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ASIA AND CLIMATE CHAOS

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ABSTRACT

The COP Treaty from 2015 in Paris outlines the plan for global de-carbonisation during this century up to around 2075. However, this is not an achievable objective, because the largest emitters of CO₂s are not planning to follow the steps in the COP project, namely the giant Asian countries in East, South East and South Asia. The ever wider set of Asian economic miracles are basically driven by the “take off” strategy (Rostov, 1970) (when poor) or the “catch-up” strategy (Barro, 1991; Barro and Sala-i-Martin, 1992, 1995) (when affluent). Their stated future energy demand surpasses the global de-carbonisation plan.

INTRODUCTION

The largest emitter of GHGs is the Asian continent, especially South Asia, East Asia and South East Asia. One can be sure that the now ongoing release of massive methane from the melting permafrost and fracking in the US will force the Keeling curve upwards, perhaps with a *chaotic jump*. This may herald *Hawking irreversibility*, i.e. the point in time where global warming becomes unstoppable chaotic.

KEELING CURVE AND METHANE EMISSION

The theory of chaos was reinvented in the 1960s by E. Lorenz, who was studying differential equations, applied to climate (Gleick, 1988). He found that a system of three such equations, coupled with a positive feedback and a negative feedback, could not be predicted in the future. That is why the “butterfly effect” started to be mentioned: a small (infinitesimally) variation of weather (the “wind” produced by a butterfly) could lead to a big variation in the weather far from there.

Yet, we have other coupled differential equations, which can help predict climate change that is simpler mathematically. Climate change in the 21st century depends upon the Keeling curve, which relates temperature rise to CO₂ emissions. The Co₂ equivalent measure includes also the methane emissions besides the other greenhouse gases (GHC).

The threat of a rise in methane emissions due to the melting of the permafrost must be related to the rising Keeling curve. All evidence points to a further advance in Diagram 1: rising CO₂s, the many positive feedback loops, deoxygenation of oceans, melting ice at the poles and glaciers, extremely violent storms and rain, sea level rise, etc.

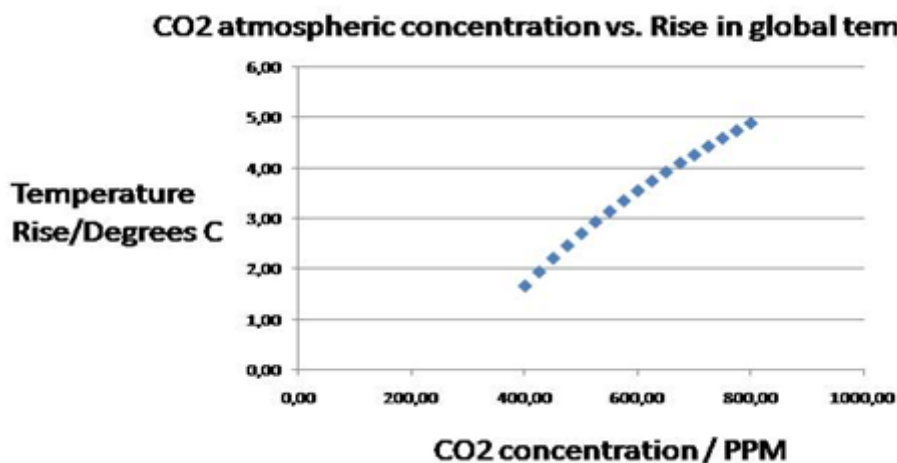


Diagram 1. The Keeling curve

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Today, the Keeling curve stands at 410, but it could soon hit 420-30, which would make the plus 2 degrees Celsius objective unfeasible already before the implementation of COP21 begins.

There are several greenhouse gases. The UNFCCC has concentrated upon halting and reducing carbon dioxide, but now we are about to face a methane threat. Methane concentration augments; the main sources are: Agriculture; Wetlands; Biomass burning; Melting permafrost. Fossil fuel production and use - fracking (Pearce, http://e360.yale.edu/features/methane_riddle_what_is_causing_the_rise_in_emissions);

We will simulate the growth path of methane emissions in the likely future by some equations - see Diagram 2.

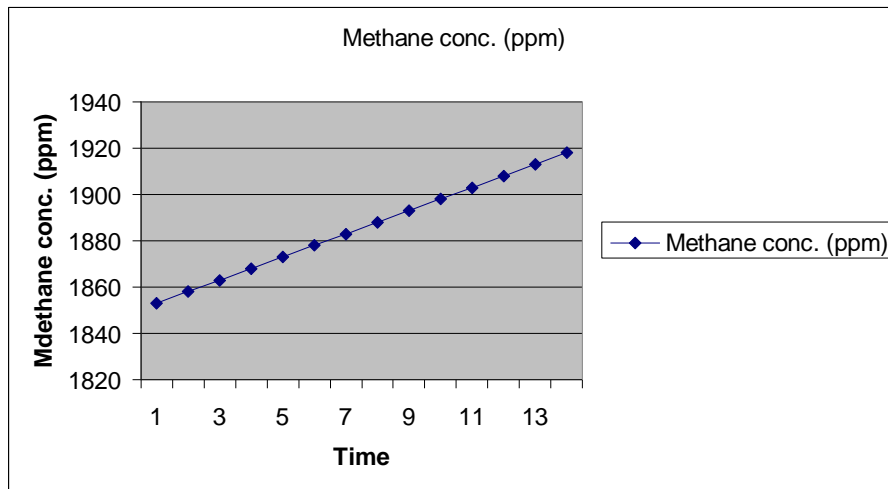


DIAGRAM 2. Projected increase in methane

Why all the GHGs that raise global temperature, bring havoc to mankind? Because of energy demand, necessary for affluence. Remove fossil fuels now, and the world economy plunges into deep recession with loss of billion jobs/

ENERGY AND EMISSIONS

Energy is at the core of the climate change debate. And energy consumption is enormous at the same time as energy demand is projected to further increase substantially. Energy demand is predicted to be enormous in Asia, as poor people try to change their situation and the new middle classes strive for even more of affluence as well as the newly rich billionaires and millionaires throw themselves into conspicuous consumption. Can really Asia manage de-carbonisation and at the same time augment energy supply with 30-50 per cent? Figure 1 shows the global connection between energy consumption and CO2 emissions.

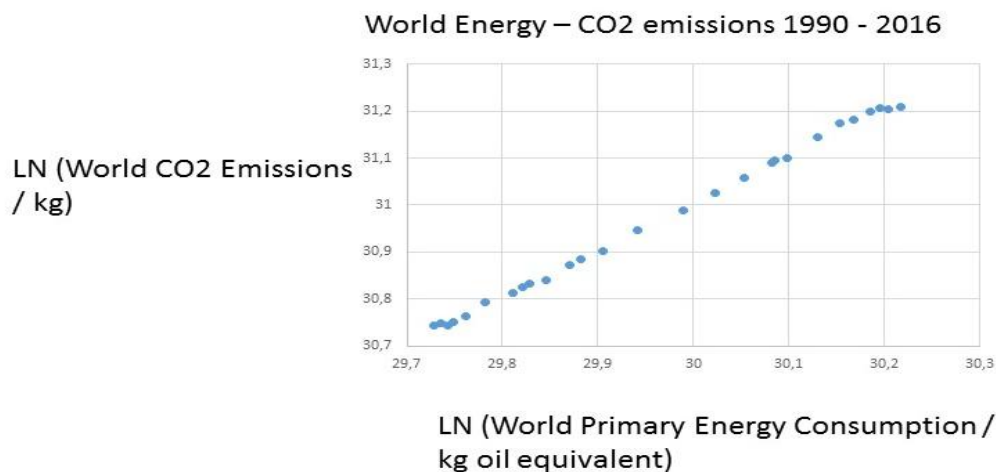


FIGURE 1. Energy and CO2: $s:y = 1,01x$; $R^2 = 0,99$

Source: BP Statistical Review of World Energy 2017, <http://www.bp.com/statisticalreview>; Janssens-Maenhout, et al, 2017.

