



Moral Case For Fossil Fuels

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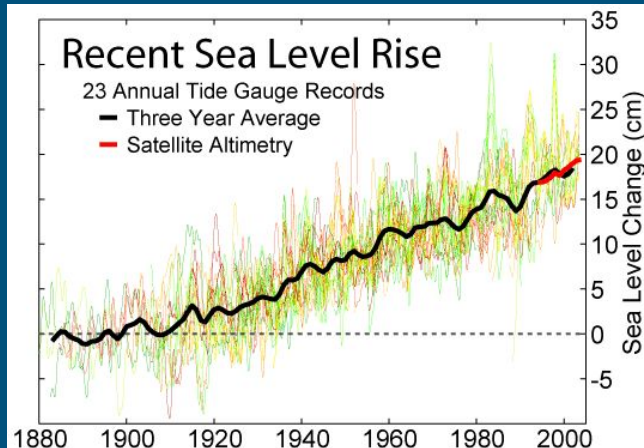
Schedule

1. The Environmentalist Narrative
2. Reshaping the Moral Case
3. The Truth About Environmental Costs
4. Benefits of Fossil Fuels
5. Critiques
6. Conclusion

1. The Environmentalist Narrative

Fossil fuels have enabled great advancements but our usage is dangerous

- Our current level of emissions of greenhouse gases from fossil fuels will lead to dangerous and uninhabitable living conditions.
 - Temperatures have risen
 - Natural disasters are more prevalent



2. Reshaping The Moral Case

Reshaping the Moral Case

- An activity is moral if...
 - It is fundamentally beneficial to human life
- Are Fossil Fuels moral?
 - Efficient, abundant, and reliable
 - Improves industries and individuals
 - Fuel of technology and opportunity
- Improves our livable environment
 - Threats
 - Resources



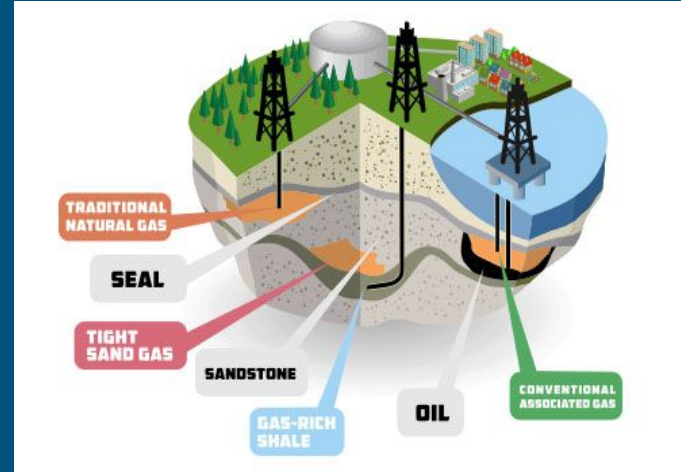
Reshaping the Moral Case: Threats

- Nature is not hospitable
 - Natural Forces
 - Predators
- Fossil Fuels allows us to create a livable environment
 - Sturdy homes, purified water, fresh food, heat and air-conditioning, irrigation of deserts, dry malaria-infested swamps, hospitals, pharmaceuticals

