



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

Ideas for Sustainable Development

Climate Change / Innovating the Mechanisms?

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ABSTRACT

Despite the incontrovertible scientific evidence of the anthropogenic influence on the Planet's climate change, the negative outcome of the far too many world conferences on the subject actually leaves no hope about a possible global agreement on curbing climate-altering gas emissions.

Following the adoption of the Climate-Energy strategy based on the 20-20-20 package targets, the European Union has put forward the 2050 Roadmap for moving progressively to a low-carbon economy, where greenhouse gas emissions are expected to be reduced by 80% by 2050. Nonetheless the ETS (Emission Trading Scheme) system, which Europe's targets are largely grounded upon, has proved to be inadequate and inefficient due not only to the economic crisis – which has caused energy consumptions and, consequently, emissions and emission rights costs to collapse – but mainly when it comes to managing the effects of the development of the global goods and services trade.

As a matter of fact, a large part of the impressive growth of energy consumption and emissions by emerging countries, like China, India, Brazil, Korea, cannot be ascribed to demographic expansion or to higher domestic energy consumption but rather to goods and services export to western countries.

All of the above was hardly expected at the time when the European strategy was decided, actually in 1995-1997 when the Kyoto Protocol was adopted, that is much earlier than China's WTO membership in 2001 and in an international context very different from today's, where trading activities with emerging countries were negligible.

Actually, nowadays replacing European products with others imported from emerging countries has led to an apparent decrease in Europe's emissions, but to a substantial increase in global emissions due to the lower energy and environmental efficiency of such kind of products.

It must be then noted that as to climate change not only is Europe essentially isolated within the global context but it also runs the risk of paying such high a price for its policies, with no substantial benefit to the environment.

The risk is that the instruments currently available to reduce greenhouse gas emissions may be an additional factor for loss of competitiveness for Europe and Italy: industry bears higher costs without actually benefiting from any of these policies.

The strategy allowing Europe to make environmental targets – which are undeniable– fit that of keeping the manufacturing industry solid, must be mainly grounded on the possibility to make the higher environmental quality of European products recognizable by a system of emission tracking and specific labelling, enabling consumers to choose more eco-friendly products.

A privileged taxation needs to be applied, based on LCA (Life Cycle Assessment) criteria, which could replace the ETS system. It is therefore a non-discriminatory, non-protectionist taxation, which simply enables to distinguish the products most impacting on the environment from eco-friendly ones.

The ENEA Agency is strongly committed to climate change at the national and international levels in the framework of collaborations with the Italian Government and the major research institutions active in the field.

Now that the Kyoto phase has come to an end (2008-2012), the negotiation process by the UN Conference of the Parties seems to be at a standstill, and concerns are growing about the actual efficacy of global and European policies so far implemented to offset climate change.

Although vast consensus exists on the need to reduce greenhouse gas emissions to keep the Earth's average surface temperature to values lower than 2°C compared with the preindustrial levels, actually global emissions keep soaring rapidly.

As is known, the EU is the most active subject on the field: after adopting the Climate-Energy strategy, one-sidedly forcing Member States to reduce emissions by 20% by 2020 compared to the 1990 levels, the EU has put forward a Roadmap to achieve an emission reduction by at least 80% by 2050.

The current EU negotiation strategy for mitigating climate change, based on ad-hoc legally binding emission targets, is not to date accepted by those countries mostly responsible for emissions, such as U.S.A., China and other emerging countries.

Hence, the creation of a global carbon market on the model of the EU "*cap and trade*" ETS system seems even farther from possible.

Therefore, the ETS system risks remaining a non-unified model, applied in Europe and in some other single countries only.

Yet, some important doubts are starting to be raised about the efficacy of objectives and the adequacy of instruments.

Actually it must be considered that from the Kyoto Protocol to date significant changes have occurred on a global scale which are related to the strong increase in the global goods and services trade.

This has contributed to determine a significant increase in emissions in the net exporting countries.

