ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 07, Issue, 07, pp.13913-13918, July, 2017

ORIGINAL RESEARCH ARTICLE Open Access

THE NEW FOCUS OF DEVELOPMENT THEORY: ENERGY AND SOLAR POWER

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ARTICLE INFO

Article History:

Received 09th April, 2017
Received in revised form
24th May, 2017
Accepted 16th June, 2017
Published online 22nd July, 2017

Keywords:

Development Theory,
Old and New,
Decarbonisation, COP21 GOALS,
I, II, III; Ouarzazate Solar Power Parks,
Energy-Emissions Conundrum.

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ABSTRACT

The theory of development would have almost seemed to have lost its identity due to globalization. Several scholars from public administration and economics have stated that from now on the world is ONE and that the separation between the developed world and the developing countries lacks theoretical foundation. All countries strive for economic growth and all nations search political stability in one way or another, but typically by means of legal-rational authority. However, the new focus of development theory in the 21st century must be decarbonisation. Stephen Hawking warns about the irrevocability of global warming, which would hurt the developing countries terribly hard.

Citation: Jan-Erik Lane, 2017. "The new focus of development theory: energy and solar power", *International Journal of Development Research*, 7, (07), 13913-13918.

INTRODUCTION

Development theory has always had a special place in the political sciences and economic theory. Not only were there a set of courses, institutes and journal orientated towards the so-called developing countries, but a number of handbooks have been published on these two themes: a) development polities, and b) development economics. One may speak of three inspiration sources after the Second World War:

To

- Weber's bureaucracy model: ta make the state Western, restrain corruption and accomplish legal-rational authority: either rule by law ot rule of law;
- Rostow's model of the take-off: to allow the developing countries to urbanise and industrial by themselves, thus initiating automaticsocio-economic progress;
- Barro's model of catch-up: some of developing countries could be emerging economies, attaining such a high level of growth that they could close the distance to the develop world, like e.g. the Asian tigers.

As globalization began its evolution, the separation between two sets of countries – developing and developed – appeared to look inadequate or old-fashioned. The bureaucratic ideals were hardly met anywhere. Some Third World countries managed the take-off stage as well as the catch-up stage, whereas others merely fell into more poverty, criminality and anarchy. Why?. Especially in economics, it proved difficult to come up with a set of tenable development recommendations. They shifted from one of the world stareconomist to another, exercising influence over the policy-making in the World Bank and the IMF by sending graduate students to lucrative contracts with these organisations, together with WTO.

Over aperiod of some fifty years, the message about what constituted real development of Third World countries changed profoundly, from deep state intervention in the 1950s-1970s to neo-liberalism with the Washington Consensus in the1980-1990s. Then followed a period of putting the state back, but in the form of good governance. "Good governance" was never clearly defined, but it covered policies to restrain embezzlement and corruption over women empowerment to micro financing of family enterprises. Also democratization was launched as a development idea, but it was never clear whether it means rule of law and order, as in China, or rule by law and popular participation, as in India. Small wonder that some scholars concluded that development theory had mot established its own disciplinary identity, but could be taught as an integral part of general politics or economics, micro or macro.The arrival of the global warming crisis and the climate change phenomena change all of this. Now development theory must focus upon energy and emissions in poor and emerging economies and polities.

THE UNFCCC, COP21 and GLOBAL WARMING THEORY

The UNFCCC holds a new meeting this fall in Bonn with host country Fiji – the COP23. It has to find a way forward towards the implementation of the COP21 Treaty, although there is already one defection. The islands of Fiji fear of course the sea level rise attending global warming, as there is now a set of islands becoming inhabitable in the Pacific Ocean, like e.g. Tuvalu. But the dangers involved in the global warming process concern all countries on the globe in various forms of risks, immense one in reality. H. Kahn showed in 1962 by Thinking of the Unthinkable that one can scientifically theorize future scenarios with the inter alia one terrible outcome, namely the elimination of the human species. Nuclear deterrent has proved effective against this result, with the possible exception of North Korea. But its leader knows that if the country hurts surrounding nations, it will suffer a terrible punishment. Global warming is different, as there is no efficient halting process in place. Global warming theory has come of age. It entails the possibility of a process of continuous warming of the globe until irreversibility is arrived at. Then, humanity is finished forever, as Mother Earth enters a new stage in its giant evolutionary path over hundreds of millions of years. What must be done by international coordination is to set up and operate a common pool regime (CPR) that is capable to halt this climate change process in the 21rt century, and maybe reverse it. Is the UNFCCC framework this CPR? I doubt that.