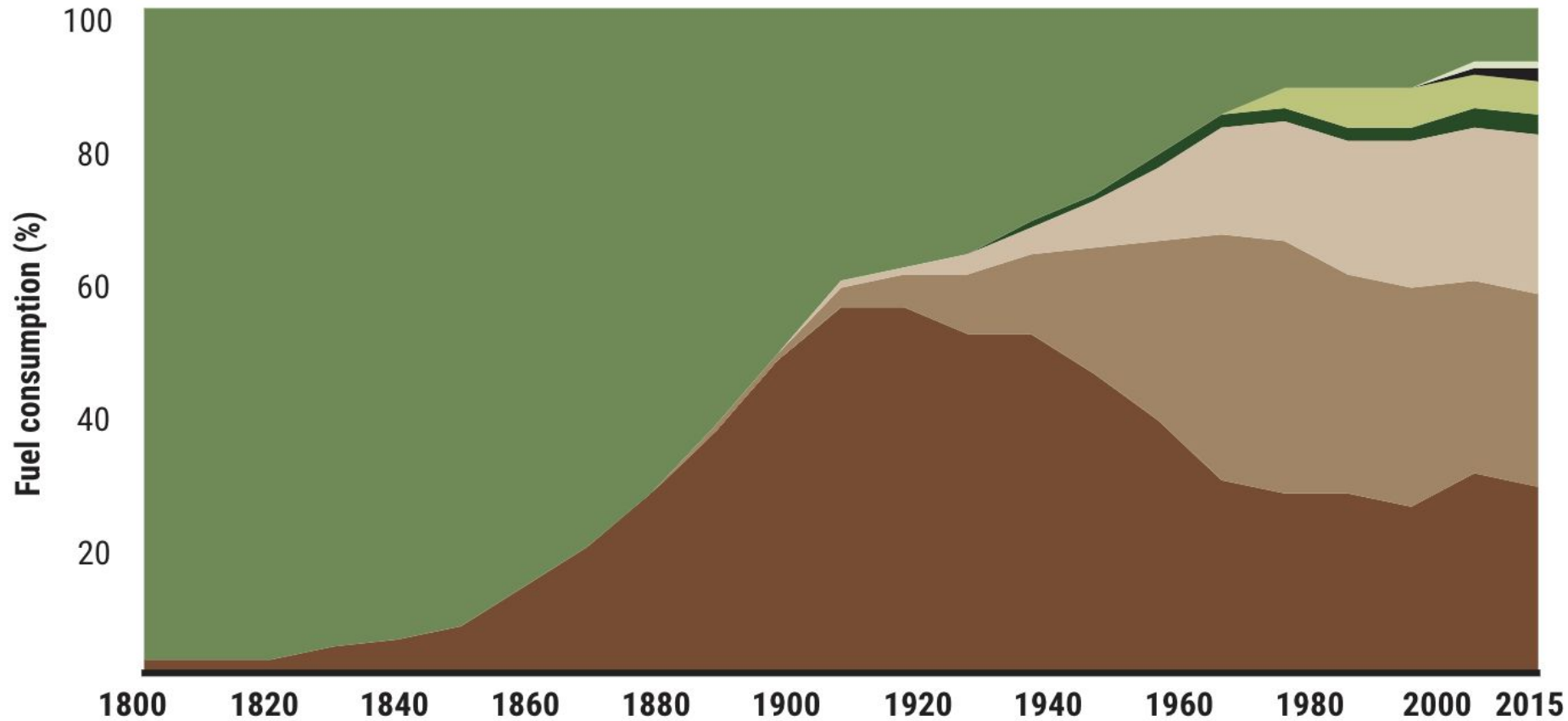


Reshaping the Moral Case: Resources

- We are not depleting resources, we are *creating* them
 - Natural Gas
 - Coal
 - Oil
- Resources are not inherently useful
- “Vaclav Smil (2005), “The most fundamental attribute of modern society is simply this: Ours is a high energy civilization based largely on combustion of fossil fuels.”

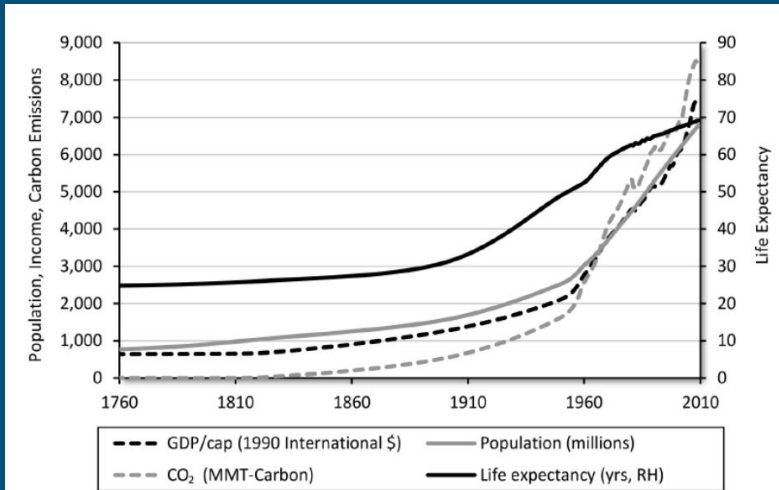


● Wind and solar electricity ● Hydroelectricity ● Traditional biofuels ● Nuclear electricity ● Modern biofuels
● Coal ● Crude oil ● Natural gas

