Paper prepared for the
Euroacademia Global Forum of Critical Studies
Asking Big Questions Again

Prague, 13 – 15 December 2012

This paper is a draft
Please do not cite

CRITICAL COMPARISON OF "GREEN GROWTH" AND "CARBON FOOTPRINT" THEORIES: ANALYZING THE PRACTICES OF INTRODUCTION OF OPEN LOW-CARBON INNOVATIONS AS AN INSTRUMENT FOR CLIMATE STABILIZATION

Oleksiy Savkevych, Svitlana Bespalova, Mykola Shestavin
Donetsk National University, Donetsk, Ukraine

Annotation:
Comparing the results of implementation in different countries of "green growth" and "carbon footprint" theories shows the validity of the conclusions put forward in the almost forgotten report by the Club of Rome "Limits to Growth". Modern development of the economy, energy sector and environment is based on the conclusions stated in the report by Nicholas Stern "The Economics of Climate Change" and the research conducted by McKinsey & Company, who propose a switch towards the "green" economy through implementation of low-carbon technologies in all spheres of human activity. These technologies can provide sustainable economic growth, but in case of their large-scale implementation in the countries of the world the problem is that they do not actually take account of "carbon and ecological footprint" at all the production stages – from manufacturing to exploitation. Some case studies of implementation of renewable energy technologies and the technologies for carbon capture and storage (CCS) are used to demonstrate a contradiction between economic growth and environmental (climatic) consequences of their implementation. It is proposed to switch to open innovation principles in order to involve the whole mankind into solving the issues of climate stabilization. The necessity of returning to the paradigm of "limits to growth in all spheres of human activity" as an alternative way of human development is substantiated.

Key words: Green growth, carbon footprint, Limits to growth, Low-carbon technologies, Renewable energy sources, Carbon capture and storage, open innovations

---

The study was carried out within the Grant Contract No. DCI/ENV 2010/243-865
"Low-Carbon Opportunities for Industrial Regions of Ukraine"
implemented by Donetsk National University and
funded by the European Union (www.lcoir-ua.eu)

Introduction

In most countries of the world the issues of climate change adaptation and mitigation have become recently the top priority of the economic development. In order to realize the transition of national economies to this model, the strategies of the so-called "green" economy based on the idea of "green growth" [1] are developed. According to them, the paradigm of development is the maximum profit and free competition, while the direction of development is upgrading or creating of new enterprises through introduction of low-carbon technologies that allows minimizing the impact on the environment and climate.

In parallel, the idea of "carbon footprint" [2] for enterprises, cities, communities, families and individuals is developed, allowing to estimate the contribution of any activity (both individual and collective) to global warming by calculating the greenhouse gas emissions that are released to the atmosphere in the result of this activity. While such calculations are approximate, they show an overall picture of the impact of a particular person, event or production on global climate.

So far, these two ideas have been developing in parallel without overlapping on specific issues of economic development of the countries: industrialists are reporting on reduction of greenhouse gas emissions at their plants, while environmental activists are trying to prove the increase of emissions having only indirect evidence of their value. The role of the government in this process should be to obtain real data from enterprises, process them and make them public.

Similar studies of global development models were conducted in the 70's of the past century and their conclusions were enunciated in almost forgotten reports by the Club of Rome “Limits to Growth” [3] and “Beyond the Limits of Growth” [4], where the following basic parameters were considered: economic growth and population growth in conditions of limited natural resources. Conclusions about the need to change the paradigm of development in order to prevent the predicted “collapse” in fact were ignored by politicians who only introduced the new term “sustainable development” while continuing making every effort to ensure an economic growth (currently – a “green” growth) of their countries.

This policy has led to the emergence of the global climate change problem, which is currently being solved using the old economic methods highlighted in the report by Nicholas Stern “The Economics of Climate Change” [5] and research by McKinsey & Company [6], offering a transition to “green” economy through the introduction of low-carbon technologies in all spheres of human activity.

The study of contradictions

Low-carbon technologies are practically all technologies, the application of which will result in reduction of greenhouse gas emissions as compared to technologies previously used in the industry. But these new technologies often lead to an increase in production costs, which influences a consumer (directly – through increased prices, or indirectly – though obtaining of subsidies from the state). Implementation of low-carbon technologies on a voluntary basis could hardly be realized (as most companies follow the dominant paradigm of maximizing their profits), therefore the state typically uses two methods to intensify the “green” growth:

- a fiscal one, introducing a tax on excessive greenhouse gas emissions or excessive consumption of energy, resources, etc.
- an incentive one, introducing subsidies for implementation and benefits for the use of such technologies.

It is almost impossible to predict social and economic consequences for a particular country due to the uncertainty of private business reaction on these intensification methods. Some studies of this reaction have been performed in Europe in recent years. For example, the change in private employment in relation to a 1%-increase in tax on energy consumption was studied [7]. It turned out that the average employment change was -0.25% (overall decrease in employment), while the maximum reduction of -1.25% was observed in air transport, followed by a lesser extent of reduced employment in production of office equipment, building constructions, electrical and radio equipment, cars, etc. However, employment increased to +0.4% in production of textiles, apparel, wood products, metal, plastic, cement, etc.