There is a one-to-one relationship over time between energy consumption and CO₂ emissions. The cost for Asia is clear, as the Asian Development Bank states (ADB, 2015: Foreword). The ADB calls for anti-global warming policies, recommending carbon capture. This technique would allow for continued high economic growth, but it is neither safe nor least expensive, as solar power parks offer a better technique, given much sun on this continent.

Figure 2 has the regional picture, showing the huge augmentation in CO₂s in Asia. Note also the big contribution by maritime and airborne transportation which is very relevant as air traffic now explodes and LNG shipping enters a new stage.

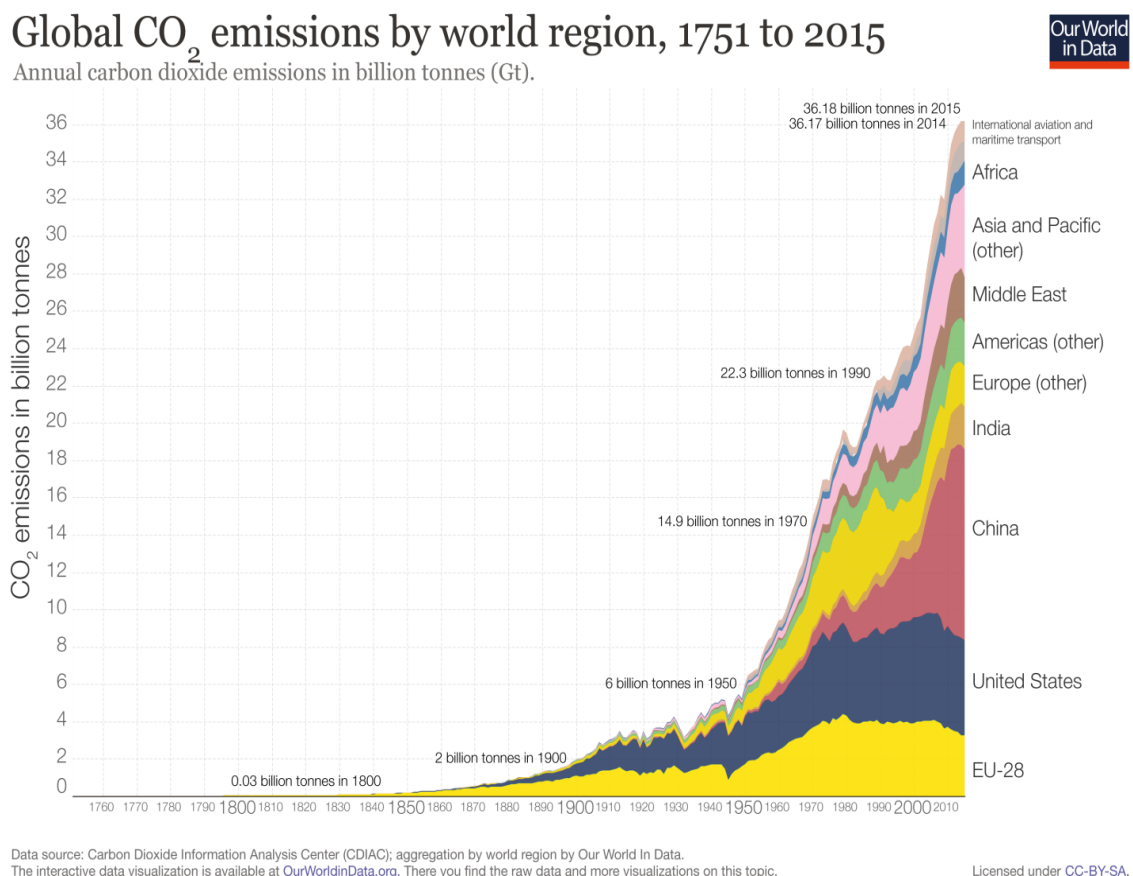


FIGURE 2. CO₂ EMISSIONS by Region

The greenhouse gases (GHG) have anthropogenic sources, being linked with socio-economic development or economic growth via the consumption of energy, especially the burning of fossil fuels, use of cement and the emission of methane from land sinks, cows, microbes, etc. The UNFCCC has focused on halting CO₂s and decreasing them in a gigantic de-carbonisation policy globally in this century.

Since 1970, global energy consumption has more than tripled, the share of Asia augmenting phenomenally. The Asian economic miracle started in Japan after the Second War, spread to the four miracles – Taiwan, South Korea, Hong Kong and Singapore – only to include mainland China since 1980, in order to further widening to South East Asia and South Asia plus Kazakhstan and Turkey as well as the Middle East oil and gas tycoons. Now Asia has more than 50% of all energy consumption and it is more than 80 percent fossil fuels, globally. In several Asian countries, fossil fuels make up 90 percent of energy consumption.



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The late 20th economic revolution has turned Asia into the set of factories of the world, thus increasing quickly affluence and wealth as well as succeeding in diminishing poverty. But energy transformation requires huge changes in Asia, like the elimination of coal as soon as possible as well as the building of many more solar and wind power plants.

COP21 POLICY GOALS

The COP21 Treaty is just a paper outlining global de-carbonisation:

The COP21 Treaty of 2017 in Paris enters into the global system of international relations. Thus, an answer to Stern's question must be found in the inertia of global political coordination, which harbours lots of gaming, promises and defection. From the point of view of state rationality, one government may delay anti-global warming policy-making and policy implementation if it trusts that other governments will act, or believes that no government will act. If all governments do the same, there is complete coordination failure.

- i) Stall the rise of CO₂s by 2020 (GOAL I);
- ii) Decreasing the CO₂s by 30-40% by 2030 from some level base line in the past (2005) (GOAL II);
- iii) More or less full de-carbonisation by around 2075 (GOAL III);
- iv) Decentralised implementation under international oversight, financial support and technical assistance.

These are enormous goals, as only one country – Uruguay – is near GOAL I and GOAL II. Can they be implemented? Or will the states to the Agreement renege in a giant *ocean PD game* (Prisoner's dilemma)? Few countries have decreasing CO₂ curves today.

Under international law, the states signing and ratifying COP21 are bound by their promises, but the COP21 is all but clear:

- a) No sanction against non-compliance is outlined;
- b) A control mechanism of the fulfilment of promises is only sketched minimally;
- c) Big money is promised from a so-called Super Fund, to assist countries in energy transformation, but no funding or management strategies are outlined.

The difficulty is *defection*. First, the respect for international law depends much upon the states' wish to comply, as sanctions from the Security Council are restricted to issues of war and peace. Second, all CPRs face the temptation of renegeing. When a country notices that it promised too much, like the COP21 project, it simply reneges, allowing for increases in GHGs.

