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« Green Economy and resource efficiency, which models for tomorrow? »

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SUMMARY This article's publication coincides with the beginning of the "green week", organised by DG Environment, with this year's theme being resource efficiency.
The green economy aims at combining improved well-being with a reduction of environmental damage and of resource use. Implementing the green economy presupposes the availability of better measurement of the scarcity of resources. In order to overcome the dilemma between growth slowdown and resource depletion, and to green its economy, the EU is betting on "decoupling" between economic growth and resource consumption. Transforming this ambitious challenge into a success requires, firstly, to rely on innovative technologies and practices already implemented at local level and, secondly, to seek new business models.

"The power of population is so superior to the power of the earth to produce subsistence for man that premature death must in some shape or other visit the human race". What would Thomas Malthus say today, he who already rang this baleful alarm bell to his contemporaries back in 1798[1], while our planet counts close to 7 billion people, almost seven times more than at his time? Today, two important lessons can be drawn from the controversy that he launched on the balance between available resources and population growth, lessons which echo current debates on Green Economy:

- themes such as scarcity and depletion of resources emerged in the economic and political debates well before that of climate change;
- until today Malthus' theories have not been verified as the role of innovation and its fundamental effects were ignored[2]. European decision-takers are more than ever preoccupied with our capacity to innovate, in order to conciliate the restoring of growth and respect for the environment.

GREEN ECONOMY, AVATAR OF SUSTAINABLE DEVELOPMENT?

The United Nations define a Green Economy as one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities[3]"; it is not reduced solely to the fight against climate change or to the discovery of clean technologies. Much more than a simple metamorphosis of sustainable development, Green Economy is the **effective implementation of sustainable development in the economic activity**.

It is in the twentieth century that pressure, exercised by mankind on our planet's natural resources or "natural capital", water, raw materials, energy, soil, increased and accelerated in unprecedented proportions: this acceleration resulted from an increase of population and above all from t**he major changes in patterns of consumption**, mostly coming from the wealthiest section of the population. Even though growth brought new prosperity and lifted part of the population out of extreme poverty, it was often accompanied by an undesirable procession: waste of accessible resources, water and air pollution, destruction of arable land and habitats.

The concept of « **sustainable development** » appeared at the end of the 80's thus giving a name to a pathway dreamed of by the stakeholders of worldwide development, states, economic players and civil society: reconciling economic development, protection of the environment and social commitment. The diverse discussions on environmental questions within the international community have crystallised into a small number of subjects: climate change, scarcity of natural resources, in particular energy sources, and loss of biodiversity. Twenty-five years

1. "The vices of mankind are active and able ministers of depopulation. They are the precursors in the great army of destruction, and often finish the dreadful work themselves. But should they fail in this war of extermination, sickly seasons, epidemics, pestilence, and plague advance in terrific array, and sweep off their thousands and tens of thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow levels the population with the food of the world" – Thomas Malthus, 1798. From "An essay on the principle of population", Chapter VII page 61.

2. See the chapter « La fausse question de la surpopulation » in l'Atlas des Futurs du Monde, by Virginie Raisson, pages 124-125.

3. UNEP report, « Towards a Green Economy, Pathways to a Sustainable Development and Poverty Eradication» published 21 February 2011, page 16.

later, more than ever present in our thoughts, this dream is still far from being within reach: few experienced scientists, economists or observers would be willing state that current growth trajectories fall within the framework of sustainable development.

It is in the wake of the 2008 crisis that new debate topics, "Green Growth" then "Green Economy" emerged, in major international forums, the United Nations, OECD and in institutions of the large economic regions (EU, USA, China). Green growth is mainly presented as a means to overcome the financial crisis by using environmental technologies or "cleantechs", capable of reducing energy intensity, carbon intensity of production and of creating new jobs.

The international debate finally adopted the semantics of "Green Economy", a more comprehensive concept than that of "green growth", which was previously used by the United Nations. The rationale of this Green Economy concept is to prevent the degradation of the world situation due to damage on the environment and climate inflicted by man. In its broadest sense, Green Economy is simply the economy we must strive for, in which development is lasting and sustainable.