A comparison of the dependence between the value of greenhouse gas emissions in various sectors of activity and the added value from the number of people employed in this sector, performed in 27 OECD countries [8], indicates a trend according to which the industries being the major source of greenhouse gas emissions – energy, metal and chemical plants – are moved out the countryies. These enterprises are transferred to third countries, where there is no strict legislation on the volume of greenhouse gas emissions and a cheap labor force exists. A transport sector, which is one of the main pollutants, is forced to upgrade in the direction of “green” vehicles, because there is no way to change its location. As a result, unemployment is increasing in these countries, while the third countries become “the main culprits” of air pollution, greenhouse gas emissions and climate change.

Such public policy can provide a temporary stable economic growth, but in case of large-scale implementation of these technologies, the problem is that they do not actually take account of

"carbon and ecological footprint" at all the production stages – from manufacturing (the majority of components are manufactured in third countries) to exploitation.

Case Studies: Renewable Energy Sources

A number of case studies dedicated to introduction of Renewable Energy Sources [9-11] is used to show a contradiction between economic growth and environmental (climate) impact of their implementation. Widespread use of these technologies is expected to reduce CO_2 emissions in 2050 by 21%, which, along with introduction of other low-carbon technologies will reduce by 2050 the expected volume (without the use of low-carbon technologies) of CO_2 emissions of 62 Gt / year by 14 Gt / year, which corresponds to half of the CO_2 emissions in 2005 [12].

What it is not taken into account is the fact that development of wind energy needs considerable expenditures of cement (for supports) and metal (power and electrical constructions), as well as transportation over long distances. All of these procedures of creating wind turbines require a considerable amount of energy and resources that is taken into account when determining the value of the facilities, but not included in the reports concerning the replacement of traditional power generation capacities.

It is necessary to introduce the concept of "resource payback" by analogy with the concept of financial return on investment projects, which will characterize the period of wind turbine work, needed to compensate for the greenhouse gases that were released to the atmosphere during its manufacture, transportation, installation and commissioning.

Similar concepts can be applied to other sources of renewable energy: solar energy of all kinds, geothermal and hydro power, etc. It is also possible to use an already introduced concept [13] of an "environmental footprint", consisting of three components:

- Ecological footprint, measured by the area of contaminated land taken out of agricultural, municipal and domestic use;
- Carbon footprint – the volume of greenhouse gas emissions, and other pollutants;
- Water footprint – volume of contaminated water unfit for human use and production.

The ecological footprint can also be divided into the so-called material footprints:

- Mineral footprint, meaning the removal of metals, non-fuel minerals, building materials, etc from the land;
- Chemical footprint is the production of biopolymers, petrochemical products and other chemical products;
- Energy footprint – the use of renewable energy sources (wind, sunlight, underground heat, etc.), fossil fuels, minerals, fuels and other energy sources.

And if all of these FOOTPRINTS are considered together, their convergence will result in socioeconomic footprint, which is directly related to the man: his employment, health and population. And this is actually a repetition of well-known models of global development [3], realized in other terms, and the solution of these models under different scenarios provides the prospect of global climate change [14].

Case Studies: Carbon Capture and Storage

A similar situation exists in the sphere of widespread adoption of Carbon Capture and Storage (CCS) technologies [15-17], which should lead to a 19% reduction of CO_2 emissions in 2050 from the expected (without the use of low-carbon technologies) CO_2 emissions volume of 62 Gt / year

[12]. Introduction of CCS technologies will rise the price of electricity by an average of 30 % (energy footprint), as well as will leave uncertain at the moment "ecological footprint" – as a result of land use for transporting and geological storage of CO_2, and "chemical footprint" associated with the use of various chemical methods for CO_2 capture. These implications of CCS technologies deployment require careful research when choosing a source where CO_2 will be captured and specific sites for CO_2 geological storage.

The role of intellectual property

The important role in solving the problems caused by climate change belongs to the international system of intellectual property protection, which often prevents the transfer of low-carbon technologies to developing countries [18-20]. Developing countries are currently becoming the main producers of "dirty" products, as far as the developed countries raised highly their standards of quality of life; as a result important, but "dirty" productions are transferred to third countries where there are no strict rules for environmental protection. Such operations bring more profit to owners of these "dirty" industries and they are not interested in their voluntary modernization, which requires significant financial costs.

Also the modernization of "dirty" technologies used by local entrepreneurs in developing countries is hampered by the international system of intellectual property protection, when the transition to any "clean" technology requires the acquisition of intellectual property rights (even non-exclusive). Using the principles of "open innovations" in deployment of low-carbon technologies in developing countries can contribute to solution of global climate problems [20]. If all the known (patented) low-carbon technologies are provided the status of open innovations, this will be the main tool for solving the problems of climate stabilization.

