Research in Economics and Management
ISSN 2470-4407 (Print) ISSN 2470-4393 (Online)
Vol. 2, No. 2, 2017
www.scholink.org/ojs/index.php/rem

ASIA: Economic Success but Uncertain Future

Jan-Erik lane[1*]

[1] Public Policy Institute, Belgrade, Myanmar

[*] Jan-Erik lane, E-mail: janeklane@gmail.com

Address: 10 Charles Humbert, 1205 Geneva; 559 A, 3rd Floor, Thuya Street, 9th Quarter, Yangon, Myanmar

Received: May 16, 2017 Accepted: May 25, 2017 Online Published: June 7, 2017

doi:10.22158/rem.v2n2p77 URL: http://dx.doi.org/10.22158/rem.v2n2p77

Abstract

The rise of East Asia, South East Asia and SOUTH ASIA economically to become the leaders of global capitalism with some 50% of output in the world market economy has one negative drawback, namely the enormous increase in CO2 emissions in this part of the world. Together with general environmental stress, Asia may come pay a heavy price for its stunning economic success, if present trends continue over the 21st century. Asia, here with Australia added, cannot just wait for the eventual implementation of the COP21 Treaty. It needs to go ahead and become the leader in environmental protection.

Keywords

GDP, capitalism East-West-East, Asia plus Australia, emissions, energy, affluence

1. Introduction

The second half of the 20th century showed convincingly that economic production is the road to affluence for Asian nations. In the early 21rst century, Asia dominates global GDP with almost 50% of global production. Poverty has declined dramatically, although not entirely for certain. This global transformation leads to two questions about the vibrant Asian market economies, one historical and one futuristic, namely:

1) Did capitalism really originate in Western Europe?

2) Can Asian capitalism handle the climate change challenge?

One may remind of the fact that Asia was the leader in economic output before the industrial revolution. It has now retaken its earlier leading position, but for how long? See Figure 1.

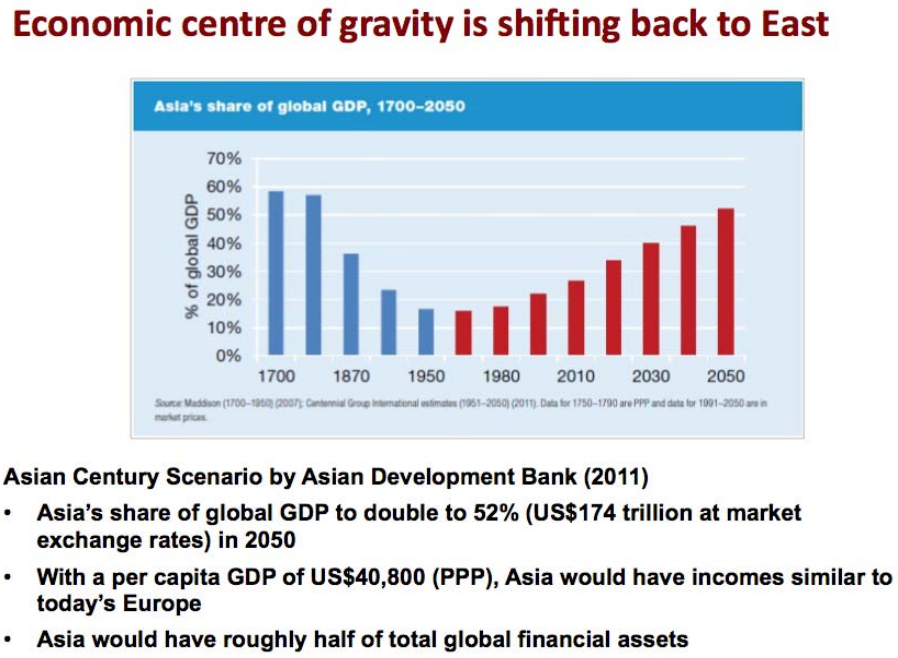


Figure 1. Asia's Revenche

But global warming may change all this. If global warming continues unrestrained, much of Asia will be negatively affected, just as Australia is on the verge of losing its coral reefs. There will be sooner or later:

a) Huge land losses along the costs;

b) Too high temperatures for men and women to work outside;

c) Food production decline;

d) Fish harvest decrease;

e) Droughts and starvation;

f) Lack of fresh water supply;

g) Drying up of rivers, affecting electricity supply;

h) Ocean acidification and species extinction;

i) Highly volatile climate with tremendous damages;

j) Negative effects on health from smog and other air pollution.

The Asian nations seem to rely upon the UN and its activities, especially the COP framework. But is it enough? I will speak below about "Asia" as East Asia, Far East Asia and South Asia, not including Arab Asia or Central Asia.

2. The Asian Energy-Emission Conundrum

The Asian economic expansion has been based upon fossil fuels and wood coal, meaning that Asia is the largest CO2 polluter on the globe, especially the countries of China, India, Indonesia and Japan as

well as South Korea. Let me pin down the links between GDP, energy and emissions for Asia in 2015. First, the GDP and its correlate, namely the level of human development. Figure 2 shows that several Asian countries are in the top now—a stunning transformation since 1945.

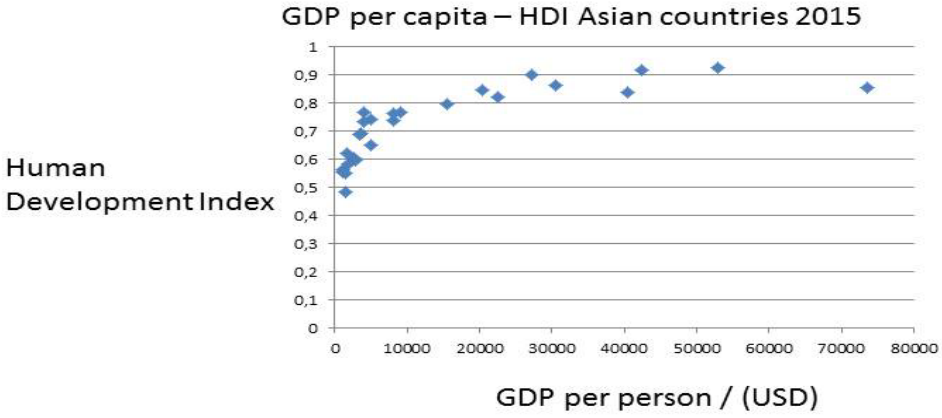


Figure 2. GDP and HDI

Sources: World Bank Data Indicators; UNDP Human Development Index.

Affluence is high is several Asian countries and Australia. South Asia is different, lagging behind but developing fast now. The drawback is the huge increase in CO2 emissions (Figure 3).