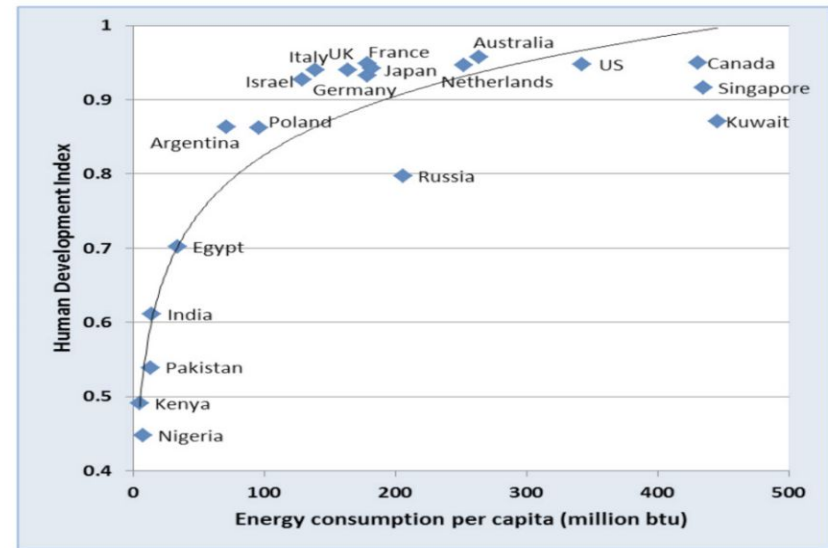


Reshaping the Moral Case: Economic Growth

“The bottom line is that an enormous increase in energy supply will be required to meet the demands of projected population growth and lift the developing world out of poverty without jeopardizing current standards of living in the most developed countries” (Brown et al., 2011).



Source: Goklany, 2012.



3. The Truth About Environmental Costs

Experts' Warming Predictions

- Based on computer modeling
 - Frequently dramatically overpredict warming

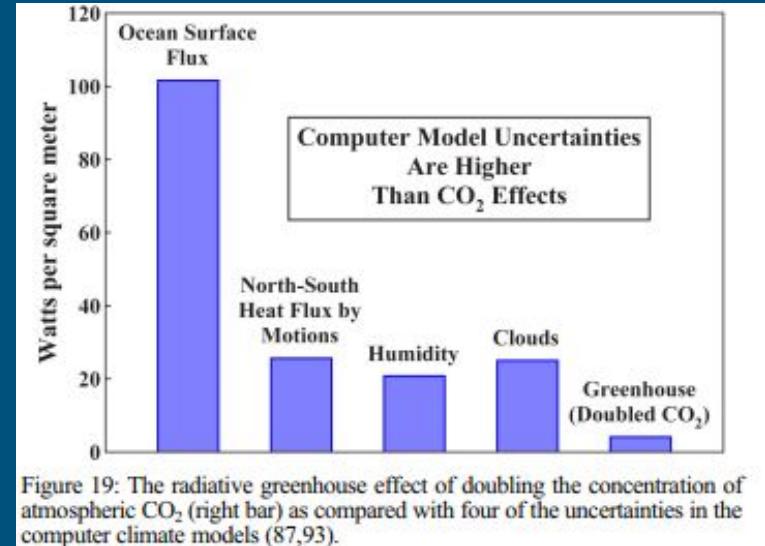
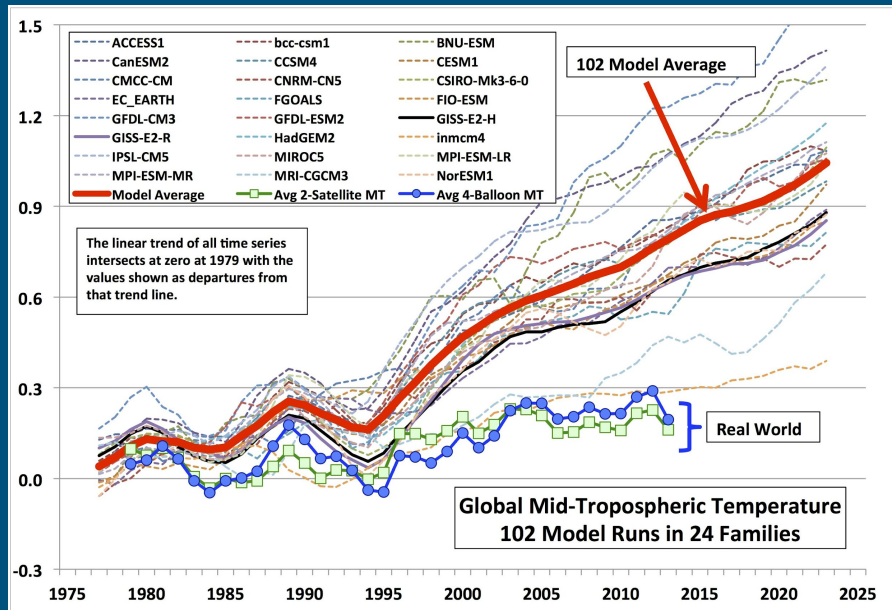