As anti-global warming policy-making has been entrusted the UNFCCC framework, the climate change problematic has been confounded with other issues, like global redistribution, sustainable economy, poverty alleviation, etc. It would be preferable if a smaller body like the G20 group of nations could concentrate upon ONE issue – climate change – and take effective measures that save mankind from the point of Hawking irreversibility, i.e. when global warming becomes unstoppable and so severe at 4-6 degrees plus Celsius that humanity is threatened.

The COP21 Treaty is just a set of promises that can be renegeed upon at any time. The US has already defected and aims at becoming the global exporter No 1 of oil and gas in the near future by means of the new technology of fracking, which is detrimental to the environment. China promised to stem its CO₂ increases already 2016, but it now increases again. Germany and Australia appear to talk about some form of defection. And India would certainly renege without billions from the Super Fund. And South Korea has given up parts of its nuclear power program and bets on the LNG option instead, which Japan may also chose, although carbonization writ large.

To estimate the likelihood of the implementation of global de-carbonisation according to the COP21 Agreement, one needs to look at the standard energy projections among the global players. Energy is at the core of the climate change debate. And energy consumption is enormous at the same time as energy demand is projected to further increase substantially.

The Internal Energy Outlook 2013 by the EIA presented the following scenario, which hardly amounts to de-carbonisation. The same observation is to be made in the standard BP projections. Finally, the International

Energy Agency in 2017 does not deviate in its normal case. “Sustainable development” scenario is utopian (Appendix I).

CO2 EMISSIONS IN ASIAN: Some examples

China: 20% more energy up to 2030

China has expressed support for COP21, especially when smog hits Beijing. But its economic expansion endeavours remain unchanged, not least over Asia with the New Silk Road as well as in Africa. Alarming information now arrives that China, the biggest emitter of CO₂s, will not succeed to halt its curve for CO₂s due to hydro power shortages. Instead, it counts upon some 3 per cent increases the nearest 1-2 years – see Figure 3.

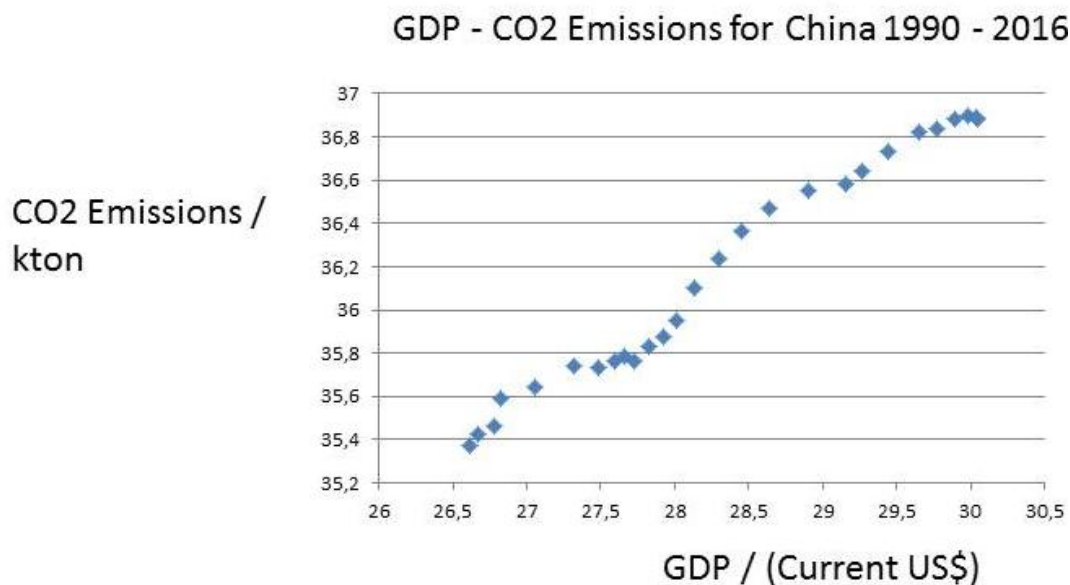


FIGURE 3. China: GDP and CO₂s: $y = 0,46x$, $R^2 = 0,98$

Will China renege upon both GOAL I, halting the increase in CO₂s, and GOAL II, reducing CO₂s by some 30 per cent in 10 years? Promises and intentions are one thing, defect, but real life developments are another matter. All countries in this CPR can at any time renege, the US has already done being not willing to pay to the Super Fund.

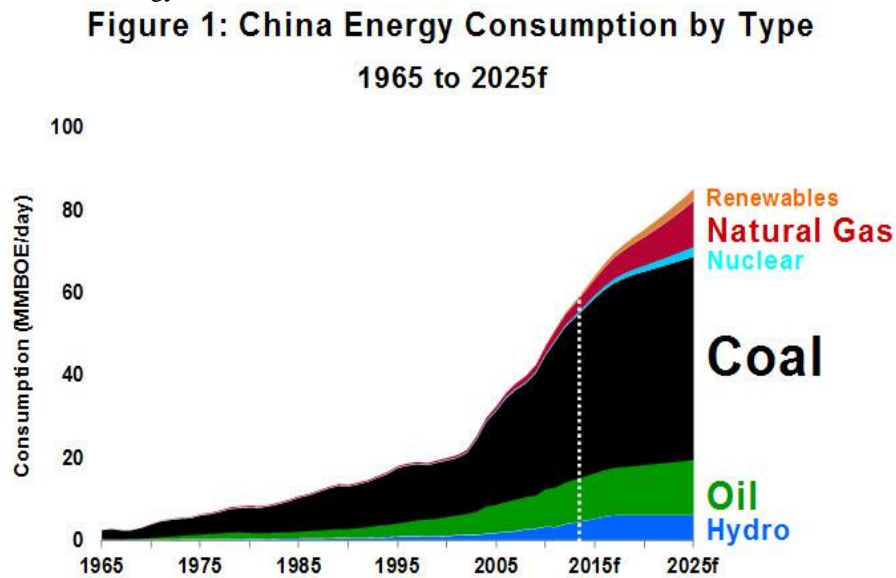
China invests in both nuclear power and modern renewables. Yet, it has magnificent economic ambitions over the next decades:

- i) Airports and own constructed aircraft;
- ii) Largest air traffic in the world;
- iii) Biggest car market in the world’
- iv) More SUVs and ever larger engines;
- v) The New Silk Road: infra structure expansion into Central Asia, Pakistan and the Middle East.

Air and sea transportation adds much to CO₂ emissions. Even if electrical cars are launched massively in China, one must ask where the electricity comes from. Coal?

China expanding outward meets Kazakhstan, Pakistan an otherKhanates when building the new highway to Turkey, an enormous project with strong CO₂ consequences.

FIGURE 4. China’s future energy mix



Source: Historicals - BP, Forecast - ARC Financial Research

Figure 4 sends a vision of a future that is not the same as that of the COP21 project.

India: Super Fund Hope

Its Rostov take-off point in time would 1990, when Nehru’s economic regime was abandoned for free market economics. Unleashing the dormant giant of India has led to enormous economic expansion and growth in CO₂s – see Figure 5.

