Tax Reform: Core of a Workable Climate Policy

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Abstract

Climate change is a global energy economic commons, which characteristics impose stringent constraints on workable policies and usable policy instruments. The climate is saved when the world urgently and drastically converts to carbon free and sustainable energy systems, i.e. renewable energy. Given the costs of a full renewable supply the conversion is but affordable when fuel and electricity intensities of the world's economies are divided by factor 4 to 10. Such cuts in intensities only happen when overall end-use prices step up irreversibly. Only tax reform can install this type of solid buoyancies.

Given the stalemate on the Kyoto protocol and the failing EU emission trading scheme, the world is searching a better alternative. A Global Agreement on Energy Intensity & Taxing can engage all UN nations in effective efforts to bring down year after year their fossil fuel and grid electricity intensities by a home-made tax reform. Compliance on the committed progress trajectories by country is easy to monitor. Through a Global Climate Fund wealthy nations transfer technology and money to less wealthy nations according income groups and according performance in meeting the individual progress trajectory.

Keywords: tax reform, energy intensity, climate policy, redistribution, climate agreement

CLIMATE CHANGE IS AN ACCEPTED REALITY …

The Fourth Assessment Reports by IPCC in January, April and May 2007 [IPCC, 2007] add scientific vigor to the many other studies published over the last years on human induced Climate Change [e.g. Stern, 2006] and to the popularizing initiatives such as Al Gore's 'The Inconvenient Truth'. The reality of Climate Change is widely recognized by the peasants in Africa up to the CEOs of the global corporations. Symptoms are identified and monitored. Effects and impacts are assessed more fully with clearer view on the uncertainties. Causes are known and tracked: the ever increasing quantities of greenhouse gases, mainly carbon dioxide, emitted second after second by almost all activities by almost all people of this world. The emissions add to a relentless creeping up concentration of greenhouse gases in the atmosphere what traps the heat on earth. The present concentration and its present building up result from uneven emission quantities by industrialized, industrializing and developing nations. Responsibilities are common but clearly differentiated, as was adopted at the Rio summit in June 1992.

… BUT GLOBAL POLICY IS LACKING

Autumn 2006, the Stern Review states "Climate Change presents very serious risks, and it demands an urgent global response" [Stern, 2006]. The world is in high need of a

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workable Global Climate Policy Regime but the stakeholders (USA, EU, Japan, Russia, Canada, Australia, China, India, Brazil and the Groups of developing nations) are not engaged in a common effort to define such a workable regime in the short term. The stalemate on the Kyoto Protocol and its implementation is not settled, with opinions varying from “the best one can realize” up to “a waste of time and resources” [Hahn and Stavins, 1999; Nordhaus, 2005]. The protocol provides not a global regime for an essentially global problem, and so fundamental changes are needed. The implementation by the adopters of the protocol is based on flexible mechanisms. A patchwork of Tradable Emission Permit schemes is growing in the industrialized states, failing in delivering a clear, predictable carbon price as buoyancy for investors. In a February 2007 interview Sherri Stuewer of Exxon Mobil pointed to the “inevitably volatility and uncertainty in the price” of such tradable systems, and added: “a system which has a clear, consistent, stable cost of carbon that is predictable over the long-term is much better at drawing in the investment necessary”[EurActiv, 2007].
Clean Development Mechanisms (CDM) is the second main instrument for enhancing efficiency and for transferring resources and technology to the developing countries. BP’s John Browne [2004] states “In principle, the CDM was a good idea. In practice, it has become tangled in red tape and has required governments and investors to do the impossible: estimate the level of emissions that would have occurred in the absence of a project and then to calculate the marginal effect of their actions”. Red tape has been removed by a few bankers, consultants and factory owners in not so poor countries, that enrich on the billions of CDM dollars, as revealed by Bradsher [2006], Lohmann [2006] and Open Europe [2007].

Continuing building on Kyoto’s shaky foundations is defended with practical and sunk-cost arguments and with naïve claims of textbook market models. Clearing the Kyoto ground and ramming new foundations for a global climate policy regime is coming on the UN table and academics, industry think thanks and policy makers are exploring the field. Sir Stern [2006] presents “Climate change (as) a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen”, and therefore “the first element of policy is carbon pricing”; “carbon pricing gives an incentive to invest in new technologies to reduce carbon; indeed, without it, there is little reason to make such investments”.
The Kyoto 1997 fabric is not going to deliver the necessary global, clear carbon pricing. Taxing as instrument has been suggested by many, e.g. Weiszäcker [1990], and tax reform argued by Görres [2002]. A global uniform carbon tax is a theoretical attractive but practically naïve alternative [Cooper, 1988, 2001, 2005], [Dresner et al., 2006], [Nordhaus, 2005], [Shapiro, 2007]. But how to construct a policy regime supplying the adapted, sufficient and necessary carbon pricing signals?

CRITERIA FOR A WORKABLE CLIMATE POLICY

Blueprinting a workable policy starts at the conditions such regime should obey.
First, be global i.e. involve and commit all UN member states.
Second, for having any chance to meet the first condition, respect fairness in recognizing the different historical and present responsibilities for greenhouse gas emissions and resulting concentrations in the atmosphere.

Third, recognition of different responsibilities should be translated in real money and technology transfers across states according to responsibilities and to needs.
Fourth, start from present differentiated realities in UN member states and reside practical decisions on implementation of the policies under member states scrutiny.
Fifth, meet the standard criteria of policy performance: effectiveness (emissions go down, urgently, drastically and irreversibly), efficiency (costs for reducing emissions are as low as possible), fairness (costs are assigned according to transparent and fair principles, avoiding windfall profits, corruption, but helping people in need of support), monitoring & enforcement (participants performance is supervised in a light way with limited transaction costs, and non-performance is enforced by built-in mechanisms).

Obeying all above criteria is peculiar, and still an extra condition looms as a huge challenge: "drastic change is urgently needed" [Stern, 2006]. On the one hand we best avoid overhasty confusion and idealistic calls for excelling new citizenships (Al Gore), as Popper argued that the way to heaven mostly ends in hell. On the other hand, become very critical to the standard business-as-usual and solutions because they have brought our technologies, economies and societies to the non-sustainable course of today. Deliberately reconsider and question all thinking and all proposals that continue business-as-usual, and search for crossing ways to take. In other words: real progress is required on Our Common Future's challenging program of changing our uses of natural resources and energy, technological developments, direction of investments and related institutions [WCED, 1987].

