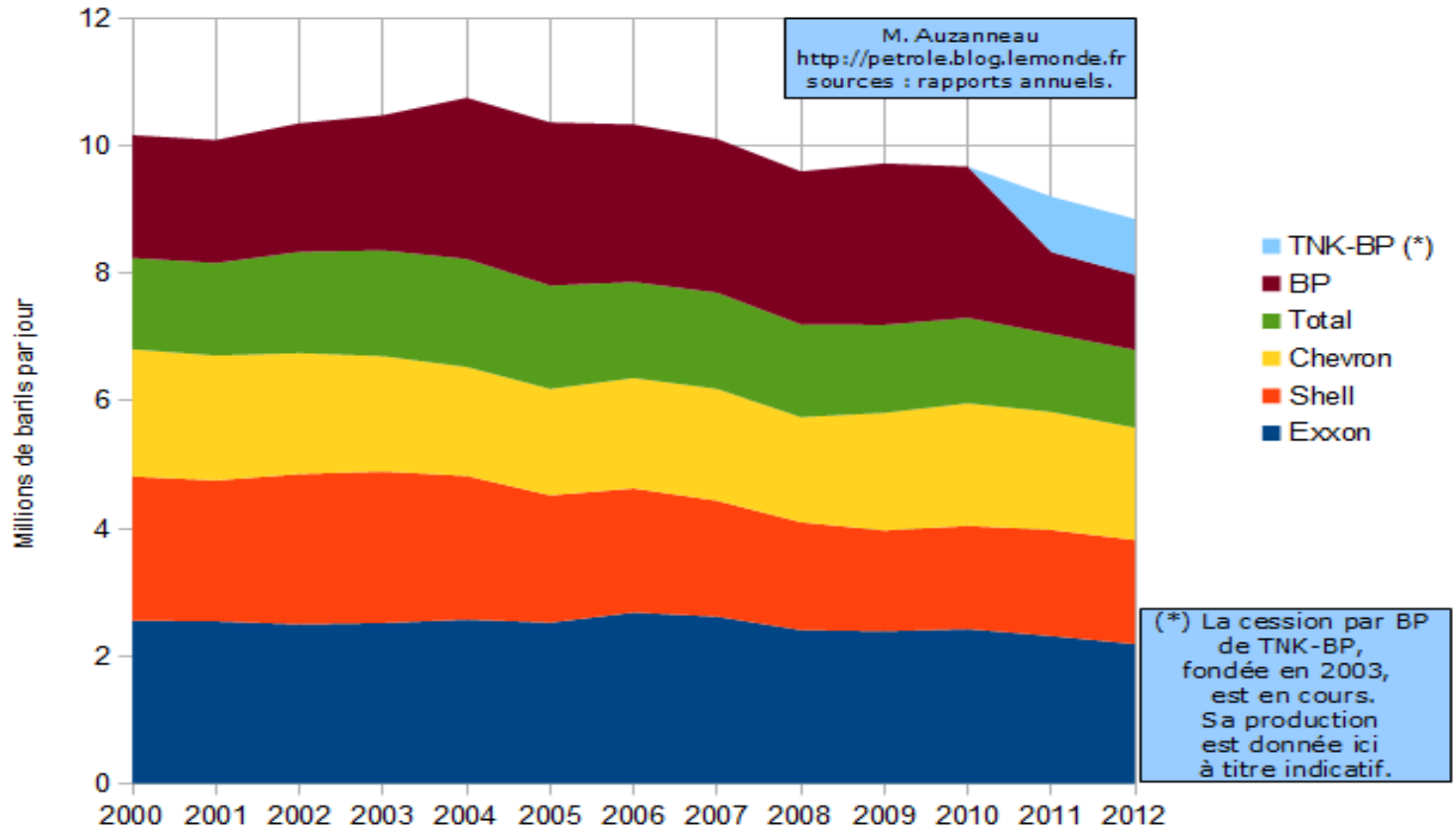
HARD TO PREDICT THE FUTURE





HARD TO KEEP THINGS GOING

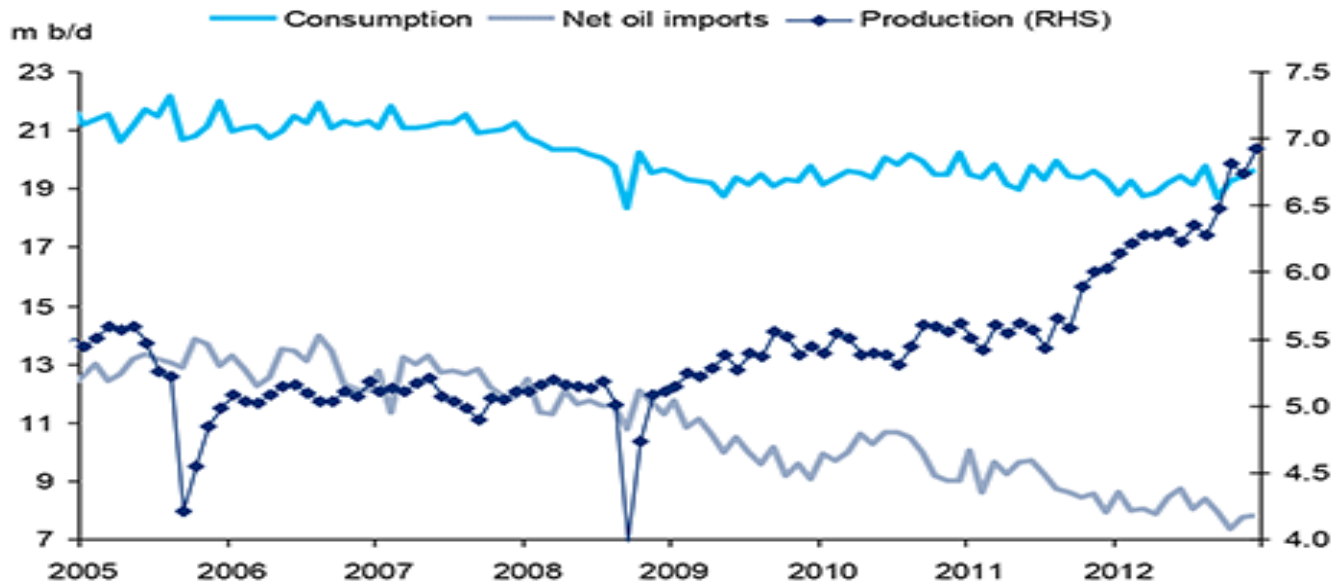
Déclin depuis 2004 du cumul de la production de pétrole des 5 "majors"
(pétrole brut conventionnel, gaz naturels liquides, bitumes)





HARD FOR SOME TO BE HONEST

AS CRUDE PRODUCTION HAS SURGED WHILE DEMAND IS IN STRUCTURAL DECLINE, NET IMPORTS HAVE BEEN FALLING SUBSTANTIALLY



SOURCE: EIA, CITI RESEARCH



YES, BUT WHAT ABOUT...