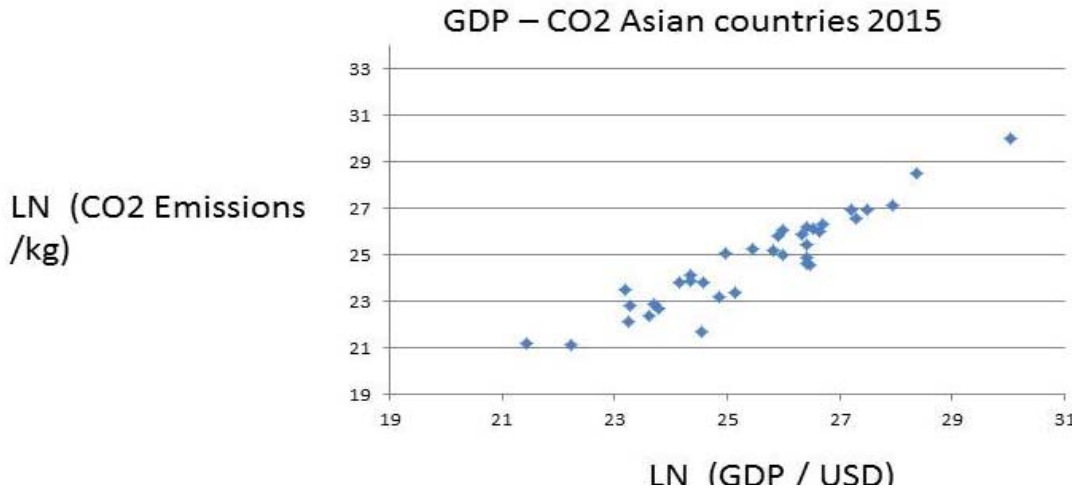


Figure 3. GDP and Emission of CO2: $y = 1{,}051x$, $R^2 = 0{,}886$

Sources: World Bank national accounts data, and OECD National Accounts data files; EDGARv4.3.2, European Commission, Joint Research Centre (JRC)/PBL Netherlands Environmental Assessment Agency. Emission Database for Global Atmospheric Research (EDGAR), release version 4.3.2. http://edgar.jrc.ec.europe.eu, 2016 (forthcoming).

The anthopogenic emissions of greenhouse gases are driven mainly by the need for energy in a wide sense in human social systems of various kinds. Energy consumption means affluence, as the richer a country the more energy it needs. Figure 4 shows the energy explosion for Asia, and standard prediction speak of a 30-50% increase in coming decades.

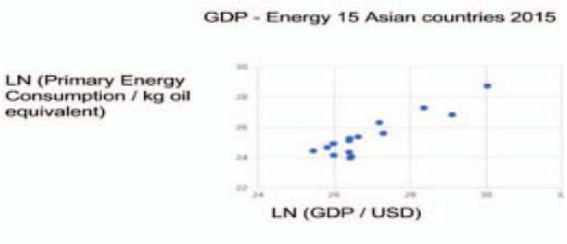


Figure 4. Energy Consumption and GDP

As Asia delivers almost 50% of global output, it is now responsible for almost 50% of CO2:s. The economies of Asia constitute vibrant markets that have economic freedom and are mainly with a rather high degree of openness. Though capitalism in Asia is often named “crony”, it delivers both output and affluence, according to Say’s law.

3. Brief Exclusion on Asian Capitalism

The historical trend above in global economic The output with its major swing between EAST and WEST and back now may permit a small reflection on the emergence of modern capitalism, or the institutionalized market economy with joint-stock firms, free labour and bourses. Two meanings of “capitalism” should be sharply separated:

(i) Capitalistic spirit, or the acquisitive endeavour (Tawney, 1922);

(ii) Systems of capitalism, i.e., various institutional set-ups (Williamson, 1985).

In the great debate about the origin of modern capitalism in early 20th century in Germany, Max Weber obviously used the word “capitalism” in both the micro sense (incentives) and the macro sense (systems of norms). Perhaps he argued that the micro attitudes of the great Protestant leaders and personalities were different enough compared with the Catholic Church fathers to pave the way for “modern” macro capitalism, especially in the theory of predestination, considering greed as somewhat of a call? Thus, even if Protestantism, or the Protestant ethics denying the possibility of magic and accepting rents had something to do with the origins of modern capitalism in the West—i.e., economic rationality or even overall rationality (Entzauberung der Welt), which though remains an essentially contested issue, it could never guarantee any persisting advantage. It is difficult to chisel out an interesting hypothesis about “modern” capitalism and the world religions that would have any relevance today.

Yet, “modern” capitalism was conceived by Weber institutionally as the market economy with stocks

and bonds, stating:

"It is only in the modern Western world that rational capitalistic enterprises with fixed capital, free labor, the rational specialization and combination of functions, and the allocation of productive functions on the basis of capitalistic enterprises, bound together in a market economy, are to be found" (Weber, 1978, p. 165).

Yet, the institutions of modern capitalism can be exported and adopted by other civilisations, learned and refined, which is exactly what occurred in the 19th and 20th centuries. Today, modern capitalism, at least when measured in terms of output, is perhaps stronger in South, East and South East Asia, with a few strongholds also within Islam, like for instance the UEL, Kuwait and Qatar. If "capitalism" stands for a set of institutions, or rules, then one may wish to enumerate a number of different types of capitalisms during known history: ancient, state, feudal, prebendal, modern, oriental, financial, etc. Weber displayed in his historical books that he mastered all these types of capitalism as well as that his emphasis upon mundane incentives meant that he always counted upon the role of the acquisitive spirit. Perhaps both Weber and Sombart bypassed capitalist activities in East and South East Asia, what new historical research needs to examine closely. Weber neglected the huge pottery factories, driven capitalistically with huge exports, during various dynasties in China (Vainker, 1995; Glahn, 2016), just as Sombart in his effort to link "modern" capitalism with the finance capitalism of the new merchant class around 1500 (Sombart, 2001) bypassed the Indian Ocean trade. The Arab, Indian and Chinese merchants on the Indian Sea, from Mocha and Aden to Malcckaand Canton, were no less capitalistic in spirit or rational in performance (Kumar & Desai, 1983; Riaao, 2009; Um, 2009; Chaudury, 2010). "Modern" capitalism was not as exclusively European as some authors have claimed, following Weber (Beaud, 2006; Neal & Williamson, 2015; Kocka, 2016). The famous so-called "thirteen factories" in Canton were capitalistically operated. Just look at the leading country Japan after the Meiji restoration when China had begun to slide towards a long period of anarchy!

4. Modern Capitalism As the "Take-off" Stage

Scholars analysing capitalism come up with a list of different kinds of capitalism, institutionally speaking, like Sombart (2001) and Schumpeter (1989). Weber separated between at least the following kinds:

a) Ancient Period: trade in slaves and tax farming;

b) Feudal capitalism: exploitation of serfdom as well as fiefs;

c) Merchant capitalism: profit seeking in luxuries trade and political banking, i.e., lending to monarchs for instance;

d) Industrial capitalism = modern capitalism above.

Contrary to Sombart and Schumpeter, Weber never envisioned a final stage of capitalism disintegration, because he rejected the functionality of a pure socialist economy, or the command economy.