DRIVERS OF CARBON EMISSIONS

The stage of blueprinting a workable climate policy is set by basic facts related to carbon dioxide emissions. Ehrlich and Holdren (1971) developed the IPAT identity, expressing Impact (on the environment) as a product of (number of) People x Affluence ($/person) x Technology (impact/$). A hybrid of the identity focuses on the carbon emitted per person as a function of wealth per person, energy intensity of wealth and carbon intensity of energy used:

$$\frac{Carbon\ Emitted}{Person} = \frac{\$}{Person}\ x\ \frac{kWh}{\$}\ x\ \frac{Carbon\ Emitted}{kWh}$$

The task is bringing down the left side of the equation, by finding out how to work on the three components of the right side. Reducing wealth and wealth growth is no option for the world because the poor majority wants a better life and the rich minority is not giving in. To bring emissions down energy intensities and carbon intensities should decrease [Pizer, 2005]. First I discuss lowering carbon intensity of commercial energy use, next energy intensity.
Four contenders offer to lower carbon dioxide emission: fuel substitution, nuclear power, carbon capture and storage, and renewable energy.
Fuel substitution is familiar. After coal had driven out wood as a fuel in the industrializing economies hydrogen weight in fossil fuel use has steadily progressed. Oil for coal, natural gas for oil, and hydrogen for natural gas, raise the hydrogen content so lowering carbon/hydrogen ratios. However, the third substitution where the ratio could fall to zero

(and solve the emission problem) contains a circular reference because hydrogen is not freely available on earth. It has to be derived from fossil fuels or by use of nuclear or renewable energy.

Nuclear power is second contender. No energy technology on earth enjoyed a similar vast support by the scientific, business and political communities during decades. Still some belief the full nuclear option can save the world, but others show that nuclear development is part of the problem not of the solution [Verbruggen, 2007]. As much as possible nuclear was tried during the last 50 years. As part of the business-as-usual gallery it cannot bring the drastic change needed. The particular risks of nuclear are documented (accidents, waste, proliferation), nullifying its ambitions of sustainable technology. Apart from this, nuclear is competing or opposite with the next two contenders for low carbon emissions.

Carbon dioxide Capture and Storage is under development to keep the vast coal resources accessible for energy supply in the future [IPPC, 2005]. It is still early day to judge the performance of this option but when successful, the centralized conversion of coal into grid electricity or into synthetic fuels (including hydrogen) will stay part of the energy system.

Fourth, there are the renewable energy sources, covering a wide range of technologies and applications. Apart from their sustainable appeal and zero or low carbon intensity, renewable energy owns few attributes to smoothly fit in the business-as-usual energy structures and habits. Many do not deliver at command but intermittent, are not centralized but distributed, not concentrated but diffuse, not cheap to mine but expensive to collect. As they stand now, they are technically and economically not ready to respond to the exigencies of the energy intensive practices of the industrialized and industrializing societies. But what is today must not be tomorrow. The renewable energy technologies surf on most new technological developments of the last decades: micro-electronics, new materials, bio-technology, and their progress in performance and cost reductions is significant and promising. But even then, we cannot change the universal laws of the earth circulating the sun on a particular ellipse. An almost fully renewable energy economy will be clean but not cheap. The cost will be such that the world cannot afford to meet the past and present energy intensive habits and so we have to focus on the middle factor of the above equation: energy intensity.

ENERGY INTENSITY IS CRUCIAL

Addressing energy intensity of wealth, best focuses on commercial end-use energy, i.e. the energy used in our appliances, buildings, transport engines, industrial equipment, etc. There are two main types: fuels (oil products, delivered gas) and grid electricity (two thirds derived from fossil fuels, mainly coal, one sixth from nuclear fission and one sixth from renewable sources, mainly hydro). Energy intensity is a composition of efficiency (how much energy is used for an activity?) and of structure (what activities make up the domestic product of a country?):

$$Energy\ Intensity = \sum_A \frac{kWh}{Activity} x \frac{Activity}{\$}$$

Several studies analyse energy intensities of OECD economies forthcoming from about 20% by structure and about 80% by efficiency in using energy [Geller and Attali, 2005].

Talking commercial energy end-users is talking about all people of the world except the most deprived ones having no access at all to commercial energy. People using energy do so in the most diverse activities for the most diverse purposes on the most diverse moments and in the most diverse places. Telling all such energy users they should reduce their commercial energy use intensity, requires a global language all such people understands, is willing to listen to and at the end adopts the message conveyed. But one language is up to the job, i.e. the language of energy end-use prices [Arrow, 1974].
In the last 60 years this language tells people that energy is cheap, that fossil fuels are abundant, that the atmosphere is an unlimited sink for our waste products and that the earth can absorb all the pressures and risks we put on it. That is why end-users use a lot of commercial energy in meeting the goals they strive for.
Indeed, the height of the energy intensity end-users adopt is the outcome of a rational decision-making process. Although there may house a lot of personal preference, adopted customs, cultural heritage, even passion, etc. in the end-uses we use energy for, energy itself is something no-one really is interested in. No-one has ever seen or smelled an electric kWh and touching it is very unpleasant, while oil stinks and gas is explosive. High energy intensity is not what we want. But low intensity is not our interest neither when we must spend effort or other economic resources on it. All of us balance the optimal energy intensity at the point of least economic costs.
It is a very comforting observation that people decide on energy intensity in a neutral, economic way: people excelling above themselves is not required. One can stay at the earth's surface and has not to climb to heaven and fall to hell. But move is needed and triggered by a planned, deliberate trajectory of energy end-use price increases.