Shale Gas and Oil

- Expensive process
 - Average well costs \$7-10 million
 - Uses lots of water, truck traffic
- Fast declines, low productivity per well
 - Average Bakken (ND) well 100 bpd
- Most oil and gas in a few “sweet spots”
- Rapid declines create drilling treadmill



SHALE OIL AND GAS

There are only a few big fields, including

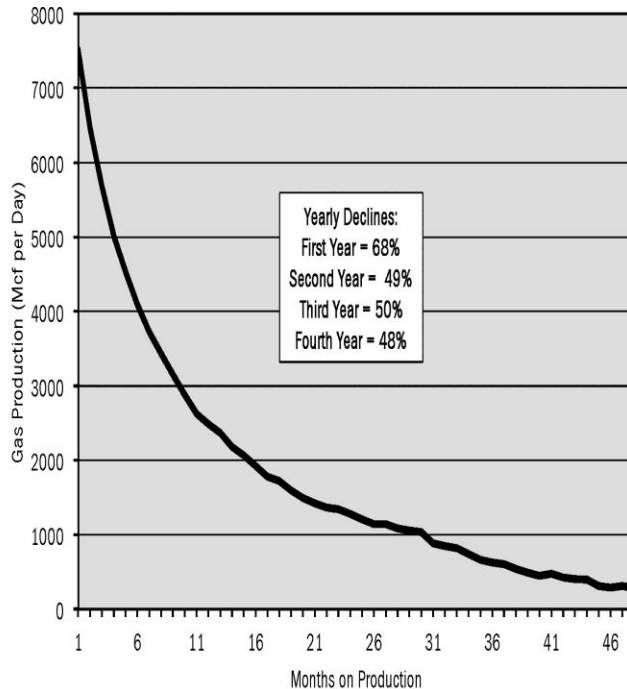
- Haynesville – gas – La/Texas
- Marcellus – gas – Pennsylvania
- Eagle Ford – oil/gas – Texas
- Bakken – oil – North Dakota



SHALE OIL AND GAS

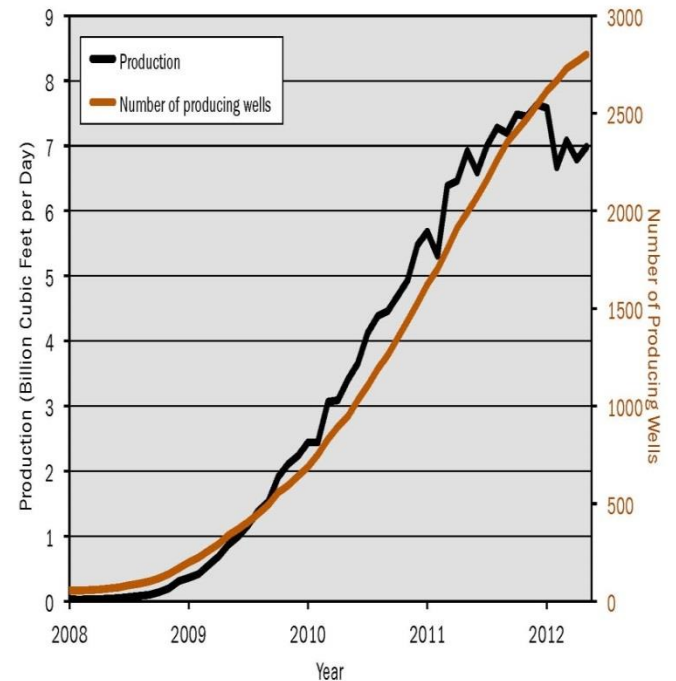
HAYNESVILLE RESULTS

Type decline curve for Haynesville shale gas wells



Based on data from the four years this shale play has been in production.

Shale gas production and number of producing wells for the Haynesville play, 2008 through May 2012

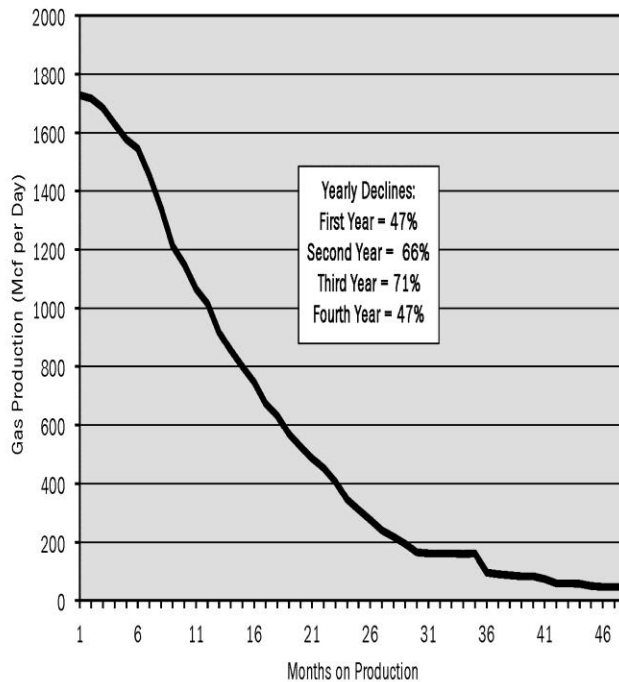


Production peaked in December 2012, despite continued growth in the number of operating wells.



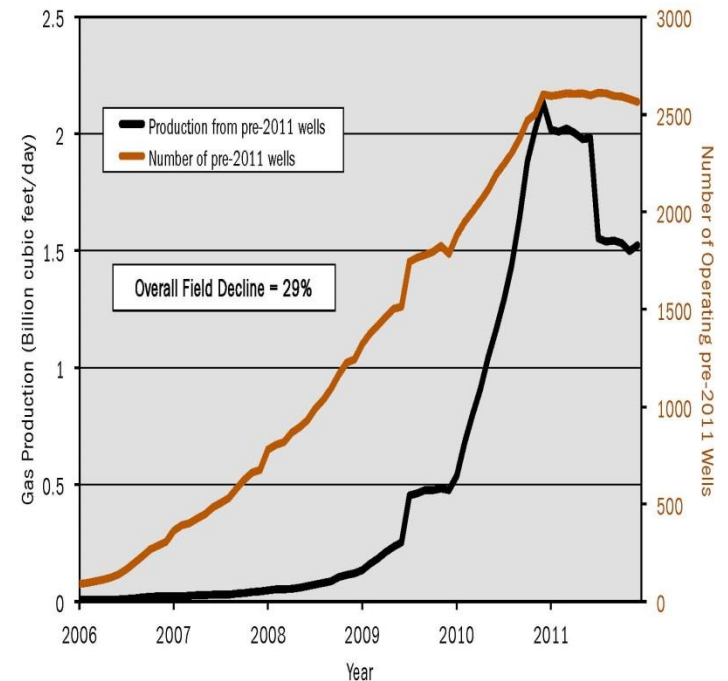
SHALE OIL AND GAS MARCELLUS RESULTS

Type decline curve for Marcellus shale gas wells.