However, the question of a WSET-EAST split in capitalism remains. If it is a matter of industrial

capitalism, then the Rustow (1960) theory of the take-off stage is very helpful. If modern or industrial capitalism can be dated in time at all, then ROSTOV's take-off idea would be the closest—see for instance a stylised listing in Table 1.

Table 1. Take-off Dates for a Few Countries

	COUNTRY TAKE-OFF
1	GREAT BRITAIN 1783-1802
2	FRANCE 1830-1860
3	BELGIUM 1833-1860
4	UNITED STATES 1843-1860
5	GERMANY 1850-1873
6	SWEDEN 1868-1890
7	JAPAN 1878-1900
8	RUSSIA 1890-1914
9	CANADA 1896-1914
10	ARGENTINA 1935
11	TURKEY 1937
12	INDIA 1957
13	CHINA 1957

Source: http://easyeconomicsforyou.blogspot.ch/2010/07/rostows-stages-of-development.html

The interesting observation in Table 1 is of course Japan, experiencing a very fast capitalistic development after the Meiji Restoration, not later than take-off in France and Germany—see The Economic Development of Japan 1868-1941 (Macpherson, 1987). The year for China is probably wrong, as there were much earlier developments, especially in Canton. Also India may have to be revised as far as take-off stage is concerned. The evolution of industrial or modern capitalism in South, East and South East Asia needs more study, as for instance strong merchant capitalism in Malacca (with 100 000 inhabitants) has been underestimated.

Yet, the return of Asia as global capitalist leaders has one most unfortunate consequence, namely environmental destruction, especially the CO2 emissions that are the highest in this part of the world.

5. The Asian Giants: Energy and Emissions

Each country faces its peculiar CO2 problematic depending upon what energy sources it has come to rely upon. Below I make a short overview of a few country predicaments and pose questions about the implications of the COP21 Treaty for policy-making in the coming decades. Can decarbonisation be accomplished by Asian giants?

5.1 China

China has recently made great strides towards halting its increasing CO2 emissions. Thus, solar, wind and atomic power plants have shot up the last years, but China has to do much more in the form of energy transformation. China was a developing country until yesterday. Now new and bigger cars and aircrafts are multiplying in new extravagant airports.

One finds almost always that the emissions of GHG:s or CO2:s follows economic development closely in Third World countries. The basic explanation is population growth and GDP growth—more people and higher life style demands. Take the case of China, whose emissions are the largest in the world, totally speaking (Figure 3).

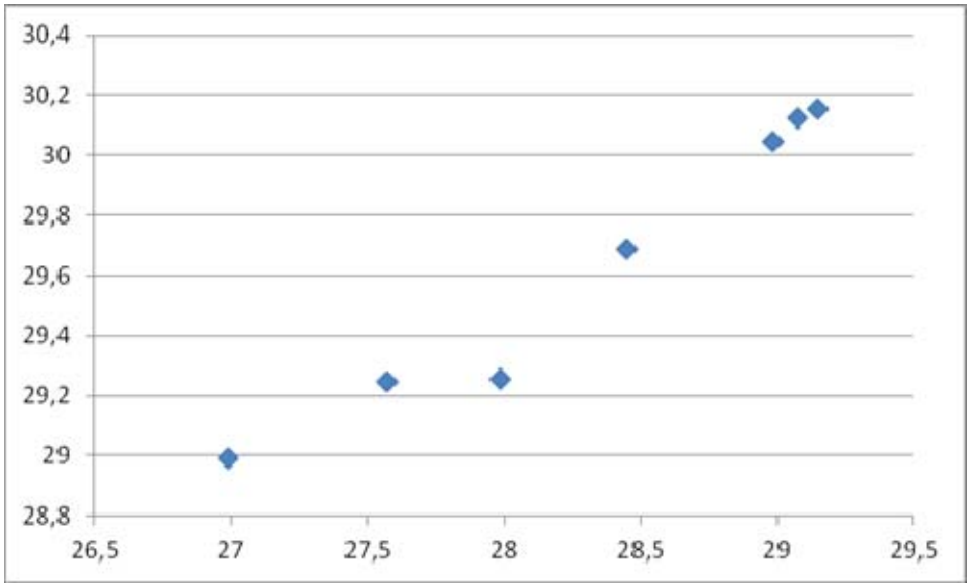


Figure 5. LN (GHG/Kg CO2 eq) and LN (GDP/Constant Value 2005 USD)

Note: GHG = y-axis, GDP = x-axis.

The sharp increase in GHG:s in China reflects not only the immensely rapid industrialization and urbanization of the last 30 years, but also its problematic energy mix (Figure 4).

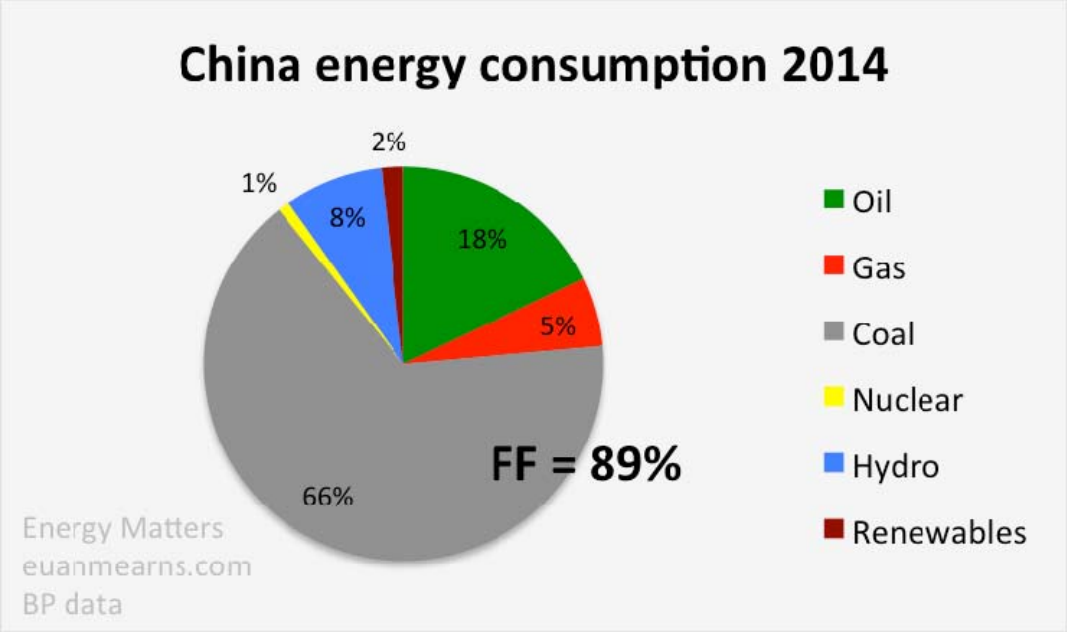


Figure 6. China's Energy Mix

Almost 70 per cent of the energy consumption comes from the burning of coal with an additional 20 per cent from other fossil fuels. The role of nuclear, hydro and other renewable energy sources is small indeed, despite new investments. This makes China very vulnerable to demands for cutting GHG emissions: other energy sources or massive installation of highly improved filters?