One may distinguish between two parts in GWT, one much developed set of hypotheses bout the natural sciences' contribution to understanding climate change, and one poorly developed set of hypotheses about the difficulties in engaging in collective action, like the COP21 common pool regime (CPR) for decarbonisation. The first anticipation of the global warming mechanism was done by Frenchman J. Fourier in the early 19th century, but the theory was developed by Swedish chemist Arrhenius around 1895. He calculated that a doubling of CO2 ppm would be conducive to a 5 degree increase in global average temperature, which is not too far off the worst scenario for the 21rst century, according to UN expertise now.
Yet, it was not until Stephen Schneider published Global Warming in 1989 that the theory started to receive wide attention, no doubt strengthened by the work of Keeling in measuring CO2 ppm globally. Moreover, techniques for viewing the CO2 layer were developed, increasing the attention to climate change. Now, the UN reacted with creating a few bodies to look into the changes going on, one of which was the COP framework. The economists jumped in besides the natural scientists, worried about the future costs of this transformation of the atmosphere. On the one hand, Kaya and associates (1998) presented a model that explained CO2:s with energy and energy intensity of GDP. On the other hand, Stern (2007) called global warming the largest externality in human history, calling for international governance in order to stem the growth of greenhouse gases. Stern outlines a number of activities aimed at reducing CO2 emissions, promising also a Super Fund to channel money from rich advanced nations to poor countries and developing economies. As little has been done through the UN system of meetings and agencies up to date, Stern (2015) later asked: "What are we waiting for?"

All theories need confirmation. When the polar ice mountains began to collapse, it seemed decisive evidence for the global warming theory. Other important test implications like glacier retreats everywhere, ocean warming and acidification as well as desertification in Africa also gave support for global warming theory. Denials of climate change appear more and more unfounded, although it is true that more of CO2 may benefit some fauna or environment niches. Considering the probable damages from global warming, it is astonishing that global warming theory has not been better recognized or even conceptually developed or empirically corroborated.. 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:

- Huge land losses along the costs;
- Too high temperatures for men and women to work outside;
- Food production decline;
- Fish harvest decrease;
- Droughts and starvation;
- Lack of fresh water supply;
- Drying up of rivers, affecting electricity supply;
- Ocean acidification and species extinction;
- Highly volatile climate with tremendous damages.

This list is far from complete or exhaustive. One could even mention worse outcomes, like the transformations of warm and cold currents in the oceans. What one may underline is that so far no known negative feedback has been found that could stem global warming naturally. We have only positive feedbacks, meaning outcomes reinforce each other in the same direction.

THE PROBLEMATIC: Constantly Increasing Energy Needs

To have a firm foundation for understanding the immense increase in CO2 emissions the last two decades, we resort to the Kaya model, linking CO2:s with energy and affluence. One basic theoretical effort to model the greenhouse gases, especially CO2:s, in terms of a so-called identity is the deterministic Kaya equation. The Kaya identity, "I = PAT" – model type, describes environmental (I)mpact against the (P)opulation, (A)ffluence and (T)echnology. Technology covers energy use per unit of GDP as well as carbon emissions per unit of energy consumed (Kaya and *Yokoburi*, 1997).

In theories of climate change, the focus is upon so-called anthropogenic causes of global warming through the release of greenhouse gases (GHG). To halt the growth of the GHG:s, of which CO2:s make up about 70 per cent, one must theorize the increase in CO2:s over time (longitudinally) and its variation among countries (cross-sectionally). As a matter of fact, CO2:s have very strong mundane conditions in human needs and social system prerequisites. Besides the breading of living species, like Homo sapiens for instance, energy consumption plays a major role. As energy is the capacity to do work, it is absolutely vital for the economy in a wide sense, covering both the official and the unofficial sides of the economic system of a country. The best model of carbon emissions to this day is the so-called Kaya model. It reads as follows in its standard equation version – *Kaya's identity*. (E 1) 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 TeraWatt year." (http://climatemodels.uchicago.edu/ kaya/kaya.doc.html)

