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Original Paper

The Path to Global Warming

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1. Introduction

One would like to know when the outcomes of global warming become truly horrific. If it is the case that climate change is unstoppable (Hawking irreversibility), then when will this be undeniably visible? Several ecological disasters occur new weekly around the globe. Are they due to rising temperatures? Ecologists speak of a gigantic crisis for Planet Earth with the extinction of many species, True? Gould global warming be indirectly the cause of many disasters?

In Table 1 the relationship between energy consumption and temperature rise is modelled. Energy consumption is near 16 billion with + 1 degree. Looking at stylised projections, we will move towards 24 billion with + 2 degrees. That would create lots of difficult problems for mankind.

Table 1. Regression Estimates for Temperature Rise Based on Energy Consumption

Global Energy / btoe	CO2 concentration / PPM	Temperature rise / degrees C
16	430	1.1
18	450	1.3
20	470	1.5
22	490	1.7
24	510	2.0

2. Three Basic Models

a) The demand for energy is rising rapidly meaning fossil fuels may only diminish relatively. This is not the place to analyses at length the various policies for alleviating poverty around the globe. What is to be emphasized is that poverty reduction necessarily involves country Economic growth or development. Thus, the enormous economic advances in East Asia have Lifted millions out of poverty. But the price is heavy air pollution. India is faced with the very Same problematic-rapid economic growth versus environmental degradation. Poor countries cannot bypass the general relationship

between socio-economic development on the one hand and increasing CO2 demand on the other hand. The two horns of this global dilemma are poverty reduction and CO2 increased where both outcomes are driven by economic growth. It is urgent to invent how development can be promoted by carbon neutral economic growth. Development can be carbon neutral. The relationship between energy and global economic output can be modeled as follows:

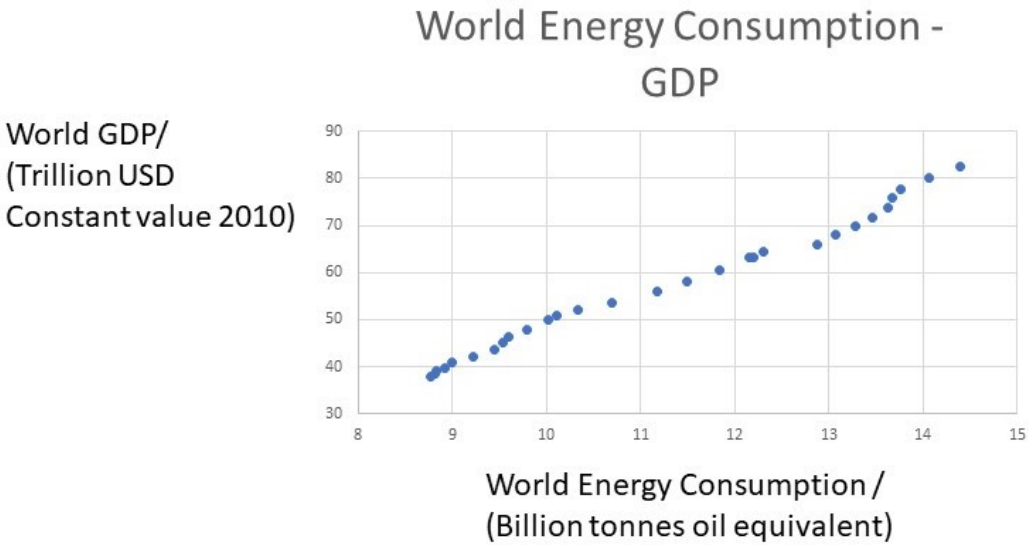

Figure 1. World Energy Consumption-Global GDP

$y = 7{,}275x - 24{,}706$ (1)

$R^2 = 0{,}9895$ (2)

b) CO2 CONCENTRATION

The Cambridge Dictionary lists two meanings of "sustainable"; able to continue over the period of time firstly, and secondly causing no or little damage to the environment. Taking together these two concepts fit well into the environmental framework, but they do not apply to the demand and supply of energy. Here we need a second equation, namely:

(II) y: CO2 concentration in ppm, x= Energy in Billion tonnes of oil equivalent.

$y=267{,}5+10*x$ (3)

$R^2 = 0{,}992$ (4)

The regression tells us that one billion energy amounts to an increase of ten CO2 ppm.