ENERGY PRICES DETERMINE INTENSITIES

The relationship between energy prices and commercial energy use has been the subject of thousands of researches [Lafferty et al., 2001; Sterner, 2003]. Demand for energy depends on technology which development and implementation is decided by prices and incomes. Most researches do not focus on energy intensity as such but on energy use, mingling up people's high request for the goods & services delivered with the help of energy on the one hand and their neutral, indifferent attitude towards how much energy to use on the other hand. Also many studies do not properly distinguish the short-run from the long-run perspective.
In the short-run people is not allowed the time to adapt to new conditions, in particular a changed energy price level. Changes on short notice always bring unease. Sudden and sharp price hook-ups like the ones experienced in the 1970s create significant economic loss and disturbance, also distress for the poor that cannot fall back on buffered wealth.
In the long-run, i.e. the period long enough for adapting to higher price regimes, house-holds, industries, drivers, etc. know well to re-optimize their economic positions by becoming more energy efficient. End 1970s - begin 1980s efficiency improvements made obsolete before they started plans for megalomaniac energy supply expansion (nuclear serial construction, nuclear breeders, synthetic fuel winning from heavy oil shale and sands, revitalizing coal mining in Europe). But because supply infrastructures are long-lasting and mainly sunk-cost, energy prices fell down again once the tightness of the markets released. End-users again re-optimized: they did not scratch the acquired efficiency but projects for further improvements were shelved when requiring effort or

investment. The experience shows that market price left over to itself, is too volatile to provide the clear pricing guidance needed to address climate change challenges.

EFFICIENCY IS TARGETED AT KEEPING BILLS CONSTANT

People are truly uncommitted to energy efficiency but economically rational. Although some barriers exist to attain the theoretical first-best economic optima (as they do in most markets), the re-optimizing reactions come swift and effective once the signals are clear. What is behind the reactions looks as a conservative propensity: households and industries strive for a return to their original positions of spending a particular share of their income / total budget on fuel and grid electricity bills.

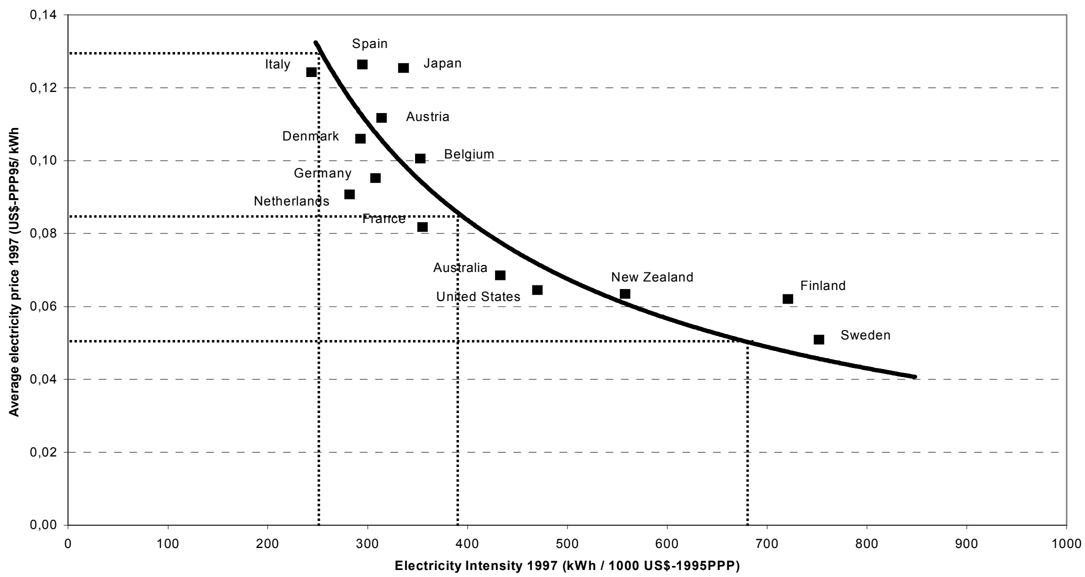
The phenomenon is illustrated in figure 1 for the wealthiest OECD nations [Verbruggen, 2006]. The abscissa shows the electricity intensity (in kWh per 1000 US$-1995PPP); the ordinate the average household-industrial grid electricity prices. The available observations for 14 nations are the black squares with the names along. The curve represents the best fit to the technology for reducing electricity intensity. In present jargon it is called a "marginal mitigation cost" curve. The panel data and the curve reveal "price x intensity ~ constant", i.e. the long-run price elasticity is ~ -1. The meaning of the constant (in the example ~3.4) is the share of the GDP spent by the countries on the supply of electricity.

Lessons to learn from such analysis are multiple. First, intensities diverge a lot between otherwise similar countries, all with a high income per person and with access to the globally available electricity end-use technologies and solutions. Every country owns some particularities but about 80% of the differences are due to diverging end-use efficiencies in using electricity. Differences are striking: when USA intensity would equal the Japanese one, half of the ~TW (a billion kW) USA power generation complex could be mothballed.

Second, there is a strong relationship between end-use price and intensity. When prices are high, so is efficiency bringing intensity down. When prices are low, so is efficiency pushing intensity up. There are no short-cuts here, and policy should live upon this basic economic law, just as engineers must live upon the basic laws of thermodynamics.

Third, high end-use prices are not destroying economies but rather make them efficient. The share of GDP that countries spend on electricity supply is overall almost equal whatever the end-use price regime being adopted. This is expressed by the equal areas of the rectangles in figure 1.

Figure 1: Marginal Mitigation Cost function of Electricity Intensity, revealing: Price x Intensity = Constant [based on 1997 data of wealthy OECD nations; GDP in Purchasing Power Parities]



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Fourth, transiting from high intensity to low intensity electricity economies requires “rotating bills”: transform the flat horizontal rectangle towards a square, remodel the square to a standing rectangle, up to an obelisk type when very low intensity is necessary to afford electricity supplies based almost fully on renewable sources. The remodelling process of the electricity bills is but possible when price pressure is relentless and increasing, gauged by grid electricity taxing policies.

