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RENEWABLE ENERGY SOURCES AND THIRD GENERATION UNIVERSITY

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ABSTRACT

Since the beginning of the 21st century, entrepreneurs are able to use the innovations at the universities in order to set up their own business. That collaboration is part of the concept of the "Third Generation University". The aim of this paper is to outline some possibilities for innovative business development in the Ruse region, Bulgaria that are aimed at supporting technostarters who use biomass for energy production. It describes the need of renewable energy sources in EU context, gives some arguments in university support to entrepreneurs and describes an example of the collaboration of Ruse University with a company that uses biomass for energy production.

Keywords: *Renewable Energy Sources, Technostarters, Third Generation University*

RENEWABLE ENERGY SOURCES AND THIRD GENERATION UNIVERSITY

INTRODUCTION: THE NEED OF RENEWABLE ENERGY SOURCES

The presence or lack of natural sources is a constant factor for the development of national economies and their links to their international economic relations, as they are both the sources and the limits of economic development. According to Kunev (2006) it means that the economy stays constantly dependent on scare resources.

The increased attention to scare sources, the ecology issues and the multiplication of the negative effects to the population have been the fundament of many studies which aim to develop a long term strategy in search of a solution of the limited sources supply. These studies underline the main aspects of the social-economic activities that achieve long term protection and preservation of the vital elements and areas of natural environment.

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For the first time these issues were systematically addressed in 1972 in the first Club of Rome report, headed by Aurelio Peccei, with an alarming content. This first Club of Rome report, written by a group of researchers from the Massachusetts Institute of Technology in Cambridge, Massachusetts, was the well-know "The Limits to Growth". It was published in 1972 and after two updates in 1992 and 2004, it still remains a benchmark for everyone who is committed to the issue of the future. "The Limits to Growth" was followed by more than 40 other Club of Rome reports, centered on different topics to help build the basis for a sustainable and suitable future (Club of Rome, 2008a).

The report is a warning of coming global catastrophes, based on the following discoveries (Papazov, Papazov & Pavlov, 2003):

- the global population growth is too high in view of scarce resources and pollution effects;
- the natural sources are too scare to supply what people need;
- there is a rapid growth of energy demand and the use of energy sources;
- there is a serious threat of a total pollution of the nature;
- the interactions of these trends is particularly threatening. Each trend is very threatening; the combination is disastrous.

The report's scenario shows clearly that if the "business as usual" continues, the planet will end in a disaster. To improve the understanding of these inter-related issues, which will determine the future of humanity, the Club of Rome launched in 2008 an integrated programme for international research, consultation and outreach to world leaders and to the public; this programme will identify the strategies and actions needed to achieve "A New Path for World Development" (Club of Rome, 2008b).

The political responsibility of the 'Club of Rome challenge' was formed in 1987 by the United Nation World Commission on Environment and Development (UNWCED) in the so called Brundtland Report "Our Common Future". It gives the conception for sustainable development as a mean to guarantee acceptable conditions for life style for the present and future generations. According to this report, the sustainability is "*development that meets the needs of the present world without compromising the ability of future generations to meet their own needs"* (Henriques & Richardson, 2004).

At the end of 20st century, the world entered upon a new stage - "eco-social-marketing economy of tertiary informational type, integrated in the world nets…it is a transition to a system, that balances the economic growth, the limitations of the social polarization in the society and ecology

environment" (Kunev, 2006). Our economic system is based on many sources; one of them is energy, which is widely used in all sectors.

The regional balance and more exactly the *Balance of Spatial Development,* is determined by social, economical and natural elements. The changes in these elements have a direct influence on the regional balance. The Spatial Regional Balance attempts to reveal the potential harmony both in each economic sector and between them in a fixed space, but also between all regional unites in a territorial complex. Nowadays the ecological and social elements of the balance are increasingly managed through economic instruments (Kirova, 2008).

The energy consumption of the European Union grows and the union becomes increasingly dependent on energy import from other countries. Unfortunately it is a constantly increasing trend that scares many people and organisations. At the same time, there are many requirements to the energy sector about eco protection. A significant step to face the energy needs of the future generation was set in 1997 by the White Book for the Renewable Energy Sources, which contains a strategy of their usage. In 2000 there is a new edition – the Green Book, which is related to the security of the energy production. Both books give a tremendous attention to the development of the usage of the renewable energy production (Kaneff, 2007).