SCARCITY OF RESOURCES AND THEIR MEASUREMENT, AT THE CENTRE OF THE GREEN ECONOMY

Simply put, **Green Economy** is "**low carbon, resource efficient and socially inclusive**"[4]: the question of resources is therefore of central importance. Is it possible to assess it simply? Not so easy if we do not have a recognised unit of measurement. Such a unit capable of evaluating the main impact of mankind's action on the climate exists: "tonne of CO2 equivalent" emitted into the atmosphere. Since the end of the 80's this sole common standard and language element on climate change has facilitated the scientific debate and the emergence of models, leading up to a corpus of scenarios and guidelines shared by the international community[5]. This progress was made possible despite the methodological differences between carbon footprint methods used within the different European Union territories, listed in the comparative study published in 2009 by College of Europe and the Veolia Environnement Institute[6].

In the case of **resource exhaustion**, a challenge probably even more crucial than global warming, holding a scientific and political debate is more difficult for the following reasons:

- first of all there is the methodological difficulty of creating and sharing a common measurement tool (similar to "tonne of CO2 equivalent" of the climate debate). The resource[7] is extraordinarily multiform: ore, livestocks, water resources, forests, energy sources, biodiversity, etc.
- the second reason is due to the difficulties of evaluation, consolidation and updating of the concepts "reserves" and "resources"[8] of non-renewable basic materials, such as those used in the production of goods (iron, copper, aluminium etc.) and energy-yielding substances (petrol, gas, uranium etc.).
- finally, though the tonne of CO2 equivalent emitted anywhere in the world has the same effect on climate change, the local situation is often a determining factor for resources including renewable ones (water, wood, sunshine) which can either be scarce or over-abundant from one territory to another.

Yet simplifying methods prepared by scientists allow for the evaluation of the total pressure put on resources at human, territorial, city or mankind level. As an example, the "**ecological footprint**" is a concept that appeared in the wake of the Rio de Janeiro conference in 1992, since refined by the Global Footprint Network[9] association. Applied to the soon-to-be 7 billion human beings, this footprint stands at nearly one and a half times the availability of natural resources currently offered by the biosphere[10] and five times that if the living standard of each person on earth was that of a North American.

This **overshoot**, in effect since the 70's, leads to complete exhaustion of the earth's non-renewable natural resources and to an increased accumulation of unrecovered waste as the pressure on resources continues to inevitably grow. According to the average United Nations scenarios, if we were to continue with the current demographic and consumption trends, the **ecological footprint of humanity would stand at two times the availability of natural resources by 2040**. As such, today's human beings are "borrowing on their capital resources", a loan taken out on the planet without paying the

4. PNUE report, "What is a green economy?" page 16.

5. Examples :
- Different scenarios of the IPPC foresee global warming from 1,8 to 4°C by 2100;
- International Energy Agency « Scenario 450 », where the concentration of CO2 equivalent in the atmosphere is limited to 450 ppm, in order to maintain global warming under the 2C° mark.

6. « Comparative analysis of local greenhouse gas inventory tools », Nikolas Bader, Raimund Bleischwitz – College of Europe – April 2009 - http://www.institut.veolia.org/ive/ressources/documents/2/491,Final-report-Comparative-Analysis-of.pdf

7. The notion of "natural resource" first identified the raw materials (minerals, metals) and biomass (wood, animals, vegetables) useful to man, followed by the different useful energy-yielding forms such as agriculture (horses, mills) and later industry and transport (fossil fuels). Renewable or not, resources have always been at the source of human needs, from the essential ones (water, food, energy sources to protect against the cold) to the more complex ones, those attained through social or cultural practices, acknowledgement or prestige (mobile phones or flat screens which require many metals for manufacturing). Sustainable development has widened the concept of natural resource to those essential not only to man but also to all ecosystems which make ecological services useful and quasi irreplaceable: forests, arable land necessary for food production, fish stocks in oceans and rivers, natural habitats and biodiversity.

8. Definitions from the US Geological Survey (USGS 2010)
- Resource: A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.
- Reserve : part of the resources identified which could be economically extracted or produced at the time of determination

9. The ecological footprint measures (in hectares) the productive part of the earth's surface and the aquatic ecosystems necessary for the production of used resources and absorption of waste by using current technologies.

10. All parts of the earth which contain living beings.

instalments, leaving it to future generations to take care of the repayments.

As it compares and consolidates very diverse data, the measurement method for the ecological footprint, its rigour and precision can and must be challenged; it does however have a great pedagogical strength and the ability to foster the international scientific debate on the question of resources.

This overshoot can be observed with most commonly used raw materials. Let's take the example of the most common metal: steel, the production of which has multiplied by 30 during the 20th century. A reference study foresees the **exhaustion of iron ore by 2042**.[11] This same study foresees the **exhaustion of metals such as chrome, tin, zinc, silver and lead by 2030**.