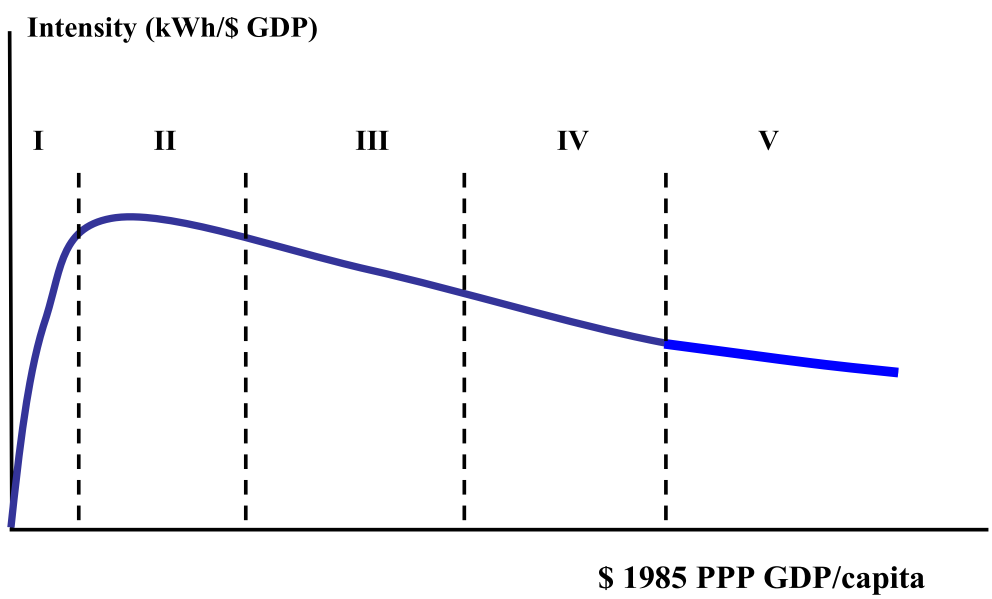
The example is based on electricity use (considered to be little price elastic). Similar results are observed for car fuels [Hammar, et al., 2004]. Price elasticity of energy demand at ~ -1 in the long-run is documented frequently.
The example illustrates the static case of “frozen” technology. However, high end-use prices induce technological invention and innovation in the field of efficiency and renewable energy that eases remodelling the bills.

Global Agreement on Energy Intensity & Taxing

The goal of limiting global carbon emissions must be reached from two sides. One is the stepwise reduction of fossil fuel and grid electricity end-use intensities. The other is the stepwise introduction of renewable energy sources and technologies. The affordability of the latter depends fully on the success of the former, and the primary driving force must be addressed first.

The focus on energy intensity does not obstruct economic development. Some economies export a lot of their production and climate policy should avoid to bias comparative advantages and trade among countries.
The electricity intensities in the panel of wealthy OECD nations (figure 1) show that at present energy intensities differ a lot among countries. A practical policy must start from such differences and take them into account. Globally, there are two main sources of the differences in intensities. First, there is the status of industrial development of a country. Medlock and Soligo [2001] show that the average energy intensity depends on GDP/cap (figure 2). Very poor countries are in a phase of rising intensities because they build up infrastructure and industrial activities; in a next phase intensity is highest when the industries are fully developed; then there is a steady decline in intensities the more wealthy the countries grow (by changing activities that compose the GDP and by improved efficiency). We distinguish five groupings of countries by GDP/person levels from very poor (rising intensities), poor (maximum intensities), medium (first decline in intensities), rich (second decline) and very rich (lowest intensities). The pattern of figure 2 refers to average intensities by GDP grouping.

Figure 2: Average Energy Intensity of economies as a function of GDP
[Source: Medlock and Soligo, 2001]



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Second, within every group, and in particular in the wealthiest nations, there is a significant variation around the mean intensity value, mainly due to a different energy price history in the particular countries (figure 1).

A Global Agreement on a workable climate policy should encompass:

(1) All UN countries are invited to participate and every country is listed in one of the five income groups depending on the height of GDP/inhabitant.
Data needed by country are yearly energy balances as structured by WEC, IEA, OLADE, EUROSTAT, etc. and yearly national income statistics as assembled by IMF. For countries lacking these data today the international effort of collection and processing good statistics is limited.

(2) The data provide fossil fuel and grid electricity use and intensities by country. Also the shares of GDP spending on end-use supplies of fossil fuels and grid electricity by country and averages by the five income groups of countries are assessed.

(3) Every country commits itself to a domestic tax reform that abolishes all subsidies for fossil fuel and grid electricity use and shifts part of the tax burdens on merit goods to taxes on energy end-use [foes]. How a country organizes the tax reform is left over to its own scrutiny, while the World Bank and regional organisations (ASEAN, LACEA, OECD, EU, etc.) can develop templates adapted to various economic structures. Every country's tax reform clearly earmarks fossil fuel and grid electricity use taxes for adding to yearly revenues (called "Climate Tax Revenues") to compare to total GDP.

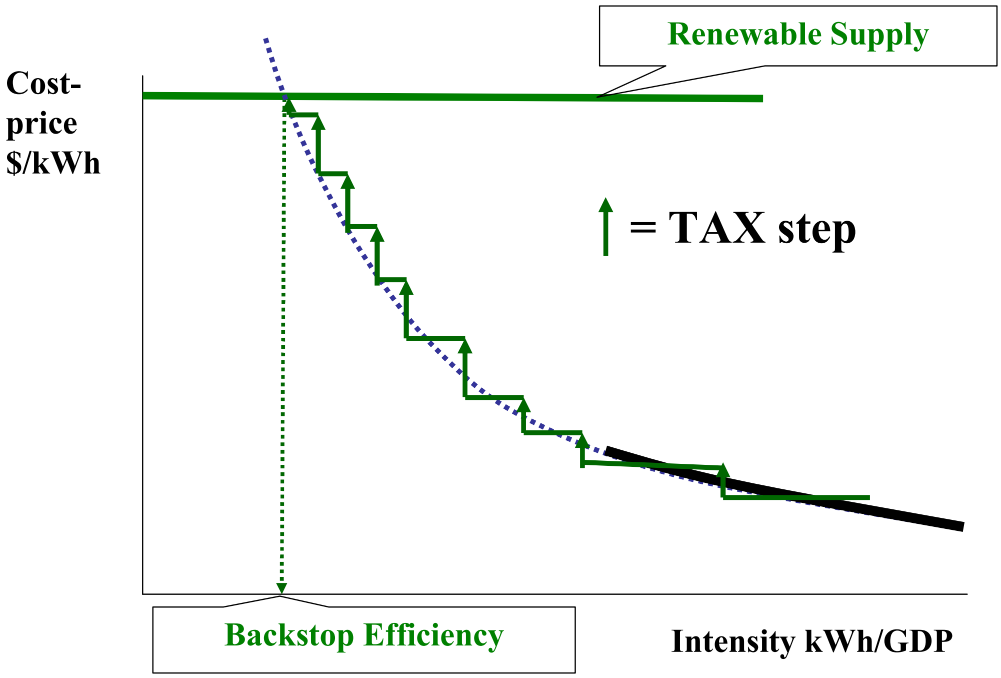
(4) Every country of the four income groups that have passed primary industrialisation commits itself to a trajectory of "stepwise reducing" fossil fuel and grid electricity intensities over the next ten years. As shown in figure 1 this implies "rotating bills" from "long and flat" to "high and narrow". The remodelling needs increasing and lasting pressure exercised by end-use prices bolstered by suitable taxing of fossil fuel and grid electricity end-use.
I.e. the country commitments are pairs of targets {tax revenue, intensity level} specified by grid electricity and fossil fuel end-use sector (transport, heating, particular industrial activities, horticulture, etc.). The targets will vary by country depending on the actual state of the energy economy, natural and historical factors, national policies, etc. Imposed is only that reduction in fossil fuel and grid electricity intensities yearly progresses along the constant bill curves (price x intensity = constant; figure 1 and figure 3) established by income group of countries.

