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„Green Growth“:

From a growing eco-industry to a sustainable economy

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„Green Growth“: From a growing eco-industry to a sustainable economy

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Abstract

There are still many illusions to overcome in the growth discussion. These illusions may be seen in the idea that long-term, significant growth could be achieved using government resources or that the solution to pressing financial and social problems necessitates higher growth. It is also an illusion, however, to say that giving up on growth is the alternative. In fact, it is about radical growth in environmental and resource-saving technologies. It is also about radical “de-growth” in products and processes that undermine long-term living and production conditions. Is the concept of "Green Growth" proposed by the OECD and other established institutions in Europe and Asia part of the growth illusion? This paper traces the transformation of the concept of "Green Growth" and evaluates the strategy that accompanies it in order to provide a more nuanced answer.

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1 Introduction

The current growth debate is full of all sorts of illusions. This primarily involves the belief that one can retain the resource-intensive model of growth of the past with only minor modifications. The successful model of the 20th Century does not only fail today because we lack the necessary inexpensive raw materials, but it also fails due to the limited capacity the earth has for emissions and waste. Another illusion is the idea that the state can facilitate high long-term growth using its resources. The EU followed this idea in its Lisbon Strategy (2000), which aimed at a compound annual growth rate of three percent. In the end, it only achieved a growth rate of less than two percent. The quantitative target has since been abandoned, much like the neo-liberal growth model of "unleashing the forces of growth" through deregulation, denationalization, privatization, and wage cuts. What has not yet been given up is the illusion that pressing social, financial, and employment problems can be solved through higher growth. It is time for these issues to be addressed following their own causal logic. Another illusion is also the notion that one can solve ecological problems with a zero growth rate. A stagnant economy, from which capital flees, will not bring about the necessary acceptance for the change. The only truly ecological measure would be zero growth is the conversion of raw materials into products, wastes, and pollutants, leaving them at the level of the previous year (see Spangenberg 2010). What this is really about is radical shrinkage - "de-growth" – especially for resource-intensive processes and products and radical growth in environmental and resource-saving technologies and services.

Is the concept of “Green Growth” also one of the illusions of the growth discussion? The rapid growth of literature on this topic shows how important this question has become. One should not be content to believe that the environmental issue has now reached the core of global economic elites. This has occurred, however, and should be highlighted. It is the change of paradigm which environmental scientists and environmentalists have been calling for more ecological production for decades.

The concept of "Green Growth" has undergone a remarkable development in recent years. For a long time, it only applied to the growth of "eco-industry" (Ernst & Young 2006, EU Commission 2009, Jänicke / Zieschank 2011). In recent publications, however, the usage of the term "Green Growth" has been expanded. Now the growth of the entire economy is implied by the usage of this term. Green Growth now affects not only the quality of growth, but of production a whole. In this case, growth results from the investment in the upgrading of the entire production system to environmental and resource-saving processes and products. A prototype of this phenomenon is the climate- friendly "low-carbon economy." In this broader sense, there is also discussion of sustainable "green economy"; this is about a comprehensive business innovation process.

In the following sections, important recent studies on this topic will be discussed. These include the OECD’s "Green Growth Strategy" (2009, 2011), the UNEP’s "Green Economy Re-

