MOVING TOWARDS INDUSTRIAL ECOLOGY

To build a sustainable economy, consuming fewer natural resources, we need to think in terms of growth, not otherwise. The issue of sustainability should be tackled in a dynamic way. By setting a new model for the lifecycle of materials, we can project what the future's economic model could look like.

ParisTech Review – You stand out among the economists of sustainable growth by your focus on economic growth.

François Grosse - In fact, we don't really have a choice: growing is the only thing we are good at. That's why political leaders are so much concerned about economic growth. During the last hundred years or so, despite some occasional setbacks, our growth went hand in hand with a steady increase of the raw material consumption. Let's take an example: the world's crude steel production has been multiplied by 30 during the 20th century, while the average growth steadied around 3.5%. This overall rate defines exactly an exponential growth.

The increase of raw material consumption is a stubborn fact, an unavoidable reality of our modern societies. The superficial dematerialization of part of the economy can't let us forget this fact.

Don't take me wrong, this isn't only about the access to mass consumption of the millions of people from emerging countries. In the developed countries, in spite of a relative economic stagnation – and even if we are lured by the illusions on our so-called sobriety – our ever-growing consumption leads us to use

and stock raw materials more and more. Take the example of the car industry: in France, from 1996 to 2008, 20% of new car registrations have been devoted to the growth of the vehicle stock. Not to mention the increase of the vehicle average weight. To remain in France, between 1970 and 1996, the average surface area of dwellings has increased from 22m2 to 35m2 per habitant. That's a 60% increase. During the same period, the world population has also increased.

To imagine a sustainable growth, we must confront this first fact: we live in exponential growth.

Given these facts, is degrowth a utopist dream?

If we think on the very long term, degrowth is unavoidable insofar as we live in a limited physical environment with finite resources. But the prospect of degrowth is still very far away from our current situation and besides, we are at a loss to imagine what it will look like. Some crucial points challenge the basis of economy as we know it: how can we run an economy without rewarding investors in the short to medium term?

These are major questions to which we don't have the slightest answer. I would even emphasize saying that today, speaking only of degrowth is a way to avoid confronting the main issues of the coming decades: how do we support growth by controlling our consumption of raw material and energy? The whole issue is about separating economic growth from raw material consumption.

From this point of view, recycling becomes a crucial matter and paves the way to an almost circular economic growth model. Here's the challenge: how do we curve an exponential ascending graph? In global terms, the issue of "prosperity without growth" – according to the British economist Tim Jackson – is still at stake. But on the short term, today's challenge is to organize the shift

towards sustainable economy by defining measurable goals for public policies and without destroying the only engine at our disposal for economic stability and social well-fare: growth.

What should our time-scale be to think of these issues?
We have to be realistic; all these matters concern the long-term. If we speak today of public policies regarding resources, we should be targeting the next two or three generations. What's going on with the global climate issues? We can see that a few decades aren't barely enough to invert such heavy tendencies as raw material use and consumption.

A first date in the step-by-step deadlines could be 2050. By then, the emerging countries may have narrowed the gap. But we can also imagine that by then, the developed countries have accepted degrowth and downscaled their economies to compensate the overconsumption of Asia and Africa. It would be foolish to think that once the other countries catch up, everything becomes simple. In fact, the need for growth has nothing to do with average wealth. We are well aware of this since studies by sociologists like Jean Baudrillard, who showed in the 1970s that consumer societies don't aim at satisfying material needs.

A change of model will occur but today, our only concern should be to prepare it. My research seek to analyze and find the turning points, anticipate and model the current dynamic, so as to determine the conditions of this transition. The next task would be to imagine a new economy based of these conditions: that's an enormous challenge.

What are the grounds of your thought?
First of all, we can't extract resources without losing some. But we should strive to keep the amount of goods circulating in the economy above the amount the flow of input and output. That's the heart of the model.

We need to think in terms of flows of materials and stocks. Nothing revolutionary about it, except that there are several ways to think that way. We must understand that the raw material lifecycle is a dynamic process which results from growth. The same applies to the stock of goods in use: we must shed a new light on the way it affects the depletion of resources. If we seek to reduce the input-output balance, it's important to consider all these parameters.

Equally important is to determine which indicators are correct to follow. The time raw material spends in the economy would be one. Again, let's take the example of steel, the most recycled raw material today: after transforming iron ore into metal, the material might be used in a spare part for a car or for a washing machine, which in turn will be used several years before being thrown away. To give you an idea of what we're talking about, I had taken a 17 years basis for the time steel spends in the economy. On their side, the International Panel for Sustainable resource Management of the UNEP estimates this lifespan between 25 to 40 years. It's an average lifespan which includes the metal's use in a roof structure as well as in a drink can.

For a given consumption, recycling prevents from extracting new raw material, all other things remaining equal. Recycling is the only way to time-shift resource depletion as well as minimize the effects of extraction and consumption on the environment. However, in a permanent and constant growth situation, recycling proves dramatically insufficient unless combined with other factors, so as to achieve an "almost circular" economic growth. Three conditions are required: first, a slow material growth; second, a low amount of stock which aims in discharging (in waste) as much material as consumed; third, recycling most of the non-renewable waste.

The principle is simple, but its application could prove quite complex.
Of course, mostly because multiple data and also many players take part in this matter. Besides, just as for the climate change, we're tackling a global problem. However, we can think of new models and research on this matter is progressing. The OECD, for instance, has started to work on the issue of material compatibility and its future applications.