Based on data from the most recent four years of this play's production.

Overall field decline for the Marcellus play based on production from wells drilled prior to 2011



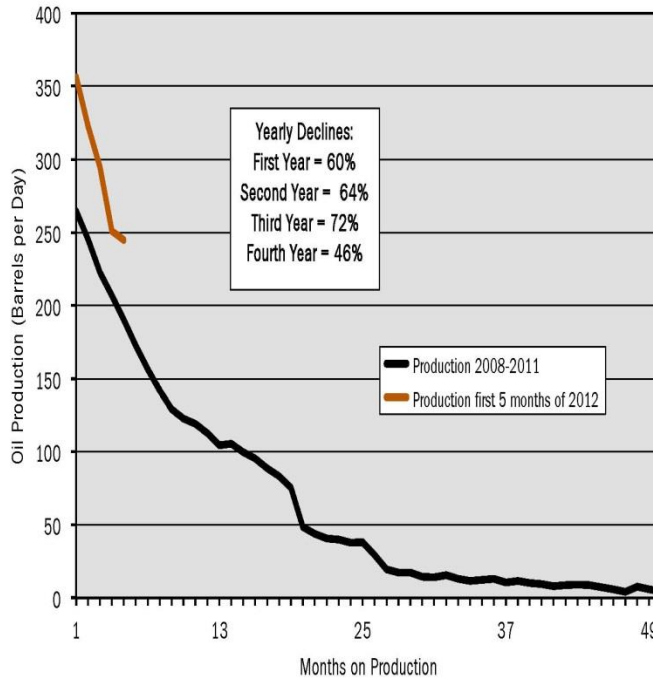
In order to offset the 29 percent decline rate for the field, 561 new wells producing at 2011 rates are required.



SHALE OIL AND GAS

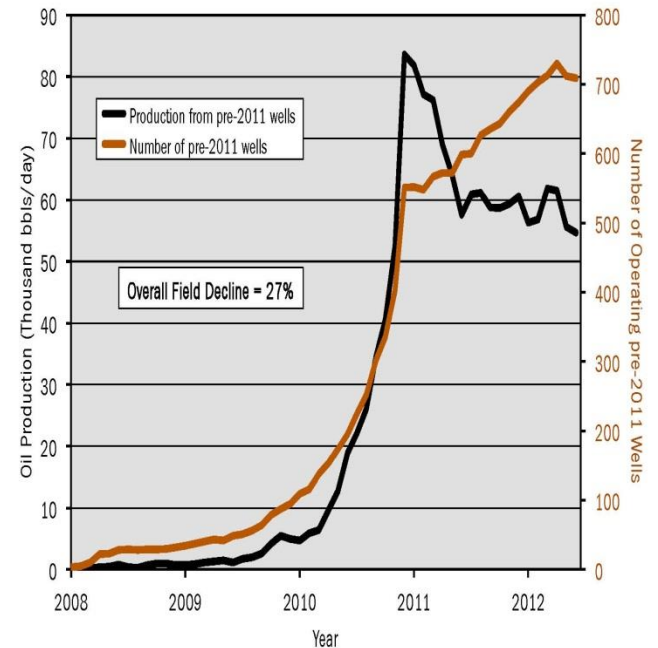
EAGLE FORD RESULTS

Type decline curve for Eagle Ford tight oil wells



Based on data from the most recent 50 months through year-end 2011 of this play's production. Production for the first five months of 2012 is also shown, indicating that IP's are rising as drilling focuses on recently defined sweet spots.

Overall field decline for the Eagle Ford play based on production from wells drilled prior to 2011



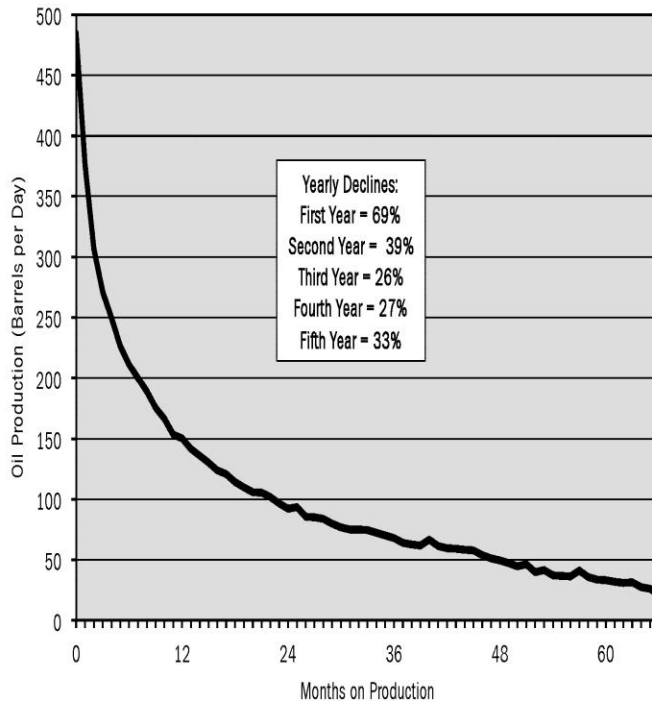
The actual overall field decline is likely steeper than shown as many pre-2011 wells were being connected over the subsequent months as indicated by the rising well count in 2011 and 2012. If the 27 percent rate is accepted, it would require 723 new wells producing at 2011 rates to offset field decline each year from current production levels.