(5) The ten-year commitments should be reviewed every 3 to 5 years to represent an accurate trajectory of moving progress, taking into account technological invention and innovation that will be induced strongly by the set-up policies.

(6) Yearly reporting to the UNFCCC secretariat reveals progress in decreasing fossil fuel and grid electricity intensities and reveals climate tax revenues. IMF and the World Bank can support and verify the reporting.

(7) A "Global Climate Fund" is organised. Countries of the wealthiest group commit to payments to the fund for providing drawing rights to countries of the poorer groups. Payments and receipts are depending on performance in intensity reduction and in realising climate tax revenues by the tax reform policies undertaken.

Figure 3: Deep Cuts in Intensities requires a Taxing Stair by Country



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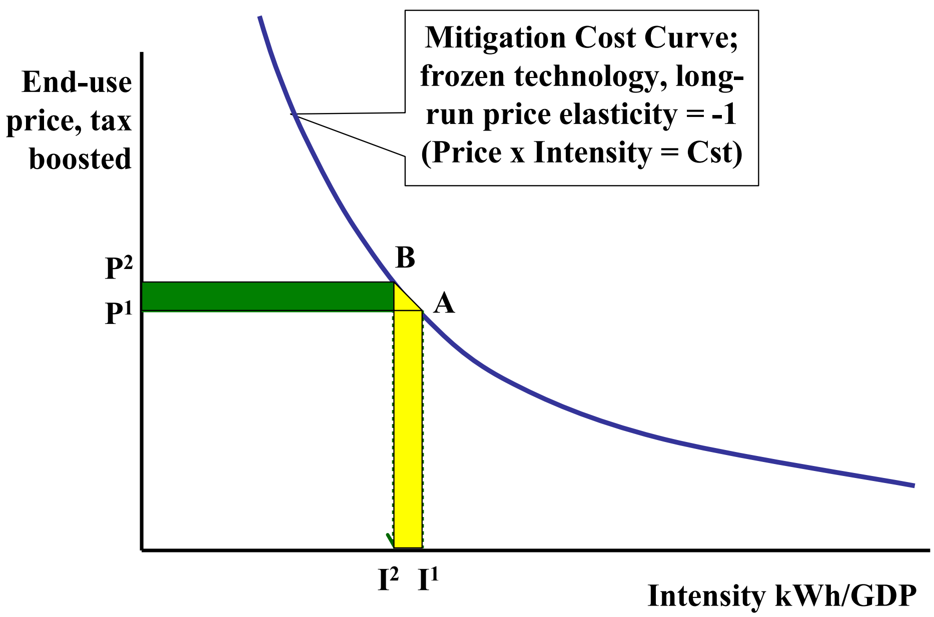
Realizing reductions in grid electricity and fossil fuel intensity for levelling the playing field for renewable energy solutions requires tax reform. It is not feasible to attain deep cuts in fossil fuel and grid electricity intensity without a deliberate and well-designed tax reform policy with stepwise increasing energy tax rates. The mechanism of tax reform for decreasing energy intensity is shown in figure 4.

In position 1 (or A) an economy charges energy prices P^1 having resulted in an energy intensity I^1 occasioning a bill shown by area OP^1AI^1. A next step in taxing raises the price to P^2 and households, companies and organisations work on bringing the intensity down to I^2 keeping the energy bill constant, now as area OP^2BI^2. With an elasticity = -1 both areas and both bills are of equal size, i.e. the initial and the final positions are economically as affordable.
Lowering intensity from I^1 to I^2 costs area I^1ABI^2. If costs would be higher, end-users would not lower intensity by adapting investments and behaviour but rather pay the tax imposed. If they would be lower, end-users would already have adapted investments and behaviour before. Both such attitudes in the long-run are not observed.
Area I^1ABI^2 represents real costs for investments in efficiency, substituting goods and services, adapting behaviour, etc. In principle tax reform can redirect the tax receipts (area P^1ABP^2) for paying the costs of the efficiency transition step.

To fully remodel bills, the intensity-end-use price-tax recipe for a country will have to impose rising tax rates over time, adapted to the state of the patient but tapping from a transparent diagnosis (figure 3).

Figure 4: Revenues from Tax Reform can cover the Efficiency Transition



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The speed of reducing energy intensities is mainly determined by the pace of diffusion and adoption of available energy efficiency technologies (fixed long-run marginal cost curves expressing frozen technology as shown in figure 1) and can be faster with bursting innovation and invention (causing the marginal cost curves shifting downwards), all pressed by increasing end-use prices imposed by the tax reform pattern adapted to the country [Popp, 2002; Edenhofer et al., 2006].

The money that every country collects by carbon taxing remains within the own country, except for the transfers to the Global Climate Fund as discussed below, because as Nordhaus [2005] argues “it is necessary to locate the decision making at the political level that can internalize the spill-over”. Also every country can find out how it fine-tunes the taxing and return system in order to avoid regressive distributional effects or to avoid hardships for particular economic activities that need a longer transition period than the average. Only the effective energy intensities and the total “climate tax revenues” are monitored and source of adjustments (of the tax rate growth pattern), and of penalties or rewards (see next).