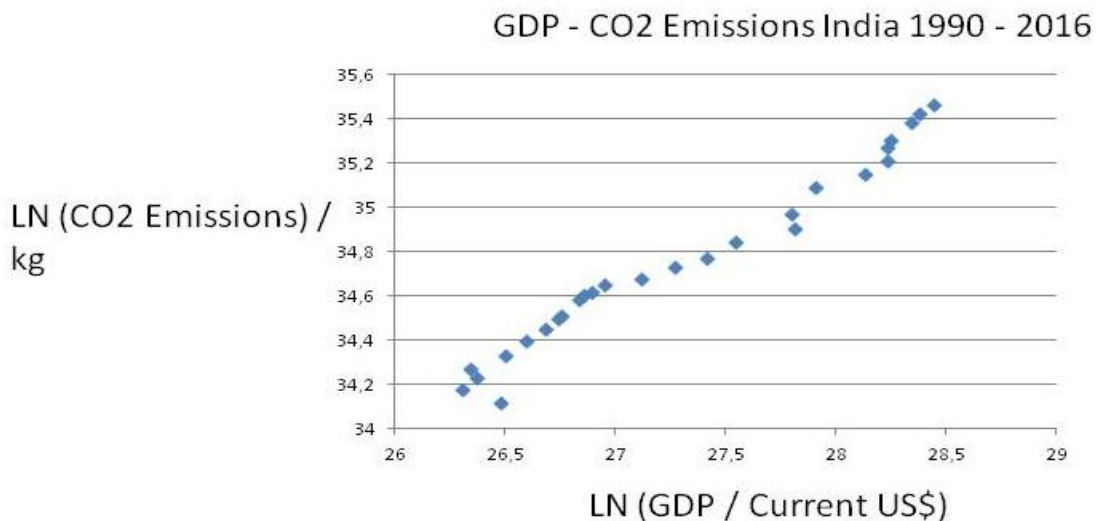


FIGURE 5. India: GDP and CO₂

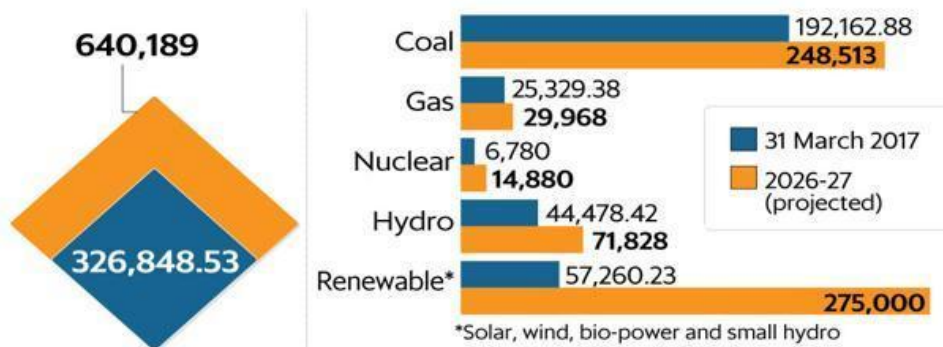
India takes the position that any reduction its economic growth due to the fulfillment of global de-carbonisation must be compensated by the West. Moreover, the Super Fund should be employed for the energy transformation that is necessary for India to comply with GOAL I and GOAL 2.

Ramesh (2015) insists that India cannot alone uplift its million poor without coal power. In addition, families in India rely much upon wood and charcoal – traditional renewables. The country is investing in nuclear power and modern renewables. However, its hydro power suffers from water scarcity – a positive feedback loop from climate change.

India's changing energy mix

India is moving towards a robust energy mix, focusing on sustainable energy sources such as solar and wind. By the end of 2026-27, India is projected to get 56% of its installed power capacity from clean energy sources.

India's total installed power capacity (in MW)



Source: Central Electricity Authority, Draft National Electricity Plan

FIGURE 6. India's planned energy mix (Excluding transport)

India says that it will renege, if no massive support from the Super Fund. Its future plans, according to Figure 6, comprise a 20% energy increase. And it must reduce coal more to comply with COP21. Renewables in India consist of much wood coal.

Indonesia: Massive emissions

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 three more examples, like e.g. giant Indonesia – now the fourth largest emitter of CO₂:s in the world (Figure 7).

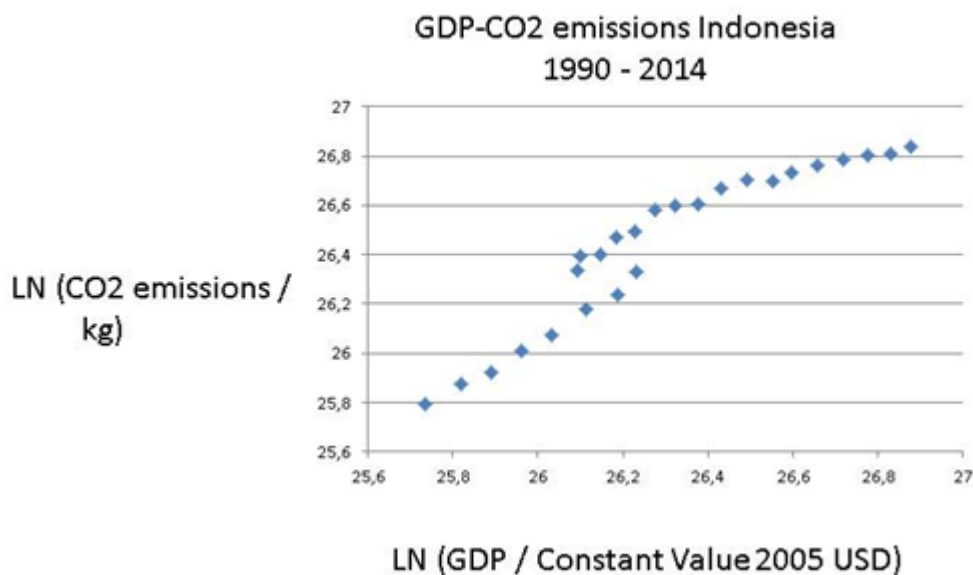


FIGURE 7. Indonesia's link GDP-CO₂: $y = 0,95x + 1,6$; $R^2 = 0,89$

Indonesia is a coming giant, both economically and sadly in terms of pollution. Figure 8 reminds of the upward trend for China and India. However, matters are even worse for Indonesia, as the burning of the rain forest on

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Kalimantan and Sumatra augments the GHG emissions very much. Figure 8 presents the energy plan for this huge country in terms of population and territory.