As an example, after 2001, when it gained the WTO membership, China almost tripled its emissions achieving almost 9 CO₂ equivalent tons (t CO₂ hereinafter) in 2010, i.e. almost the overall sum of the emissions produced in USA (5.25) and UE (4.05).

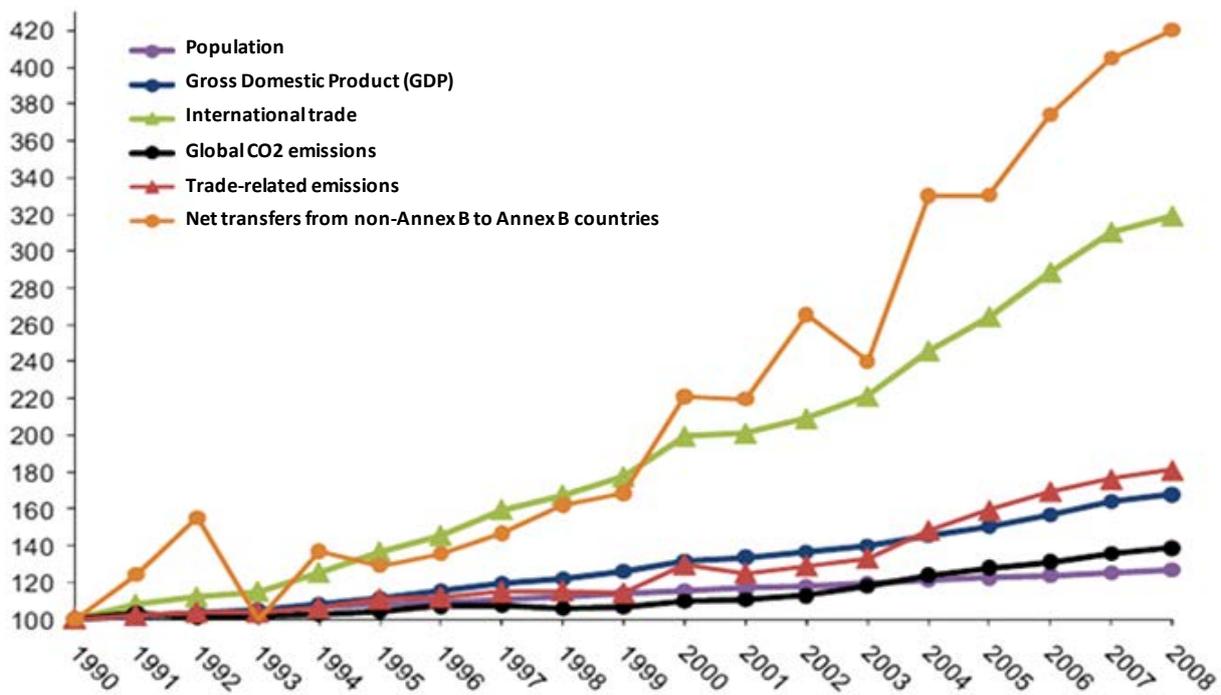
Such turbulent increase led China to reach a level of per-capita emissions equal to Italy's (6.8 t CO₂/year), although the latter's per-capita income was about 7 times as lower.

These data, along with those of other countries with a high growth rate of net exports, suggest that the emissions from the international trading activities have become crucial to explain the emission change.

Actually, the substantial coincidence between the emissions produced in a territory (*production based*) and those deriving from the consumption of goods and services in the same territory (*consumption based*) no longer exists.

Specifically, due to the international trade development, from 1990 to 2008 the net emission transfers from non-Annex B (i.e., not subject to the Kyoto commitments) to Annex B countries, related to goods and services trade (see Fig. 1), have increased over 4 times; hence, in most of developed countries *consumption based* emissions have increased much more than territorial *production based* emissions (Peters et al 2011).

Fig. 1 - Evolution of CO₂ emissions and economic variables, index numbers as of 1990



Source: Peters et al., 2011

Similarly, Davis and Caldeira (2010)¹ show the accounting of *consumption based* CO₂ emissions related to the import and export of end products² with sectorial and regional details, highlighting the major exporting and importing countries.