It should be pointed out that several small countries have much higher emissions per capita than China. This raises the enormously difficult problematic of fair cuts of emissions. Should the largest polluters per capita cut most or the biggest aggregate polluters? At the COP21 meeting, this issue was resolved by the creation of a Super Fund to assist energy transition and environment protection in developing counties, as proposed by economist Stern (2007). Will it really be set up with 100 billion dollars per year to spend n energy transformation? Or will some countries renege, like for instance Trump's USA?

In a uniquely rapid economic development over a few decades, China has moved from the Third World to the First World with stunningly new giant cities cropping up and modern infrastructure being introduced to its old cities. With economic growth rates hovering around 10 per cent, China is no longer a poor nation. The trick has been to employ market incentives a la Hayek (1991), resorting to a massive mobilisation of energy, partly imported from Australia among others. Figure 5 has the colossal step in terms of GDP and energy towards a mature economy.

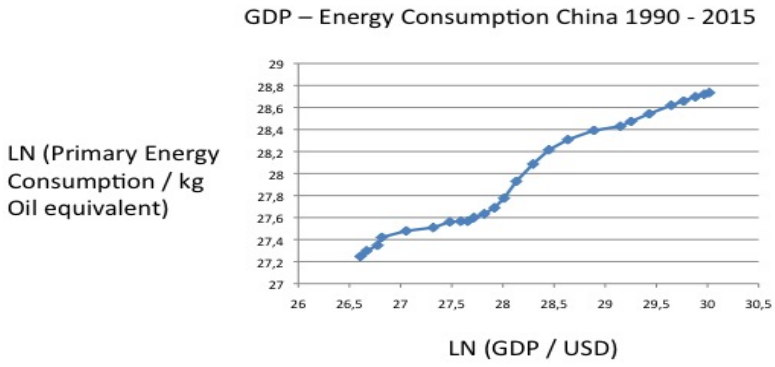


Figure 7. Energy and GDP: y = 0,46x; R^2 = 0,97

China has multiplied its energy usage several times over, drawing upon internal and external resources, mainly fossil fuels. It used to rely upon internal oil and natural gas, but now it is a major global importer. Its exports are gigantic to the US and the EU, and it is tying other Third World countries into patterns of cooperation, or some would say dominance economically, like African nations and Pakistan. However, the price is not only overall environmental deterioration but also the world's largest CO2 emissions.

Question: China keeps pursuing a very rapid socio-economic development, which requires more energy. Can renewables supply the increase and replace coal at the same time?

5.2 India

India will appeal to the same fairness problematic as other Third World nations, namely low per capita emissions in the Third World against huge aggregate emissions. The country is even more negative than China to cut GHG or CO2 emissions, as it is in an earlier stage of industrialization and urbanization. India relies upon wood coal in a massive way, like central Africa. It has been claimed that wood coal is carbon neutral, but in reality it leads to deforestation and desertification on a huge scale.

Figure 6 shows the close connection between emissions and GDP for this giant nation.

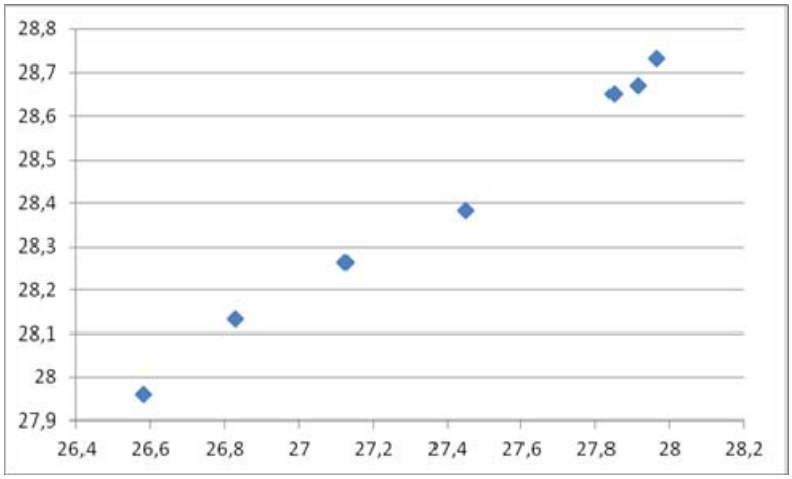


Figure 8. INDIA: LN (GHG/Kg CO2 eq) and LN (GDP/Constant Value 2005 USD)

Note: GHG = y-axis, GDP = x-axis.

India needs cheap energy for its industries, transportation and heating as well as electrification. From where will it come? India has water power and nuclear energy, but relies most upon coal, oil and gas as power source. It has strong ambitions for the future expansion of energy, but how is it to be generated, the world asks. India actually has one of the smallest numbers for energy per capita, although it produces much energy totally. Public intellectual and former minister Ramesh (2015) admits openly that India cannot do without stone coal fired power stations for socio-economic development reasons. In addition, India relies massively upon wood coal.

Figure 7 shows its energy mix where renewables play a bigger role than in China.

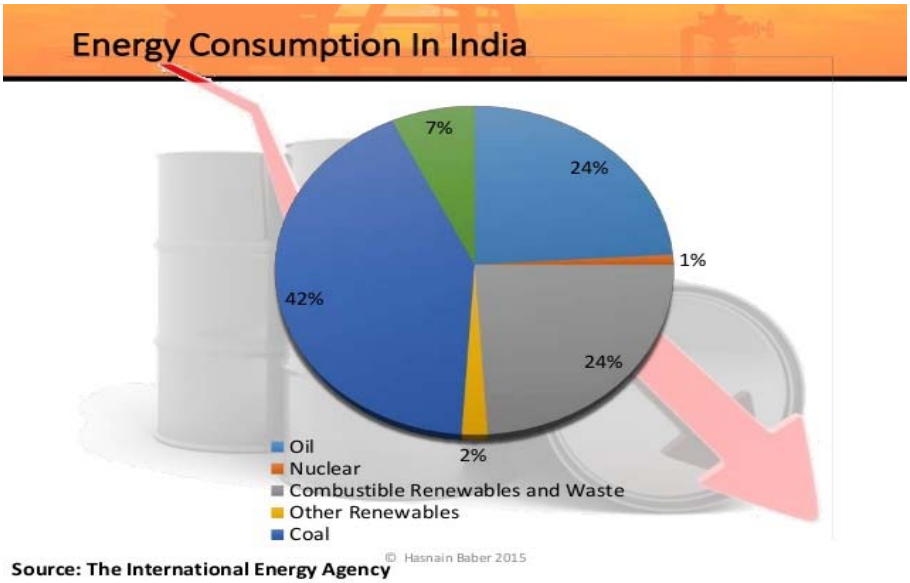


Figure 9. India's Energy Mix

India needs especially electricity, as 300 million inhabitants lack access to it. The country is heavily dependent upon fossil fuels (70 per cent), although to a less extent than China. Electricity can be generated by hydro power and nuclear power, both of which India employs. Yet, global warming reduces the capacity of hydro power and nuclear power meets with political resistance. Interestingly, India uses much biomass and waste for electricity production, which does not always reduce GHG emissions. India's energy policy will be closely watched by other governments and NGO:s after 2018.

