

A RAPIDLY CHANGING WORLD: Preparing for the Converging Crises of Energy, Economy & Environment

"If we want our world to be different, the first act needs to be reclaiming the time to think."

Margaret J. Wheatley

Port of Port Townsend Commissioner's Retreat
Climate Change, Resilience, and the Broader Energy and Economic Context

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The nature of our predicament...

- Over the coming years, our basic assumptions about “how the world works” are likely to be deeply challenged – unsustainable trends have caught up with us
- Perpetual growth will slow or cease as easy to access energy dwindles
- As more energy is needed to get energy, less energy will be available for “everything else”:
 - Rising asset values and earnings
 - The ability of individuals, businesses and governments to pay their debts
 - European vacations, symphony orchestras
 - Mitigating for, and adapting to, climate change
- Without growth, the system we assume will multiply our savings and provide for our retirements may cease to function
- It may be possible to mitigate some impacts (e.g., through efficiency), but this will only slow the impacts of the scarcity of cheap energy

Key concepts to help frame our dialogue . . .

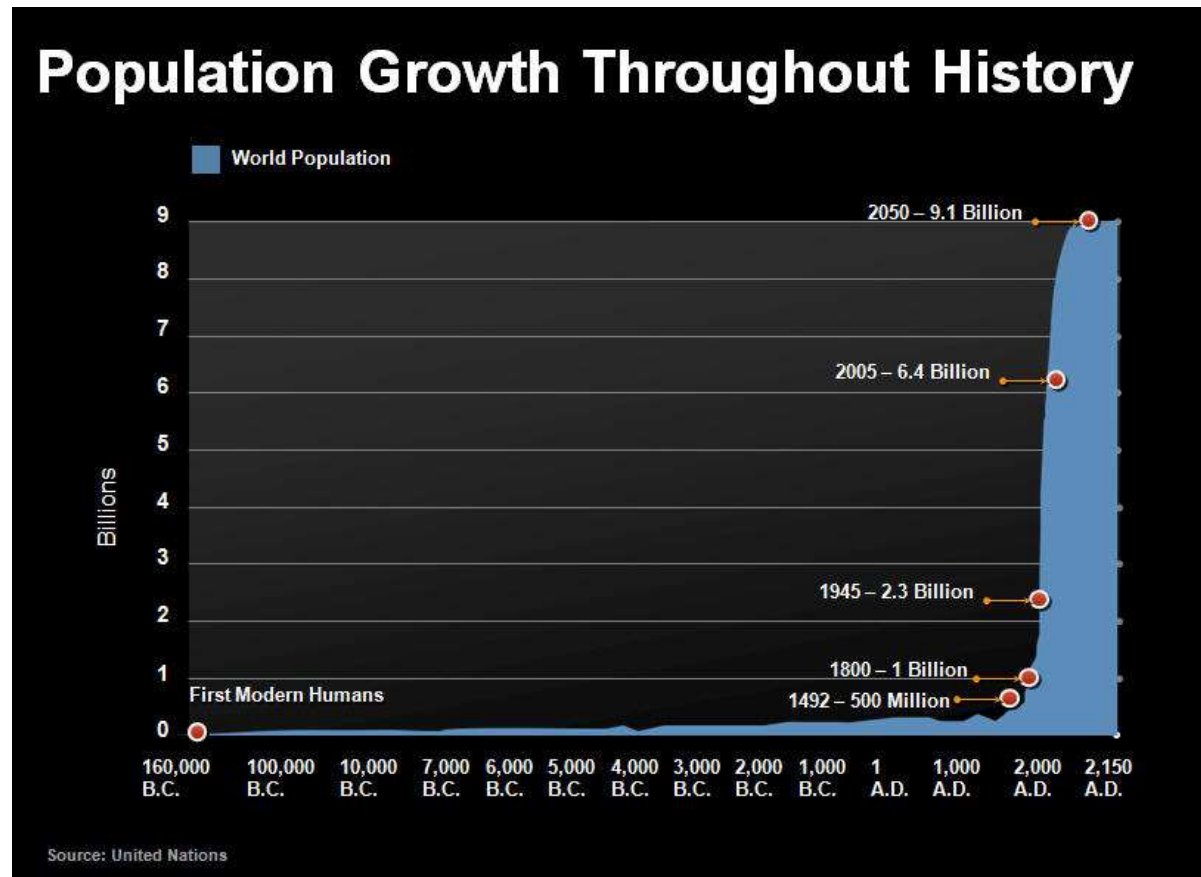
- Economic “laws” were created during an aberrant and un-repeatable period in human history (i.e., the last 100-200 years)
- The economy is a subset of the environment – not vice versa
- Vast amounts of cheap and easily accessible energy, not **technology and ingenuity**, have driven the accumulation of wealth and increases in productivity
- Energy is the “master resource” the “hemoglobin” of every economy; energy = the ability to do work
- Energy is unique and non-substitutable
- Money/financial instruments are just markers for real capital (energy, natural resources, and their secondary/tertiary byproducts)
- Debt is a claim on *future* energy and natural resources
- Energy measured in *energy terms (EROEI)* is the **true** cost of capital