SHALE OIL AND GAS

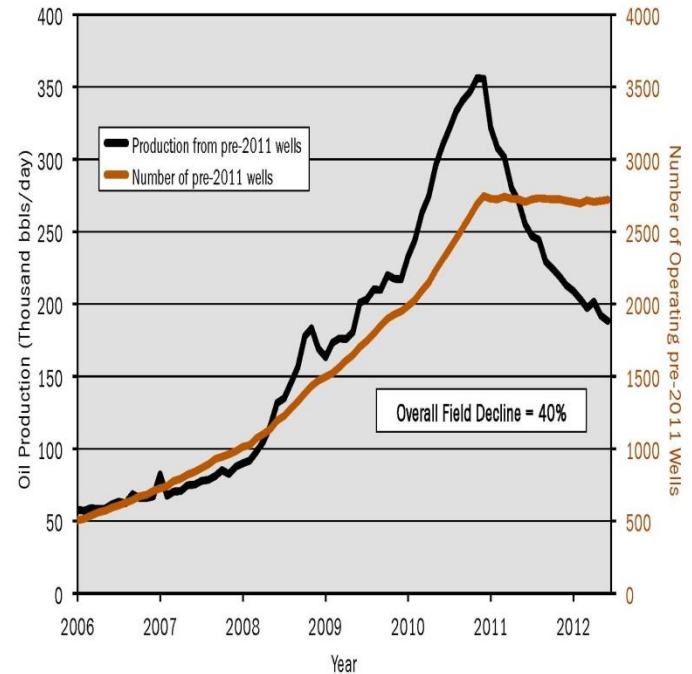
BAKKEN RESULTS

Type decline curve for Bakken tight oil wells



Based on data from the most recent 66 months of this play's oil production.

Overall field decline for the Bakken play based on production from wells drilled prior to 2011

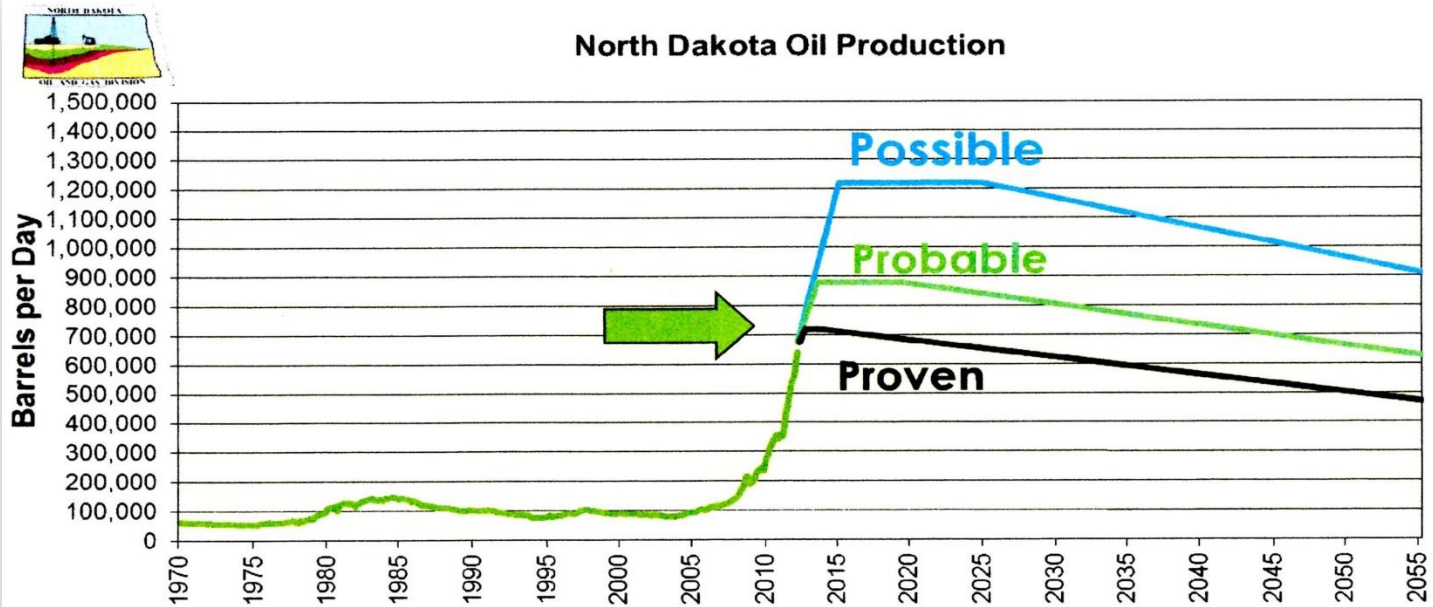


In order to offset the 40 percent decline rate for the field, 819 new wells producing at 2011 rates are required.