In 2004, 23% of global emissions (6.2 Gt CO₂) was related to international exchanges, mostly exports from China and other emerging markets to consumers in developed countries, mainly United States, Japan, and Western Europe.

As shown in Fig. 2, China is the major net emission exporting country. In particular, China's exports for 2004 are related to the sectors of mechanics (134 Mt CO₂), electronics (117 Mt), clothing (80 Mt), textile (37 Mt), chemistry, rubber and plastics (44 Mt), and mainly to intermediate products (787 Mt); against modest imports when it comes to mechanics (32 Mt) and electronics (9 Mt).

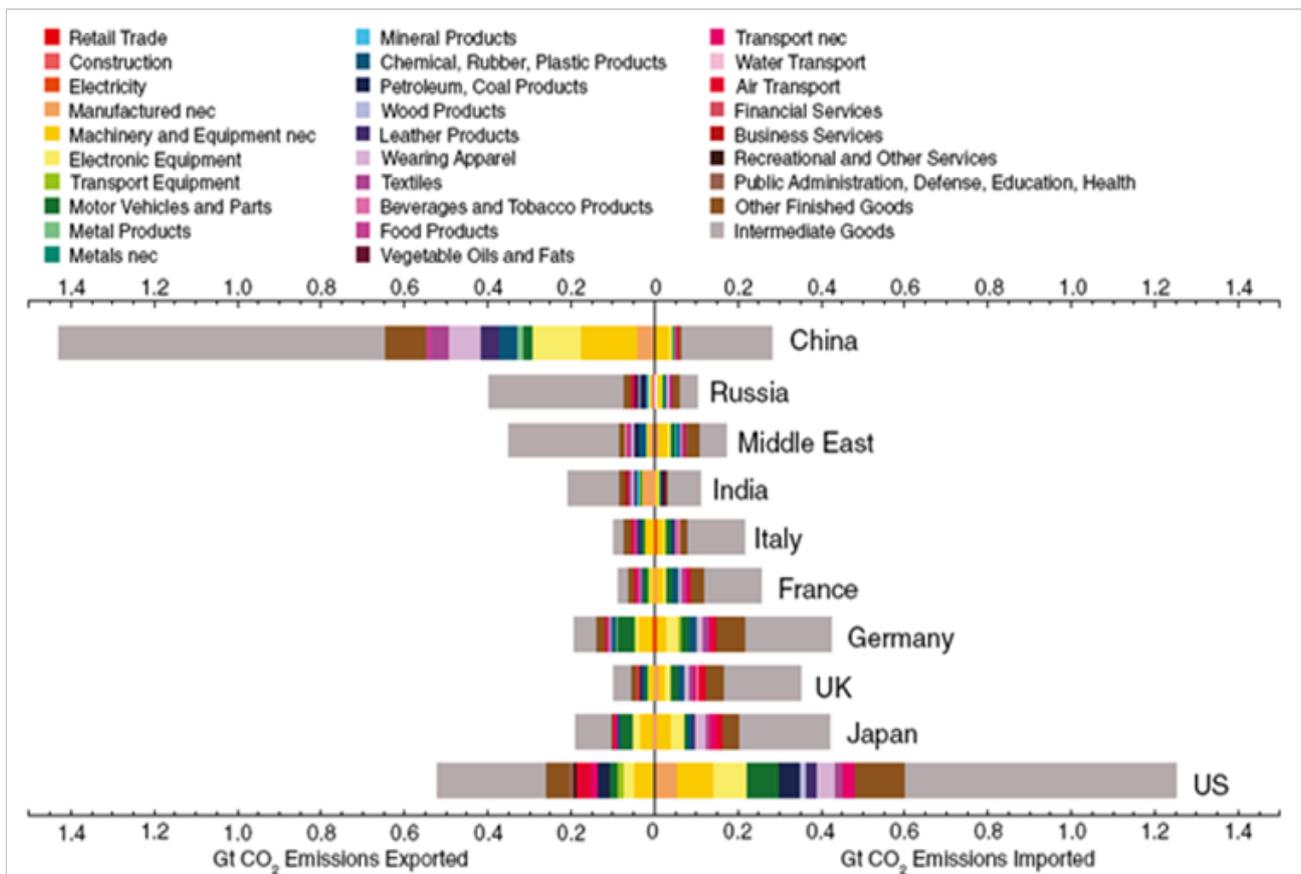
¹ Davis S., Caldeira K., "Consumption based accounting of CO₂ emissions", Edited by Clark W.C., Harvard University, Cambridge, MA, 2010.