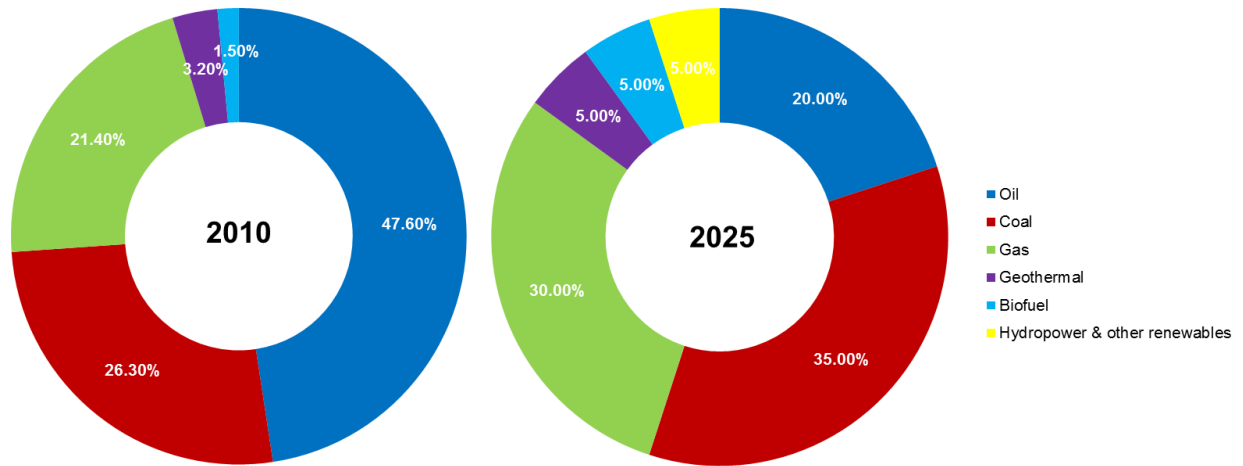


FIGURE 8. Indonesia energy future

Source: <http://indosole.blogspot.com/2012/06/geothermal-energy-in-indonesia-its.html>

Only 5-6 per cent will come from hydro power or geothermal power with almost 80 per cent from fossil fuels and the remaining from biomass, which also pollutes. Indonesia cannot control the illegal burning and cutting down of its rain forest. Thus, it is a very major contributor to global warming, especially as energy supply will increase.

South Korea: From Nuclear to LNG

South Korea is today a member of the club of First Advanced economies, the OECD. From dismal poverty, it has pursued a spectacularly successful catch-up strategy, making it a global leader in technology and car production. The transformation is all the remarkable, as the country possess few internal power resources. Thus, it has relied upon imported fossil fuels, with the result in Figure 9, huge CO2 emissions.

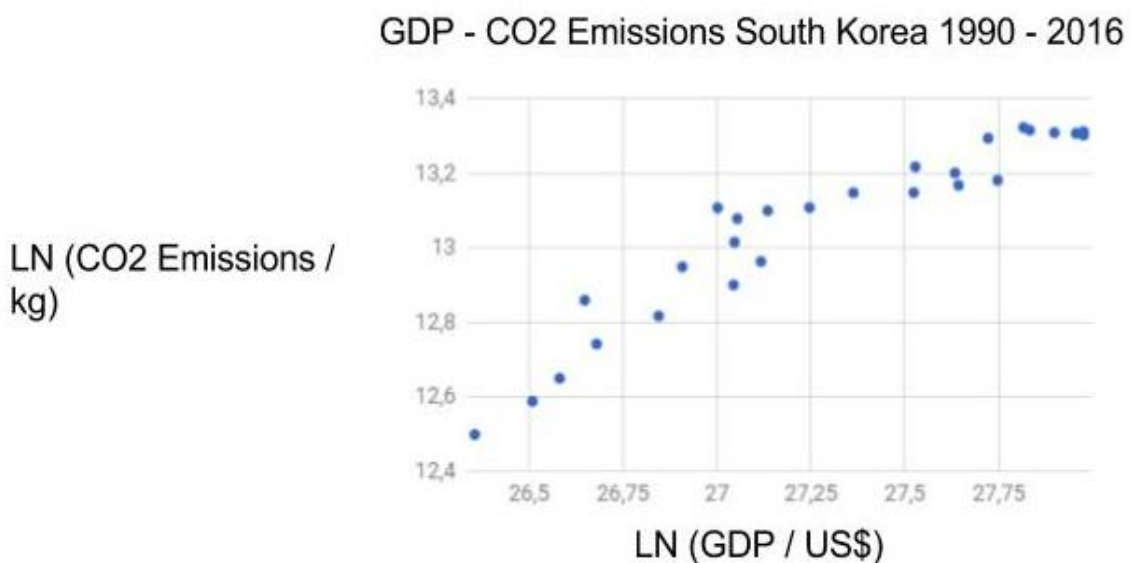


FIGURE 9. SOUTH KOREA

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To come to grips with its enormous GHG emissions, South Korea has attempted to reduce its coal dependency. Thus, it engaged upon a most ambition nuclear program, as its force is the largest power source in the world. South Korea with its advanced technology can build new and better as well as safer atomic power plants, also constructing them abroad. But the new president hesitates about nuclear power, like the European governments, and has launched a new energy strategy based massively upon natural gas (LNG), imported mainly from Australia and Indonesia. But it will still result in CO₂ emissions higher than GOAL II in CO₂1. And international maritime transportation is a major source of CO₂s.

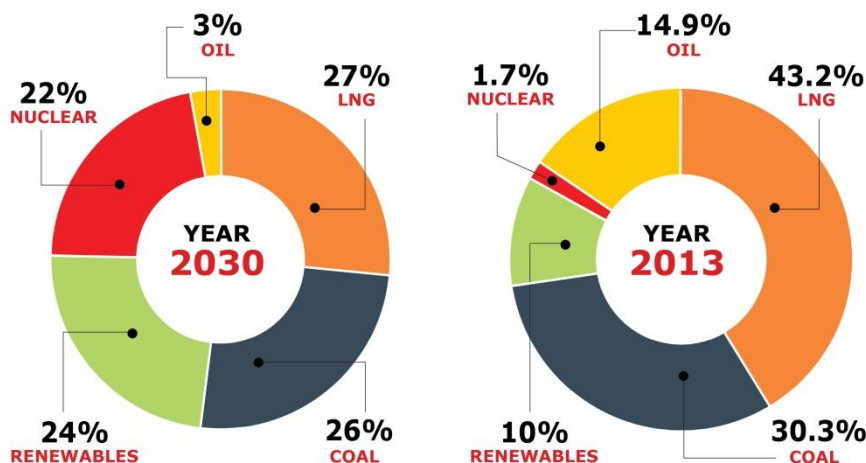
The LNG option may also appear attractive to Japan, hesitant about the use of atomic power

Japan: Energy uncertainty

The Fukushima atomic power plant disaster changed energy policy in Japan, with an almost %-stop of nuclear plants. But what to use in Japan? See a plan in Figure 10.

JAPAN'S ENERGY MIX BY 2030

Japan sees renewable energy such as solar and hydro edging out nuclear power by 2030.



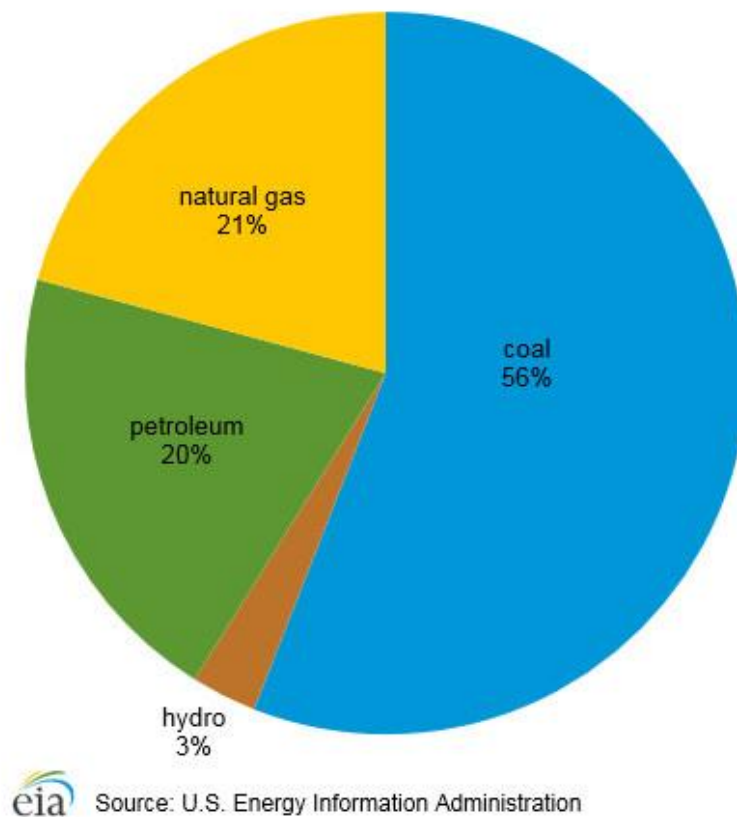
Source: Ministry of Economy, Trade and Industry, Japan, 2015

FIGURE 10. Japan's future energy mix

This plan relies upon a big return to nuclear power, as there are safer models now. But is it politically realistic? If not, Japan must increase imports of fossil fuels, and renege upon COP21.