It is necessary to provide the business community with long term stability demands in order to make rational investment decisions in the renewable energy sector so as to put the European Union on track towards a cleaner, more secure and more competitive energy future. The objectives set out can only be achieved by significantly increasing the contribution from renewable energy sources in all Member States in electricity generation and transport, and in the heating and cooling sector. The challenge is huge, but the proposed target can be achieved with determined and concerted efforts at all levels of government assuming the energy industry plays its full part in the undertaking. (Commission of the European Communities, 2008)

In the beginning of 21st century the share of the Renewable Energy Sources (RES) in the total EU energy consumption is about 6%, while the total share of petrol fuels, coal and natural gas is about 79% and the share of the nuclear power electricity is 15%). Half the energy sources necessary to satisfy the EU energy consumption are domestic; the other 50% are imported. If the EU trends in energy production remain the same in the next 20-30 years, then the share of mineral fuels will be even more dominant (86%); the nuclear power electricity will be 6%, while the share of the RES will rise to 8%. Besides, it is expected that the share of imported energy sources will reach 70% from the total energy supply and most of it will be petrol - about 90%. (European Commission, 2008a)

The development of renewable energy - particularly the energy from

wind, water, solar power and biomass - is a central aim of the European Commission's energy policy. There are several reasons for this (European Commission, 2008a):

- Renewable energy has an important role to play in reducing Carbon Dioxide (CO_2) emissions - a major EU objective.
- Increasing the share of renewable energy in the energy balance enhances sustainability. It also helps to improve the security of energy supply by reducing the EU's growing dependence on imported energy sources.
- Renewable energy sources are expected to be economically competitive with conventional energy sources in the medium to long term.

The way forward for the EU is an integrated energy and climate change policy, as the burning of fossil fuels is a major contributor to climate change. EU leaders endorsed such a policy in March 2007. This demonstrates Europe's global leadership in tackling climate change while paving the way for the EU to increase its security of supply and strengthen its competitiveness. To underline its determination and set an example for its partners to follow, the EU has agreed to cut its own greenhouse gas emissions by at least 20 % by 2020 regardless of what other countries do (European Commission, 2007a). Also, the renewable energy sources an important part of the solution towards a sustainable energy future. The European Union has therefore made a commitment to raise the share of renewable energy to 20% by 2020 as well as to increase the level of biofuels in transport fuel to 10% by 2020 (European Commission, 2007b).

In the context of the common EU policy, there are many efforts for the reduction of the climate change and the development of a common energy policy. The target is to increase the share of renewable energy supply and reach 20% from all energy consumption in 2020 in compare to 8,5 % in 2005 (see Fig.1). In order to achieve this goal, each EU member state is expected to increase the renewable energy production and use it for electricity, heating, cooling and transport.

The European Union had signed up through the Kyoto Protocol to reduce the emission of gasses with hothouse (or greenhouse) effects with 8% until 2008-2012, and yet, in the years after signing the document, nothing significant has happened. Germany was one of the countries, which took the commitments seriously, imposing a very ambitious objective for the reduction of gasses with hothouse effect with 21% (Stefanescu, 2008).

Renewable energy has three different applications: electricity generation, heating and cooling, biofuels for transport (see Table1). These three applications represent different technological processes and industrial sectors.

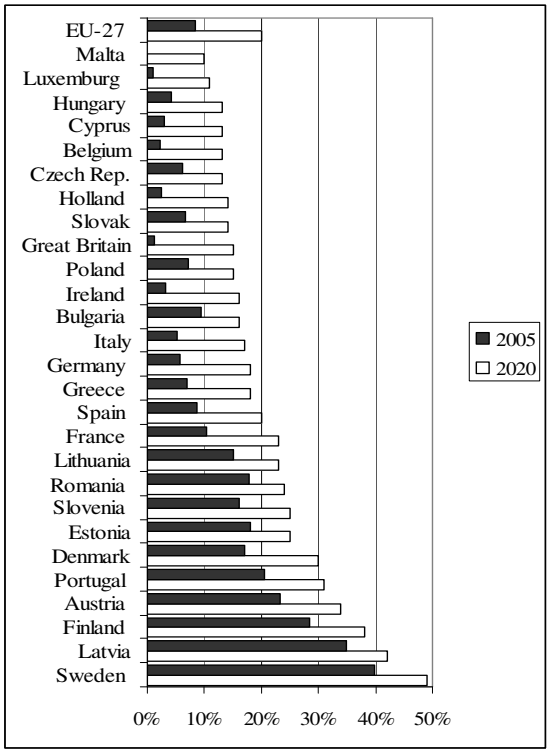

Figure 1: Share of Renewable Energies in Primary Energy Consumption of EU Countries in 2005 and Goals for 2020