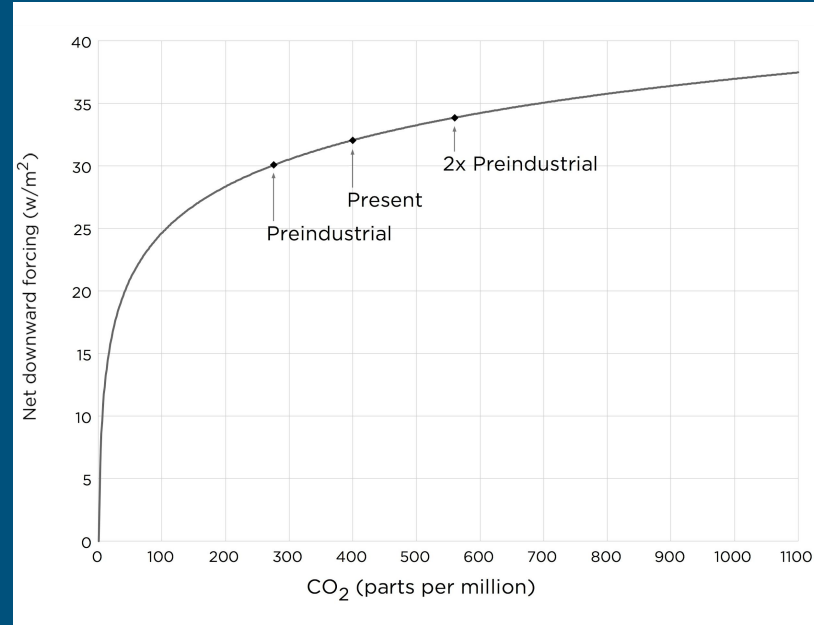
Figure 19: The radiative greenhouse effect of doubling the concentration of atmospheric CO₂ (right bar) as compared with four of the uncertainties in the computer climate models (87,93).

Actual Effects

- Much less dramatic temperature change than predicted
- Fossil fuels also becoming more efficient and clean
 - Further decrease CO₂ emissions/warming