Energy consumption in India is planned to augment over the coming decade, as the ambition is to provide electricity to the whole population. Some 300 million people are today without electric power, and the population of India is growing fast. Mass povertyis the only outcome of this imbalance between total energy and total population, where India is heading for becoming the largest country in the world soon population wise. Public intellectual and former minister Ramesh (2015) states that India has no alternative but to build more coal firef energy plants. Thus, we may expect that Figure 8 will show more of an upward trend in the decade to come.

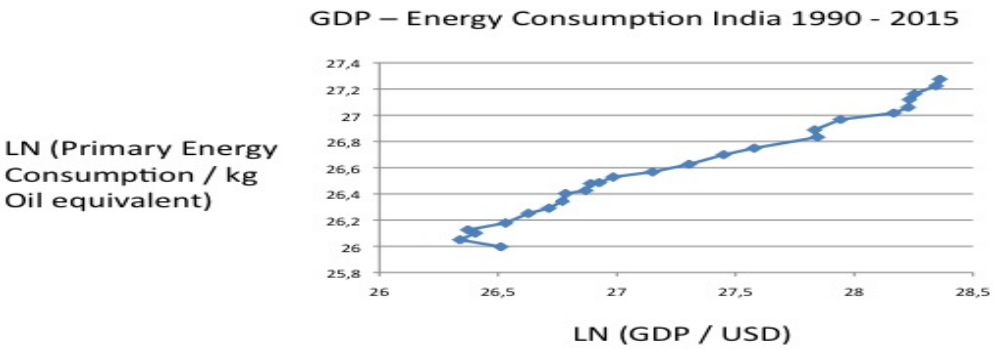


Figure 10. India: GDP-Energy Link: y = 0,55x; R^2 = 0,98

Besides burning lots of fossil fuels, Indian housholds rely much upon wood coal in its various forms, uch as charcoal, peat and dung. Wood coal is detrimental to people and the environment. As wood coal releases CO2:s, the use of biomass is typically defended by the argument that it also stores CO2, meaning that biomass would be basically carbon neutral. However, this argument completely bypasses that wood coal in poor nations is conducive to deforestation and desertification, which is what happens on a large scale in India.

Question: India wants to deliver electricity all its billion inhabitants. Can it be done with burning coal, stone or wood?

5.3 Indonesia

One may guess correctly that countries that try hard to "*catch-up*" will have increasing emissions. This was true of China and India. Let us look at a few more examples, like, e.g., giant Indonesia—now the fourth largest emitter of GHG:s in the world (Figure 9).

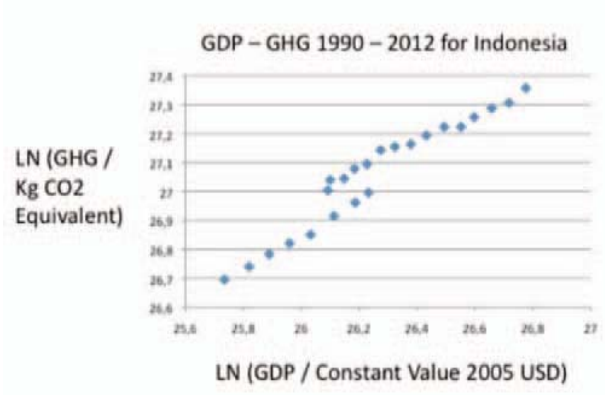
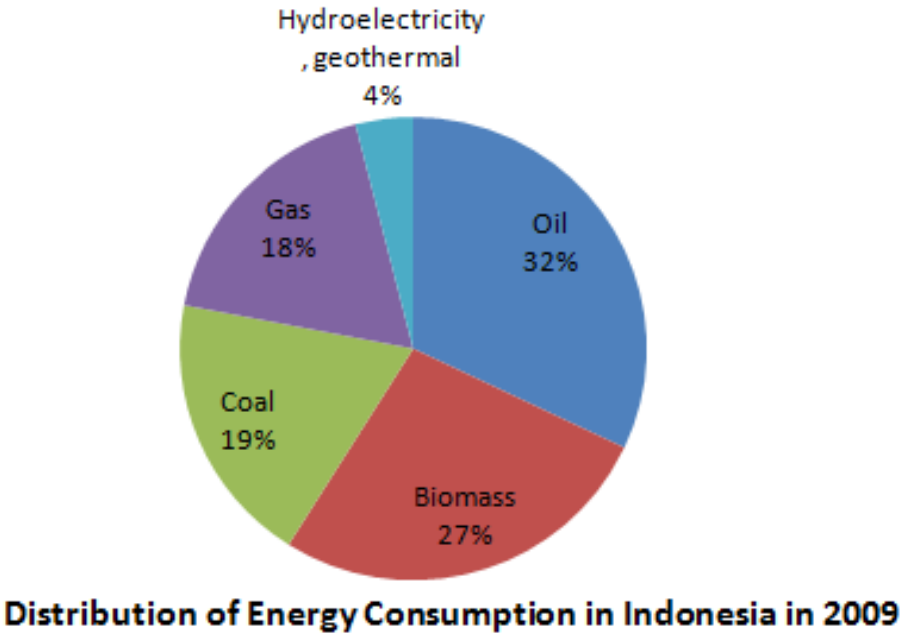


Figure 11. Indonesia: LN (GHG/Kg CO2 eq) and LN (GDP/Constant Value 2005 USD)

Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 11 reminds of the upward trend for China and India. However, matters are even worse for Indonesia, as the burning of the rain forest on Kalimantan augments the GHG emissions very much.



Figrue 12. http://www.missrifka.com/energy-issue/recent-energy-status-in-indonesia.html

Only 4 per cent comes from hydro power with 70 per cent from fossil fuels and the remaining 27 per cent from biomass, which alas also pollutes.

Indonesia has rapidly moved up as a major consumer of energy in the early 21rst decade, refelcting growimh political stability and a strong effort to catch-up with the other Asian miracles. It has definitely passed its “take-off” point, but interestingly its enormous consumption of energy has not

been accompanied by high real economic growth in most recent years (Figure 13).

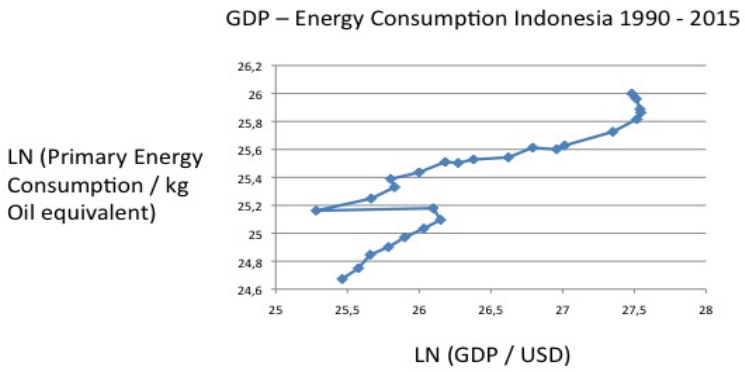


Figure 13. Indonesia: GDP-Energy Link: y = 0,46x; R^2 = 0,79

The inward and upward sloping curve for Indonesia must be of concern to the elite in the country, because Indonesia has become a major contributor to CO2 emissions. If economic growth stalls due to inflation, then how to defend the enormous emissions?