Source: Commission of the European Communities, 2008

Table 1: Used Types of Renewable Energy

Energy / RES	Electricity	Heat	Transport Fuel
Biomass	YES	YES	YES
Solar	YES	YES	
Geothermal	YES	YES	
Wind	YES		
Ocean	YES		
Small Hydro	YES		

Source: European Commission, 2007b

Biomass could have a significant contribution to solving the EU energy issues using the biomass energy potential and existing technologies. The

White Book explicitly outlines that it is necessary to have much better information campaigns in the EU including dissemination of knowledge about the positive effects of biomass technology and fuel.

The need for EU support for Renewable Energy is clear. Most technologies are economically viable and competitive. Others depend only on the rate of increasing demand and thus production volume to achieve the economies of scale necessary for competitiveness with traditional energy generation. In fact, looking at the various sector markets in early 2003, it is probably not over-optimistic to conclude that the lion's share of remaining market resistance to the penetration of Renewables relates to factors other than economic viability. This should be seen against the rapidly improving fiscal and economic environment being created in the EU, both by the swinging into full implementation of European legislation itself and the Member States' own programmes and support measures, which despite the short-term macro-economic background, are accelerating rapidly at the time of publication (European Commission, 2008a).

The proposed EU Energy Policy "Energy for a Changing World" (European Commission, 2007c) aims to achieve by 2020 the formula of 20%-20%-20%, which includes: reducing greenhouse gas emissions by at least 20%; improving energy efficiency by 20%; raising the share of renewable energy to 20%; increasing the level of bio fuels in transport fuel to 10%, but these goals are achievable if there is a reliable collaboration with researchers, giving freedom to their technical skills and innovative thinking at the universities. The collaboration with scientists is a fundament for successful implementation of the renewable energy priorities. The Directorate-General for Energy and Transport (European Commission, 2007b) the priorities are: renewable electricity generation technologies to increase efficiency and reliability; renewable fuel production systems and technologies; technologies for cheaper, more efficient heating and cooling from renewable energy.

A study (Kulcsár & Bolender, 2008) of the social impact of ethanol plants in Kansas and Iowa (Iowa is the largest ethanol producing state in the US) shows that there is no significant increase of rural jobs because of the ethanol plants. These plants are quite mechanised – they can be operated by 3 people (one engineer in the computer control room, and two loaders who work with the equipment to load the biomass onto conveyor belts or something). There are some multiplicators, in terms of jobs in transportation (i.e. truck drivers who haul the biomass in and the product out), but these do not necessarily show up locally. There is no evidence whatsoever for the demographic turnaround (i.e. slowing aging or net immigration) in rural American because a biofuel plant.

Bulgaria updated its national legislative system by adopting a Law on Alternative and Renewable Energy Sources in 2007. It caters for diversity of energy supply, environmental protection, increasing the capacity of SME and energy production from RES. The energy distributing companies are obliged to buy all RES energy produced.

As shown in Figure 2, the share of the renewable energy sources in Bulgaria is comparatively low. It is necessary to establish a better dialogue between on one hand, the suppliers of innovations – the universities and their research centers for development of RES technologies, and on the other hand entrepreneurs, who are willing to implement these innovations in their business. This dialogue is part of the so called "Third Generation University".