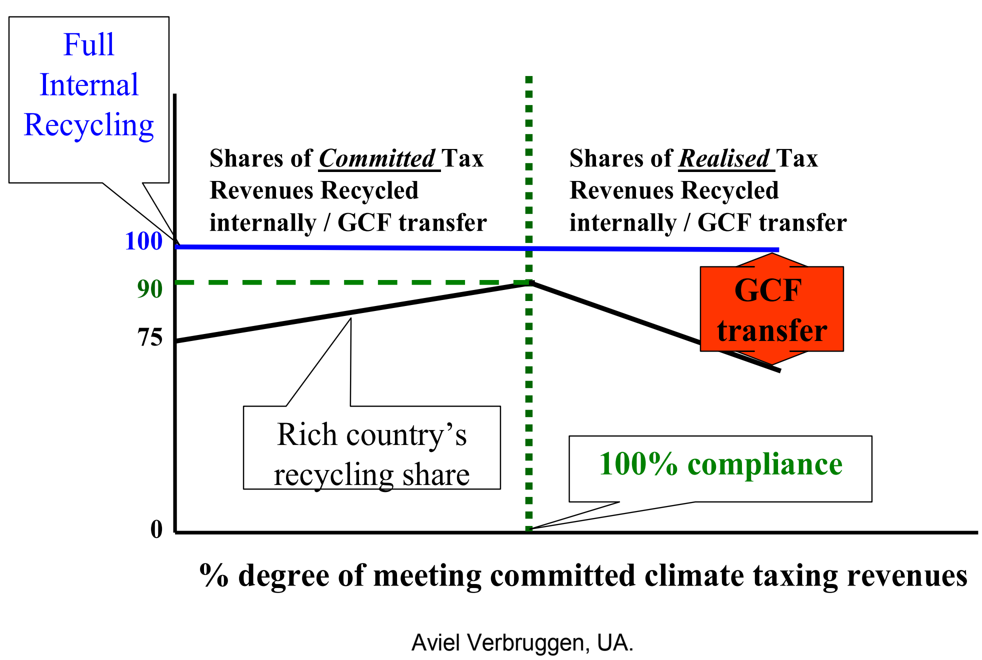
Transfers to low-income countries

By necessity of a sustainable development, by obeisance to the basic ethical principles and by thinking of the own survival, the self-interest of the wealthy nations of the world is best served by an '*as much as fast as possible*' transfer of sustainable technology to developing countries. With the proposed five groups of rich-to-poor countries, the Global Agreement on Energy Intensity & Taxing can include a system of transfers based on GDP/person status and on the countries' performance on committed intensity reductions and climate tax revenues in the agreement. The two yearly aggregate indicators provide the basis for measuring performance and for regulating the transfers. Some first ideas on a possible transfers system based on the realisation of climate tax revenues are presented here.

The Global Climate Fund (GCF) is financed by two sources. First, penalties are paid by the wealthier countries when they fall short of the committed GDP share in climate tax revenues for attaining the reduction in energy intensities. Second, part of the carbon tax revenues collected in the rich countries is transferred to the fund. Poor countries receive drawing rights on the fund: the full amount when they meet their commitments fully, a decreasing amount the more they fall short of their duties down to none when their performance in tax reform falls very short of the committed terms.

Figure 5 shows what share of its climate tax revenues a country of the richest group should recycle internally and what share should be transferred to the Global Climate Fund, as a function of its tax reform performance.

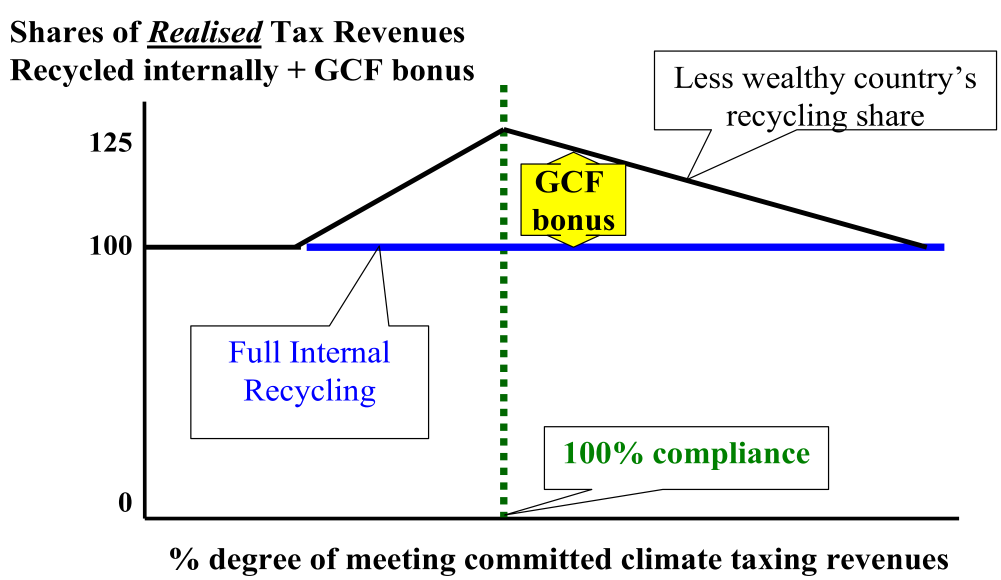
Figure 5: Wealthiest Countries: climate tax revenues regulation for recycling / transfers to the Global Climate Fund, including incentives for good commitment and good compliance



The abscissa measures the % degree of meeting the committed climate tax revenues (or GDP share in such tax raisings) by a country. The ordinate shows how the yearly climate tax revenues by country are allocated as shares of the total climate tax revenues the country had committed or had realised. The major share of the tax receipts is kept within the particular country for internal recycling (the horizontal line at ordinate 100 represents full internal recycling).
The wealthiest nations engage themselves to transfer a share of the tax receipts to the GCF contingent on the degree the committed tax cashing effort has been met. The lower broken line in figure 5 represents one possible regulation scheme for sharing revenues between internal recycling and funding the GCF. Incentives are built in to set the targets properly and to meet the committed targets.

Less wealthy countries follow a different regulation scheme (figure 6). When meeting their commitments, a bonus is obtained as a % of the committed climate tax revenue target. The bonus decreases linearly to zero the more they fail in doing what is needed to control fossil fuel and grid power intensities.
The bonuses may not be assigned as cash money but as carbon drawing rights for funding CDM-type projects in developing countries. So the essence of CDM (agreed upon in Kyoto, 1997) is maintained and given an implementation for meeting the stated goals: real technology and capital transfer to the poorer nations to realise energy intensity reductions.