Petrol, a resource which has become crucial in the 20th century and a symbol of common precariousness of non-renewable materials, is a recurring source of public debate following the oil crises of 1973, 1979 and 2008. Revealed via brutal oil price hikes, its scarcity disseminated through the world an unvoiced but deep consciousness of upcoming depletion, largely echoed by "peak oil"[12] theories.

All these observations describe the "change in gear" in accelerating the pressure (mostly coming from developed countries) on the planet's resources that happened at the turn of the 20th century. Thus, in a few generations' time, an outright exhaustion of non-renewable resources such as ore for common metals, petrol or gas[13] can be predicted.

THE « DECOUPLING » CHALLENGE BETWEEN GROWTH AND RESOURCE USE

Even though little doubt remains as to the inability to sustain growth trajectories from a resource point of view, the institutions of large economic areas (EU, USA, China) are having difficulties theorising their positions. Amongst these players the **European Union** is **more advanced in its strategic thinking**, as demonstrated in several communications:

- the communication on "Tackling the challenges in commodity markets and on raw materials"[14] foresees a range of measures in order to secure the access of the European Union to raw materials. It lists 14 critical raw materials[15] the shortage of which will largely impact the European economy, with a supply risk coming from their production being mainly concentrated in a very small number of countries outside the European Union;
- the communication on "A resource-efficient Europe"[16], a flagship initiative under the Europe 2020 Strategy, sets in chapter 4 a list of actions to undertake which will aim at " **decoupling economic growth from resource use and its environmental impact**", and "creating a low-carbon economy by 2050";
- the communication on "Sustainable consumption and production"[17] suggests an action plan using tools to "create more value while using less resources": rules for setting ecodesign of products, energy labelling, "green" eco-innovation public procurement policy etc.;
- the communication on "Thematic strategy on the sustainable use of natural resources"[18], already targeted in 2003 a "reduction in the negative impact of resource use on the environment while remaining in a developing economy".

The decoupling promoted by the European Union is said to have already partially existed for several years[19]. If such a phenomenon could be confirmed over a longer period it would be very encouraging and could give the EU the lead in the efficient use of resources and hence a competitive advantage. It is important however to be cautious with these observations and to endeavour to distinguish those that are genuine successes in efficient resource use policies and those derived from a cyclical reduction in production.

It is also important to **ensure consistency between different strategies** and their objectives. Injunctions that are too different bear the risk of paralysing the economic players. Taking recycling as an example, there is perceptible tension between the desire to attain a circular economy i.e. "recycling society", in which waste is the resource, and that of an economy deprived of this resource via a waste prevention policy.

Whatever the difficulties in ensuring coherence between the different strategies, the European Union's decoupling challenge is a key, clear and extremely ambitious objective. It will allow to **cleverly**

11. USDI/USGS Mineral Commodities Summary 2010, quoted in l'Atlas des Futurs du Monde by Virginie Raisson.

12. The moment when half of the world's original petrol reserves have been depleted and when production decline is characterised by a price hike and supply disruption.

13. The "Club de Rome" achieved world recognition by publishing in 1972 a report entitled "the limits to growth", improperly translated in French into "halte à la croissance?". In this document, MIT researchers questioned the virtues of growth within the conditions of that period of time, with the growing awareness of the precariousness of access to energy resources and the consequences of industrial development on the environment.

14. Communication 2011/25 of 2 February 2011

15. Antimony, beryllium, cobalt, fluorspath, gallium, germanium, graphite, indium, magnesium, niobium, platinoids, rare earths, tantalum, tungsten.

16. Communication 2011/021 of 26 January 2011

17 Communication 2008/397 of 16 July 2008

18. Communication 2003/572 of 1 October 2003

19. Communication 2008/397 of 16 July 2008, paragraph 3.1: « In the EU, resource productivity has improved 2.2% per annum in real terms over the past 10 years. This means that the EU has been able to stabilise resource use in the growing economy, largely due to efficiency improvements in production as well as an increasing role of services in the economy".

solve this dilemma in which both options are equally unacceptable: a declining economy which would impoverish people, or on the other hand an economy which would continue its unchanged trajectory towards foreseeable shortages.

HOW CAN THIS CHALLENGE BE TURNED INTO A SUCCESS? TOWARDS A GREATER RESOURCE USE EFFICIENCY

The first priority is to **improve the efficiency of resource use**. This will be done firstly with a more economical use of energy at city and territory levels. The development of **heating and cooling networks** is a promising path for promoting low-carbon energy.