It should be noted that this complex problem can be segmented according to the material which is taken under consideration. Even though different materials interact one with another, we could still isolate a quantitative analysis. We've finally taken in account the systemic scale of raw material consumption. However, from the point of view of flow dynamics, we can also analyze these phenomena in terms of separate, limited problems. Aluminum might substitute to iron over time but one ton of iron will keep being the same all along its material lifecycle. By dividing the global problem in smaller issues, we give ourselves a chance to deal with them separately and avoid being overwhelmed by too great complexity.

For my part, I focus on determining the way flows stabilize so as to understand under which conditions we significantly delay the consumption of raw material (directly extracted from natural deposits). To put things simply, it's all about a four variables equation: the challenge is to represent mathematically the relation between the time lag, the efficiency of recycling (the proportion between recycled matter and waste), the growth of aggregate consumption, and the average time spent by a given material in the economy (in other terms, its accumulation rate in economy or its discharge rate in waste).

What are the results?
First of all, some orders of magnitude. In the first place, it appears

that above 2% growth in global consumption, for any given raw material, the effects of recycling are utterly insignificant, whatever the intensity of the recycling be. In fact, recycling only becomes significant under 1% of annual growth. In other words, the growth of the aggregate consumption of a material (primary + recycled) appears according to my analysis as the principal parameter.

Second, if we really want to achieve a significant impact, we need a very high efficiency of recycling, between 60% and 80%. That means 60% to 80% of a primary material should be recycled from the waste flow to the economy.

Last, for a useful recycling on the long run, the accumulation rate – that is, the addition to stock – must be keep lower than 20%, which means the economy must reject into the waste at least 80% of what it consumes from each material.

The growth rate of consumption, the efficiency of recycling and the rate of accumulation (or discharge) are the three keys for a better management of primary non-renewable resources, which would significantly delay the aggregate consumption deadlines of primary resources. Their great advantage is that they are virtually independent one from another and precisely defined.

An important aspect of these studies is to show that a purely environmental approach of economic sustainability (which would merely count the inputs and outputs from natural deposits) would be powerless if we seek to set up effective policies. This is major flaw in stock accounts which concentrate on consumed material amounts whereas we need to see to aggregate flow of material to understand the dynamics behind the economy. Economic growth doesn’t rely on raw primary materials consumption alone but on aggregate primary materials (primary + recycled). This is shown by the example of lead: if we consider the extraction of primary material alone, the graphs show a decrease between 1970 and

1995, whereas the global consumption hasn't stopped from increasing. It's the recycling rate that has increased during the same period, until reaching its optimum. At that point, the primary material consumption began to increase once again.

Recycling is important but we must resist to the thought that it would play alone the crucial role in preservation of natural deposits and decrease of environment impact from the consumption of primary goods. Nothing is possible if we don't strive to slow down the increase of consumption of primary material or else try to take control over the increase in stocks of material in use.

As regards immediate action, should we speed up the recycling machine, to maintain economic growth while stabilizing stocks?
Or make it more efficient. At any rate, it's the only compatible solution with our economic model, centered on growth.

This idea shouldn't mislead us into producing each time more waste. What's significant is not the amount of waste but rather, its value regarding material consumption. We gain true leverage only by adding stock, not by generating waste. When we manage to subject our consumption of new material to the dismantlement of older units of primary material, only then will we be able to weaken efficiently the addition rate to stock.

Is it possible otherwise than by constraint?
We will set norms, quotas for instance, which will redefine the way in which we confront with the lifecycle of materials. This redefinition however, is first of all an economic fact and should probably be anticipated by the players.

Today, we tend to focus all efforts on controlling the *discharge* of waste, whereas the dynamic analysis shows that production of

primary materials plays the greatest role: it's no longer an outbound flow but an inbound one. For the time being, public policies focus mainly on waste producers and prompt them to mitigate their discharges, even though this could mean more material accumulation. On the other side, the same policies promote recycling by encouraging all waste processing methods. Ultimately, the issue isn't about the amount of discharged or even recycled waste, but about the portion of primary materials that proceeds from recycling. That's when an ecological industry comes in.

Could we imagine paying waste producers to speed up the introduction of these new lifecycles of materials?
These new lifecycles are already integrated for example by the cardboard and metal industries, where waste is used in commercial trade. It seems difficult, though, to drive households into this kind of trade. In Germany, however, the blue bin is left at the direct disposal of consumers by private players, who then use its contents as items for sale.

There are certainly many ways of activating the dynamic flow of physical materials. Public policies might use financial tools or even set taxation tools (positive and negative nudges) but also legal measures... These could come in gradually. The example of carbon quotas in the European Union shows how one can think in ambitious terms. In particular, it shows that price is only part of the solution and that some sort of allowance system must be set. Theoretically, we can imagine a system of certificates in which in order to consume primary material, you would have to prove that somewhere else inside the economy, someone has dismantled an almost equivalent amount of the same material. We would then bring the stock addition rate under control.

New services, whether technical or financial, will emerge from this management of restrictions. They will use the information in new

and challenging ways, to locate efficiently the materials circulating inside the economy and assign them to the different players, for instance. We're witnessing the rise of a new kind of economy.

This leads active firms in the field of recycling, such as Veolia Environment, to relocate from sorting waste to regenerating primary materials. Besides, we start digging into the new business models which are involved in information management. The standards are shifting, also because new places of added value are appearing. These are new opportunities. We won't be able to assess them properly if we don't consider the lifecycle of materials as a whole.

Source : http://www.paristechreview.com/2011/12/21/industrial-ecology/