Fossil hydrocarbons have fueled a once in a species bonanza

- A treasure of liquid fuel containing over 300 million years of concentrated solar energy
- Like any other species with a competitive advantage, we began to burn it all up
- We developed technology after astonishing technology, expanding our population nearly eight-fold
- Increasing standards of living to levels never imagined by prior generations



The human trajectory ...



- At the turn of the 19th century there were roughly 1 billion people
- Today, the world's population nearly 7.9 billion, and is projected by the United Nations to exceed 9 billion by 2050

We live in an entirely unique & unrepeatable period in human history ...

- We are blind to the incredible energy density and versatility of oil
- We have assumed that it is a resource that we can draw upon forever
- Generations have been born into the oil age and then left seeing it fully transformed in a single lifetime
- Our never-ending growth expectation is woven within our psyches and our civilization's political, economic and social structures
- We have created a growth-based money system to leverage this potential
- Compounding growth has become normal - almost entirely on the back of cheap hydrocarbons

Where we live . . .

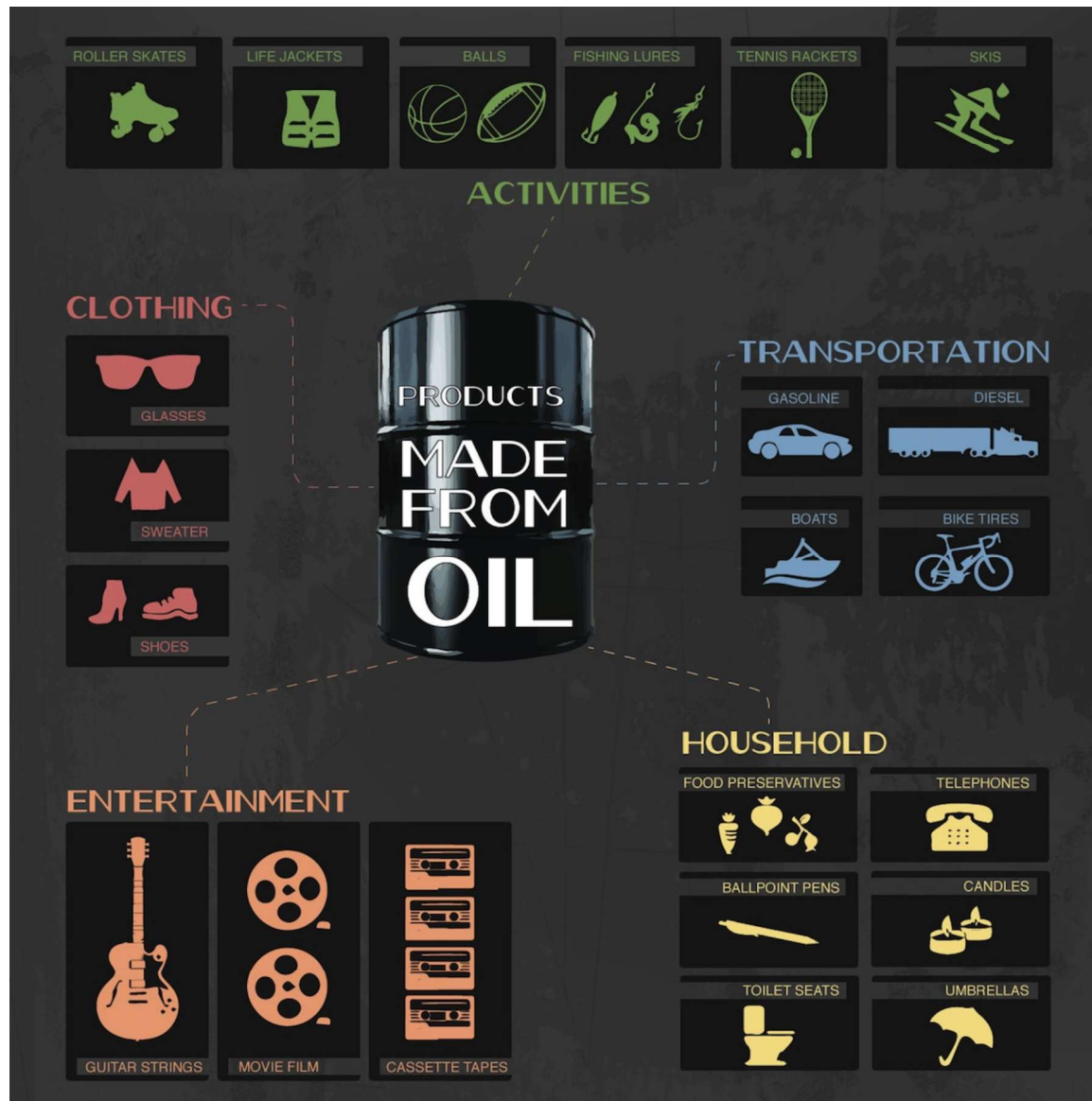


“We expect better jobs and higher returns on investments . . . but we live on a finite planet!” -- Richard Heinberg, Senior Fellow, Post Carbon Institute

Unfortunately, we have no ready substitute for oil to power our economy . . .

- All economies are essentially a function of available energy
- Without energy, there could never be an economy
- Oil is the “**master resource**” the “**hemoglobin**” in our trade based global economy because it fuels over 95% of the transport of our goods
- Oil has a hand in nearly every single dollar of global GDP, and at present there is simply **no other ready comparable substitute**

Look around - nearly everything is derived from, or transported by, coal, oil & natural gas ...