Kazakhstan: Oil and gas

Here, we have a nation very much occupied with the catch-up strategy, as its exit from the Soviet Union worked like a "take-off" stage. It wants to copy the Asian miracles, moving to affluence in a few decades, using its immense fossil energy resources (Figure 11). But this picture of over 90% fossil fuels is very far from the obligations under the COP21 Treaty.

Figure 2. Kazakhstan energy consumption by fuel, 2014

FIGURE 11. Energy mix

Kazakhstan's energy consumption leads to enormous emissions. The stunning economic development, including the great project of a modern Silk Road from China to Turkey through Kazakhstan implies that the CO21 goals cannot be accomplished here. Catch-up strategy and huge infrastructure trump climate change. Countries with no hydro power often display increasing trends for emissions. Kazakhstan employs its vast fossil fuel resources for energy consumption besides exporting a lot. But it has to start energy transformation towards renewables

Turkey: Imported energy

Turkey has never been politically stable, neither today nor historically speaking. The Ottoman Empire was an example of oriental despotism, namely *sultanismus*. When the Young Turks set up modern Turkey, they failed to stabilize the country with a permanent constitution. The many constitutional changes reflect not only *coup d'état*, but also a weak tradition of the *Rechtsstaat*. Economically, things are entirely different, as Turkey is one of the giants of the global economy, especially important with connections to the West and dominance in Turkestan. Comparing the picture for Turkey with that of "catch-up" nations, one may state that Turkey has the typical GDP-GHG link, despite lots of hydro power. Strong economic development is combined with heavy emissions increase. Since the world organisations – the UN, WB and IMF – opt for more of economic growth, one must ask whether emissions growth really can be halted. Figure 12 supports this picture of Turkey as an energy consuming giant.

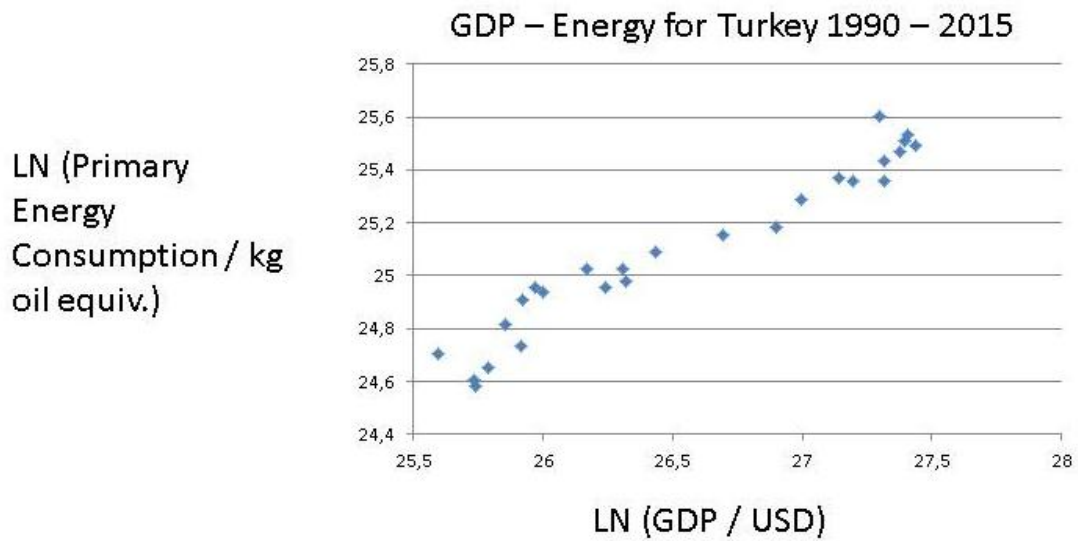


FIGURE 12. Turkey: energy-GDP link

Strong economic development is combined with heavy energy-emissions increase. Oil and gas are imported from the East. Only hydro power is a large internal source of energy. Wind energy has become fashionable, but solar energy would be an ideal solution. Figure 13 displays the still heavy reliance of Turkey on fossil fuels, mostly imported. Decarbonisation according to the COP21 Treaty implies that Turkey must change drastically, as it now depend at 90% on fossil fuels.

Primary Energy Consumption of Turkey

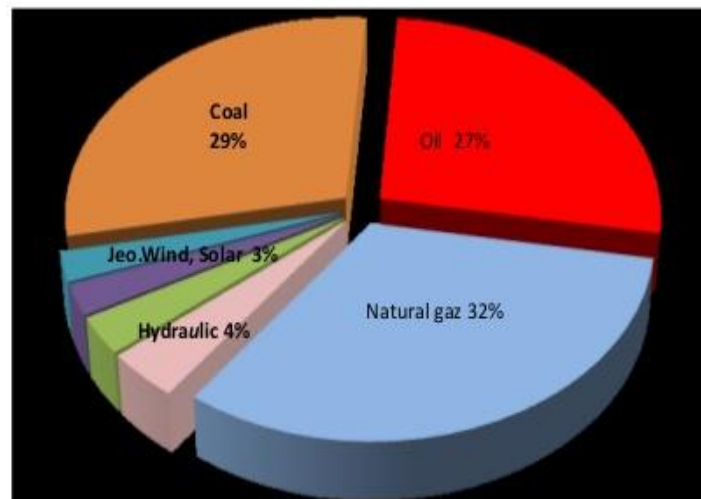


FIGURE 13. Energy mix in Turkey

Source:<https://www.slideshare.net/omerfarukgurses/world-energy-outlook-2015-presentation>

Turkey, Iran and Kazakhstan pursue the "catch-up" strategy in relation to the advanced capitalist countries (Barro, 1991, Barro and Sala-i-Martin, 1992, 1995). They are not very eager to take on the burden for global

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decarbonisation, especially if it hurts their economic development. They would demand compensation from the promised Super Fund, as Turkey has now threatened to regene upon its COP21 promises.

Iran: Need of Solar Power

Countries may rely upon petroleum and gas mainly – see Iran. CO2 emissions have generally followed economic development in the giant carbon rich countries. In Iran though, there seems to be a planning out recently, perhaps due to the international sanctions against its economy. Iran has made considerable economic advances, despite international sanctions, but it’s CO2:s has also increased much (Figure 14).