Concerning the equation (E 1), it may seem premature to speak of a law or identity that explains carbon emissions completely, as if the Kaya identity is a deterministic natural law. It will not explain all the variation, as there is bound to be other factors that impact, at least to some extent. Thus, it is more proper to formulate it as a stochastic law-like proposition, where coefficients will be estimate using various data sets, without any assumption about stable universal parameters. Thus, 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 for empirical research on global warming, the following 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 data from some 59 countries. I make an empirical estimation of this probabilistic Kaya model - the cross-sectional test for 2014:

(E4) k1= 0,68, k2=0,85, k3=0,95, k4=0,25;R2= 0,895.

Note: LN CO2 = k1*LN (GDP/Capita) +k2*(dummy for Energy Intensity) + k3*(LN Population) + 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). The Kaya model findings show that total CO2:s go with larger total GDP. First, we see that CO2 emissions are closely connected with energy consumption, globally speaking. And the projections for energy augmentation in the 21st century are enormous (EIA, BP, IEA). Figure 1 shows how things have developed since 1990.

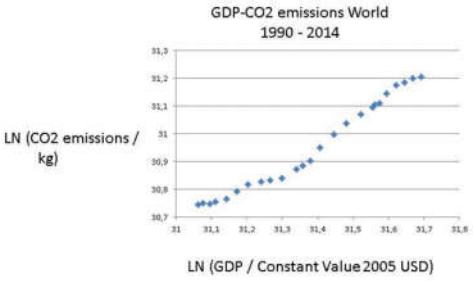

Figure 1. GDP – CO2 emissions

To make the dilemma of energy versus emissions even worse, we show in Figure 2 that GDP increase with the augmentation of energy per capita. Decarbonisation is the promise to undo these dismal links by making GDP and energy consumption rely upon carbon neutral energy resources, like modern renewables and atomic energy.

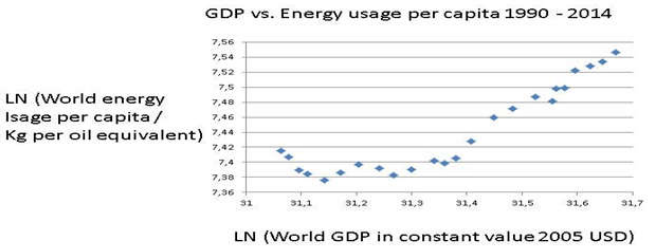

Figure 2. GDP against energy per person (N = 59)

Thus, we arrive at the energy-emissions conundrum: GDP growth being unstoppable requires massive amounts of energy that results in GHC:s or CO2:s. The only way out of this dilemma is that renewables become so large and effective in a short period of time decarbonisation becomes feasible or likely, not merely desirable.

SOLAR POWER PLANTS

Let us examine what this hoped for reduction of fossil fuels implies for the augmentation of renewable energy consumption, here solar power. The use of atomic power is highly contested, some countries closing reactors while others construct new and hopefully safer ones. I here bypass wind power and thermal power for the sake of simplicity in calculations. Consider now Table 1, using the giant solar power station in Morocco as the benchmark – 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?. Enormous numbers, the Third World would argue against the First World. As little has been done through the UN system of meetings and agencies up to date, Stern (2015) later asked: "What are we waiting for?"Reply: his promised Super Fund! All these countries above except China need financial and technological assistance It is time for THE COP21 to start moving. Allow me to doubt that the UNFCCC or the COP21-22 are aware of the immensity of the task of implementing GOAL II until 2030. Several countries will find even GOAL I hard to fulfill! The COP23 must urgently clarify how such enormous amounts of solar power can be achieved by 2030 – plan or spontaneous order?