Figure 4.1: The Decelerating, Logarithmic Greenhouse Effect



Human Ingenuity

- Humans can adapt to our environment



Improvements in Air/Water Cleanliness

Figure 1.6: U.S. Air Pollution Goes Down Despite Increasing Fossil Fuel Use

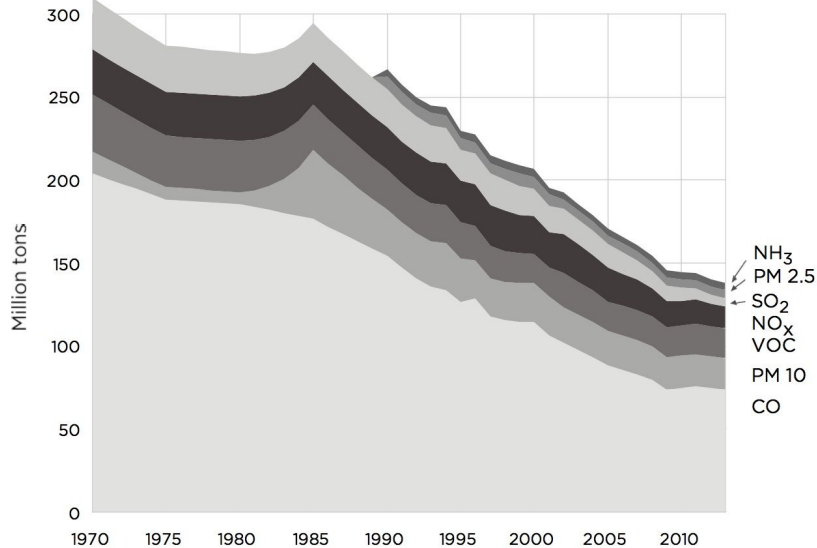
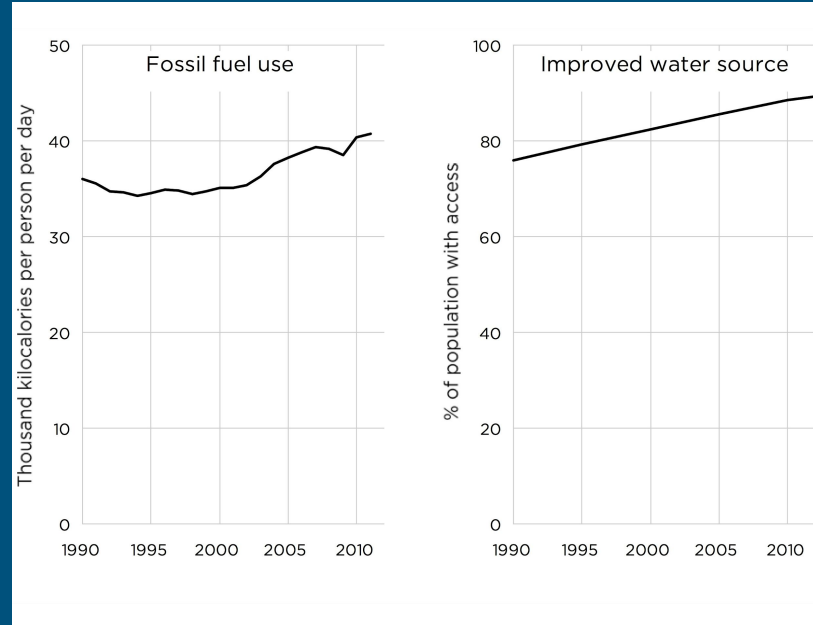


Figure 1.7/6.1: More Fossil Fuels, More Clean Water



4. Benefits of Fossil Fuels

Fossil Fuels are Cheap

- Natural Gas in particular is very cost efficient, and will continue to be
 - Projected to continue to be the cheapest fuel by MWh(1)
- High initial cost for wind and solar is a major downside
 - Installation cost for wind capacity is estimated to be up to \$2,000/KWh(2)