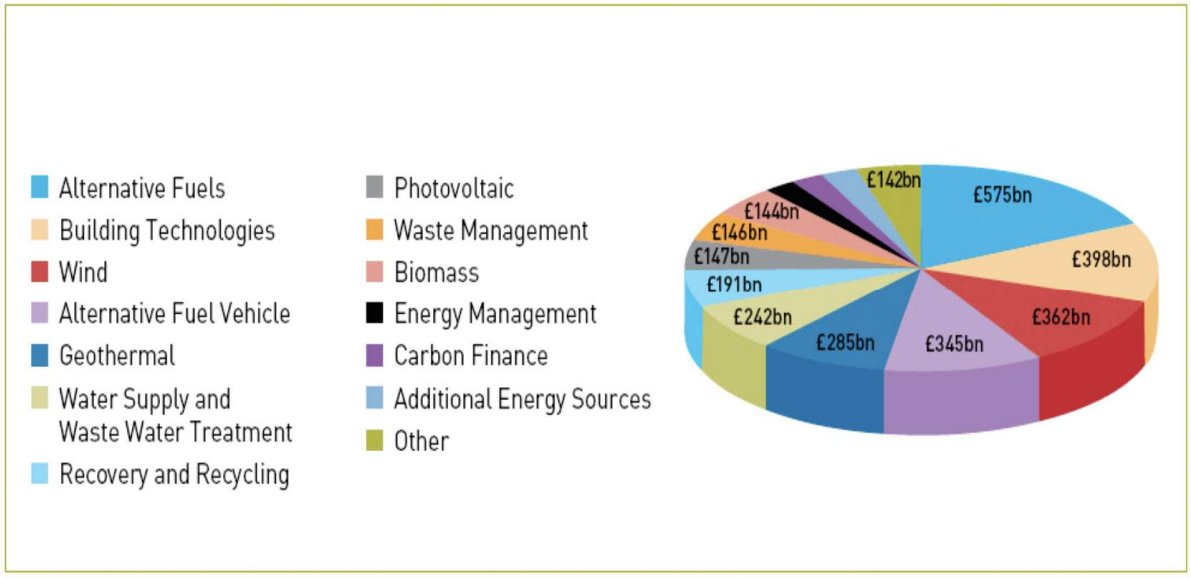
port" (2011), the EU strategy "Europe 2020" (EU Commission 2010), the study of European research institutes titled "A New Growth Path for Europe" (Jaeger et al. 2011), and finally, the sustainability program, "Towards a Sustainable Asia," presented by 26 Asian academies of Sciences (AASA 2011; see WBGU 2011).

This publication will examine the specific concept of growth, the role of "environmental-innovations", and the importance and change of the environmental sector. In conclusion, factors to drive "green" economic growth, which have contributed to the environmental issue from the "brake on growth" to a "growth engine" will be identified.

2 Green Growth as Growth in the Environmental Sector

The scope and dynamic of the environmental sector have long been underestimated, in part due to insufficient data as well as demarcation problems inherent in the sector itself. The concept of "environmental industry" has long been understood as only being the economic activities that provide technical solutions for (downstream) environmental protection. This would include everything from filtration systems for air pollution to waste management. In this area, there is satisfactory data. It was only later that this was expanded to include the clearly defined and tangible renewable energies. As a next step, energy-efficient technologies, and ultimately, material-saving processes and products and up until white biotechnology were also included. Especially in this area, there arise problems of demarcation and data. Roland Berger estimates the German environmental sector to be 8 percent of GDP (2007). For 2020, they predict a share of GDP of 14% (BMU 2009, 3), which would be a tremendous challenge in terms of the conditions, which would need to be created in human capital. The present global market for "low-carbon and environmental goods and services" is estimated in recent studies to be $5 trillion in size (INNOVAS 2010).

Figure 1: Global Low Carbon and Environmental Goods and Services 2008/9



Source: Innovas 2010

For Germany, the resulting structure and dynamics of this sector, as estimated by Roland Berger, are as follows: the double-digit growth rates are consistent, and particularly high in the field of climate-friendly technologies. At the same time, this sector has a high level of competitiveness (see table).

Table 1: "GreenTech" Germany: Market Share and Annual Growth Rates

	Global Market Share (in %)	Annual Growth 2005-2007 (in %)	Forecasted Annual Growth 2008-2010 (in %)
Renewable Energy	30	29	35
Energy Efficiency	12	20	22
Eco-Efficient materials (biotech, etc.)	6	21	24
Recycling	24	18	16
Sustainable Water Management	10	15	14
Sustainable Mobility	18	15	17

Source: BMU/Roland Berger 2009

In addition to underestimating the scope of the environmental sector, its growth has also been underestimated. Another picture of the growth dynamics in the environmental industry as compared to previous EU studies (see above) may be seen when the "unproductive"