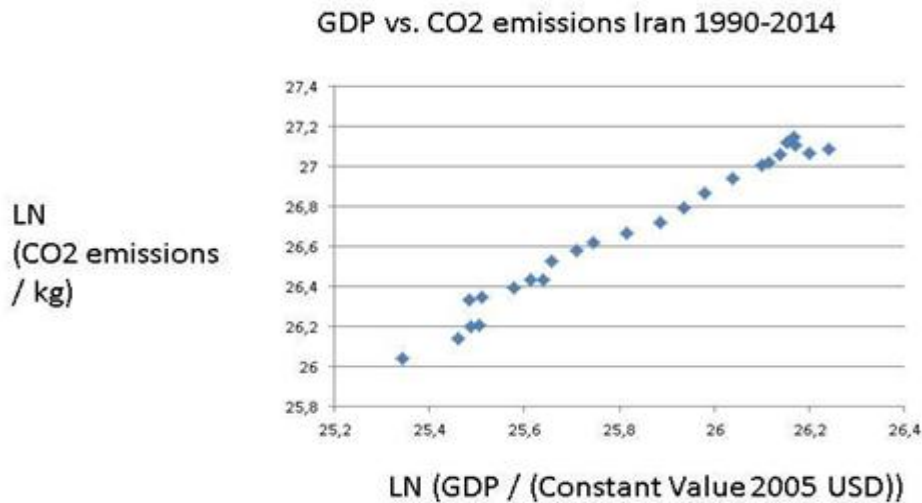


FIGURE 14.Iran: GDP-CO2 link ($y = 1,22x - 4,91; R^2 = 0,98$)

Iran is together with Russia and Qatar the largest owner of natural gas deposits, but also Turkmenistan and Uzbekistan have enormous gas reserves. But despite using coal in very small amounts, its CO2 emissions are high. Natural gas pollute less than oil and coal, but if released unburned it is very dangerous as a greenhouse gas. Iran relies upon its enormous resources of gas and oil (Figure 15) to support the “take-off” of its economy (Rostow, 1960).

Iran's total primary energy consumption, share by fuel 2013

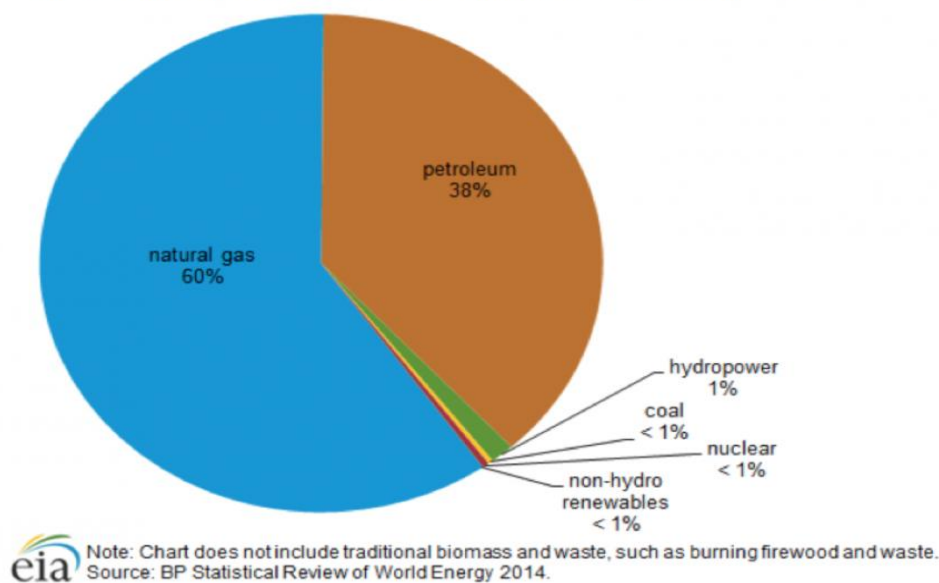


FIGURE 15.Iran: Energy mix

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Iran is far from the goals of the COP21 Treaty, relying to 95% upon fossil fuels. It face difficulties with all three major objectives of the UNFCCC: GOAL I, II and III. Iran needs foreign exchange to pay for all its imports of goods and services. Using nuclear power at home and exporting more oil and gas would no doubt be profitable for the country. And it would also help Iran with the COP21 goals achievement. Solar power parks are the best solution.

COP21 POLICY IMPLEMENTATION

The COP21 Treaty is just a set of promises that can be reneged upon at any time. The US has already defected and aims at becoming the global exporter No 1 of oil and gas in the near future by means of the new technology of fracking, which is detrimental to the environment. China promised to stem its CO₂ increases already 2016, but it now increases again. Germany and Australia appear to talk about some form of defection. And India would certainly renege without billions from the Super Fund. And South Korea has given up parts of its nuclear power program and bets on the LNG option instead, which Japan may also chose, although carbonization writ large.

To estimate the likelihood of the implementation of global de-carbonisation according to the COP21 Agreement, one needs to look at the standard energy projections among the global players – see Appendix 1.

The UNFCCC suggests a decentralized management strategy for de-carbonisation. Reflecting the enormous differences in available energy resources in the member states of COP21 Treaty, each government must develop a strategy for achieving Goal I, Goal II and Goal III. The COP 24 in Poland 2018 may wish to concentrate upon the following measures start credible de-carbonisation:

- 1) Phasing out coal power plants; convincing a few countries like India and Australia not to build new ones;
- 2) Replace wood coal with natural gas – small or large scale, stopping deforestation and the use of charcoal in households in poor nations, giving them free small gas ovens;
- 3) Turn some countries away from massive dam constructions towards solar power parks, like Brazil and India, as the environmental damages are too big;
- 4) Help some countries maintain their huge forests: Brazil, Indonesia, Malaysia, Russia, Congo, India, etc;
- 5) Abstain from expensive and unsafe carbon sequestration techniques in favour of electricity: solar power and electrical vehicles.
- 6) The promise of financial support – Super Fund –has to be clarified about both funding and budgeting. A management structure has to be introduced for oversight of the entire de-carbonisation process. As the emission of methane increases, the reduction of CO₂s is all the more important, if irreversibility is to be avoided with a margin.
- 7) The resort to atomic power plants is highly contested. Nuclear power gets safer and safer, but the problem of storing the used uranium has no solution yet, although Finland says it knows how. Old atomic plants could be made much safer in France and Germany for instance. Full scale climate change would be worse than single nuclear disasters.
- 8) Massive construction of solar power and wind power plants in all countries, as well as stimulate small scale solar power;
- 9) Solar power parks: How many would be needed to replace the energy cut in fossil fuels and maintain the same energy amount, for a few selected countries with big CO₂ emissions? Table 1 has the answer.

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Table 1. Number of Ouarzazate plants necessary in 2030 for COP21's GOAL II: (Note: Average of 250 - 300 days of sunshine used for all entries except Australia, Indonesia, and Mexico, where 300 - 350 was used).