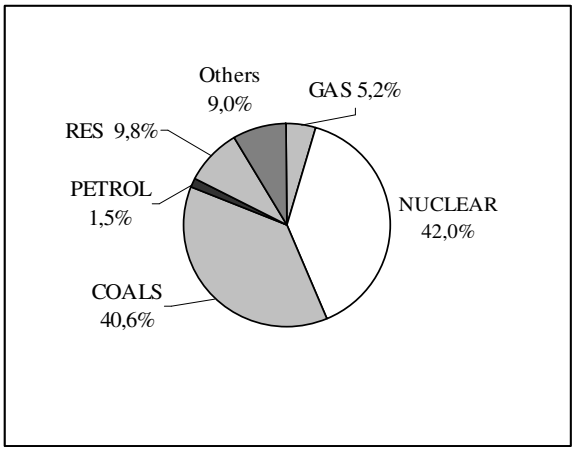

Figure 2: Gross Electricity Production in Bulgaria by Energy Sources in 2005
Source: European Commission, 2008b

TECHNOSTARTERS AND THIRD GENERATION UNIVERSITY

In the previous part it is described the need of RES. At the same time the society is expected to undertake initiatives to give a better development of RES usage. Universities are part of the society and they should be also involved in this nature protection process. Part of their involvement is to support students who try to develop their RES businesses. But what could motivate the universities to help such starters? Some possible answers are given bellow, as well as an example of such support.

According to Wissema (2006) technostarters are students or academics, who are willing to start their own science- or technology-based firm. They own the know-how, which is the fundament of the IPR for the

management of their firm. They are usually associated with universities of technology, science and medical faculties of general universities, and agricultural universities. In addition, corporate R&D departments and governmental or independent research organisations also act as cradles for technostarters, while there are many technostarters who just begin on their own. They can use cutting edge technology or intelligent applications of existing technology for renewable energy production.

RES is based on technologies and it is very important to support the creation and development of these technologies. The RES technostarters use them, but should universities support these entrepreneurs? Wissema (2006) gives some main reasons why universities should support technostarters.

The first reason is the economic need to create new employment through new, innovation-based, business activities. This employment should offset the loss of mass-production-based employment. And universities can deliver. The effect they can have was first brought to light by the now legendary "BankBoston Report". This study stated that if the companies founded by MIT (Massachusetts Institute of Technology) graduates and faculty were to form an independent nation, the revenues produced by the companies would make that nation the 24th-largest economy in the world. The 4000 MIT-related companies (located world-wide) that existed in 1997 employed 1.1 million people and had annual world sales of $232 billion. That is roughly equal to a gross domestic product of $116 billion, which is comparable to the 1996 GDP of South Africa or Thailand. The study found that MIT "imports" entrepreneurs, as many companies were not spin-outs of the university, but rather company founders who came to Massachusetts to benefit from the presence of MIT.

The second reason why universities should support technostarters is to satisfy the needs of students, staff members and alumni, too, who sometimes have considerable work experience and who want to create a new venture in the proximity of the university. Many of them choose self-employment and entrepreneurship as the path to self-fulfilment and we speculated that many will choose this path as the stepping-stone to a career in existing corporations. As educational institutions, universities have a duty to match this trend and satisfy the increasing group of (potential) entrepreneurs. While universities can be significant creators of wealth if they put their minds to it, the benefits to the university itself are largely indirect. There will be income from licences, consulting, contract research and endowments, and although the amounts can be substantial, they maximally account for only a few percent of the university's budget (not counting the endowments; Harvard University alone has a fund of $26 billion coming from endowments; Yale has $12 billion). The indirect benefits lie in the attraction the university has for entrepreneurial students, academics and industry –

either the industry that it helped create or the industry that it attracted. In this way, a strong regional network of knowledge-based enterprises and institutions can develop, from which the university, being at its center, can benefit.

The third reason why universities should support technostarters concerns the changing power field in which universities operate. Universities cannot escape the trend towards globalization as students, staff and sponsorship funds rapidly become more international, and in many cases global. This means that universities enter internationally competitive markets for education and research. In order to meet the challenges of this form of globalization, universities will have to reinvent themselves and become what is called *Third Generation Universities*.

The most creative researchers and best firms will not like to miss such a center, because it is the place where something happens and where the ingenious has to be, no matter if he is a student, or a researcher, a firm or a technostarter; what matters is his efforts to be in the first line. A model of such a center is the Stanford University with his Silicon Valley, Massachusetts Institute of Technology, Cambridge University with his firm "Cambridge Enterprise" and many others.