SHALE OIL AND GAS

N. DAK. GOVT PROJECTION



**Proven=7 BBO – Probable=10 BBO – Possible=14 BBO
(billion barrels of oil)**

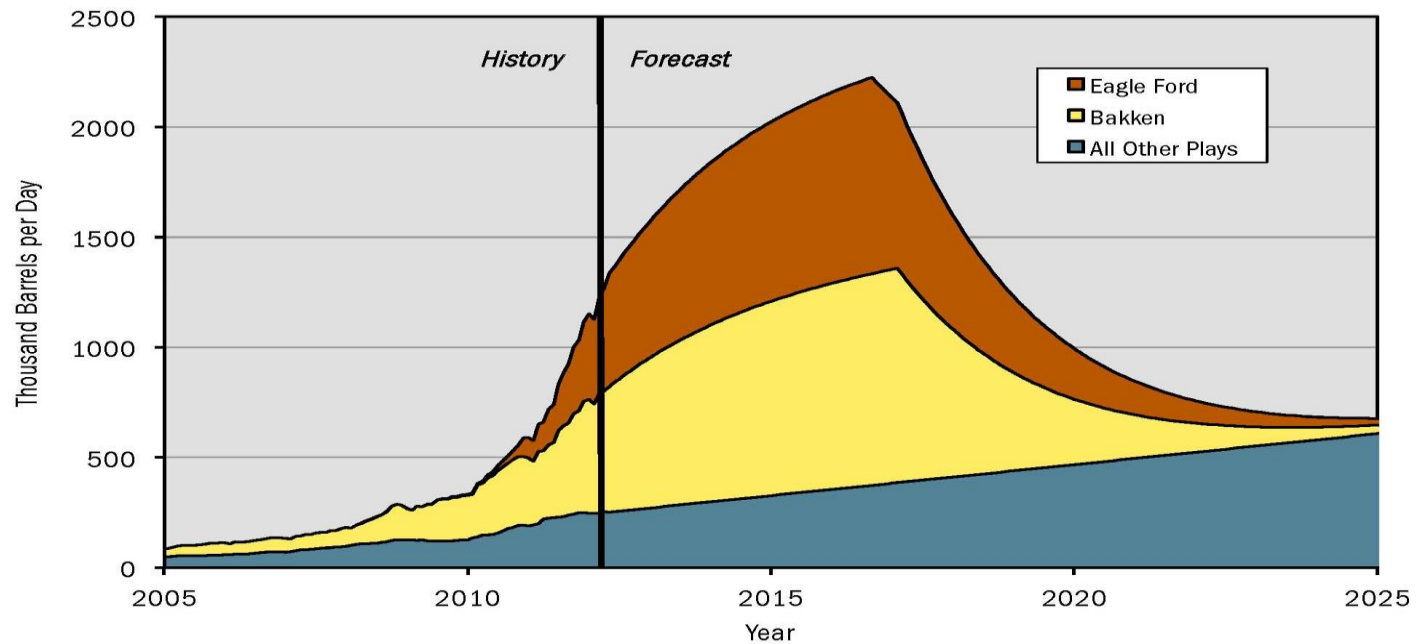




SHALE OIL AND GAS

Here's the latest forecast for the US

Projection of tight oil production by play in the U.S. through 2025



Based on vintaged type curve production, the number of drilling locations projected by the EIA for the Bakken and Eagle Ford plays, and the assumption of continued recent growth rates in the other plays.

Source-Hughes, *Drill, Baby, Drill*, Feb, 2013



UNDERSTANDING PEAK OIL

Likely consequences from Peak Oil

- NOW: highly volatile prices, as we've seen since 2004
- SOON: higher prices to support production, reduce demand, and develop alternatives
- Economic competition, disruption, and contraction
- Political and international unrest
- Amount of oil available for world trade in decline
- Biggest impacts – transportation and agriculture



YES, BUT WHAT ABOUT...

Alternative energy sources

- Wind
- Solar
- Geothermal
- Algae

Problem 1 – Large inputs, low efficiency

Problem 2 – electricity, not transportation

Still continue aggressive research



YES, BUT WHAT ABOUT...

Electric Cars

- Engineering and batteries
- Cost
- Scale
- Source of electricity
- Infrastructure



UNDERSTANDING PEAK OIL

- Without more oil, we are seeing slowing, and ultimately the end, of overall growth in the “real” economy
 - This is not a problem monetary manipulations can fix
- Some areas are already in decline



PART THREE

*WHEN SMOKE BLOWS AWAY,
WHERE EXACTLY IS “AWAY”?*



UNDERSTANDING GLOBAL CLIMATE CHANGE

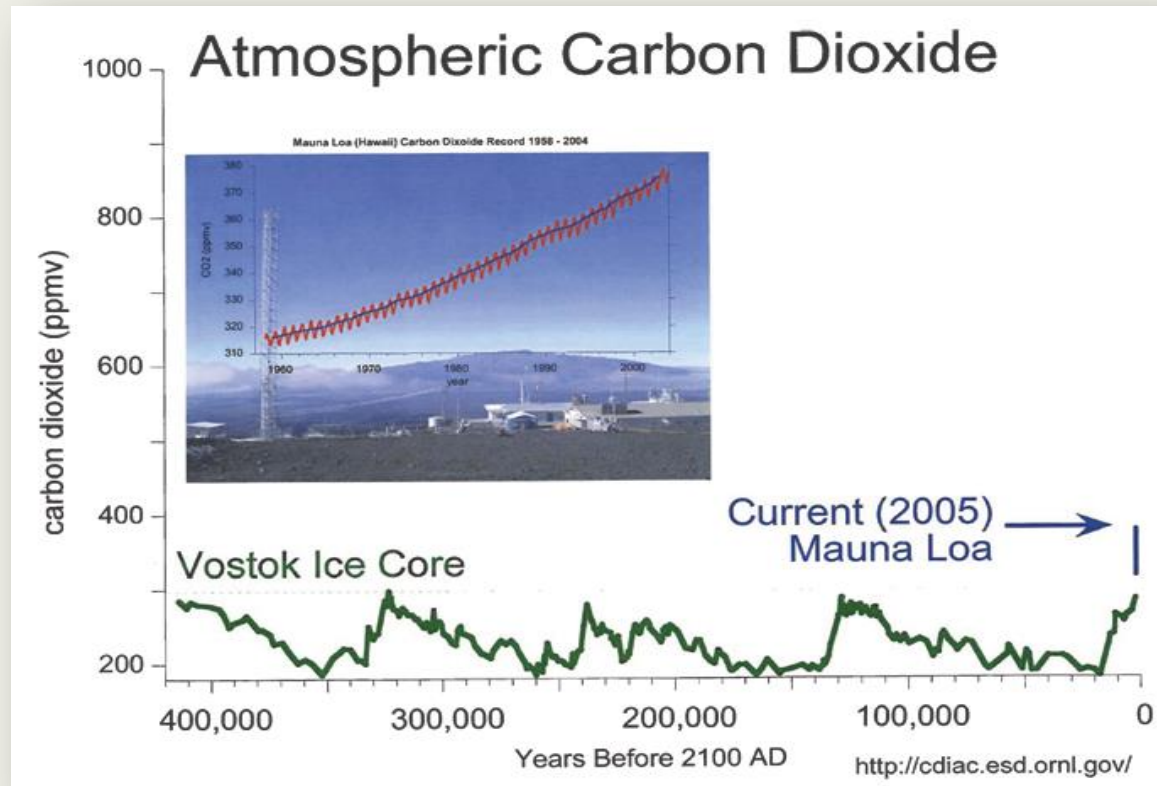
Global Climate Change defined

- The average temperature on the earth's surface is increasing, and other environmental systems are affected, as a result of increasing levels of carbon dioxide (CO₂) and other greenhouse gasses.
- Both Peak Oil and Global Climate Change are aspects of human use of, or need for, fossil fuels and other energy sources. We'll refer to the collective problem as **PO+GCC**.