Nation	Co2 reduction pledge / % of 2005 emissions	Number of gigantic solar plants needed (Ouarzazate)	Gigantic plants needed for 40 % reduction
China	none ⁱ	0	3300
India	none ⁱⁱ	0	600
Japan	26	460	700
South Korea	37	260	280
Philippines	70	70	40
Turkey	21	60	120
Indonesia	29	120	170
Saudi Arabia	none ⁱⁱ	0	150
Iran	4 – 12 ^{iv}	22	220
Kazakhstan	none ⁱⁱ	0	100
Turkey	21	60	120
Thailand	20 - 25 ^{iv}	50	110
Malaysia	none ⁱⁱ	0	80
Pakistan	none ⁱⁱ	0	60
Bangladesh	3,45	2	18
Australia	26 – 28	130	190
World	N/A	N/A	16000

Notes: i) The United States has pulled out of the deal; ii) No absolute target; iii) Pledge is above current level, no reduction; iv) Upper limit dependent on receiving financial support; v) EU joint pledge of 40 % compared to 1990

The USGCRP summarizes the evidence about the outcomes, if climate change continues:

“In addition to warming, many other aspects of global climate are changing, primarily in response to human activities. Thousands of studies conducted by researchers around the world have documented changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; and increasing atmospheric water vapor.”
(<https://science2017.globalchange.gov/chapter/executive-summary/>)

CONCLUSION

Comparing the energy demand plans of major Asian economies with the COP21 TREATY de-carbonisation steps for this century, one notes the enormous difference. Something has to give. The Asian economic miracles

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are still in “catch-up” stage, betting upon economic growth to make them close the gap to the. The Asian economic miracle is going to run into mega pollution from GHGs. Solar panel parks are the reply, and not carbon sequestration, suggested by the Asian Development Bank (ADB). The politics of global de-carbonisation (Conka, 2015; Vogler, 2016) has been underestimated, being conducive to illusions. Hawking irreversibility is a most real menace, the *climate chaos* threat. The COP21 project is not credible for global decarbonisation in this century

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GHG and energy sources:

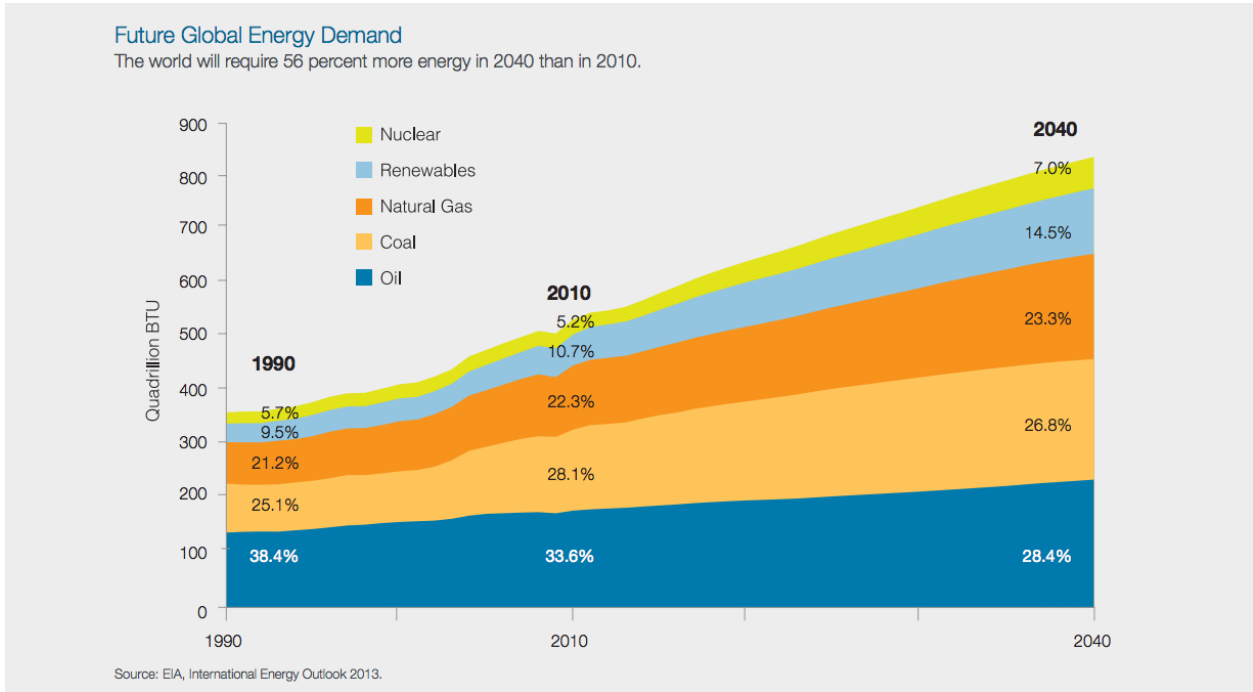
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APPENDIX 1

Energy Information Administration



British Petroleum

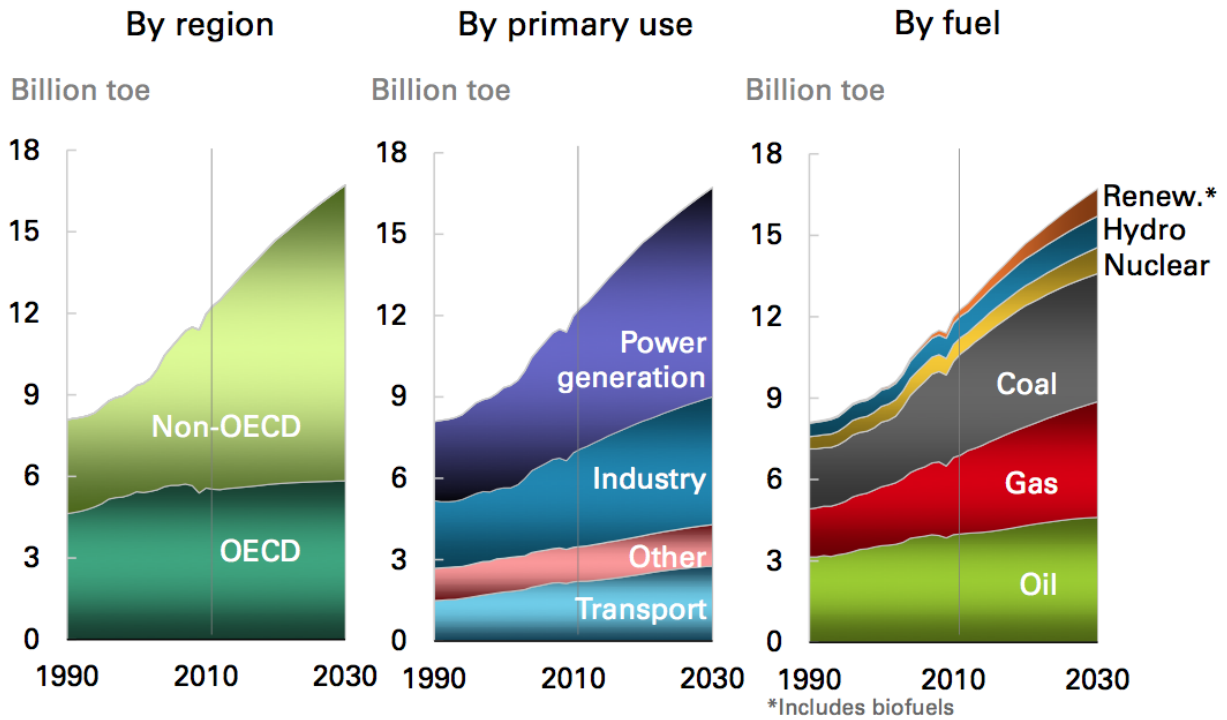




Figure 2.9 ▸ World primary energy demand by fuel and energy-related CO₂ emissions by scenario