and slow-growing sector of the downstream end-of-pipe technology is separated from the real eco-efficient products and processes. Here Ernst & Young separate environmental protection (pollution control) from the field of resource efficiency (resource management). It is useful to distinguish between these "two faces" of the environmental industry (Jänicke/Zieschank 2011). While downstream environmental protection - with classic clean technologies - creates additional costs, resource-saving technologies can reduce costs, thus increasing productivity. This is an essential difference that is easily overlooked when evaluating rigorous and complex environmental protection measures. This fact is also part of the differences between these two varieties of environmental industry: in developed economies, like the German economy, the importance of downstream environmental protection techniques is decreasing. At the same time, the importance of resource-saving technologies - renewable energy, energy efficiency, recycling, etc. - is growing dynamically. This also applies to global demand. The investments in renewable energy systems grew between 2005 and 2010 to the global annual average of approximately 39%. The capacity of solar PV around the world rose in this period by 72%, while that of wind turbines rose by 27% (REN21 2011). Roland Berger also predicts high growth rates for other technologies by 2020, from plants for waste separation (15%), energy-efficient vehicles (29%), and up to 35% for bio-plastics (BMU 2009).

The table above shows that in Germany the environmental sector is growing dynamically; it not only has high competitiveness, but has also developed a high pace of innovation. A growing number of industrialized and emerging countries now take part in this global market. This competition has led to intensive innovation. Using the example of climate-friendly technologies, their dynamics may be split into phases: the beginning of the 1990s, where there were individual cases (e.g. by the IPCC), which were relegated to the win-win effects of climate policy. As a result, pioneering countries developed a "green" growth sector. Since 2004, Germany, Denmark, and some additional countries, has developed political export strategies for renewable energies. Founded in 2009 in Bonn, the International Renewable Energy Agency (IRENA) is a by-product of this development. In the last five years, more and more countries have proclaimed the goal of helping climate friendly technologies gain a leadership role in the global economy. Since 2009, efforts have also occasionally been seen to promote the export of environmental and climate-friendly technologies, even with subsidies. South Korea, for example, invests billions to promote the export of "green technology" (JoongAng Daily May. 14, 2010). In 2009, it also set up a special "Green Growth" committee for the President as an authority to implement a "low carbon, green growth" vision of government. Korea is one of the countries that fits the observation made by Cecilia Tortajada: "In some countries, decisions on investment in green growth and cleaner energy did not seem to have been directly related to the impacts of climate change, but to economic advantages" (OECD Forum 2010).

3 "Green Growth" as a Topic of International Institutions

3.1 The OECD's "Green Growth" Strategy

As with the activity in South Korea, "green" growth strategies have been influenced by the "Green Growth Declaration" decided upon by the OECD Ministerial Council at its meeting in June 2009 (OECD 2009). They then ran into the global financial crisis and the investment programs to overcome it. "Green Growth" is meant here as the core ecological component of a global investment program. In fact, for the main countries concerned, on average about 16% of programs to overcome the financial crisis were for the first time concentrated on the environmental sector. The OECD and the UNEP spoke of – in accordance with Roosevelt's economic program and the appropriate references to President Obama - a "Green New Deal" (UNEP 2009). "Green Innovation" was another guiding principle, which also functioned as a trademark of the OECD in this debate.

There is now an OECD "Green Growth" strategy that has been submitted with one of the 2010 interim reports (OECD 2010). At the 50th anniversary of the OECD in May 2011, a foundational text entitled "Towards Green Growth" was published. It was edited by the OECD Secretariat. The definition from this publication states:

"Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD 2011). A "business as usual" approach bears "risks that could impose human costs and constraints on economic growth and development. It could result in increased water scarcity, resource bottlenecks, air and water pollution, climate change and biodiversity loss which would be irreversible" (ibid., 9).

In contrast to previous texts, the OECD text regards "Green Growth" as an integral, complete economic mechanism. It is expressly emphasized that it is about more than sectoral growth of the "environment industry." Rather, it calls for a "mainstreaming" and an "integrating of green growth into core economic strategies and …government policies" (OECD 2011, 13). This dual strategy of innovation and crisis prevention is new. This is positive in that there is (a) the use of "green" growth levers: increased resource productivity, eco-innovations, the potential of "green markets" or environmentally friendly household consolidation. It is also negative in that there is (b) an avoidance of harmful interference with the natural growth of capital and resources. Here this means "imbalances in natural systems, which raise the risk of more profound, abrupt, highly damaging, and potentially irreversible effects." The term "planetary boundaries" (cf. et Rockström al.2009) is used to refer to the space in which growth must take place. In the case of climate change, the threshold of 350 ppm CO_2 has already been surpassed at the current level of 390 ppm (2010). Additionally, the OECD has confirmed that the "planetary boundary" for the global nitrogen cycle and the loss of biological diversity has been exceeded (OECD 2011, 9).