In such case what are the characteristics of such university, which support the technostarters? Is it enough to say that if a university supports entrepreneurs, then it is a "Third Generation University"? The characteristics should be clear for all starters, including the ones who face business activities, based on RES. According to Wissema (2006) the characteristics of the Third Generation University are:

1. The ambition to become the center of an international know-how hub by establishing a powerful know-how carousel with on-site and network collaboration with industry, private R&D, financiers, professional service providers and other universities.
2. The commercialization of know-how becomes the third university objective, leading to facilities for contracts with large enterprises, technology transfer centers for small or medium size enterprises (SMEs) and technostarters.
3. Except for a privileged few, Third Generation Universities cannot escape being mass universities. In order to play a leading role in the carousel, they will have to attract the best and brightest students and teachers. This requires special facilities such as "*grandes écoles"*, university colleges, honours degrees, extra curricula and other educational forums for selected students and given by selected staff. Third Generation Universities will be "*and-*

and" universities, catering for selected students while continuing mass education in separate programs.

4. The idea of *and-and* university also applies to the domain of research. The massification of universities and the expansion of the academic staff have lowered the average scientific level. This has led to obligatory publications that have neither scientific nor practical value. Third Generation Universities will have to tolerate this kind of research as an instrument for development of its staff.
5. Third Generation Universities will adopt English as the language for research, teaching and administration. Only the return to a *lingua franca* will enable universities to cooperate with carousel partners, offer international courses and participate in international networks and conferences.
6. Third Generation Universities will be private institutions, disconnected from the state, with no direct state-financing, no involvement of the state with the management of the university, and freedom for the university to choose its labor conditions.
7. The dominant organizational structure of the Third Generation University will be the University Institutes. These are transdisciplinary units that focus on a particular area of science. Such institutes will often be responsible for MA or MSc courses, and in this way they can coalesce with postgraduate University Colleges. Faculties can still be responsible for basic education, but they can eventually be replaced by course managers who hire teachers from the University Institutes. This comes down to tilting the organization and replacing the faculties by University Institutes that have an entrepreneurial nature, academic leadership and their own networks.

The renewable energy sources are subject of increased scientific interest for their better usage. Ruse University "Angel Kunchev" (Bulgaria) has advantages and may join a knowledge cluster as a knowledge supplier (Antonova & Pavlov, 2008) to the firms, which are interested in implementing technologies, based on RES or reduced energy consumption. According to a study "*A knowledge cluster is a system of the creation of strategic alliances between large and small businesses and other interested partners with a view to coordinating the efforts to attract international investors for joint ventures, supply of strategic information about possible usages of technological information in specific productions and co-policy of state purchases"* (Antonova et al., 2008). It is a good example for Third Generation University, too.

A study of Koev, Koeva, Tonkova and Petrov (2005) has outlined the main problems of Bulgarian small and medium enterprises: finding new ideas for entrepreneurship opportunities; finding new financial sources and finding new customer approaches for Bulgarian products and services. In order to solve these problems, it is important for the entrepreneurs to have access either to innovations, which they could buy, or to facilities that help them to generate some proper innovations. Universities are of great importance, because of the concentration of students (ideas) and laboratories. The Entrepreneurship Center and the Center for Technological Transfer at the universities are expected to have key mediating roles.

The opportunities for the creation of the Entrepreneurship Center at Ruse University (Bulgaria) are limited, mostly because of financial issues (Penchev & Pavlov, 2006). In preparation for fund searching, Ruse University developed in 2008 all official documents that create the institutional infrastructure of the Entrepreneurship Center to exist. The other 3GU elements already exist – Career Center (since 2004) and Technology Transfer Center (since 2007) – both establishments having been funded by external sources.

It is important for technostarters to have adequate university support. According to a study (Stoyanov, 2007), it is necessary to combine successfully the following factors: the student willingness to be entrepreneurs; proper facilities at Ruse University to support the innovations and their commercialisation; attraction of funds.

Such a dialog was established in 2008 for the development a common project in environmental protection by energy efficiency, with the participation of (Ruse University, 2008):

- Ruse University scientists in biomass energy usage (engineers and economists);
- Ruse University Pilot Plant for the production a technological lines;
- A Ruse University student with experience in selling woods for heating, and with the ambition to start a new direction of his young firm (NIK-05 Ltd) – pellets (eco-briquettes) production and selling;
- ECORYS consulting agency – Sofia office, Bulgaria.

