Energy: The interconnection of energy limits and the economy and what this means for the future

Gail Tverberg, OurFiniteWorld.com, October 17, 2022
Why listen to Gail Tverberg?

- Many researchers specialize in one area
  - Economists, geologists, historians, physicists, limit-to-growth modelers, inventors
  - Can’t put together the full picture
- Gail Tverberg is an actuary
  - Masters’ Degree in Math; Fellow of the Casualty Actuarial Society
  - Worked until 2007 in the insurance industry
  - Since 2007, she has tried to put together the “real story” of energy and the economy
    - Started OurFiniteWorld.com blog in 2007
    - Also became editor at TheOilDrum.com
    - OFW continues today; completely not-for-profit
    - Readers contribute research ideas
- There is a big market for research that provides happily-ever-after endings
  - Much less interest in research that only wants to determine the real story
Is it *always* possible to fix economic problems by adjustments to the financial system?

- My answer is no:
  - It is easy for central banks to print money and raise and lower interest rates
  - But *we can’t eat money*

- System must be more complex
  - Actual physical goods and services are needed
  - Takes energy and other resources
  - Problems with energy supply need to be considered as well
The physics perspective
Physics view of the economy says that the growing supply of affordable energy is the foundation of economic growth.


![World Energy Consumption 1820-2010](image-url)
Relationship between GDP and Energy Consumption 1965 to 2021

\[ y = 0.1683x - 18.951 \]

\[ R^2 = 0.9835 \]

Source: Energy from BP; GDP from World Bank

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Energy is “dissipated” in all aspects of the economy

- Humans eat food
  - Food provides energy, measured in calories
- Cooking food requires energy
- Heating homes requires energy
- Making solar panels requires energy
- Transportation requires energy
Anything that seems to grow by itself is a dissipative structure. These structures eventually come to an end.
Physics-based economy: The economy is built up in layers, like a child’s building toy. The center is hollow.

The economy is a self-organizing physics-based system (Y. Shiozawa, 1996; Chaisson, 2001; Roddier, 2017)

Chart by Gail Tverberg
OurFiniteWorld.com
Energy supply needs to be both *inexpensive-to-produce* and *growing-in-quantity* to maintain a growing economy.

- Example: Food supply for a growing population
  - Energy used in food production needs to be inexpensive
  - Quantity of energy used needs grow with population
  - Quantity of energy used may need to grow *faster* than population
    - More people per unit of arable land leads to more intensive agriculture
    - Or citizens demand more meat

- At same time, food needs to be affordable
  - High energy prices lead to high food prices
  - Poor people starve if food prices are too high
Major problem: Cost of energy production eventually rises

- First fossil fuel removed is easiest to extract and ship
  - Later extraction is more expensive
    - Diminishing returns
  - Improved technology helps keep prices down for a while
    - But eventually fails
- High energy prices spill over to everything else
  - Food
  - Automobiles
  - Homes
- If regulators hold oil prices down, producers stop drilling
  - We get a problem of low supply and recession
Finances provide a two-way lever
As an economy grows, growing debt is helpful

- On the way up, growing debt allows investments of all kinds
  - Plant a field
  - Build a factory
  - Train a worker
- If the cost of energy products starts to rise, increasing debt at lower interest rates can help hide the problem
  - Lower interest rates keep monthly payments on cars, homes lower, even if asset prices rise
  - Principle central banks have been using since 1981
Chart below shows huge decrease in interest rates since 1981. Lower rates have allowed a growing debt bubble.

- Some interest rates near 0% since 2008
- Now central banks are raising interest rates again
Obstacles are hit when cheap-to-produce energy stops growing sufficiently rapidly. Shift occurred in 2019.

- Governments find it easy to increase money supply, but they can’t increase energy supplies in the same way
- **Inflation becomes a problem**, if added funds get back to the consumer
- Central banks raise interest rates
  - Higher monthly payments
  - Fewer buyers can afford homes, cars
- Economy slows
  - Debt bubble may collapse
  - Asset prices likely to fall
Economy could start to shrink
World GDP has grown at close to 3% per year. Will this continue, or will growth turn to shrinkage?

Historical GDP based on World Bank; shrinkage assumes -3% per year; growth assumes 3% per year
Shrinkage likely not to be shared equally; stronger countries will try to push aside weaker countries
Europe began using its local fuel supplies many years ago; now it is heavily dependent on imports.

Data source: BP 2022 Statistical Review of World Energy
Now Europe’s energy consumption is falling, even with imports. Wind and solar play a minor role.

Source: https://www.iea.org/regions/europe
What can Europe do now?
1. The energy problem is likely to be persistent. Need to simplify.

- Encourage multiple generations to move in together
  - Or friends share an apartment
- Cut back on non-essential purchases
  - Prioritize food, warm clothing
- Encourage home schooling
  - Also, encourage families to care for own small children at home
- Prioritize health care for young people over the elderly
  - Fewer years of active life lost if elderly cannot get adequate care
2. Understand the dynamics

- Europe is terribly dependent on fossil fuel imports
  - Needs to be on good terms with exporters
    - Even Russia
  - Holding down prices is counter-productive
    - Exporters will produce less
- Wind and solar are not living up to expectations
  - Don’t provide much heat in winter
    - Summer to winter storage is impossible
  - Don’t help food supply
- Wars are part of the dynamics of not enough resources to go around