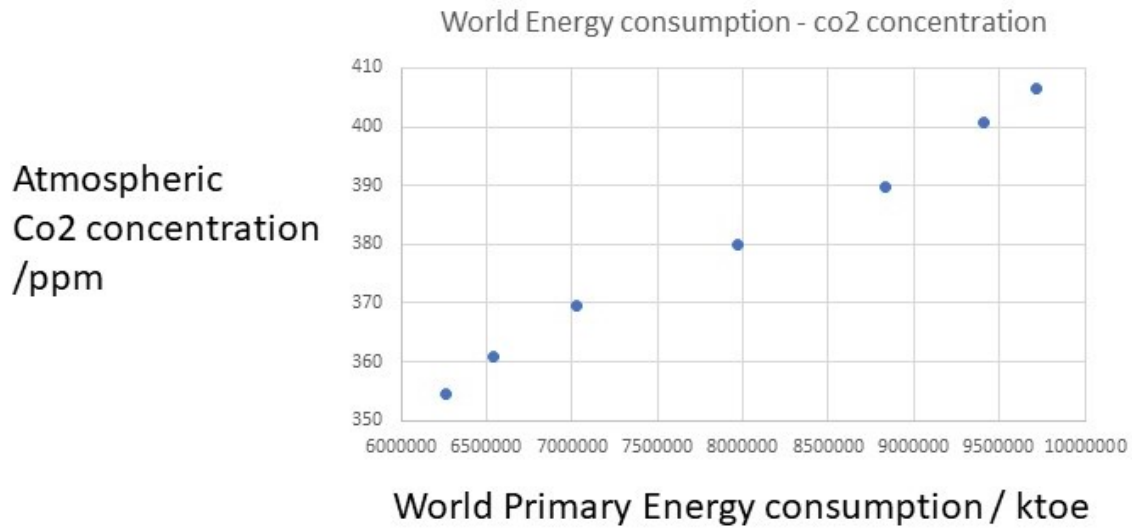

Figure 2. Energy Consumption-CO2 Concentration

c) TEMPERATURE

The yearly rises in average global temperature are welł documented. The link between atmospheric concentration and temperature increase is shown in Figure 3.

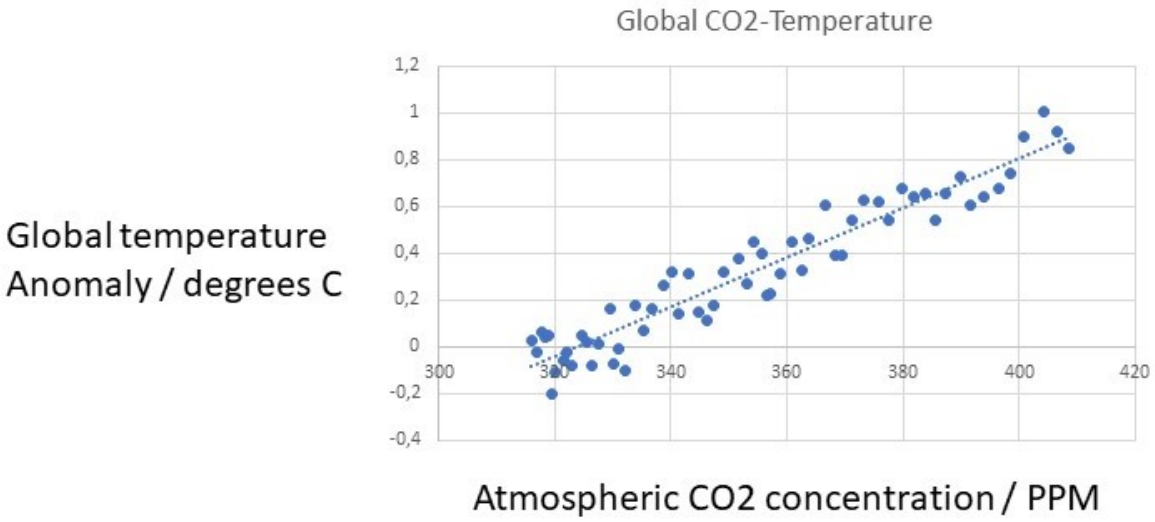

Figure 3. CO2 Concentration-Temperature Anomaly

Thus, we have:

x=atmosphere concentration CO2 in ppm

y= change in global surface temperature relative to 1951-1980 average temperatures

Regression line:

$y = -3,4277 + 0,0106x$ (5)

$R^2 = 0,913$ (6)

Increase by 1 ppm CO2 leads to increase in global temperature 0,01 degrees

CO2 concentration has grown from 315 to 410 so temperature has risen with c:a 1 degree as figure shows.