Table 2: 10 "Planetary Boundaries"

Earth-system process	Parameters	Proposed boundary	Current status	Pre-industrial value
Climate change	***i)* Atmospheric carbon dioxide concentration (parts per million by volume)**	**350**	**387**	**280**
	***ii)* Change in radiative forcing (watts per metre squared)**	**1**	**1.5**	**0**
Rate of biodiversity loss	**Extinction rate (number of species per million species per year)**	**10**	**>100**	**0.1–1**
Nitrogen cycle (part of a boundary with the phosphorus cycle)	**Amount of N_2 removed from the atmosphere for human use (millions of tonnes per year)**	**35**	**121**	**0**
Phosphorus cycle (part of a boundary with the nitrogen cycle)	Quantity of P flowing into the oceans (millions of tonnes per year)	11	8.5–9.5	~1
Stratospheric ozone depletion	Concentration of ozone (Dobson unit)	276	283	290
Ocean acidification	Global mean saturation state of aragonite in surface sea water	2.75	2.90	3.44
Global freshwater use	Consumption of freshwater by humans (km^3 per year)	4 000	2,600	415
Change in land use	Percentage of global land cover converted to cropland	15	11.7	Low
Atmospheric aerosol loading	Overall particulate concentration in the atmosphere, on a regional basis	To be determined		
Chemical pollution	For example, amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals and nuclear waste in, the global environment, or the effects on ecosystem and functioning of Earth system thereof	To be determined		

Note: Boundaries for processes in bold have been crossed. A detailed description of the boundaries and the analysis behind them can be found in: www.stockholmresilience.org/download/18.1fe8f33123572b59ab800012568/pb_longversion_170909.pdf

Source: Rockström, J. et al. (2009), "A safe operating space for humanity", *Nature*, Vol. 461, 24 September 2009, pp. 472-475. Reprinted by permission from Macmillan Publishers Ltd, copyright 2009.

Source: OECD 2011, Rockström et al. 2009

The OECD's strategy also includes a set of 24 indicators, with five key overarching indicators:

- Socio-economic context and growth characteristics
- Environmental and resource productivity
- Natural assets
- Environmental Quality and Quality of Life
- Economic prospects and policies for Green Growth (ibid. 90)

The OECD's Green Growth strategy explicitly refers to the Rio +20 process. It is stressed that the strategy only covers the common intersection of ecology and economics - only two

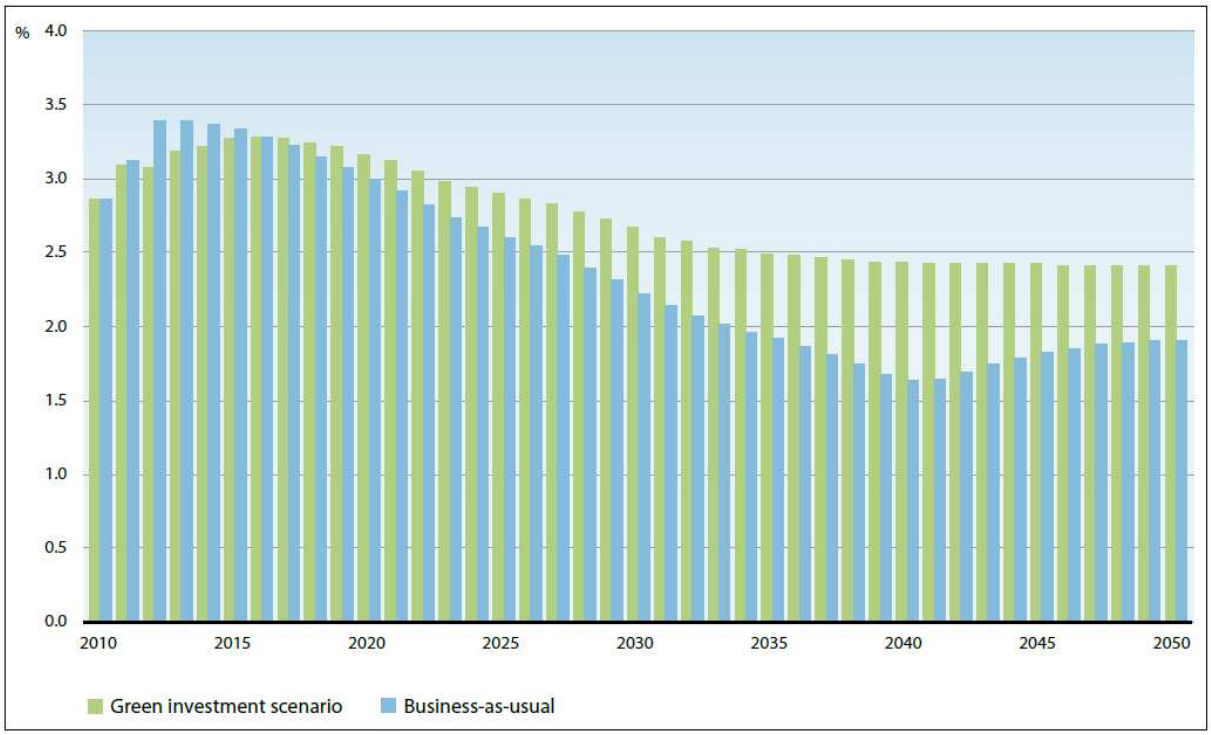
of the three pillars of sustainability – which means the social dimension must also be added.