² Estimates achieved by a multi-regional Input-Output model. CO₂ emissions per sectorial *output* unit.

Emissions imported from the United States instead exceed those of any other regions. In detail, they are related to mechanics (91 Mt CO₂), electronics (77 Mt), motorvehicles and their components (75 Mt), chemistry, rubber and plastics (52 Mt), other manufacturing products (52 Mt), clothing (42 Mt) and intermediate goods (645 Mt).

The trade balance has a composition similar to that of other net emission importing regions, such as Western Europe and Japan.

Fig. 2 - CO₂ emissions by sector, associated with exports and imports of end products from the major importing/exporting countries, 2004



Source: Davis S., Caldeira K., 2010

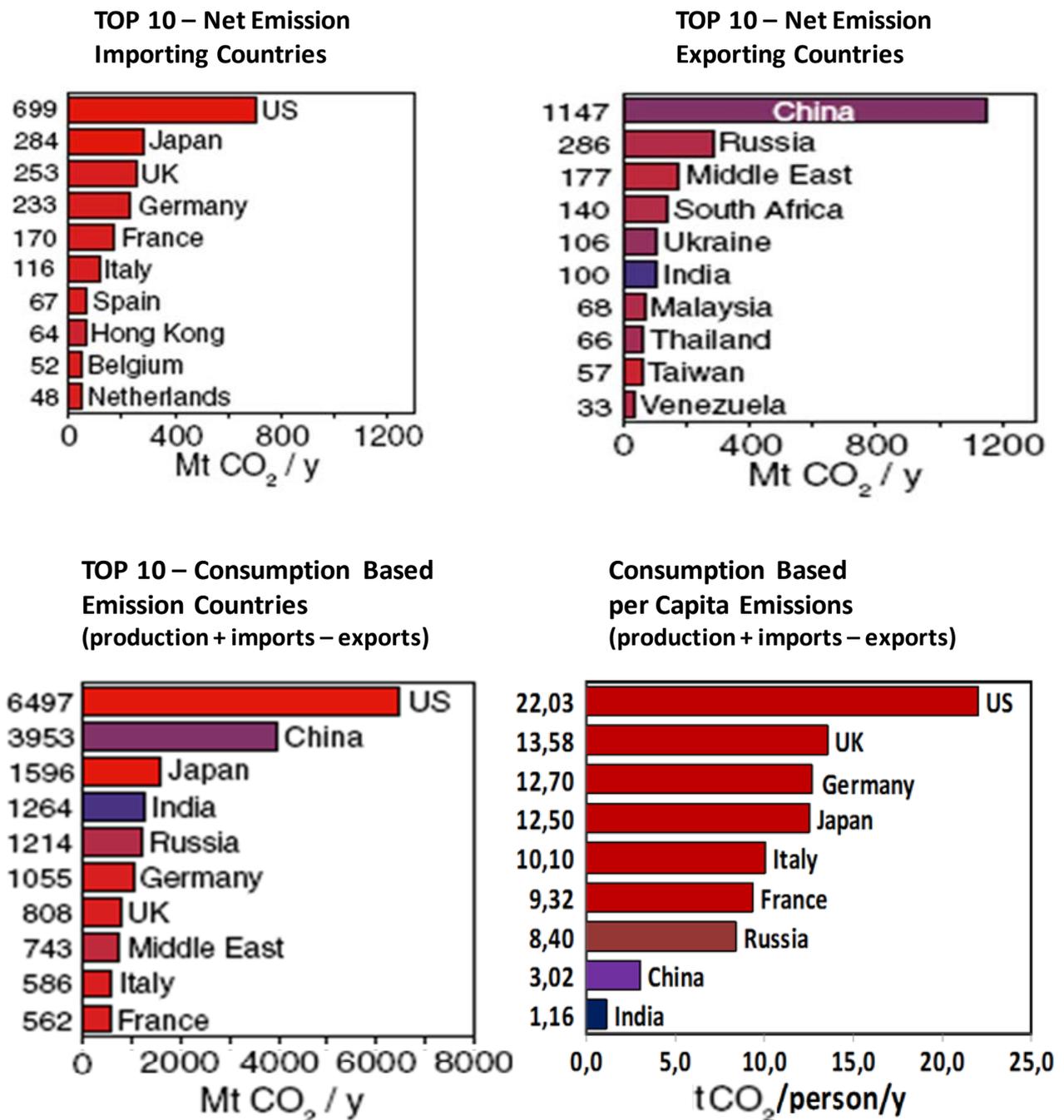
The emission accounting model, adopted worldwide and exclusively developed on a territorial basis, cannot take these new phenomena into account: the decrease in emissions in a given territory is not actually a guarantee for a similar reduction of global emissions.