UNDERSTANDING GLOBAL CLIMATE CHANGE

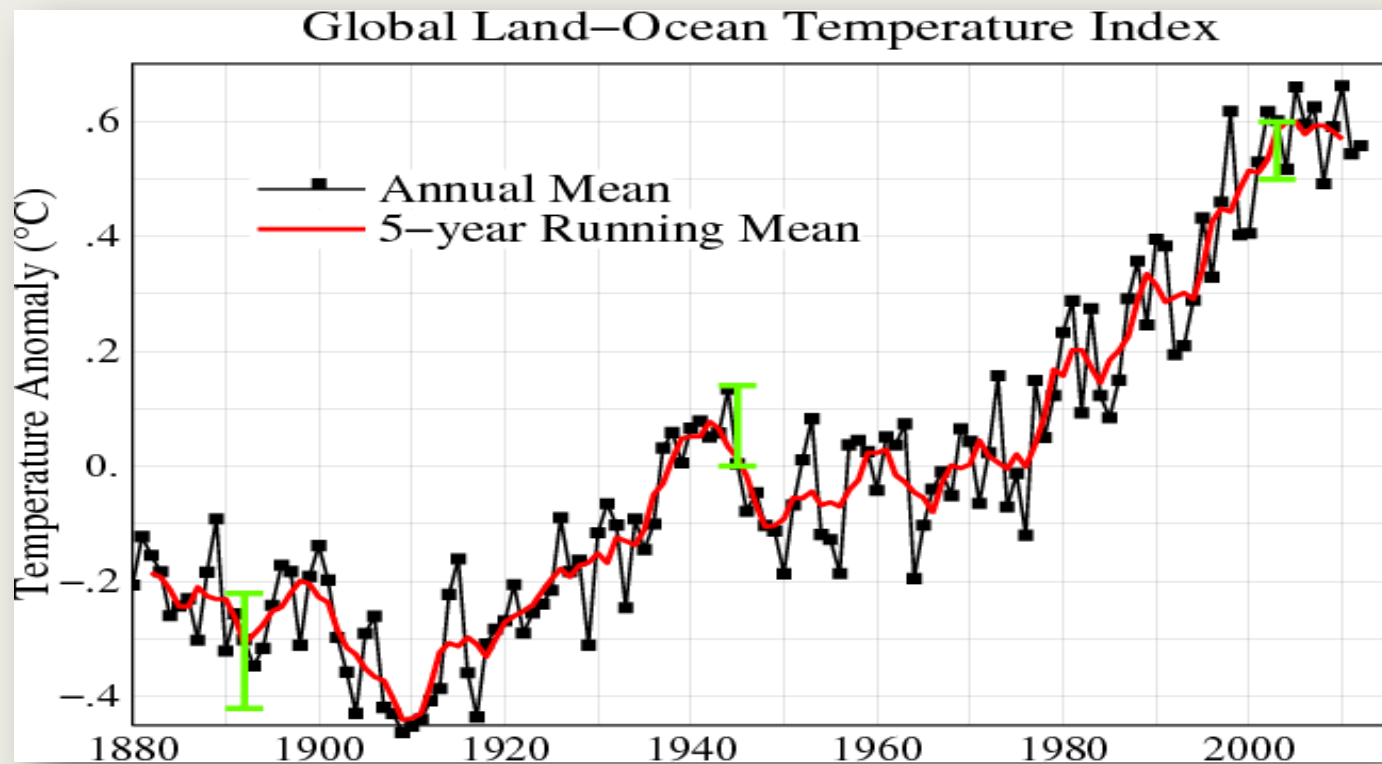
WHAT THIS LOOKS LIKE:
 CO₂ Concentration Since 400,000 BC





UNDERSTANDING GLOBAL CLIMATE CHANGE

What this looks like: **Global Temperatures since 1880**

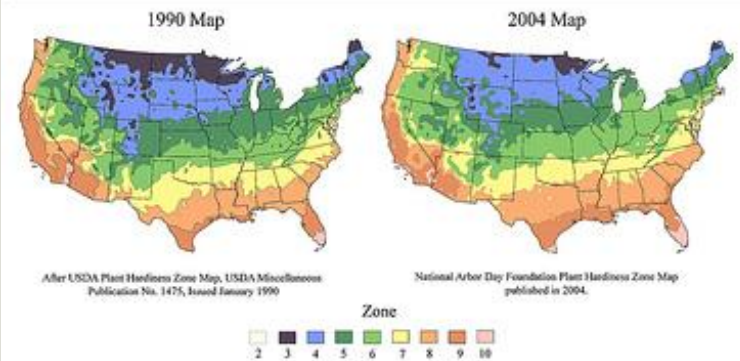
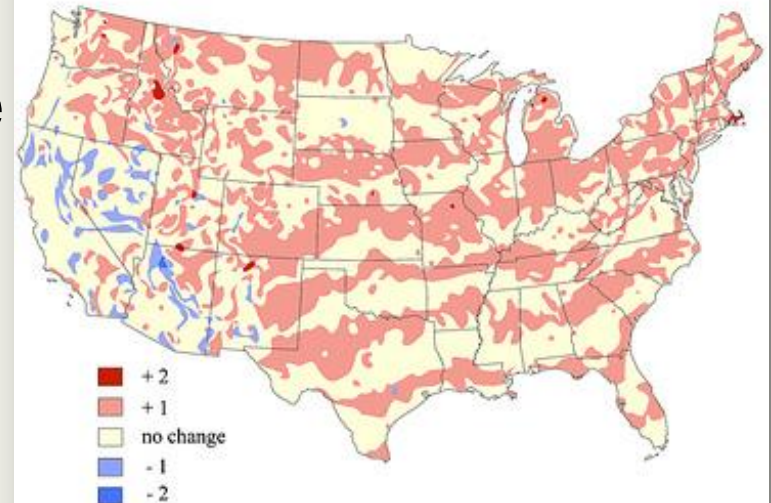