Table 1. Number of Ouarzazate type solar plants for decarbonisation 2030 in Third World countries

Nation	Co2 reduction pledge / % of 2005 emissions	Number of gigantic solar plants needed (Ouarzazate)	Gigantic plants needed for 40 % reduction
China	none[1]	0	3300
India	none[ii]	0	600
Brazil	43	180	170
Indonesia	29	120	170
Mexico	25	120	200
Russia	none[1]	0	940
Argentina	none[ii]	0	80
Peru	none[ii]	0	15
Uruguay	none[ii]	0	3
Algeria	7 - 22[1]	8	50
Egypt	none[ii]	0	80
Senegal	5 - 21	0,3	3
Ivory Coast	28-36[iv]	2	3
Ghana	15 – 45[iv]	1	3
Angola	35 – 50[iv]	6	7
Kenya	30[iv]	3	4
Botswana	17[iv]	1	2
Zambia	25 – 47[iv]	0,7	1
South Africa	none[ii]	0	190
Algeria	7 - 22[1]	8	50
Egypt	none[ii]	0	80
Senegal	5 - 21	0,3	3
Ivory Coast	28-36[iv]	2	3
Ghana	15 – 45[iv]	1	3
Angola	35 – 50[iv]	6	7
Kenya	30[iv]	3	4
Botswana	17[iv]	1	2
Zambia	25 – 47[iv]	0,7	1
South Africa	none[ii]	0	190
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

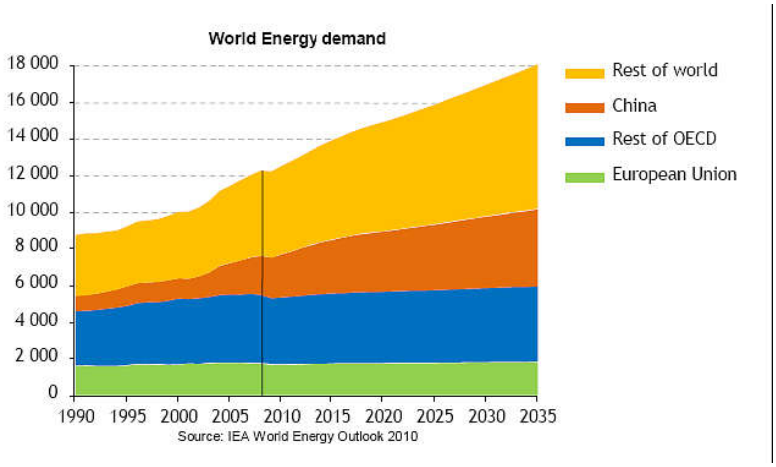

Figure 3. Future energy demand (IEA projection)

Table 2. Energy consumption 2015 (Million Tons of oil equivalent) Total %

Fossil fuels	11306,4	86,0
Oil	4331,3	32,9
Natural Gas	3135,2	23,8
Coal	3839,9	29,2
Renewables	1257,8	9,6
Hydroelectric	892,9	6,8
Others	364,9	2,8
Nuclear power	583,1	4,4
Total	13147,3	100,0

Source: BP Statistical Review of World Energy 2016

Such an enormous energy transformation can only be made by the use of market initiatives and incentives (Barry, 1982; Hayek, 1991), but governments must put down the fundamental rules of the game for the promotion of renewables: subsidies, charges or taxes? The best would be common international regulation, as otherwise each country may chose its special way (Ramesh, 2015).

DISMAL SCIENCE: Rejection of Sach's Moralism

World star economist J. Sachs preaches this message (Sachs, 2015), but it is only ethics. Economics is, as Carlyle said, a "dismal science", analyzing the IS and not the OUGHT. And the Malthusian predicament is with us with a vengeance in the form of the energy-emissions conundrums. Insisting upon the positive nature of economics, "positive" referring to the understanding and prediction of the IS, one cannot but realize that sustainable development theory deals with the OUGHT. The gulf between normative utopia and harsh reality forces one to look for how adherents of sustainable economics get from realities to vision. Take the example of Sachs, stating about SDG (sustainable development goals):
… the SDGs need the identification of new

critical pathways to sustainability. Moving to a low-carbon energy system, for example, will need an intricate globalinterplay of research and development, public investments in infrastructure (such as high-voltage direct current transmission grids for long-distance power transmission), private investments in renewable power generation, and new strategies for regulation and urban design. The task is phenomenally complex. But Sachs does not inform us how something so "phenomenally complex" is to come about, going from the IS to the OUGHT. He continues:

Market-based strategies (such as carbon taxation) can help to simplify the policy challenge by steering private decisions in the right direction, but politics, planning, and complex decision making by many stakeholders will be unavoidable.