As the official text of a major event, this is undoubtedly an important step in the right direction in the matter. OECD texts, however, are hardly ever drafted upon the practical experiences and results of all 34 members. Reality is far more determined by the "new" realization that it is also possible to earn money with environmentally friendly technologies. This is far removed from the idea of "green" economic growth as an economic crisis prevention tool (see SRU 2011).

3.2 The UNEP's "Green Economy Report"

Even in the extensive "Green Economy Report," recently submitted by the UNEP in the context of the Rio +20 process, "green" growth is now considered an integral factor of economic development (UNEP 2011, see also BMZ 2011). In a comprehensive model calculation for long-term global economic development, which for the first time accounted for the consumption of natural resources, the effects of environmental and resource-saving investment strategy can be estimated. It does this, however, for a global average; regional differences are excluded (for a critique see: Jackson 2010). For the authors it is about the different effects of environmental investments, not the implementation of appropriate targets (which in the case of climate change would be much more demanding). The effects of investment in sustainable methods of production for ten different sectors are calculated. The corresponding "green" scenario of the report, in addition to the intended environmental improvements, also predicts significantly improved employment and higher growth (see Figure 2, UNEP 2011). Specifically, the green investment strategy weakened the long-term decline in global growth rates. As in the case of the cited OECD growth strategy, the growth effect is not only shown to be positive for future investments. Rather, it is more about - negatively - the avoidance of unsustainable growth-damaging developments. The moderately high growth is thus ultimately necessary to avoid negative growth, as it occurs for example by lowering of ground water, declining soil fertility, or overfishing of the oceans.

Figure 2: Global Growth Trends 2010-2050 and the "Green Investment Scenario"



Source: UNEP 2011

Similarly, a study of five European research institutes concludes there is a positive growth differential of 0.6% of GDP in the case of an unconditional 30% reduction in greenhouse gases by 2020, as opposed to the current 20% target (Jaeger et al. 2011). Both studies conclude that this also results in significantly higher employment. The EU investigation finds an employment effect of 6 million (Jaeger et al. 2011). Unlike the other publications discussed here, the study in question reaches fairly widespread assumptions about the potential of Green Growth.

As in the OECD's Green-Growth Strategy, emphasis is placed on the promotion of technical progress and an ecological modernization of production. Even beyond this, emphasis is also placed on positive feedback mechanisms and "virtuous cycles" of induced innovation processes, as have been observed in the field of climate-friendly technologies (Watanabe et al 2000, Jänicke 2011, IPCC 2011.).