UNDERSTANDING GLOBAL CLIMATE CHANGE

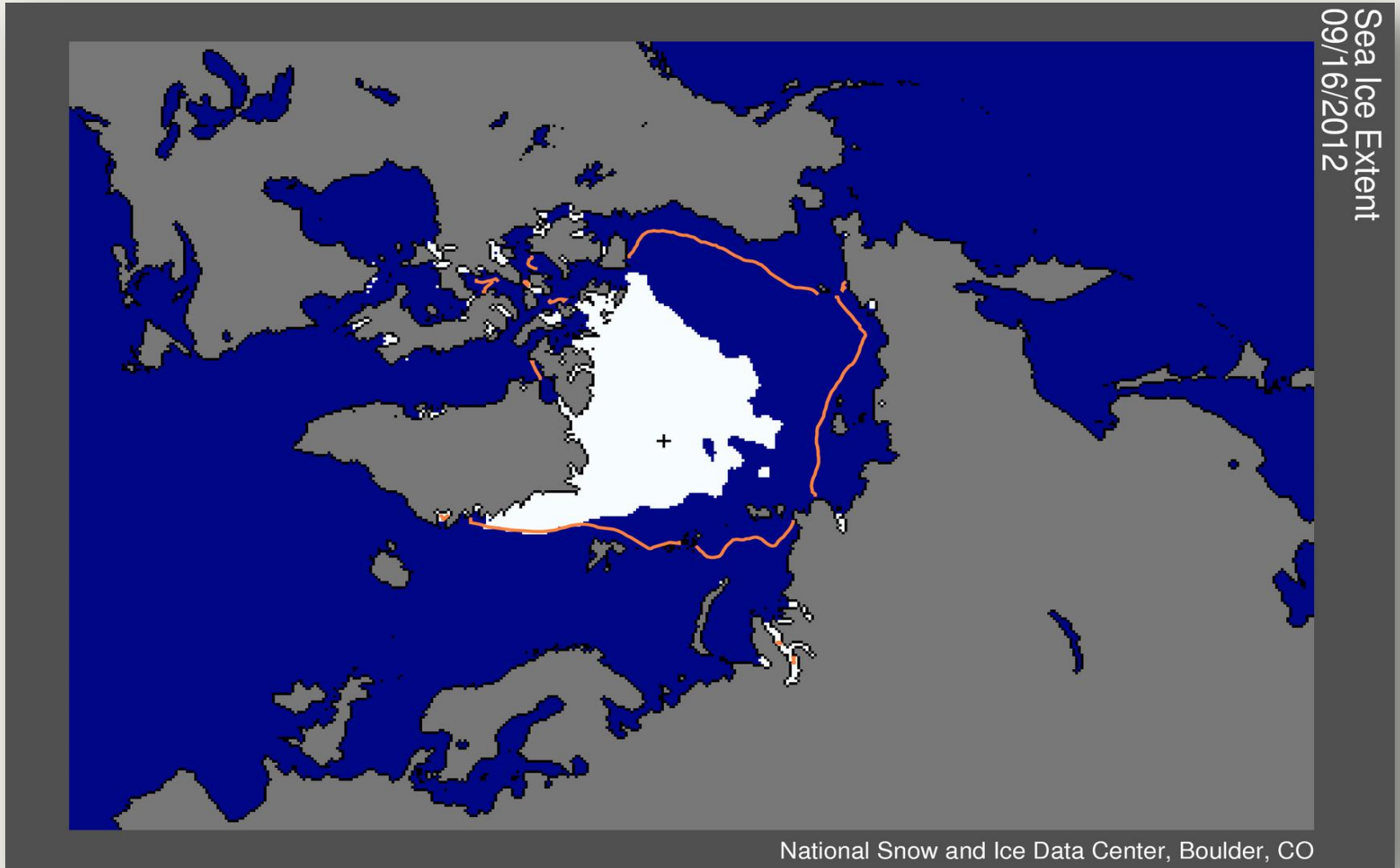
- This is not just a problem for the future
- The current impacts are significant
- The average winter temperature in US is 3-10 degrees warmer than 50 years ago

Difference between USDA (1990) and National Arbor Day Foundation (2004) Hardiness Zones



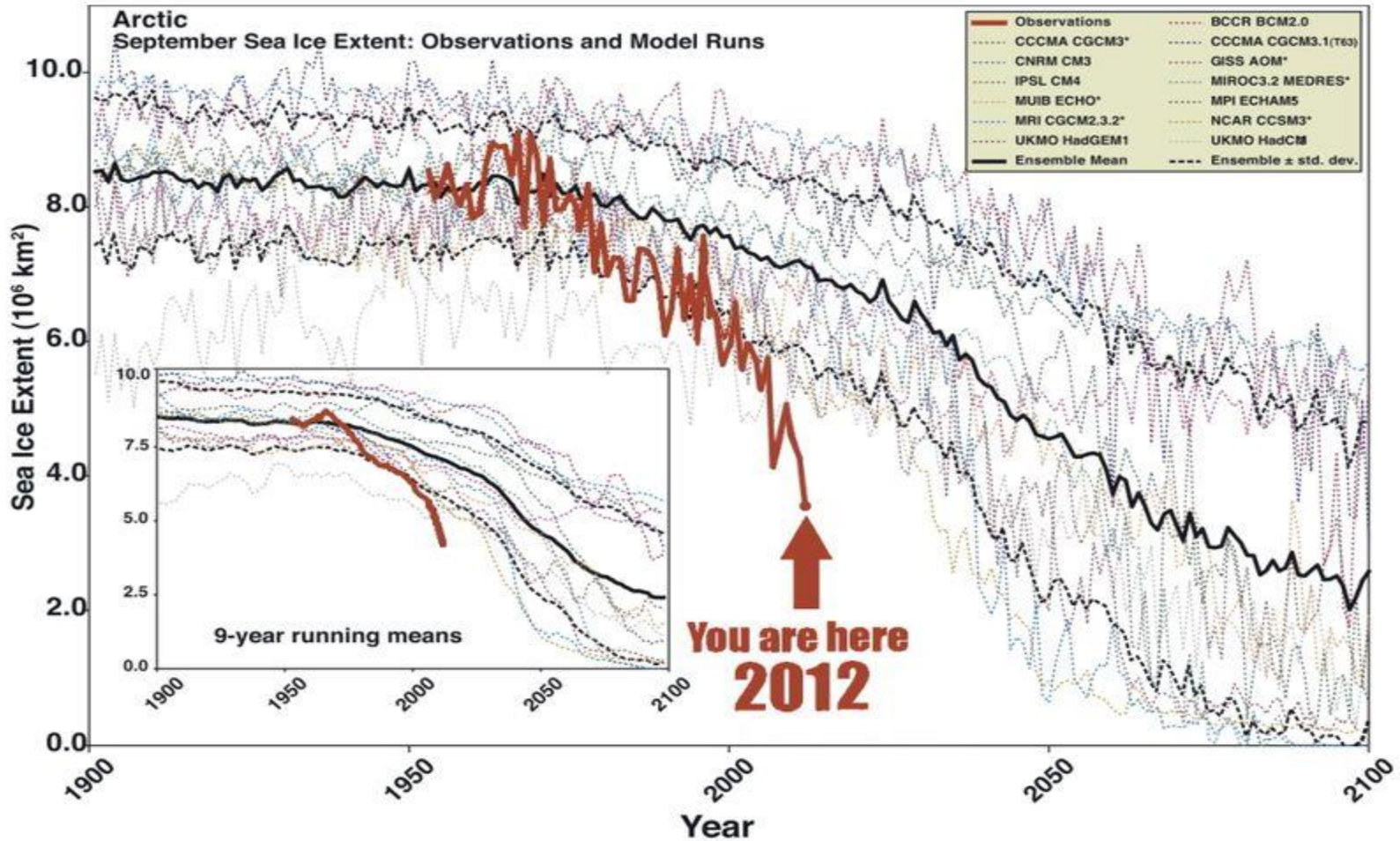


CLIMATE CHANGE PICTURES





CLIMATE CHANGE PICTURES





UNDERSTANDING GLOBAL CLIMATE CHANGE

Impacts already being seen from global warming

- Major heat waves killed vast numbers in Europe
- Intensity of tropical storms has increased
- Plants and animals losing ecological niches
- Ocean changes killing coral reefs, plankton
- Ocean food chain disrupted
- Higher temperatures allow diseases to spread
- Temperature and rainfall changes hurting agriculture

Impacts magnify other human pressures on the planet



UNDERSTANDING PO + GCC

- Peak Oil – there will be less oil available
- Global Climate change – there will be less cheap electricity available
- Global Climate Change – we'll deal with effects of more extreme weather
- This leads to an end to a century of cheap and plentiful energy
- This opens a new energy and economic system
- No one knows what it will look like



WHAT HAS STARTED?