Recommendations for development prospects

Today's global challenges pose new problems before the mankind, which in its development have approached or already crossed the "point of no return". One of the important problems is the prospect of global climate change, which can lead to acute political and socio-economic conflicts both within any state and between the countries.

All attempts undertaken currently within the old social values have not resulted in any decrease in volumes of greenhouse gases – they continue to grow on a global scale, although some states have managed to reduce CO_2 emissions over the last 10 years.

A variety of low-carbon technologies have currently been developed and partially implemented, and in case of their large-scale deployment they could solve the problem of halving CO_2 emissions in 2050 compared to 2005. But this is prevented by the international copyright protection system, which should be restructured according to the principles of "open innovations" in order to promote the diffusion of low-carbon technologies to developing countries.

Adoption of the post-Kyoto agreement which is currently being discussed would hardly lead to significant reductions in emissions of greenhouse gases on a global scale as the agreement is based on the principles of obtaining profits in any situation; therefore, it is necessary to find new (old) principles of influencing the consumer society, which is based on consumption growth (even if the growth is "green").

Time has come to return to the paradigm of the "limits to growth in all spheres of human activity" as an alternative path of human development.

Literature

1. Inclusive Green Growth: The Pathway to Sustainable Development. - The World Bank, Washington, 2012. - 174 pp.
2. Bagchi D., Biswas S., Narahari Y., Suresh P., Lakshmi L.U., Viswanadham N., Subrahmanya S.V. Carbon Footprint Optimization: Game Theoretic Problems and Solutions. - ACM SIGecom Exchanges, Vol. 11, No. 1, 2012. - P. 34-38.
3. Meadows D.H., Meadows D.L., Randers J., Behrens III W.W. The Limits to Growth. - Universe Books, 1972. - 205 pp.
4. Pestel E. Beyond the Limits to growth: a report to the Club of Rome. - Universe Books, 1989. - 191 pp.
5. Stern N. / The Economics of Climate Change: The Stern Review. - Cambridge, UK: Cambridge University Press, 2007. - 662 pp.
6. Impact of the financial crisis on carbon economics: Version 2.1 of the Global Greenhouse Gas Abatement Cost Curve. - USA: McKinsey & Company, 2010. - 14 pp.
7. Commins N., Lyons S., Schiffbauer M., Tol R.S.J. Climate policy and corporate behaviour. - The Energy Journal, Vol. 32, No. 4, 2011. - P. 51-68.
8. Towards Green Growth. - OECD Publishing, 2011. - 146 pp.
9. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (Eds)]. - Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2012. - 1075 pp.
10. Evaluating Policies in Support of the Deployment of Renewable Power. - Abu Dhabi, United Arab Emirates: IRENA Secretariat, 2012. - 24 pp.
11. Renewable Energy Jobs & Access. - Abu Dhabi, United Arab Emirates: IRENA Secretariat, 2012. - 80 pp.
12. Energy Tachnology Perspectives 2008: Scenarios & Strategies to 2050. - International Energy Agency, 2008. - 646 pp.
13. Anderson D.J. A Communications & Outreach Perspective / Critical Elements for New Energy Technologies: An MIT Energy Initiative Workshop Report, April 29, 2010. - Massachusetts Institute of technology, USA, 2010. - P 138-142.
14. Climate Change 2007: Synthesis Report // Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Core Writing Team, Pachauri, R.K. and Reisinger, A. (Eds.). - IPCC, Geneva, Switzerland, 2007. - 104 pp.
15. IPCC Special Report on Carbon Dioxide Capture and Storage [B. Metz, O. Davidson, H. de Coninck, M. Loos and L. Meyer (Eds.)]. - Cambridge University Press, UK, 2005. - 431 pp.
16. Technology Roadmap – Carbon Capture and Storage. - International Energy Agency, 2010. - 52 pp.
17. The Global Status of Carbon Capture and Storage: 2012. - Canberra, Australia: Global CCS Institute, 2012. - 218 pp.
18. Cannady C. Access to Climate Change Technology by Developing Countries: A Practical Strategy. - International Centre for Trade and Sustainable Development, Geneva, Switzerland, Issue Paper No. 25, 2009. - 44 pp.

19. Rimmer M. Intellectual Property and Climate Change: Inventing Clean Technologies. - Edward Elgar Publishing, 2011. - 495 pp.

20. Krishna R.S. Role of Open Innovation Models and IPR in Technology Transfer in the Context of Climate Change Mitigation / Diffusion of Renewable Energy Technologies: Case Studies of Enabling Frameworks in Developing Countries - Technology Transfer Perspective Series [J. Haselip, I. Nygaard, U. Hansen, E. Ackom (Eds.)]. - UNEP Riso Centre, Denmark, 2011. - P. 147-158.