Macroeconomic analyses and recent estimates in literature emphasize how significant are emissions related to the consumption of goods and services (*consumption based*), which are mainly associated with the goods imported by western countries from the major emerging economies.

Should greenhouse gas emissions accounting be reconsidered on the basis of consumption responsibility rather than on emission territoriality, the results could be dramatically different. For

instance, a large part of the impressive growth of emissions from emerging countries (China, India, Brazil, Korea) could be not ascribable to demographic expansion or higher domestic consumptions, but rather to the exports of goods and services to the developed countries.

Fig. 3 – Classification of net CO₂ emission importing, net emission exporting and consumption based emission countries, 2004



Source: Davis S., Caldeira K., 2010 and data processing by ENEA, 2011

Hence, at this point serious reflection is necessary upon the actual responsibility of the global emission increase and on new approaches and measures which may:

- ensure higher effectiveness of objectives;
- help overcome the impasse in global negotiations;
- gain higher consumers' awareness on the environmental impacts of their consumption choices in terms of goods and services, regardless of where they might be produced.

The highest difficulty in implementing a new mechanism based on *consumption based* emissions is certainly the complexity of ascribing the associated emissions to any goods or services.

Yet the new EU energy taxation directive, providing for a tax component proportional to induced CO₂ emissions, can be a first significant step ahead to overcome such difficulty and approach an environmental accounting allowing to ascribe induced emissions to any goods or services.

Regardless of its quantitative dimension, such tax component would indeed allow to calculate the emissions related to any production activity by a simple ratio; transferring such information, for example, along with billing from each phase of the production cycle to the end product, it would then be possible, at least for goods and services entirely produced in Europe, to easily track the emissions induced by any goods or services with no significant administrative burden.

This would make it possible to include the amount of induced emissions on the label, together with the price and other possible product characteristics. This would already be an important result *per se* as it would allow:

- consumers to orient their own choices also according to the lower or higher carbon content of the goods they are to purchase, against accurate and transparent information, much more exhaustive than the current *carbon footprint* calculation methods;
- companies to implement environment-centred marketing policies.

Of course, attributing induced emissions to goods and services allows to have new instruments at disposal to curb emissions themselves. Specifically, a new and innovative tax system could be formulated, which takes into account the carbon content of goods and services.

For example, an indirect tax could be adopted, the "carbon-added tax" (CAT), with a mechanism similar to the value added tax, which could represent an additional cost not for the production chain operators but rather for end consumers alone.