Source: 2210 www.thelancet.com Vol 379 June 9, 2012

Of course, but what is the likelihood that a carbon tax can be put in place (where, how much) as well as how large is the probability that planning works? Only wishful thinking! Sachs realizes the gap between desirability and feasibility, but he confronts the gap by almost religious beliefs:

The SDGs will therefore need the unprecedented mobilisation of global knowledge operating across many sectors and regions. Governments, international institutions, private business, academia, and civil society will need to work together to identify the critical pathways to success, in ways that combine technical expertise and democratic representation. Global problem-solving networks for sustainable development— in energy, food, urbanisation, climate resilience, and other sectors— will therefore become crucial new institutions in the years ahead.

Source: p. 2210, www.thelancet.com Vol 379 June 9, 2012

What is at stake for most people who understand the risks with climate change is not the desirability of decarbonisation in some form or another. They crux of the matter is feasibility: How to promote decarbonisation so that real life results occur? The real obstacles for any decarbonisation project stem from the logic of collective action, if we stick to the social sciences, as ethically neutral and truthfully objective. The energy-emissions conundrum is probably unresolvable until fusion power arrives! Actually, the dominant opinion in the social sciences and economics towards climate change has been skepticism about its claims, if not outright rejection. On the one hand, political scientist Aaron Wildavsky linked global warming theory to environmentalism, which he regarded as the leftist ideology of an anti-capitalist movement: "Global warming is the Mother of environmental scares", declared Wildavsky (1997). On the other hand, Julian Simon (2002) questioned the economic foundation of climate change as well as environmentalism in general. If the ecologists were right, there would be scarcity of basic resources in the world. But prices on raw materials keep falling, noted Simon. Today, one may speak of two currents of social science theory that are highly relevant: *Implementation theory*: In the discipline of public administration and policy-making, some ideas about the so-called "implementation gap" – *Wildavsky's hiatus* – are highly relevant to the COP21 project (Pressman and Wildavsky, 1973, 1984).
The COP21 has three main objectives: halt CO2 increases by 2018-2020 (GOAL I), decrease CO2 emissions considerable by 2030 (GOAL II) and achieve full decarbonistion by 2070-80 (GOAL III). But how are they to be implemented? No one knows, because COP21 has neglected what will happen after the major policy decision. The COP21 project outlines many years of policy implementation to reach decarbonisation, but which are the policy tools? *Game theory*: A CPR is vulnerable to the strategy of reneging, as analysed theoretically in the discipline of game theory. The relevant game for the CPR is the PD game, where the sub game perfect Nash equilibrium is defection in finite rounds of play of this game – backwards induction (Dutta, 1999). This is not recognized by Elinor Ostrom (1990) in her too optimistic view about the viability of CPR:s. It is definitely not the case that Ostrom has overcome Hobbes ("covenants are in vain and but empty words; and the right of all men to all things remaining"), as one commentator naively declared when she was awarded both the Nobel prize and the Johan Skytte prize (Rothstein' website 2014). The COP21 project is a CPR that may well fail, either due to defection or lack of management resources and skills.

Conclusion

Insufficiency Thesis

The entire UNFCCC runs with a basic *insufficiency*, making it too weak to respond to the climate change challenge that could bring about a worst case scenario for mankind. Scholars have shown that the UN climate decision-making is highly manipulated by self-interests from the major powers (Conca, 2015; Vogler, 2016). The ideas of using climate change policy-making to solve other problems like poverty, global redistribution of wealth and stopping general environment degradation make matters just more complicated, resulting in massive transaction costs and likely policy failures**.** One may employ some standard sources on energy consumption and what is immediately obvious is the immensely huge numbers involved – see Table 2. The likelihood of disaster is on the increase, which is why I have written many articles on climate change and intergovernmental coordination. It is not probable that solar energy can both replace lots of fossil fuel and wood

coal energy as well as provide for the planned increased demand – see Figure 3. More of energy in Figure 3 leads to CO2 emissions, as the demand for solar power energy will surely outpace the supply of solar power plants, according to the calculations in Table 1. Something has to give. I much fear it will be climate stability and not socio-economic development or economic growth..

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NOTES

[1] No absolute target
[1] Pledge is above current level, no reduction
[1] Upper limit dependent on receiving financial support
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