Question: Indonesia cannot control the burning of its rain forests. How then to reduce the emissions of greenhouse gases?

5.4 Japan

Japan started the Asian growth miracle, although without internal energy resources. As the economy of Japan stagnated in the 1990s and the country began using nuclear power massively, Japan managed a dramatic reduction in the emission of greenhouse gases in the first decade of the new century (Figure 14).

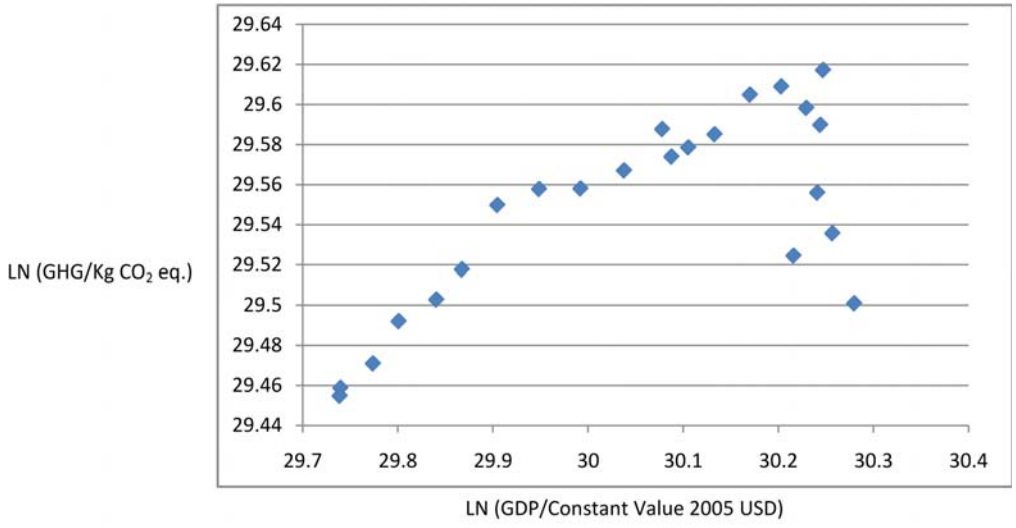


Figure 14. Japan's GDP-CO2 Link: y = 0.2648x; R^2 = 0.194

However, the numbers will go up again to high levels of emissions. It is hardly a daring guess that the

nuclear plant disaster in Japan together with the decision to close most such power plants has further increased emissions, as the country now relies upon fossil fuels much more. Governments make plans, but they may not hold for unforeseen developments. Take the case of Japan (Figure 15).

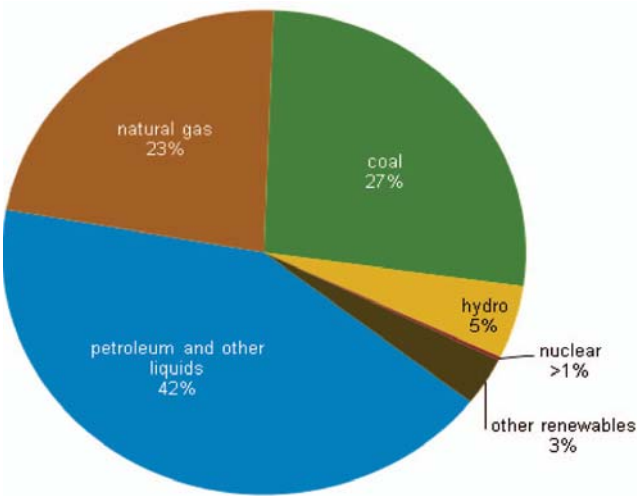


Figure 15. Energy Consumption in Japan

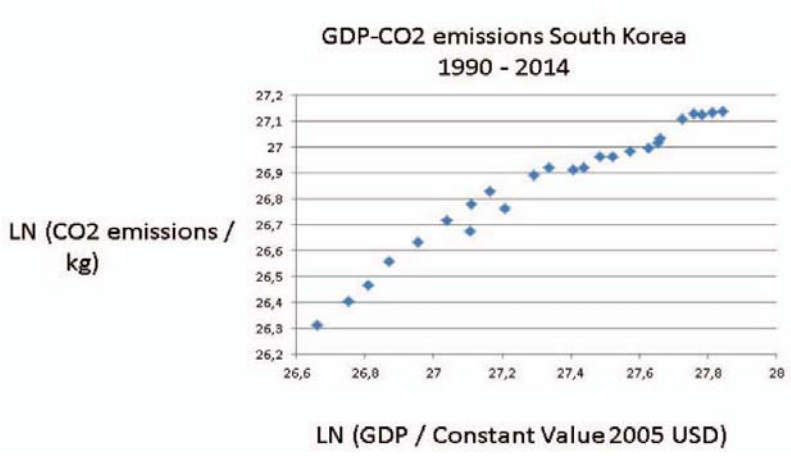
Sources: EIA International Energy Statistics, BP Statistical Review of World Energy 2016.

Japan is today more dependent upon fossil fuels than earlier due to the debacle with its nuclear energy program. Is really solar, wind or atomic power realistic in Japan on the scale needed for massive decarbonisatin? When forced, governments renege, i.e., they will turn back to the fossil fuels, as for them economic growth trumps the environment. After all, nations are brutally egoistic, at least according to standard teachings in international relations.

Question: Can really Japan develop renewable energy sources to such an extent that it can reduce fossil fuels?

5.5 South Korea

A major industrial country in East Asia is South Korea with an advanced economy and large population. It deviates from the pattern of mature economies to display a slowing down in the CO2:s (Figure 16).



Figrue 16. South Korea: GDP=CO2 Link: y = 0,65x + 9,19; R^2 = 0,96

Lacking much hydro power, South Korea has turned to fossil fuels for energy purposes, almost up to 90 per cent. Now, it builds nuclear plants, but South Korea needs to move aggressively into solar power to reverse trends.It differs from China only in the reliance upon nuclear power, where the country is a world leader in plant constructions. Reducing its GHG emissions, South Korea will have to rely much more upon modern renewable energy sources, as well as reducing coal and oil for imported gas or LNGs. Its appetite for energy is not slowing down (Figure 17).