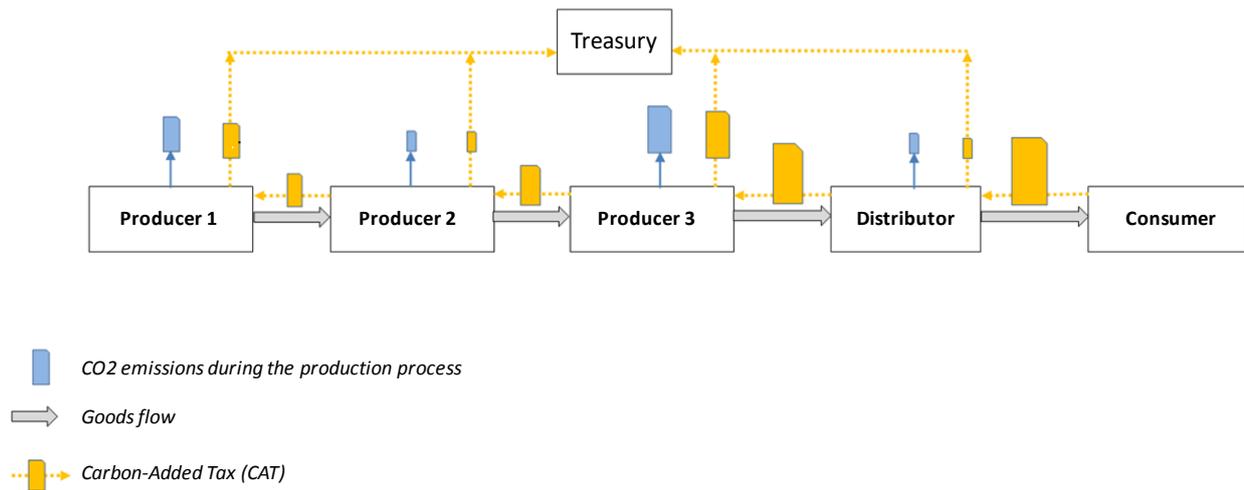
The application of such a tax could be summarized as follows:

- the non-domestic use of fuels, propellants and electric power would be additionally taxed (CAT) in proportion to the energy product emissions;
- the sellers of the above energy products would pay the relevant CAT to the treasury;
- each producer of end or intermediate goods and services could get the CAT paid to their providers (whether of energy products, raw materials, intermediate goods and services) deducted by highlighting the relevant amount on the bills of sale;

- the end seller of the goods or services required would get back from the consumer the CAT of the whole production chain, by highlighting the amounts of both the associated emissions and the related tax on the bill or the sales slip.

Fig. 4 is a scheme of such taxation mechanism, where the flows of emissions, money and goods in a simplified production chain are shown.

Fig. 4 – Emission-based taxation mechanism for consumer goods



The aim of such innovative tax system would be providing consumers with an additional price signal besides the one specifically environmental when making their choices; such a signal could be modulated according to the emission reduction targets that are to be achieved. What is more, the mechanism would also impact on the production chain since the operators purchasing a goods, whether a semi-worked or an end product, will get the direct information of a carbon tax price, so that they are given the chance to orient their own choices towards environmentally sustainable products, ensuring higher competitiveness.

The CAT could be complementary to the indirect taxation (VAT) existing in any nation, with a transaction actually neutral, that is not additional to the total indirect taxation. Such a target can be achieved by reducing the VAT rate (of all goods and services) by a percentage globally equivalent to the revenue expected from the new CAT tax.

As an alternative, the CAT could be totally or partially conceived as an additional tax to get resources for funding climate change mitigation and adaptation interventions: R&D on innovative technologies, technology transfer for more disadvantaged countries, etc.

The taxation could also be simply proportional to the product-related emissions or differentiated according to the deviation of the intensity of emissions from an average or *benchmark* value. By so doing, the virtuous products could be even more incentivized through the partial or total tax exemption, at the expense of a higher rate for those products most deviating from a reference value. On equal tax pressure conditions the best low-emission production technologies would

benefit from an even faster intervention. Otherwise, the financial flows allowing “virtuous” producers to get back the CAT paid to providers would be more complex.