Figure 6: Less Wealthy Countries: climate tax revenues regulation for recycling + bonus from the Global Climate Fund, including incentives for good commitment and good compliance



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The transfers from wealthiest to less wealthy and poor are according the carrying capacity and performance of the wealthiest countries and according the absorption capacity, needs and performance of the less wealthy and poor nations.

Impacts of a Global Agreement on Energy Intensity & Taxing

Assessing the impacts of the proposed agreement is what Regulatory Impact Assessment expects to do. Detailed analysis is out of scope of this blueprint, but is recommended by every country when tax reform is set up for implementation. Overall robustness can be tested on the main criteria policy instruments should obey: effectiveness, efficiency, equity, and in secondary order: transparency, administrative and other transaction costs (monitoring and enforcement), political feasibility, etc.

- ❖ Effectiveness: price is the main driving variable to reduce fuel & electricity intensity
- ❖ Effectiveness & efficiency: providing a clear, predictable price signal is a necessity for engaging in investments, innovations and inventions
- ❖ Efficiency: converging end-use prices across economies that exchange goods & services lead to equal marginal mitigation costs what minimizes total costs
- ❖ Transparency: a 10 year forward energy taxing plan provides the most transparent message to all that climate change policy has left the phase of words and entered the phase of deeds. All human beings involved in economic activities understand and speak the language of price, whatever different the culture and social class one lives in.
- ❖ Administrative costs: the proposed agreement is mainly based on available data and information to collect through developed tools (energy balances, IMF statistics), and is asking for the contribution by available administrations (finance, energy, environment, foreign affairs).
- ❖ Political feasibility: true is that effective fossil fuel and grid electricity taxing proposals are handicapped by some infamous political set-backs (the Carter administration's energy taxing proposals; the EU carbon/energy tax 10-year schedule; the German Greens tax propositions). There are two ways to look at the history.
  One way is to argue: taxes don't work because they are not accepted and so not enacted; the future is the linear continuation of the past and so tax reform is not feasible and we will adapt to climate change and live or die with nuclear risks.
  The other way is to make the statement of 'drastic and urgent change' reality: the future cannot be the continuation of the past; therefore powerful instruments are required and now it is time to unchain the power of tax reform systems in a globally coordinated way. The growing awareness of the public about the risks building up should be responded by clear communication on tax reform and the likely mostly beneficial impacts of such reform.

The above list skips equity as a criterion because distributional issues merit separate emphasis, inter alias because it is high time to address unwarranted rumours as should well-designed climate tax reform be unfair. This type of rumours is related to unfounded arguments as should more supplies of fossil fuels and nuclear power be necessary to improve the distribution of wealth and opportunities in this world. Here, Our Common Future was already more enlightened: "The simple duplication in the developing world of industrial countries' energy use patterns is neither feasible nor desirable" [WCED, 1987,

p.59] and they emphasised energy efficiency and renewable sources [WCED, 1987, chapter 7, pp.168-205]. Indeed, half a century of unlimited exploitation of the accessible fossil fuel resources and subsidized development of nuclear technology did not shape a fair or safe world, providing the opportunities the developing nations and the poor of the world disserve.
Distributional impacts are discussed at three levels: intergenerational, across nations (developed/ developing), within nations (high income/ low income households).

Intergenerational equity

'Future' generations climate change issues may be rather near in time. Climate change can evolve exponentially exposing the now living people to huge impacts and challenges. Strange ethics house in arguments as should present generations have no advantage in delivering emission reductions efforts for the benefit of people in the future (that, is added, will be richer than the present ones, given the expected GDP growth rates). This argument assigns privileges/ rights to people that in fact have duties. The generations that enjoyed the opportunity to exploit the globe without constraints and to shape the world up to their preferences, today are responsible for the negative side-effects of the trajectory taken. They have the duty to settle the unpaid bills of the past and to clean up the mess of the storming experiments of the last fifty years. They cannot call in more privileges as the free choice between reducing or not-reducing emissions and risks. The duty is to act drastically and urgently and to start the bending off process from business as usual.
Unpaid bills of particular activities are best addressed by imposing without delay payment on the ongoing activities, i.e. tax non-sustainable energy use immediately. Unpaid bills of the past must be settled according responsibility and accumulation of benefits received from past activities causing the harm.

Distribution across countries

The rise from the pre-industrial ~280ppm to the present ~380ppm carbon dioxide concentration in the atmosphere is due to production and consumption processes undertaken predominantly by the industrial and industrialising countries. Around 80% of the 100ppm increase is on account of the wealthy part of the world. Sharing tasks and costs in addressing climate change must take history into account.
The proposed agreement explicitly implies transfers from rich to poor countries. This refurbished CDM offers more guarantees that the money will flow to the countries in most need and in proportion to their capital needs for climate policy. When developing countries participate in the agreement and they live upon their commitments of lowering the energy intensity of their economies, they receive a significant package of drawing rights on the GCF that can be used to invest in efficient and low-carbon energy technologies.
Moreover such technologies will quickly leave behind their more experimental character and become the standard of energy conversion and use, because tax reform will drive the wealthy nations of the world to their development and implementation for own use. The benefits of a world-wide full transition from the megalomaniac capital intensive central energy systems to small-scale distributed highly performing energy solutions (end-use equipment, renewable generation, distributed plants and grids) will provide more

pecuniary advantages to the developing countries than the count of $-transfers through the GCF.
Developing nations will benefit from changing values of production factors when world energy systems have to convert to sustainable ones. It is expected that assets many developing countries own more than others such as: nature, sunshine, biomass, un-built areas, time, etc. will increase in value when the full externalities of climate change and nuclear risks are priced at their real costs, and the demand for efficiency and renewable energy goes up. Also oil and gas world prices will stabilize at affordable levels, because demand is controlled much better.

Distributional effects within countries

In sustainability terms the two preceding distributional issues are of higher importance, but the distributional effects within countries are weighing more on the political feasibility of energy taxing proposals. This is because the constituencies of national governments do not like taxes and it is these governments that decide on taxing or on agreeing about taxing commitments within a global agreement.
The standard argument against energy taxes is lower income deciles of the population are hit relatively more because energy is a necessity good and so takes up a larger share of their income than of the incomes of wealthier parts of the population. This is a true observation [Oladosu and Rose, 2005; Wier et al. 2005] and must be addressed by national policy makers when they implement the tax reform in their particular countries. One of the measures can be that part of the climate tax revenues are assigned to in-kind subsidies for energy efficiency or investments in renewable energy; many EU countries already have set up systems of subsidies but the link with energy poverty is not always clear. More deliberate measures could be that e.g. social housing of the future would be of the highest energy efficiency standards available in the market and equipped with renewable supplies, with access to developed public transport facilities.
Also progressive taxing and selective taxing of energy intensive luxury goods contribute to a shift of the burden from the poor to the wealthy, even when such solutions are not first-best along the abstract economic theory.