- US Unemployment remains high
- Europe and Japan are stuck
- The “Sharing economy” is coming
- Food trucks and diners
- The Arab Spring, Pakistan, Syria
- Fed action, stimulus, and financial repression



PART FOUR

*THERE'S AN URGENT NEED
TO DO REASONABLE THINGS*



UNDERSTANDING PO + GCC

Four possible 21st century paths

- **Business as Usual** – maybe there's no problem
- **Technofix** – “Science” will save us
- **Powerdown** – We'll respond rationally, creatively, cooperatively
- **Catastrophe** – We can't, or won't, adjust in time



PO & GCC -- FINANCIAL PLANNING PRINCIPLES

Applying financial planning principles to PO+GCC

- What are positive – or at least less depressing – ways to think about these issues?
- How would we plan for clients who have comparable problems?



PO & GCC -- FINANCIAL PLANNING PRINCIPLES

PO+GCC is a risk management problem

- PO+GCC presents a meaningful (but hard to quantify) chance of outcomes that range from unpleasant to really bad, as well as opportunities for innovation
- Risk management is what financial planners do



PO & GCC - FINANCIAL PLANNING PRINCIPLES

Resiliency is key to responding to PO+GCC

- Our economic and social systems are too fragile
- There are few reserves or inventories, little redundancy
- We're all very dependent on the system
- We need to create resiliency at both individual and social levels



WHAT IS GOING TO HAPPEN?

The world surprises us, often in good
ways

Expect things outside the range of
guesses

Innovations

Challenges

It's easier to change policies than
create resources.



WHAT CAN HAPPEN?

- Diversion of capital to alternative energy and mitigation strategies
- Innovations in many areas
 - Efficiency
 - LED lights, CAFE standards
 - Energy sources
 - Community structures – Transition
 - Mitigation and construction rules



PO & GCC -- FINANCIAL PLANNING PRINCIPLES

PO+GCC creates an opportunity for Values based planning

- Pursue “real” values
- Interior work, spiritual work
- Appreciative inquiry – “abundance vs stuff”
- Material prosperity does not equate with happiness



FINANCIAL PLANNING RESPONSES

IMPACT: PO+GCC will likely cause disruption and new rules at all levels

RESPONSES: Reduce risk exposure generally
Reduce personal debt



FINANCIAL PLANNING RESPONSES

IMPACT: PO+GCC will likely create a world in which traditional energy sources are much more expensive, much less reliable, or much less available

RESPONSES: Prepare now to live in that world
Reduce your energy and carbon
“footprint”

- Downsize
- Live close to family
- Live close to work
- Take vacations now



FINANCIAL PLANNING RESPONSES

IMPACT: PO+GCC is likely to create a world where transportation of all kinds is much more expensive than we have now.

Agriculture will be especially affected.

RESPONSES: Localization can become a way of dealing with transportation issues

- Support farmers markets
- Support local retail and production
- Participate in community organizations
- Know your neighbors
- Support alternative transportation



FINANCIAL PLANNING RESPONSES

IMPACT: PO+GCC is likely to affect the availability of products and services.

Repairing and reusing will become common again. Self-reliance will be more important

RESPONSES: Become and stay healthy
Learn new skills



INVESTMENT RESPONSES

INVESTMENT PLANNING FOR THE END OF GROWTH



INVESTMENT RESPONSES

- Lowering Expected Returns
- Stock prices =
GDP
X PROFIT MARGINS
X PRICE EARNINGS RATIO



INVESTMENT RESPONSES

Worldview One = Business as Usual

- The 20th Century's lessons and returns are still relevant
- More money can produce as many resources as we need
- Economic and material growth will go on forever
- There are no real limits
- This is the world we've traditionally planned for
- This is what clients are familiar with



INVESTMENT RESPONSES

Worldview Two = The Coming Durable Society

1. There are real constraints to what we can do materially
 - From energy
 - From climate
 - From other resources
2. As energy and environment become more expensive, the transition will require a lot of capital. Consumer products will become less available. Uncertainties and new relationships will emerge, but not in a way that can be predicted.



INVESTMENT RESPONSES

THEME 1 – INVEST TO FIGHT WARMING

- Replace coal-fired electricity
- Reduce deforestation
- Capture methane from landfills and agriculture
- Promote energy efficiency
- Build for recycling and reuse from the start
- Redesign transport to replace private cars
- Expand wind and solar power, develop storage systems
- Correctly price carbon throughout economy
- Promote sharing economy



INVESTMENT RESPONSES

THEME 2 – INVEST FOR A HOT WORLD

- Weather derivatives
- Water rights and water management
- Buy resilient farmland
- Explore Greenland for minerals
- Civil engineering and infrastructure repair
- Fight new diseases in new places



INVESTMENT RESPONSES

THEME 3 – INVEST FOR POST-PEAK ENERGY

- Find efficient energy users
- Avoid firms requiring cheap energy to be profitable
- Find firms offering local and low-cost entertainment
- Avoid expensive discretionary services
- Be cautious of leverage and fantasy returns
- Do not rely on continued public support and bailouts
- Do not assume that fundamentals matter



FINANCIAL PLANNING RESPONSES

Choosing between Worldviews One and Two

- Present both to client
- Let the client decide what part of portfolio to invest each way
- Develop a blended mix



CREDITS AND SOURCES

- Thanks to Post Carbon Institute for use of slides on shale, from 2013 book *Drill, Baby, Drill* by David Hughes
- For more information, see
 - Hall and Klitgaard, *Energy and the Wealth of Nations*
 - Tverberg, Ourfiniteworld.com
 - Grantham, GMO quarterly letters
 - ASPOUSA.org; Theoil drum.com; resilience.org



THANK YOU FOR PARTICIPATING IN THIS CONVERSATION

I welcome your feedback at
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