3.3 "Green Transition and Innovation": A Sustainable Concept for Asia

At the beginning of 2011, 26 Asian Academies of Science presented a program of sustainable management with the title "Towards a Sustainable Asia: Green Transition and Innovation." It is not only similar to the two publications of the OECD and UNEP, but also to the EU "Europe 2020" strategy. As these texts, it is based on the assumption that the traditional resource-intensive production reaches the boundaries of environmental and economic growth, while at the same time opening up new economic opportunities. Following this study, Asia faces the following challenge: the conditions for the current export boom, low wages and raw materials, have worsened following the financial crisis. The number of

comparative cost advantages that Asian countries have is dwindling in the face of rising costs of environmental and resource use. These countries' limited "carrying capacity" in this regard has created a large number of problems. The 26 academies therefore postulate: "Asia must seek new drivers … and change its development model to achieve sustainable development … a new model … that … needs to be created through system innovation." As in the previously discussed studies, emphasis is placed on ecological modernization. Accordingly, the role of rigorous environmental policy is emphasized: "green legislation and policies have a strong impact on green innovation." At the same time, it is about more than just an environmental innovation strategy. "Green transition" is the passageway to a "green development model." As with the OECD's Green Growth Strategy, this does not exclusively mean the growth of the environmental sector. Instead, it seeks a wide range of "mainstreaming green development" (AASA, 2011).

This extremely detailed program does not only deserve attention because of its reference to the texts mentioned here. It is special because for the first time, an example of the Asian exceptionalism of sustainable development is described, which may in part be explained by a certain superiority of the region. After the end of the "East Asian Miracle," Asia, a latecomer in the game, had the chance to catch up under the following "favourable conditions ":

- a "highly efficient and strong government,"
- a cultural tradition that not only emphasizes hard work and frugality, but also the "harmony between man and nature,"
- the "largest potential green consumer market in the world"
- growing capacity for innovation, and
- sizeable potential for hydro power, solar energy, wind energy, or bio-energy (AASA, 2001).

Additionally, Asia has already experienced best practice while meeting their own conditions, which made mutual learning rewarding. The work, published in Beijing, looks closely at the rapid growth of China's wind and solar energies (AASA, 2011).

Again, this text does not allow for direct conclusions about the practice of the participating countries: however, the fact alone that 26 national research institutions reached this step together (something that is hard to imagine in Europe) is remarkable. The major Chinese Academy of Science is also known be close to the decision-making centre of the country.

4 Driving Factors of "Green" Growth

The idea of a continuation of the traditional concept of growth with environmental methods is often viewed critically (Jackson 2011). Nevertheless, the question of how innovative technologies or economic development will contribute to solving environmental problems

is valid. The legitimacy of rigorous environmental policies also depends on proof that it provides economic benefits and it does not bring about the often-purported economic disadvantages.

So what are the driving forces of what is understood as, in refereed and other studies, "Green Growth"? The following presentation is also an interpretation of the potential of this approach, as they tend to go beyond the concept:

First: in all studies on Green Growth, **increasing resource productivity** is the focus of the opportunity structure. This potential has first been made evident through energy efficiency. The century of cheap raw materials is probably irretrievably over. The foreseeable tripling of raw material consumption by 2030 (UNEP 2011a) and the fact that almost 95% of the raw materials of a product have already been used before it reaches the market can expect a huge potential for innovation here. Resource productivity is also highly relevant for competitiveness. Above all else, labour as a factor of production can be relieved if productivity is not primarily increased by reducing labour. The ecological advantage is obvious. Resource consumption occurs not only at every stage of production, it is associated with energy, water, and land consumption, or transportation. Resource savings provide not only cost-effective environmental improvements; they capture diffuse pollution, something difficult for the environment to handle.

Second: **State-induced investments** with potential **refinancing through efficiency gains**. The UNEP study assumes an investment rate raised by 2%. In the EU study, the rate of investment rises from 18 to 22% of GDP. The funds go into ecological modernization, but also in the development and preservation of natural capital. The UNEP examined ten key sectors: energy, industry, transport, construction, waste and water, but also agriculture, forestry, fishing, and tourism. The refinancing of investment through efficiency gains is an important advantage during a time of rising energy and raw material costs. Long-term negative cost differentials are indicative of appropriate scenarios. This applies to low-carbon technologies, and especially for the long-term negative costs of renewable energies (Fraunhofer IBP et al. 2010). It also applies to raw material savings through recycling or eco-design. Avoided damage costs should also be added to the efficiency gains (although these are usually not recorded).