A spurious correlation ? Self-evident? No. Probably not, as it reflects the rising dependence on energy from fossil fuels. The fossil fuels are in much demand, because they offer cheap energy which is vital for affluence. Is the planet already at its Hawking irreversibility? The notion of irreversible transformation is very menacing, as policy could only slow down the arrival of a global disaster There is a way to find out about irreversibility, namely to consult the global thermometer CO2 daily: 28/12 at 412 ppm and 408 one year ago (CO2).

Following the logic of the model on (1), one cannot but arrive at a sinister future for mankind. At levels of CO2 over 450 ppm the negative outcomes of global warming will be much stronger. The best way to counteract is simply to close all coal plants right now.

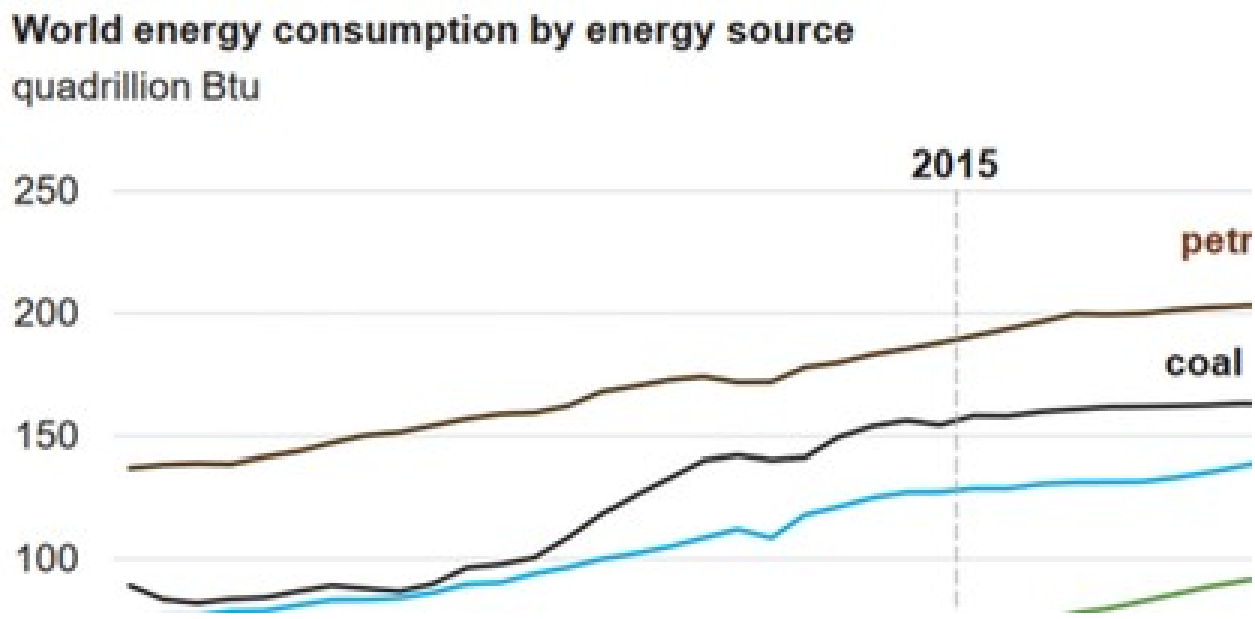

Figure 4. World Energy Projections from IEA

3. Conclusion

Below we make an attempt to calculate how much solar energy would be required to replace coal power. As benchmark the Bhadla Solar Park in India is used, projected to deliver 2255 MW once construction is ready from December 2019. In all, 900 such plants would be necessary to completely eliminate all coal power generated in 2018. Table 2 illustrates how many solar plants of this size each of the ten biggest coal producing nations would need to install to replace their entire coal power production.

Table 2. Number of Bhadla Solar Park Plants Required to Replace Coal Power by Country (Global Energy Monitor)

Country	Number of plants
Asia:	
China	475
India	100
Japan	28
South Korea	18
Thailand	2
North Korea	2
Americas	
United States	106
Colombia	1
Europe:	
Germany	32
Russia	30
Africa:	
South Africa	14

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