Less outspoken is the opposition against taxes by the middle classes and wealthy parts of the populations in the world, today enjoying the non-sustainable comfort of unpaid bills when riding exclusive cars, flying criss-cross over the globe, squandering resources, etc. It is true that effective energy taxing will lead to adaptations in such lifestyles, but also true is that sustainable lifestyles will be less hectic, stressful, alienating, and insecure than the ones that have grown out of the non-sustainable way of life of the last decades.
By a world living upon the paradigm of sustainability also the rich will enormously benefit, not just from saving the climate because of direct self-interest.

References

Arrow K.J. (1974) The Limits of Organization. W.W.Norton & Cy. New York, 86p.
Bradsher K.(2006) Outsize Profits, and Questions, in Effort to Cut Warming Gases, New York Times, December 21, 2006
Browne J. (2004) Beyond Kyoto, Foreign Affairs, July/august, pp.20-32
Cooper R. (1998) Toward a Real Treaty on Global Warming. Foreign Affairs 77(2), pp.66-79.
Cooper R. (2001) The Kyoto Protocol: A Flawed Concept, Fondazione Eni Enrico Mattei, WP 52-2001, 29p.
Cooper R. (2005) Alternatives to Kyoto: The Case for a Carbon Tax, Harvard, 10p.
Dresner S., Dunne L., Jackson T. (2006) Social and political responses to ecological tax reform in Europe, Special Issue Energy Policy, Vol.34, N°8
Edenhofer O., Lessmann K., Kemfert C., Grubb M., Köhler J. (2006) Induced Technological Change: Exploring its Implications for the Economics of Atmospheric Stabilization, The Energy Journal Special Issue, pp.57-108
Ehrlich P.E, Holdren J. (1971) Impact of Population Growth, Science, Vol.171, N°3977, pp. 1212-1219
EurActiv (2007) ExxonMobil's top executives on climate change policy, interview with K. Cohen and S. Stuewer, published Wednesday 14 February 2007 on www.euractiv.com
Eurostat (2006) Energy Balance Sheets. Data 2003-04, 535p. http://epp.eurostat.ec.europa.eu
Geller H., Attali S. (2005) The Experience with Energy Efficiency Policies and Programmes in IEA Countries. Learning from the Critics, IEA Information Paper, 43p.
Görres A. (2001) Forget Double Dividend: Ecotaxes have at least ten Dividends to Offer, Second Annual Global Conference on Environmental Taxation, Vancouver, April 1-3, 2001
Hahn R.W., Stavins R.N. (1999) What Has the Kyoto Protocol Wrought? The Real Arcitecture of International Tradable Permit Markets. American Enterprise Institute Press. Washington D.C.
Hammar H., Löfgren A., Sterner T. (2004), Political Economy Obstacles to Fuel Taxation. The Energy Journal 25(3) pp.1-17
IEA - International Energy Agency (2001) Joint IEA/EUROSTAT Annual Questionnaire Training Workshop 29-31 October, Proceedings (www.iea.org/…)
IPCC – Intergovernmental Panel on Climate Change (2005) Carbon Dioxide Capture and Storage, Special report, Summary for Policymakers, 53p.
IPCC – Intergovernmental Panel on Climate Change (2007) Climate Change 2007. Assessment Report Four. Working Group III: Mitigation of Climate Change. Summary for Policy Makers, May 4, 2007; www.ippc.ch
Lafferty R., Hunger D., Ballard J., Mahrenholz G., Mead D., Bandera D. (2001), Demand Responsiveness in Electricity Markets, Office of Markets, Tariffs, and Rates, U.S. Federal Energy Regulatory Commission, Washington, DC, January 15.
Lohmann L. ed. (2006) Carbon Trading: a critical conservation on climate change, privatization and power, Dag Hammarskjöld development dialogue, n°48, 362p.
Medlock K.B., Soligo R. (2001) 'Economic Development and End-Use Energy Demand' The Energy Journal, Vol.22, N° 2, pp.77-105

Nordhaus W.H. (2005) Life after Kyoto: Alternative Approaches to Global Warming Policies, National Bureau of Economic Research, WP 11889, 32p.
OLADE – Organizacion Latinoamericana de Energia (2007) SIEN: Sistema de Informacion Energetica Nacional, on www.olade.org.ec
Oladosu G., Rose A. (2005) The Income Distribution Impacts of Climate Change Mitigation Policy, IAEE Newsletter Second Quarter 2005, pp.17-23
Open Europe (2007) Europe's dirty secret: Why the EU Emission Trading Scheme isn't working, 56p., www.openeurope.org.uk
Pizer W. (2005) The Case for Intensity Targets, Resources for the Future, Discussion Paper 05-02, 15p.
Popp D. (2002) Induced Innovation and Energy Prices, American Economic Review, March 2002, pp.160-180.
Shapiro R.J. (2007) Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes, American Consumer Institute, 30p.
Stern (2006) STERN REVIEW: The Economics of Climate Change, Executive Summary, 27 (xxvii)p.
Sterner T. (2003) Policy Instruments for Environmental and Natural Resource Management, Resources for the Future, 504p.
Verbruggen A. (2006) Electricity intensity backstop level to meet sustainable backstop supply technologies. Energy Policy, Vol.34, pp.1310-1317
Verbruggen A. (2007) Renewable & Nuclear Power: A Common Future? submitted to Energy Policy,
WCED (1987) Our Common Future. World Commission on Environment and Development, Oxford University Press, 383p.
WEC – World Energy Council (2001). Energy Efficiency Policies and Indicators, London, 242p.
Weizsäcker von E. (1990) Global warming and environmental taxes. International Journal of Global Energy Issues, Vol.2, N°1, pp.14-19.
Wier M., Birr-Pedersen K., Klinge Jacobsen H., Klok J. (2005) Are CO2 taxes regressive? Evidence from the Danish experience, Ecological Economics 52, pp. 239-251.