At first, this new system could be applied only in Europe without violating the World Trade Organization criteria: actually for each end or intermediate product an CAT exemption can be set for those goods exported outside the EU, whereas the CAT can be applied to those goods imported according to transparent and non-discriminating criteria. For instance, an CAT related to the value of the emission specific to the European average product could be applied to imported goods, possibly charging additional amounts corresponding to the emissions related to intercontinental transport.

Yet, even in the absence of global agreements, such a model would prove attractive to both the other developed countries and the emerging economies, which could be led to adopt similar tracking mechanisms for the emissions induced by exported goods and services, even for just benefiting from the tax breaks provided for in the European market.

Manifold are therefore the potential advantages of this new approach to greenhouse gas emissions reduction.

Actually, the new mechanism could:

- allow to better exploit eco-friendly goods and services regardless of the country of origin, thus triggering a competition process by emerging countries towards more environmentally efficient productions;
- help overcome the current impasse over climate change negotiations; as a matter of fact, its transversal, non-territorial character would avoid from the very root all doubts and vetoes between emerging and developed countries about a possible global ETS system, necessarily based on the allocation of emission quotas and consequently limiting the development potential;
- implement border levelling of the costs depending on environmental factors of the imported and exported goods, bypassing the risk attributable to the ETS system of influencing the decisions on the localization of high emission intensity plants; (obviously, such an effect would be negligible for those sectors where decisions on localization are mainly related to other factors, e.g. labor cost, environmental and safety regulations, etc.);
- help keep track of the emissions induced by goods or services, with the consequent advantage of a higher awareness by end consumers, who are given the chance to choose whatever goods not only based on their price, but also on their impact on the environment.

It is worth noting that the new taxation mechanism is profoundly different from the traditional proposals to introduce a *carbon tax* (a solution which can make calculations easier but is politically hard to apply on a global scale); actually, taxing energy products through non-deductible excise taxes, although impacting on the costs of goods and services, remains “blurry” to consumers, who cannot grasp such an effect among many others that can make prices increase. Furthermore, a “*carbon tax*” applied one-sidedly in Europe would cause European productions a loss of

competitiveness, which could not be offset at the border, since information is not enough to operate in a non-discriminating way, and therefore in compliance with WTO regulations.

It must be also clear that the CAT would not require the immediate suppression of the ETS system, since theoretically it could just be complementary and not alternative to *cap and trade*, at least as long as its efficacy is not actually proven. It could also be in addition or complementary to the quantified emission reduction commitments by the various countries.

Despite the ETS system, the CAT would also have the merit to present a lower degree of arbitrariness (in determining the national emission ceilings) and to be easily readjustable according to the emission reduction targets. This allows to also overcome the possible objections as to the certainty of the achievable results³.

Obviously, against the advantages stressed above, for the actual introduction of an CAT there are also scientific, technical and organizational difficulties which require studies and in-depth analyses to be overcome, such as for example:

- study of the possible different methodology application options;
- in-depth analysis of the tax, legal, international trade issues;
- evaluation, in terms of emission reduction, of the intervention efficacy on the economic system, comparing the different options with respect to different systems, too (e.g., ETS);
- evaluation of the intervention effects on consumers' behaviour.

Of course these activities demand adequate resources and time schedules to be performed with the required punctuality. In the framework of its institutional tasks, the ENEA Agency will give its scientific contribution to get deeper into these themes, also by involving and collaborating with other national, European and international subjects.

In order for this pathway of global climate-altering gas emissions, currently so uncertain, to gain credibility again, the time has now come that this and other possible proposals for new innovative mechanisms be included with full rights in the debate and in the analyses by those institutions and research organizations taking charge of finding a solution.

³ Actually, no system can ensure an emission reduction target *a priori*: even the *cap and trade* systems indeed cannot but predict economic outcomes against exceeding the preset emission ceilings.



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