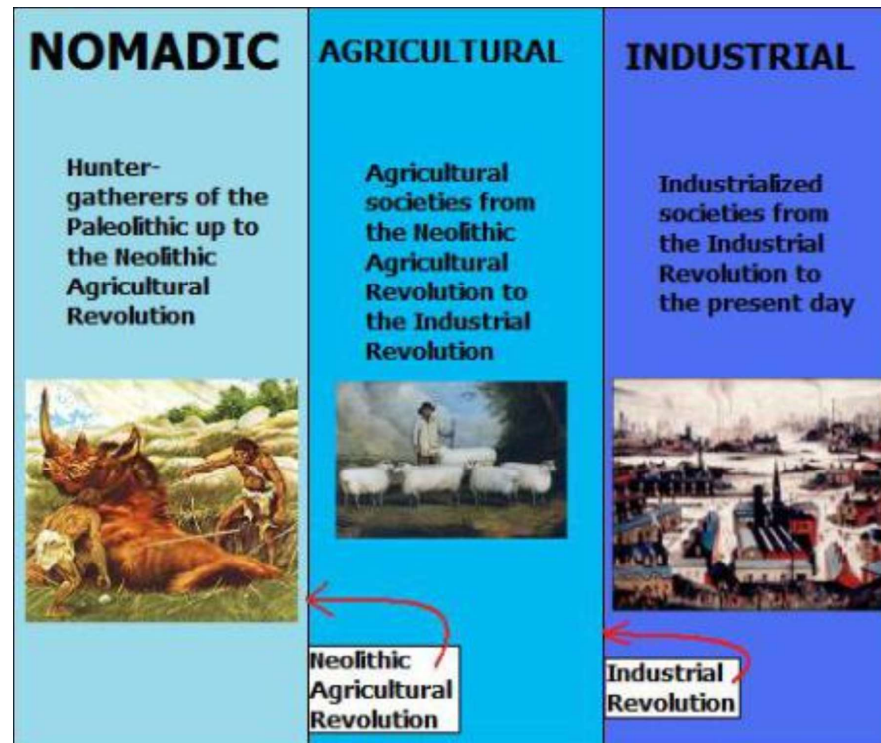


Incredible energy density and versatility . . .



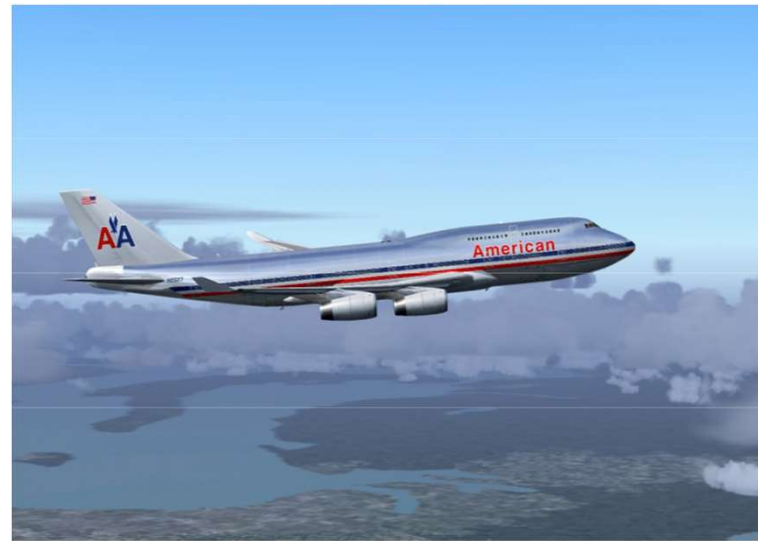
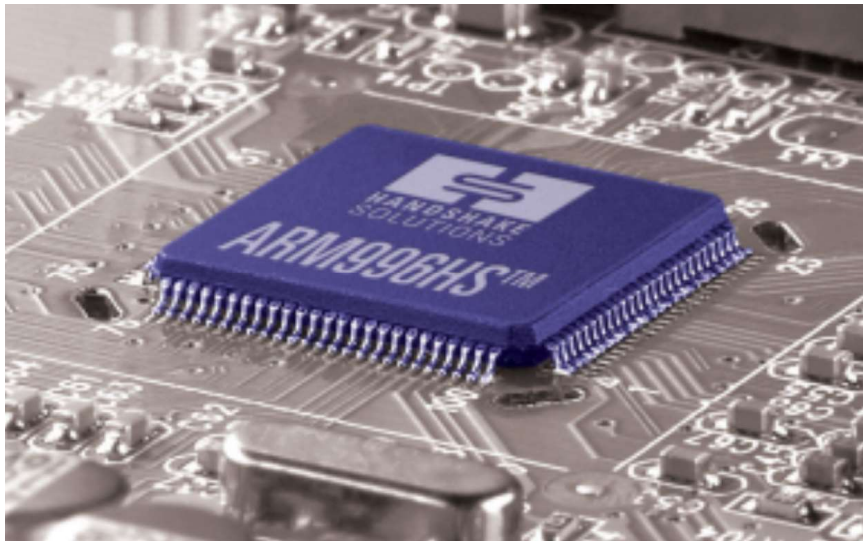
- One barrel of oil contains approximately 6 million BTUs of energy
- One tank of gasoline performs the work equivalent of about three years of hard human labor
- Drive your car until it runs out of gas and then push it back home
- A tank of gas is about \$100, but what would be the cost of three years of human labor?

Surplus energy enables social complexity ...