Third: a **forced pace of innovation** in environmental and resource saving processes and products. In few fields is the importance of innovation as emphasized as in environmental and climate protection. This is primarily due to the high innovation pressure arising from the environmental and resource protection needs of the economy, but also creates the potential for global demand (Jänicke 2008). Innovative responses to governmental environmental policy measures are the main reason that the actual cost of these measures fall substantially when compared to the ex-ante model cost calculations. The German Advisory Council on the Environment pointed to this important fact early on (SRU 1978, 2008). Meanwhile, studies on the U.S., the EU, and Germany have made this difference between expected and actual environmental protection costs clear (Oosterhuis 2006, Zeddies 2006,

Environmental Defense Fund 2009). The EU study distinguishes itself expressly from macro-economic model calculations where the dynamics of a targeted investment strategy are not calculated and therefore, the cost is systematically overestimated (Jaeger et al. 2011). Moreover, a high rate of innovation generally corresponds with the creativity of advanced knowledge-intensive societies with a well-developed infrastructure for human and social capital (World Bank 2011). The trend towards substituting resource inputs in the production through (innovative) knowledge input is essential for this change.

Fourth: the **dynamics of future green markets**. Since the environmental and resource problems of traditional, resource-intensive industrial production are global, so too are the markets for innovative solutions to these problems. The dynamic growth of markets for "green technologies" corresponds to the global pressure created by these problems. This demand in terms of "global environmental needs" is reinforced by the corresponding preferences of the rapidly growing global middle class. In addition, regulatory competition between pioneering countries, promotes markets for environmental and resource-saving technologies. Technological development is not driven by the oft-cited competition at the expense of the environment ("race to the bottom"), but rather by the eco-innovation competition. The dynamics of the markets for environmental and resource-conserving technologies - particularly prominent in the field of climate-friendly technologies - are a major driving factor of Green Growth.

Fifth: the **prevention of growth-damaging developments**. The defence of growth losses arising from rising resource costs or by increasing damaging effects to the environment (an example is the cost of the over-exploitation of groundwater resources in the Beijing area) naturally also has a growth effect. The essential premises of the studies cited here are indeed the ecological and economic limits of conventional economic growth. Without the technological transformation of the economy, ultimately a trend toward negative growth is assumed.

A consensus of the growth debate can probably be formed as: neither total economic stagnation nor shrinkage is desired. Conversely, it seems that from the studies on Green Growth that a return to traditional growth economy and its high growth rates is not plausible.

5 Green Economy as Sustainable Economies

The primary goal of the "Green Growth Strategy," the "Green Economy Reports," and the "Europe 2020" program, and also of the sustainability strategy for Asia, is no longer pure growth, but rather a total sustainable production method. The linguistic transition from "green growth" to "green development" (AASA 2011) or "green economy," as has occurred in the global modelling of UNEP, is significant. Thus elements of sustainable economies are integrated into the concept of growth: now measures of "improved human well-being and reduced inequality" are counted as being part of a Green Economy (UNEP 2010). Instead of

growth rates, not only is environmental quality a focus, but also the social dimension of business.

A similar example is the widely adopted growth term in the EU strategy "Europe 2020" (2010), which has replaced the old growth strategy (Lisbon Strategy). The EU Commission identified three priorities here (European Commission 2010):

a) *"Smart growth":* developing an economy based on knowledge and innovation

b) *Sustainable growth*: promoting a more resource efficient, greener and more competitive economy

c) *Inclusive growth*: fostering a high-employment economy delivering social and territorial cohesion".

The first two points refer to the driving factors of "Green Growth": innovation, knowledge intensity, resource productivity, and investment in environmentally friendly processes and products. The added social dimension creates a new concept of sustainable economies. It is interesting to note that the concept of sustainability presented by the Asian Academies of Science used almost identical wording. In that case it is about a new economic model "that is green, low-carbon, smart, innovative, cooperative, and inclusive" (AASA, 2011).

The fact that from an environmental perspective, "Europe 2020" was interpreted more cautiously and much more in terms of traditional growth by the European Council should not be overlooked. The difficulties that the EU has with its conditional goal of a 30 percent greenhouse gas reduction by 2020, also reveal the distance from the goal of "sustainable growth." This does not, however, diminish the importance of the conceptual competition to develop sustainable practices, which is currently emerging between the EU and Asian countries.

6 Conclusions

Let us return to the original question: is "Green Growth" one of the illusions of growth? Can the environmental question contribute to economic growth? And can this significantly help the environment? Here are several thesis-like conclusions.