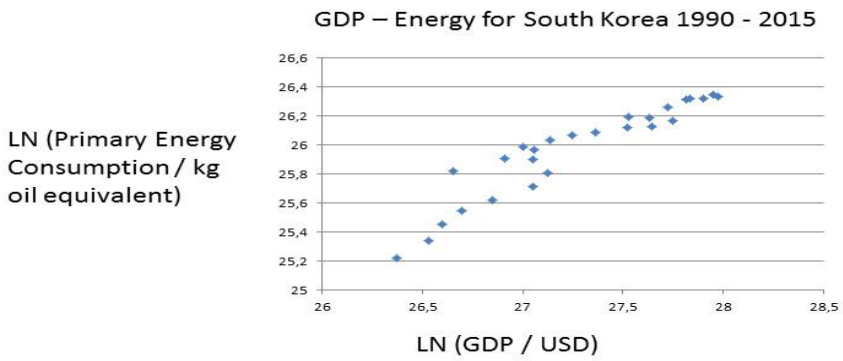


Figure 17. GDP-Energy for South Korea: y = 0,622x; R^2 = 0,88

South Korea is of course a mature economy, but it still pursues an aggressive catch-up strategy (Barro, 1991, 1993, 1995) with strong claims in electronics and nuclear power technology besides shipping and car industry. Figure 18 displays its fossil fuel dependency.

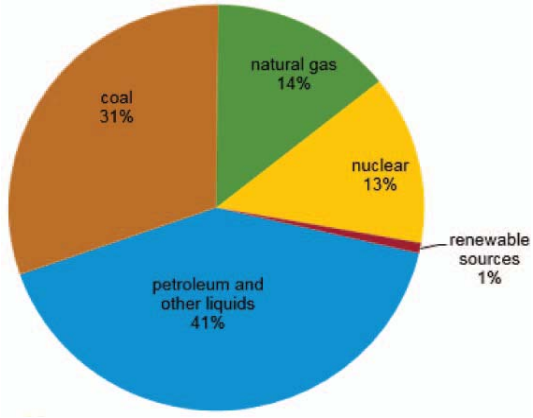


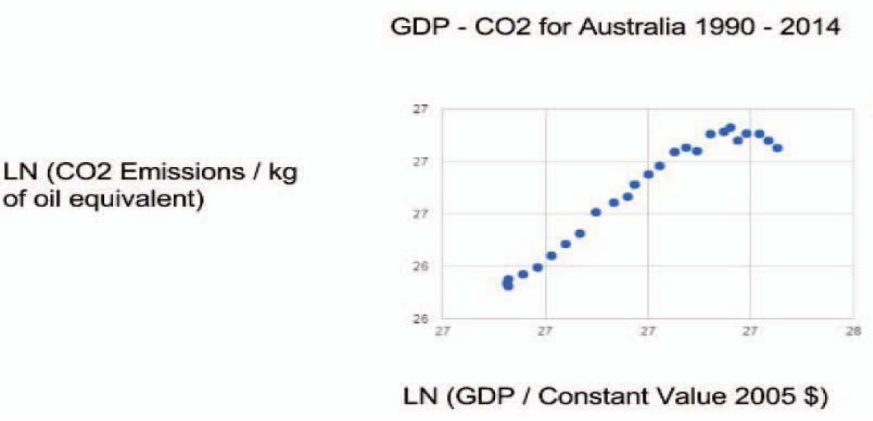
Figure 18. Energy Mix in South Korea

Note. South Korea total primary energy consumption by fuel type, 2015.

Question: South Korea has a highly mature capitalist economy, but unlike Western similar economies its fossil fuel dependency has not declined. Will South Korea renege upon COP21?

5.6 Australia

When one goes beyond the EU, one finds only two cases of declining GDP-COP curve: Australia and Japan. Japan has for a long time substituted coal for atomic power, although recently with a crucial set. But Australia has always been the country of fossil fuels, exporting coal and iron in huge amounts. However, it has reached its CO2 peak recently (Figure 19).



Figrue 19. Australia's GDP-CO2 Link

Australia has been extremely dependent upon fossil fuels, domestically and in exports in Asia. Cutting back its coal dependency will allow the country to halt its CO2 emissions, while moving to renewables.The fossil fuel dependency of Australia is simply stunning (Figure 20).

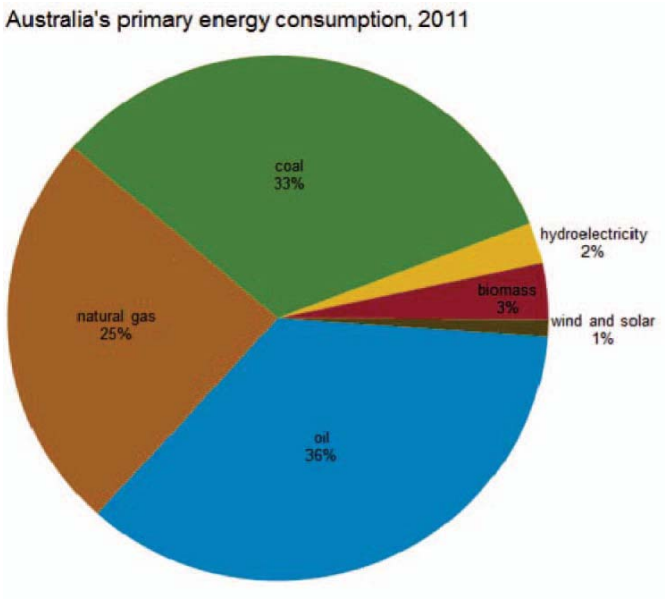


Figure 20. Energy Mix in Australia

Source: EIA International Energy Statistics.

Australia has often been accused of fuelling climate change. These accusations appear to be vindicated in the Figure above that shows an extreme reliance upon fossil fuels. Add then all the export of raw materials! One prime minister of Australia has declared that the country will reduce CO2:s only if economic growth is not hurt. It remains to be seen how Australia tackles Goal I and Goal II.

Question: Australia is a black sheep in this connection, polluting a lot by itself and exporting huge amounts of polluting raw materials to Asia. Will it change its policy and for instance assist environmental refuges from the Pacific Islands, threatened by drowning?

6. Environment and Global Warming Policy

To understand the debates within the UNCCC conferences and the call for a Super Fund, one must separate between catch-up countries on the one hand and mature economies on the other hand. They face entirely different conditions for implementing the COP21 goals:

a) Halting the increase in CO2:s by 2020—GOAL I;

b) Reducing CO2:s by some 40 per cent—GOAL II;

c) Complete or near total decarbonisation by 2075—GOAL III.

How radical these goals are appears from Table 2 where the immense fossil fuel dependency appears.

Table 2. Energy Consumption 2015 (Million Tonnes of Oil Equivalent)

Asia Energy Consumption by fuel (Millions BTU)			
	2015	2016	Change in %
Liquids	64,60	66,40	2,79
Natural Gas	26,00	27,00	3,85
Coal	112,90	114,30	1,24
Nuclear	5,00	6,30	26,00
Other	25,70	28,50	10,89
Total	234,20	242,50	3,54

World Energy Consumption by fuel (Millions BTU)			
	2015	2016	Change in %
Liquids	180,30	192,70	6,88
Natural Gas	121,60	131,50	8,14
Coal	152,00	161,70	6,38
Nuclear	26,20	27,80	6,11
Other	70,10	74,50	6,28
Total	550,20	588,20	6,91

Source: EIA, IEA, BP.