- Complexity emerges **only** in societies with energy to spare
- Our social complexity increased with the higher net energy output we gained from: burning wood; agriculture (c. 10,000 BCE); harnessing wind; burning whale oil; and finally, moving to hydrocarbons (c. 1780)
- What we now face is unprecedented: the first-time global civilization has gone down, rather than up, the energy density curve

Freed from manual labor - we have done very clever things ...



- As a significant proportion of our society was freed from the time and muscle intensive tasks of growing food, transporting water, and building and heating shelters, we could do other very clever things
- Like designing combustion engines, airplanes, or programming advanced microchip technology

However today, we find ourselves in a
predicament...

“Not only is the world struggling now to increase global oil production, but all of the new unconventional finds offer us less net energy to use as we wish.” – Chris Martenson, Peak Prosperity

Other civilizations have faced the stern laws of thermodynamics before ...

- The economy of ancient Rome was dependent upon the harnessed muscle energy of slaves
- Easter Islanders had their firewood



Human life prior to hydrocarbons . . .



- Prior to hydrocarbons, this is what we managed on the energy income of **one year's** worth of solar energy
- We managed an agrarian society from harvesting plants and animals

Then came fossil fuels . . .



- This what you get from hundreds of millions of years of stored solar energy
- Our current economy only exists by virtue of our ability to claim adequate energy from fossil hydrocarbons
- We simply add inputs and labor to produce all the complex products of our modern society

We've become a bit like hamsters in cages . . .



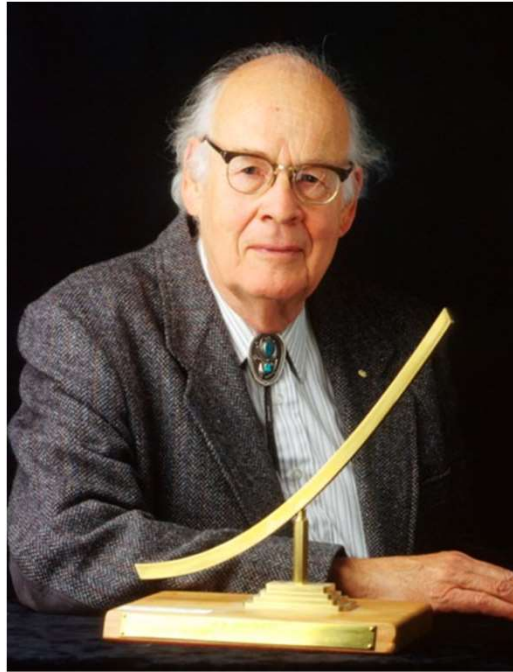
Warm, comfortable, over-fed . . . Food delivered at regular intervals and our wastes removed, without our having to pay attention to either . . .

And we persist in “doubling down” against the laws of physics



- We have constructed:
 - An economy
 - A money system
 - An industrial agricultural systemas though energy from fossil hydrocarbons will increase indefinitely on a finite planet
- As a society, we are in effect “doubling down” against the laws of thermodynamics

Can we compound growth forever?



“The greatest shortcoming of the human race is our inability to understand the exponential function.” -- Professor Albert Bartlett, University of Colorado

Money, debt, compound interest . . . they are all joined at the hip . . .

“Anyone who believes that exponential growth can go on forever on a finite planet is either a madman, or an economist.” – Ken Boulding, Economist, Educator, Systems Thinker

All asset valuations have expectations of future growth “baked in” ...