1. First, it must be emphasized that "Green Growth," the "Green Economy," and the Asian concept of "Green Transition" are all instrumental strategies of crisis prevention. They should help to avoid raw material shortages, high energy costs, water shortages, declining crop yields, climate change or environmental damage, and their costs. Green Growth is essentially the growth that results from investment in the prevention of damage and shortages that undermine long-term living and production bases. Now, for the OECD, sustainable economic activity is also production within "planetary boundaries." From a positive point of view, this is most likely to come with knowledge-intensive, innovative production, which corresponds to a creative society with highly developed human and social capital (cf. World Bank 2011).

2. The most important criticism of a resource efficient Green Growth strategy is to note that while there has been a relative decoupling of economic growth and resource consumption, the overall relief has been realized primarily through rebound effects (Jackson 2009). As true as this is, it is also correct that a rigorous strategy along the lines of an efficiency revolution has not yet been addressed. At the same time, it is also the case that shortages that occur and have an effect on prices are more likely to be effective, and thereby benefit appropriate policy. Here we are only at the beginning. Those who will focus on sufficiency instead of the required efficiency revolution will be risking that their appeals remain helpless and will not reach the necessary breadth. If in doubt, it is easier to put the top twenty world governments under pressure than to convince nearly 7 billion people of the undeniable advantages of an ecologically sound lifestyle. This is not an argument against the necessary change in values systems and the active role of the citizen as consumer, voter, and member of civil society, but rather it is an argument against putting a shift in values at a higher priority because this will require time that we no longer have.

3. From an ecological perspective, it would be highly problematic if environmental issues were simply reduced to a question of growth and not addressed from their own inherent logic. Green Growth will not make environmental policy superfluous (Hey 2011). The ten critical ecological thresholds, officially proposed by the OECD, pose serious danger and they cannot only be addressed in terms of the logic of growth. This would not even be helpful if we succeed in a major political effort to reduce the consumption of non-renewable resources to the extent required.

4. From an ecological point of view, high GDP growth cannot be "green" growth. The negative environmental effects associated with high growth momentum are can hardly be compensated through their accompanying environmental technical progress. The necessary absolute decoupling of environmental consumption from growth in economic output is not to be expected in this case. Green Growth can only be moderate growth. The difference in growth rates is very ecologically relevant. GDP growth of one percent leads to a doubling in 70 years. In this case, technological progress can keep up and - through appropriate policies -. so too can environmental effects caused by economic growth be decoupled. At 5 percent growth, within the same time period we would witness GDP increasing by more thirtyfold. This is the death sentence of any environmental strategy.

5. Rich countries can certainly make do with low growth rates. Between 1988 and 1998, Switzerland’s GDP grew by only 1.1 percent on average. This occurred with relatively low unemployment. Sweden, between 1997 and 2007, had an average economic growth rate of 1.2 percent. One percent GDP growth in Germany accounts for 24 billion Euro more in GDP. Is this too little? It is a good cushion of wealth creation in any event, especially if the social and fiscal problems facing the country cannot be addressed through structural reforms instead of desired growth. Structural reforms would mean that the productivity of resource use should be ranked higher than labour productivity, problems of poverty should

be addressed by reversing the redistribution of the last 30 years, and budgetary problems should not be postponed at the expense of future generations.

6. A Green-Growth Strategy, as has been developed by the studies examined here, is the only remaining option following the failure of the neo-liberal growth model of an “unleashing of the forces for growth" through denationalization and deregulation. This strategy is far removed from the goal of significantly higher growth rates. The UNEP Green Economy promotes slightly higher, but overall only moderate growth rates. As can be seen from the figure above, it helps to mitigate the effects of a long-term decline in growth rates. This strategy has the ability to achieve more stable economic development with higher welfare effects (Jackson 2009). This is no small feat and definitely not a euphoric strategy of increasing growth rates.

7. At stake is moderate GDP growth, coupled with a massive increase in eco-innovation and a physical de-growth process (Spangenberg 2010). The limits of marketable technical solutions are also part of the limits of growth. The necessary maintenance, revitalization, and expansion of the natural foundations of life and production - the protection and expansion of natural capital – go beyond the potential of marketable, ecological modernity.

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