Plant type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M	Levelized variable O&M	Levelized transmission cost	Total system LCOE	Levelized tax credit ¹	Total LCOE including tax credit
Dispatchable technologies								
Coal with 30% CCS ²	85	84.0	9.5	35.6	1.1	130.1	NA	130.1
Coal with 90% CCS ²	85	68.5	11.0	38.5	1.1	119.1	NA	119.1
Conventional CC	87	12.6	1.5	34.9	1.1	50.1	NA	50.1
Advanced CC	87	14.4	1.3	32.2	1.1	49.0	NA	49.0
Advanced CC with CCS	87	26.9	4.4	42.5	1.1	74.9	NA	74.9
Conventional CT	30	37.2	6.7	51.6	3.2	98.7	NA	98.7
Advanced CT	30	23.6	2.6	55.7	3.2	85.1	NA	85.1
Advanced nuclear	90	69.4	12.9	9.3	1.0	92.6	NA	92.6
Geothermal	90	30.1	13.2	0.0	1.3	44.6	-3.0	41.6
Biomass	83	39.2	15.4	39.6	1.1	95.3	NA	95.3
Non-dispatchable technologies								
Wind, onshore	41	43.1	13.4	0.0	2.5	59.1	-11.1	48.0
Wind, offshore	45	115.8	19.9	0.0	2.3	138.0	-20.8	117.1
Solar PV ³	29	51.2	8.7	0.0	3.3	63.2	-13.3	49.9
Solar thermal	25	128.4	32.6	0.0	4.1	165.1	-38.5	126.6
Hydroelectric ⁴	64	48.2	9.8	1.8	1.9	61.7	NA	61.7

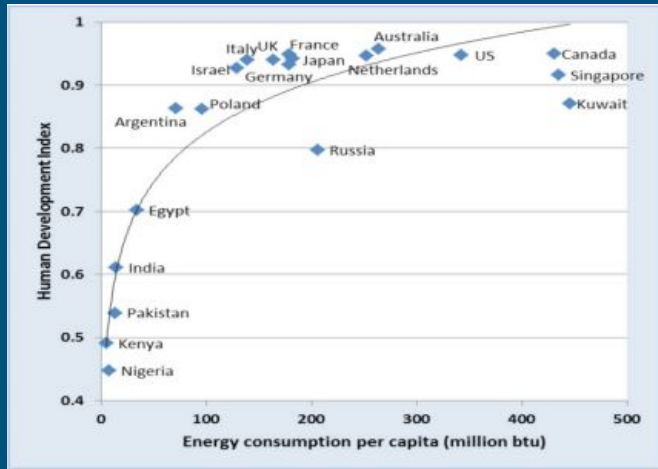
Fossil Fuels are Reliable

- Fuels like natural gas can provide energy on demand any time
 - Energy generation by wind and solar depend on hard to predict weather systems
- Having dispatchable fuels is absolutely necessary
 - Battery storage is not only not efficient enough, it is expensive (1)



Fossil fuels are better for Developing Economies

- High initial cost is prohibitive for places without large capital supplies
- Cheap energy leads to advancements in productivity and lifestyle quality
- It is moral to promote the use of fossil fuels for these economies

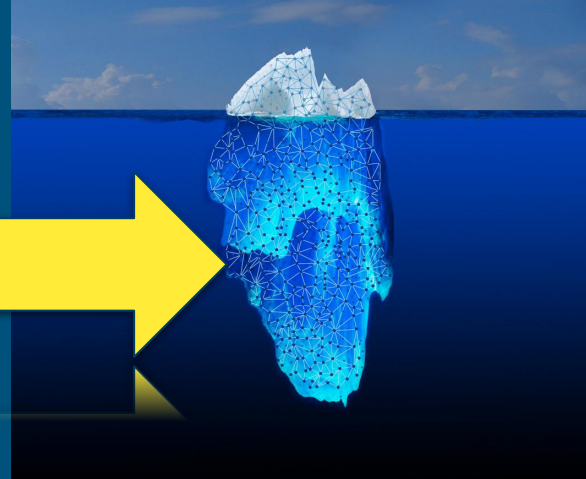


5. Critiques

Climate science has advanced rapidly in the 21st century

- It is true that some scientists in the '70's predicted global cooling
- However, this science is constantly improving
- The claims of today's scientists should not be discredited by the claims of a previous generation with poorer data

Big Data



Correlation \neq Causation

6. Conclusion

Our Take

- For the foreseeable future, fossil fuels are the best solution power our modern world
 - **Hydro** and **nuclear** are viable supplementing alternatives
 - More advancements in efficiency and cost need to be made in the renewable “greens”
- 3 billion people do not have reliable access to energy...abundance is key!



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