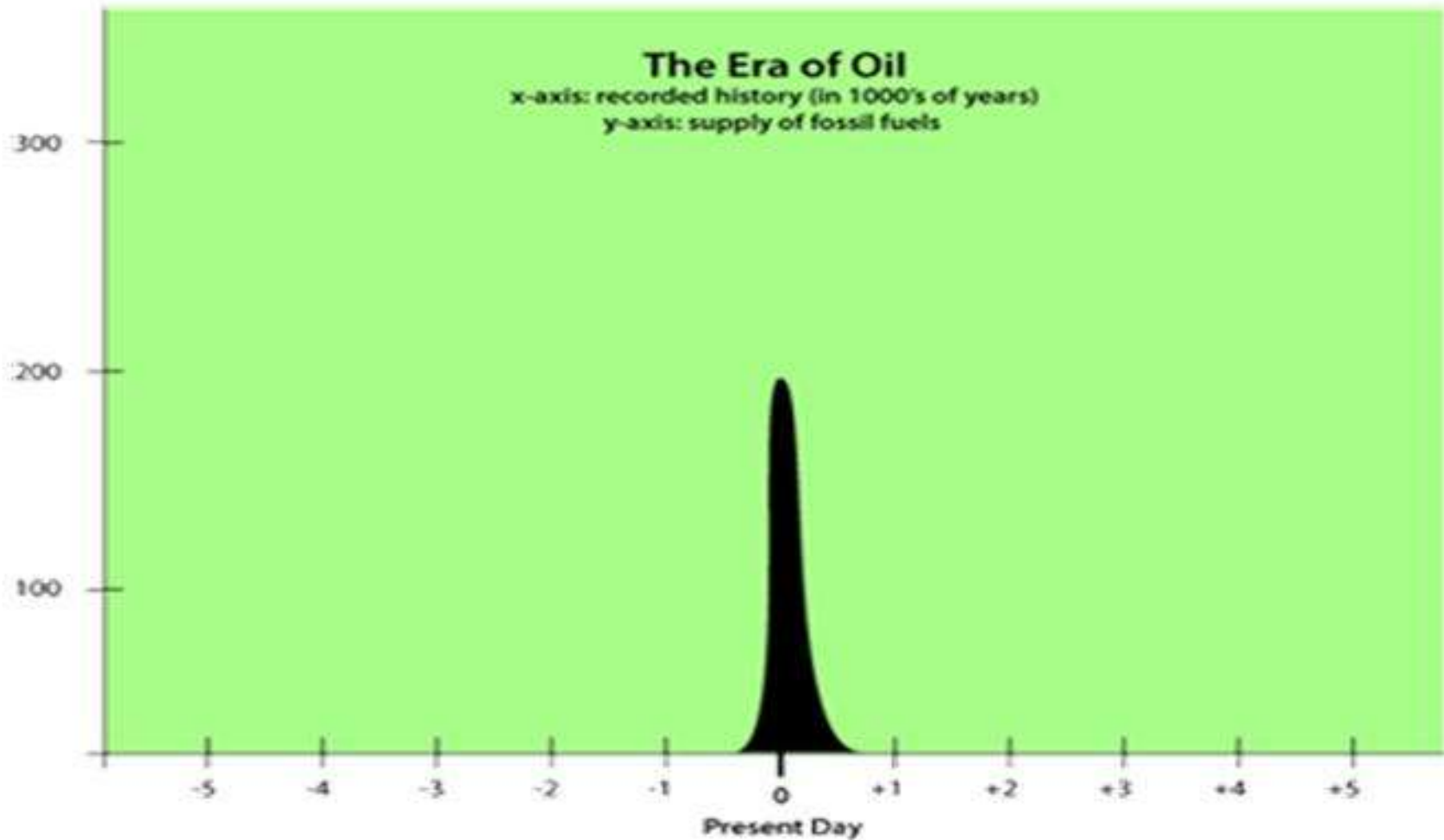
- The stock market has future increasing net energy baked into all prices
- Every upward tick of the symbol ticker is a statement that we do not understand exponential growth
- We seem to think we can flaunt the laws of thermodynamics indefinitely

But nothing lasts forever . . .