Decarbonisation is the policy promise to undo these “dismal” links by making GDP and energy consumption rely upon carbon neutral energy resources, like modern renewables and atomic energy. Thus, the upward sloping curves must be reversed but still slope outward. Sachs says that decarbonisation can be achieved with a giant global recession, output falling some 20 per cent. But countries would rather renege upon decarbonisation goals. Besides the global conundrum—GDP requires energy, but energy leads to GHG:s—there is an energy-emission conundrum for each government that signed the COP21 Agreement. Thus, each nation and its government and private sector as well as third sector partners have to develop their specific policy to promote the goals of COP21.

7. Conclusion

Asia and Australia trading closely with each other face the enormous global warming challenge, which could derail their ne wily acquired wealth. Climate change and general environmental degradation will hit Asia and Australia hard, if unstoppable. They cannot wait for the COP21 framework to deliver, given the uncertainty about the US policy position now and in the future. However, they can take the initiative to start the decarbonisation process on their own, seeking support from the EU. If China can launch the Silk Road initiative, then surely it can cooperate with other Asian countries and Australia to

reduce the threats from climate change, which is more important than for instance the timy islands in the South China Sea.

References

GDP Sources:

OECD National Accounts data files. (n.d.).

UNDP Human Development Index. (n.d.).

World Bank Data Indicators. (n.d.).

World Bank national accounts data. (n.d.). Retrieved from http://www.data.worldbank.org

GHG and Energy Sources:

BP Energy Outlook 2016. (n.d.).

British Petroleum Statistical Review of World Energy 2016 Literature. (n.d.).

Energy Information Administration. (n.d.). Washington, DC.

EU Emissions Database for Global Research EDGAR. (n.d.). Retrieved from http://www.edgar.jrc.ec.europa.eu/

EU Joint Research Centre Emission Database for Global Atmospheric. (n.d.).

International Energy Agency. (n.d.). Paris.

Olivier, J. G. J., Janssens-Maenhout, G., Muntean, M., & Peters, J. A. H. W. (2016). *Trends in global CO2 emissions: 2016 Report*. European Commission, Joint Research Centre (JRC), Directorate C - Energy, Transport and Climate; PBL Netherlands Environmental Assessment Agency, The Hague. JRC103425, PBL2315, Trends in global CO2 emissions - 2016 report, November 2016.

Research. (n.d.). Retrieved from http://edgar.jrc.ec.europa.eu/overview.php

UN Framework Convention on Climate Change. (n.d.). Retrieved from http://www.unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3814.php

World Bank Data Indicators. (n.d.). Retrieved from http://www.data.worldbank.org

World Resources Institute CAIT Climate Data Explorer. (n.d.). Retrieved from http://www.cait.wri.org

Literature

Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *The Quarterly Journal of Economics*, *106*(2), 407-443. https://doi.org/10.2307/2937943

Barro, R. J., & Xavier, X. Sala-i-Martin. (1992). Convergence. *Journal of Political Economy*, *100*(2), 223-251. https://doi.org/10.1086/261816

Barro, R. J., & Xavier, X. Sala-i-Martin. (1995). *Economic Growth*. McGrow Hill.

Conca, K. (2015). *An Unfinished-Foundation*. Oxford: OUP. https://doi.org/10.1093/acprof:oso/9780190232856.001.0001

Hayek, F. (1991). *Fatal Conceit, The errors of socialism*. Chicago: University of Chicago Press.

Kaya, Y., & Yokoburi, K. (1997). *Environment, energy, and economy: Strategies for sustainability*. Tokyo: United Nations University Press.

Ramesh, J. (2015). *Green Signals*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199457526.001.0001

ROSTOV, W. W. (1960). *The Stages of Economic Growth: A Non-Communist Manifesto*. Cambridge: Cambridge University Press.

Sachs, J. D. (2015). *The Age of Sustainable Development*. New York: Columbia University Press. https://doi.org/10.7312/sach17314

Schumpeter, A. (2009). *On Entrepreneurs, Innovations, Business Cycles, and the Evolution of Capitalism*. Piscataway: Transaction.

Sombart, W. (2001). *Economic Life in the Modern Age*. Piscataway: Transaction.

Stern, N. (2007). *The Economics of Climate Change*. Oxford: OUP. https://doi.org/10.1017/CBO9780511817434

Stern, N. (2016). Why Are We Waiting? *The Logic, Urgency, and Promise of Tackling Climate Change*. Cambridge, MA: MIT Press.

Weber, M. (1978). *Economy and Society I-II*. Berkeley: University of Cal Press.

Appendix I.

A model of carbon emissions is the so-called Kaya model:

(E1) Kaya's identity projects future carbon emissions on changes in Population (in *billions*), economic activity as GDP per capita (in *thousands of $US(1990)/person year*), energy intensity in *Watt years/dollar*, and carbon intensity of energy as *Gton C as CO_2 per Tera Watt year*". http://climatemodels.uchicago.edu/kaya/kaya.doc.html

We have this equation format for the Kaya probabilistic law-like proposition, as follows:

(E2) Multiple Regression: $Y = a + b_1X_1+b_2X_2 + b_3X_3 + ... + b_tX_t + u$

Note: Y = the variable that you are trying to predict (dependent variable); X = the variable that you are using to predict Y (independent variable); a = the intercept; b = the slope; u = the regression residual. Note: http://www.investopedia.com/terms/r/regression.asp#ixzz4Mg4Eyugw

Thus, using the Kaya model, these anthropogenic conditions would affect positively carbon emissions:

(E3) CO2:s = F(GDP/capita, Population, Energy intensity, Carbon intensity), in a stochastic form with a residual variance, all to be estimated on most recently available data from some 59 countries. I make two empirical estimations of this probabilistic Kaya model, one longitudinal for 1990-2014 as well as one cross-sectional for 2014.*Longitudinal analysis*: I make an empirical estimation of this probabilistic Kaya model - the longitudinal test for 1990-2014, World data 1990 - 2015:

(E4) Ln CO2 = 0,62*LN Population + 1,28*LN(GDP/Capita) + 0,96*LN(Energy/GDP); R2 = .90.Cross-sectional analysisIn a stochastic form with a residual variance, all to be estimated on data from some 59 : countries, I make an empirical estimation of this probabilistic Kaya model - the cross-sectional test for 2014:

(E5) k1= 0,68, k2=0,85, k3=0,95, k4=0,25; R2 = .80.

Note: LN CO2 = k1*LN (GDP/Capita) +k2*(dummy for Energy Intensity) + k3*(LNPopulation) + k4*(dummy for Fossil Fuels/all) Dummy for fossils 1 if more than 80% fossil fuels; k4 not significantly proven to be non-zero, all others are (N = 59).

These two tests of the Kaya model shows that the key factors in anthropogenic climate change are the size of the economy, energy consumption and the carbon content of energy.