- **This development is supported through the ability of developing combined heat and power generation[20]**; looking at the carbon footprint of Poznań, Poland shows that combined heat and power has allowed the city to save 14% of CO2 emissions compared to a Polish city not using combined heat and power.

- Moreover, state of the art heating networks allow for an increased use of renewable energies. In central Europe, Veolia, through its Dalkia subsidiary, plans on progressively eliminating emissions originating from coal combustion of heating networks in Poland (cities of **Poznań** and **Łódź**) and Hungary (city of **Pecs**), by building boilers entirely dedicated to biomass where coal is replaced by fuels originating from forests or agriculture.

Energy recovery often goes along with **recovery of materials extracted from waste**. This true "urban mining", represents almost four billion tonnes of waste produced every year throughout the world, of which barely one billion tonnes are recovered (one way or another). Three quarters of this gigantic resource, available in the form of recyclable materials or in the form of energy (when waste has a calorific power) are untapped. In order to tap some portions of this resource, which previously could not be done under viable technical and economic conditions, Veolia designed and built more and more automated waste sorting and recycling facilities. The plants located in **Nantes** and **Ludres** in France are combining mechanical and optical processes, soon to be complemented with chemical and biological processes.

The wastewater output of water treatment plants treating household and industry effluents can be perceived not as a waste but as a resource. Is it possible to convert the organic matter found in such waste into a valuable by-product, such as bio-plastic or methane? A first-ever experiment of that kind is presently being performed by Veolia within the premises of **Brussels-North** wastewater treatment plant, at the outskirts of the European Union capital.

From a wider perspective, the water cycle can be accelerated in the case of local unbalanced supply and demand[21]. Today, available technologies allow for the reuse of wastewater, according to the wishes of local authorities (mainly for irrigation purposes). It is even possible to produce drinking water out of recycled wastewater as it is the case in **Windhoek**, Namibia, in order to ensure supply security. The sea itself is a potential inexhaustible water resource as technological progress enables to limit both energy consumption and excessive discharging of brine from desalination plants; these can then provide drinking water to coastal settlements in arid areas, as is the case in **Ashkelon**, Israel.

After all, if efficient management of water, a renewable resource, must focus first on surface and underground water through combating network wastage and network maintenance, several other ways illustrate the new perspectives of the Green Economy such as desalination or wastewater recycling.

Urbanisation and densification of cities are putting pressure on several resources, starting with **land**. The reduction of a city's environmental footprint calls for, among other things, good **mobility management**. It is crucial to favour whenever possible mass or shared transportation versus individual transportation. The intermodal network in the Province of Limburg, in the Netherlands, illustrates the transition from a situation where travellers had to cope with a complex combination of transport networks (trains competing with bus and taxi companies) to a fully integrated organisation with a single managing body for the entire transport system, conceived in order to simplify their travel.

Ultimately, communities must ensure that **efficient management** of one of their **resources** is not detrimental to any other resource but can benefit it when

20. Combined heat and power generation allows a significant improvement of the energy efficiency compared to standalone production of heat or electricity.

21. Article « L'Union Européenne face au défi de la rareté de l'eau » - Antoine Frérot - Fondation Robert Schuman – « Questions d'Europe N°126 », 2 février 2009

possible. Thus, for example, proper collection and treatment of the waste i.e. "urban mining" resource in a territory, especially hazardous waste, is often a condition of non-contamination of watersheds and a guarantee of the quality of the water resource.

THE NEED FOR NEW ECONOMIC MODELS

The success of decoupling promoted by the European Union between economic growth and consumption of resources also demands that **new economic models** be designed with incentives for good practices. On a continental scale, the European Union has set up an innovative instrument tackling climate change with the greenhouse gas emissions trading system (ETS). In the future, this system may be complemented by a carbon tax[22].

However, it is definitely at **local level** that new standards are to be built. Several initiatives are being drawn up, in particular in order to accommodate the economy of local public services:

- **setting up a remuneration scheme based on performance, therefore partially disconnected from volumes sold**. In such a scheme, it is not in the operator's interest to sell more units (kWh or m3 of water) to increase his revenue but to achieve contractual objectives;
- another solution, in the wake of the previous initiative, consists in **transitioning from an economy based on volumes to an economy based on "non-volumes"**, with a remuneration driven by the level of spared resources.
- a third solution aims at **decoupling volumes sold from volumes extracted or collected**, by recycling wastewater and "waste materials" i.e. solid waste.