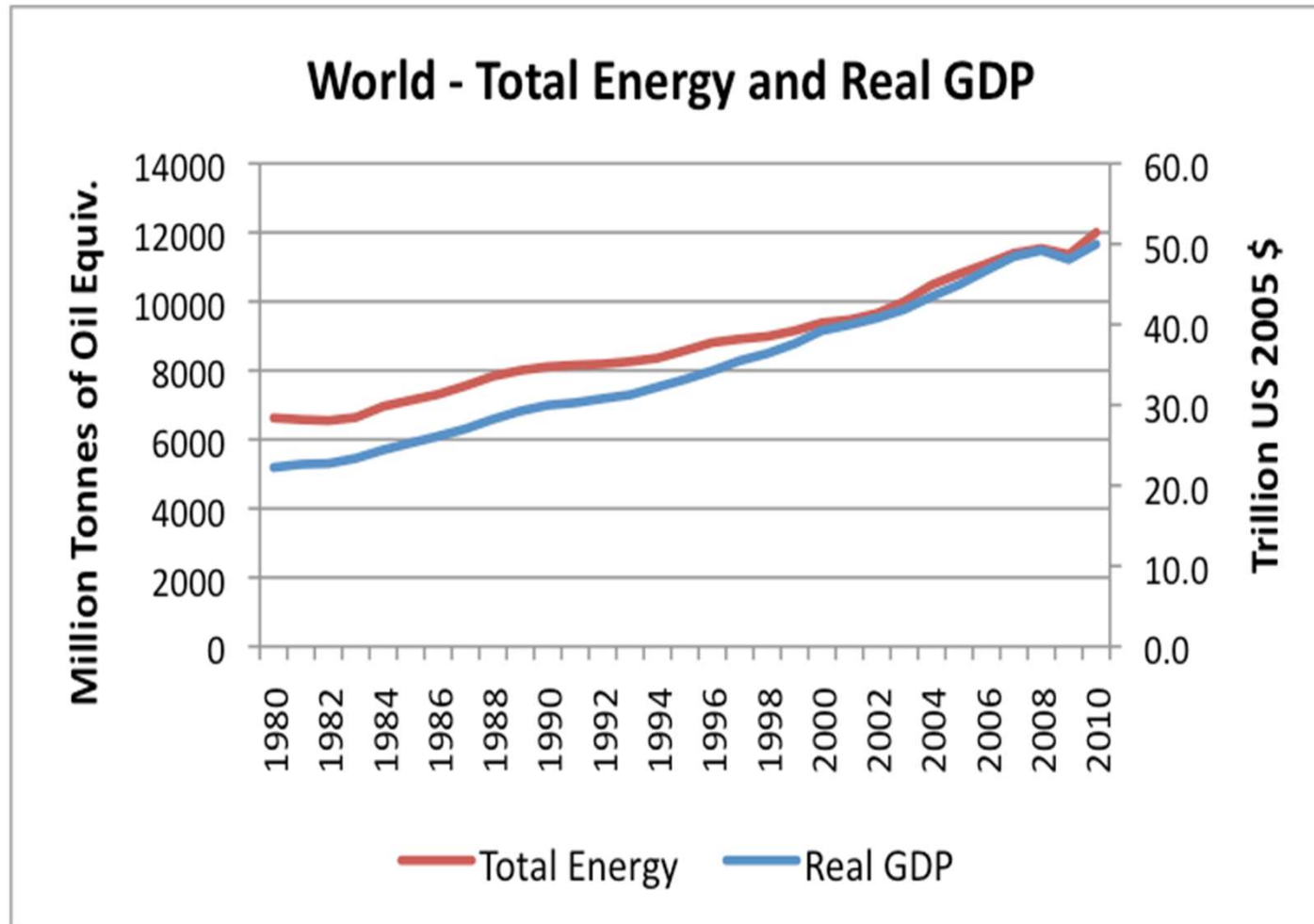
- But this debt bubble, like all bubbles, cannot inflate indefinitely
- When the total amount of debt in the system stops growing, the game is up . . . the pyramid scheme is over . . . and the result is a deflationary contraction

An entirely unique period in human history . . .



Within the **very near future**, it is likely that our massive debt bubble will burst upon the peak of global energy supply

Is decoupling economic growth from expanding energy supplies possible?