It is one of the first outstanding Ruse University steps towards actions in commercialisation of the innovations by both *technology transfer activities* and *stimulation of entrepreneurship*. The 3GU collaboration with NIK-05 Ltd has been enlarged – the firm applied to the *Voucher system*, which was started for the first time in 2008 by the Bulgarian Ministry of Economics and Energy (BSMEPA, 2008). The goal is to provide a financial mechanism in support of knowledge transfer to firms.

In the summer of 2008, NIK-05 Ltd enlarged its cooperation with Ruse University scientists in making a common study of the opportunities to apply to other RES supporting funds. The efforts are focused on Rural Areas Development Program (2007) and advantages of the public-private partnership with municipality authorities and thus to benefit the opportunities of Operational Program Regional Development (2007).

For NIK-05 Ltd, it is important to choose the proper development strategy. Papazov (2006) gives the main steps to achieve the strategic goal of any firm: first is the capital transformation into real assets, which are necessary to develop the production. The second step is related to the combination of the real assets with production factor of "labor" according to the production technology, and to have the production itself. The third step is the sale and thus to return the original investments, analyze the situation and taking a decision to develop another production cycle and by the proper production factors.

Mihaylova (2008) concludes that all these steps help the new strategy development; nowadays firms act in a dynamic market and managers face variety of challenges that force them to take adequate and on time actions. There are moments when leaders are not capable to handle the problems. Then they usually resort to consultant help. The same study outlines that recently these consultants are mainly experts in strategic planning. Therefore the owner of the firm NIK-05 again uses Ruse University's academic potential. It is important for Ruse University to keep and develop its integrative function, because it is important to attract participants such as students, firms and institutions.

Ruse University may have a strong contribution to Ruse's regional development, because regions, which have universities especially with technical expertise, are able to develop business incubators. A study of Naydenov, Enimanev, Kirova and Yordanova (2008) about IT business incubator (shows that the innovative potential could be developed as a trans-border cooperation "Ruse – Giurgiu" (Bulgaria – Romania).

The development of entrepreneurship is among the main goals of the Lisbon Strategy. Europe, compared to the USA, suffers from lack of entrepreneurs so much as Bulgaria, compared to the European average. Therefore, according to the Bulgarian National Strategy for Regional Development 2005-2015 (2005), Bulgaria needs not only more entrepreneurs, but also conditions and facilities which support their business development. Therefore the society expects from Bulgarian universities to develop proper facilities and organizational environment in order to produce more technologies and starters. Some of them should be based on renewable energy sources.

CONCLUSION

It is up to every university to choose whether to develop a policy in contribution to solve the global energy problem. Being a Third Generation University (3GU) means to behave adequately to the practical needs. One of them is the renewable energy. Exporting renewable energy technologies to other countries will also bring business opportunities, but also will enhance the 3GU transformations.

In particular, Ruse University has all necessary capacity for such 3GU policy: faculties with technological expertise, laboratories, and institutional stimulations. Ruse University (as a 3GU candidate) is also expected to find a way to benefit the outcomes of the promotion of energy from renewable sources.

The EU Action Plan for Energy Efficiency (European Commission, 2006) has set a wholly achievable goal of reducing the energy consumption by 20% by 2020 – an achievement that could save 100 billion Euros a year. It will have positive effects for industry, consumers and the environment. Renewable energies have potential to boost Europe's competitiveness, because they are expected to be economically competitive with conventional energy sources in the medium- to long-term. This process should help create businesses and jobs, and promote innovation in the EU economy. Especially using the biomass for energy purpose could have a positive effect on rural areas, increasing the life-style and facing the aging problem with proper answers.

There is no way for endless development of an economy if the ecosystems are constantly being harmed and destroyed, especially for energy needs. The 21st century economy meets variety of problems that stultify the economic goals. "The aim is a new economy to be developed in a way that to resist the human progress without destroying the supporting ecosystems and at the same time to offer a better life to all" (Brown, Flavin & French, 1999). In this aspect the Third Generation Universities should undertake their role to supply RES technostarters and thus to have a real contribution to some of the global problems. It is time for changes in the understanding and the values we have towards the economic progress. Perhaps it is possible then to achieve the so desired "sustainable development".

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