As we experience every day, economic standards are not easy to put in place. Today there is a need to "**do more with less**". How can one render the use of natural resources more efficient if the consumer, seduced by fast-changing fashions, feels entitled to squander them? In order for sustainable development services to spread, imagining them will not suffice: **clients and legislators need to accept** them. Validation of such new economic standards consistent with the goal of reducing the environmental footprint should be strongly supported by local authorities, which are, in the end, the public bodies in charge of the service and are responsible for setting the price.

It will be necessary to show some **imagination** and **innovation**: lacking either, we won't be able to escape the dilemma between "growth with pollution and resource exhaustion" and "protection of environmental and of natural resources with stagnation". In order to detoxify our economy addicted to carbon and over-consumption, the only inexhaustible resource we must endlessly call upon is our creativity; the Green Economy must be an economy of innovation.

Author : Antoine Frérot

Former student at the École polytechnique (1977) and PhD from the "École nationale des ponts et chausses", Antoine Frérot started his career in 1981 as an engineer/researcher at the "Bureau central d'études pour l'Outre-Mer". In 1983 he joined the Research Centre at the "École nationale des ponts et chaussées" as project manager and then Deputy Director in 1984-1988. From 1988 to 1990 he was the Financial Operations Manager for the Crédit National. He joined Veolia Eau in 1990 as manager, he then became general manger of the Compagnie Générale d'Entreprises Automobiles (CGEA). In 2000, he was appointed General Manager of Veolia Transport, the transport division of Veolia Environnement, and member of Veolia Environnement's board of directors. On 21st January 2003 he was appointed General Manager of Veolia Eau, the water division of Veolia Environnement and member of the Executive Committee of Veolia Environnement. At the end of 2009, Antoine Frérot was appointed General Manager and then in December 2010 Chief Executive Officer of Veolia Environnement.

[22] The more commonly foreseen forms of « carbon tax » are the carbon inclusion mechanism (CIM) or "border carbon tax" made possible by the European Union legislation on ETS and by the taxing of energy-yielding products and electricity.

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06

ANNEX – Who's talking about Green Growth or Green Economy?

The United Nations Environment Programme (UNEP) published in 2011 a well-documented report on Green Economy, which seeks to fuel preparatory debates at the Rio+20 Summit, due to take place in July 2012. The two flagship themes of this summit are Green Economy and sustainable development governance. The UNEP report concludes in particular that the reallocation, in favour of "green investments" in ten key sectors[23], of 2% of world GDP, which represents less than 10% of world investments, would stimulate the transition towards a more prosperous and more environmentally friendly low-carbon economy.

The OECD published a report in May 2010 on the "strategy for green growth" in which green growth is listed as a means of pursuing growth while preventing environmental degradation, destruction of biodiversity and unsustainable exploitation of resources. This report contains technical recommendations such as the setting up of market signals or instruments ensuring that pollution is paid for, or the setting up of new indicators.

The European Union started in 2010 its "Europe 2020" strategy which shows its ambition to promote a "more resource efficient, greener and more competitive" economy, relying in particular on green technologies and information and communication technologies; the focus is on the fight against climate change and energy issues.

In **France**, the investment programme for the future agreed upon in 2010 and which is in support of the "Grenelle de l'Environment" programme, is planning to devote several billion Euros to the "future of green sectors", ranging from biofuels to energy efficient buildings, smart grids, green chemistry and innovative vehicles.

In **the United States**, the Green Economy debate is now focused on energy, the too strong addiction of the country to fossil fuels and the concern of recovering energy autonomy.

In **China**, the extent of the damage done to the environment due to the largest growth in history is prompting observers to voice theories that the cost of this damage will cancel out a large portion (some say the entire portion[24]) of the benefits of the growth[25]. Chinese authorities, confronted with the need to substantially increase the country's energy production capacity, have launched very significant renewable energy investment programmes: China is now world leader in wind energy, both in operation and equipment manufacturing[26].

23. Agriculture, buildings, energy supply, fishing, forestry, industry (such as energy efficiency), tourism, transport, waste management, water.

24. Pan Yue, deputy director of China's State Environmental Protection Administration, 2007.

25. In a recent report, the World Bank estimated these costs at close to 6% of the country's GDP each year.

26. The world's leading investors in « clean energy » in 2010 (excluding nuclear) are (in billion $US) : China (54,4), Germany (41,2), USA (34,0)

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