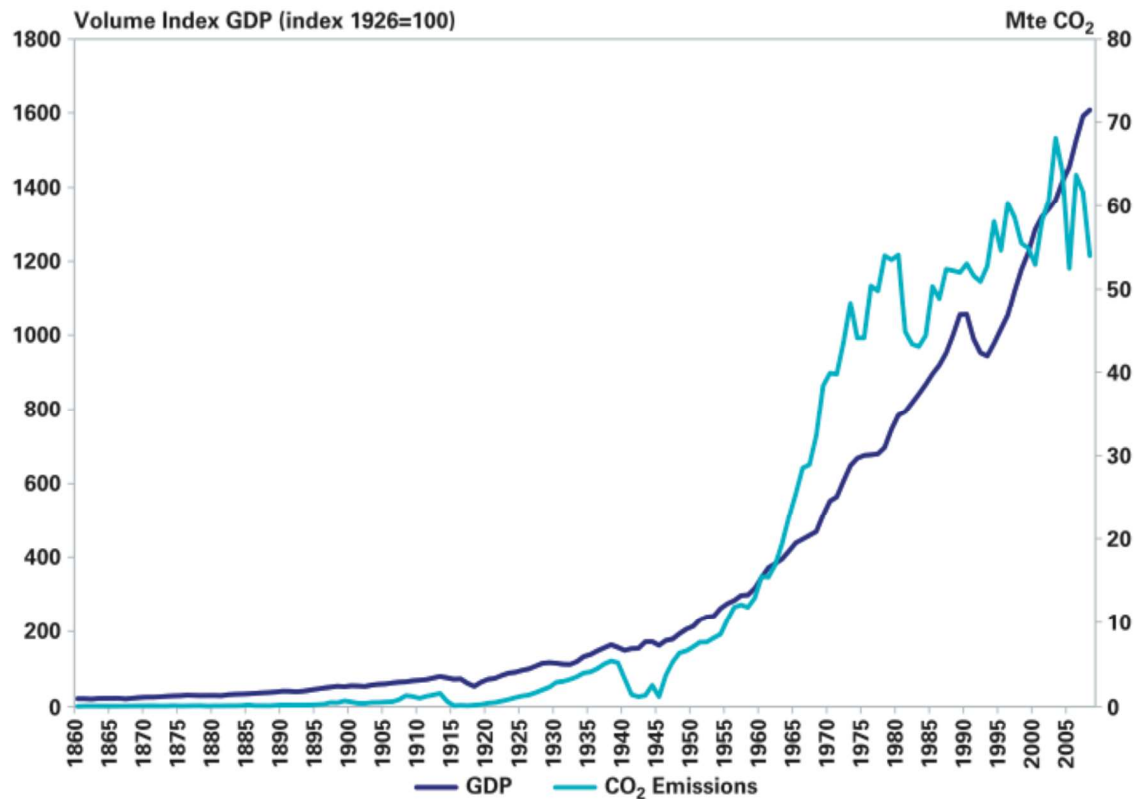


If our community fails to prepare to transition to a very different economic paradigm - what then?

- The window of opportunity to make wise investments locally is closing fast
- If local governments and individuals continue business as usual . . .
- Energy descent and economic contraction will **severely** limit our ability to respond when the days of reckoning arrive



Implications for climate mitigation & adaptation . . .



- We are subject to very real financial and human resource constraints as it is - **today**
- Will we be able to marshal the resources in the coming decades to repair environmental damage or implement many imagined climate adaptation responses (e.g., sea-walls)?

The conundrum...

- **Fossil-fueled economic growth** has caused the climate change that imperils our future
- But nearly all climate mitigation/adaptation responses are resource dependent and require continued **fossil fueled economic growth** to fund (e.g., building and deploying renewable energy systems)
- But exponential economic growth caused the climate crisis!
- Most climate adaptation responses are likely to be needed well in the future (e.g., retreat/relocating communities)
- But if economic growth slows, stops, or even goes in reverse, where will the resources come from to solve our problems?

As we teeter at the edge of the age of hydrocarbons,
we have important work to do . . .



- Rebuild and repair **core** public infrastructure and services to be more resilient and secure
- Expand practical skills (marine trades, farming) to promote community resilience and self-reliance
- Support efforts to expand local food production
- Prepare for inevitable contraction
- Adjust our expectations for the future to fit within the confines of energy systems that have a future

As we face the convergent crisis of energy, economy,
and environment – one final thought:

*“New programs within the old paradigm will
simply recreate the old problems in a new guise.”*

– William Ophuls

