

Climate change and energy policy: a European perspective

Simone Borghesi

(University of Siena)

Abstract

The ongoing process of climate change poses serious problems in both biophysical and economic terms. To overcome these problems, in the last few years the European Union has adopted several Directives but a long way is still to go to achieve even the basic carbon reduction requirements set by the Kyoto Protocol. This paper discusses the merits and limits of the recent European energy policy, devoting particular attention to the European Trading System of carbon permits and to the measures that the European Union has adopted to promote renewable energy sources. From the comparison of past goals and present results, it is argued that less ambitious but more credible targets for carbon emission reductions and renewable shares would probably help the transition towards an alternative energy system and the necessary reduction of greenhouse gases.

Keywords: pollution; sustainable development; climate change; fossil fuels; energy policy; European Union, European Trading System (ETS); renewable energy sources

Short Biographical Note

Simone Borghesi (M.Sc. University College London; Ph.D. European University Institute) is currently Assistant Professor at the University of Siena. He has held the same position in the past at the University of Pescara (2004-2008) and has worked at the International Monetary Fund, Washington and at the Fondazione ENI Enrico Mattei, Milan. He is author of several articles and two monographies in the fields of international, development and environmental economics.

1. Introduction

The current system of energy production and consumption is largely based on the use of Fossil Fuels (FF) that account for 80.3 per cent of the world total energy supply. As it is well known, however, these energy sources have two main drawbacks as they are both exhaustible and polluting. Both aspects are the object of a hot debate in the literature, but while experts disagree on the scarcity of fossil fuels and estimates of their amount deeply differ across different studies, scholars largely agree on the fact that FF contribute to climate change through an increase in greenhouse gas (GHG) emissions. In the 15 original member States of the European Union (EU), energy production accounts for 59 per cent of GHGs. These considerations call for a shift towards a different energy system that is less dependent on FF in the future, especially in the EU that import most of these resources from outside and is thus particularly vulnerable to the extreme price volatility of the oil and gas markets. However, opinions deeply diverge on the urgency and on the optimal timing of the transition process.

The object of this paper is to examine the link between climate change and the energy system from the European perspective, in order to evaluate the role that the EU has played so far and may/should play in the future in leading this transition process.

For this purpose, the structure of the paper will be as follows. Section 2 briefly discusses causes and effects of climate change, devoting particular attention to the recent economic debate on the economic consequences of the rise in the average world temperature. Section 3 examines the climate and energy policies that the EU has implemented in the last few years, focusing attention on the pros and cons of the Emission Trading Scheme introduced after 2003. Section 4 analyzes the EU renewable energy policies and discusses the speed that the transition to an alternative energy system has had in Europe so far. Some concluding remarks will follow.

2. Climate change: causes and effects

Climatologists estimate that the average world temperature increased by 0.74 Celsius degrees in the last decades (IPCC, 2007). As figure 1 shows, since the 1970s such an increase was strictly correlated to the rapid growth in the concentration of GHGs in the atmosphere. In the period 1750-1850 this concentration augmented from an average level of 280 parts per million (ppm) of carbon dioxide (CO₂) to 430 ppm today. Given the current concentration level, scientists estimate that the global average temperature may rise beyond 2°C as compared to that of the pre-industrial era by 2050 (IPCC, 2007). However, the climate sensitivity to the concentration of CO₂ in the atmosphere is still relatively unknown. In fact, available estimations (IPCC, 2007) find that there is a high probability (more than 66 per cent) that global warming will range between 2 and 4.5°C, but it could also occur (with probability less than 10 per cent) that the temperature increase will be lower than 1.5°C or, on the opposite, substantially higher than 4.5°C.¹

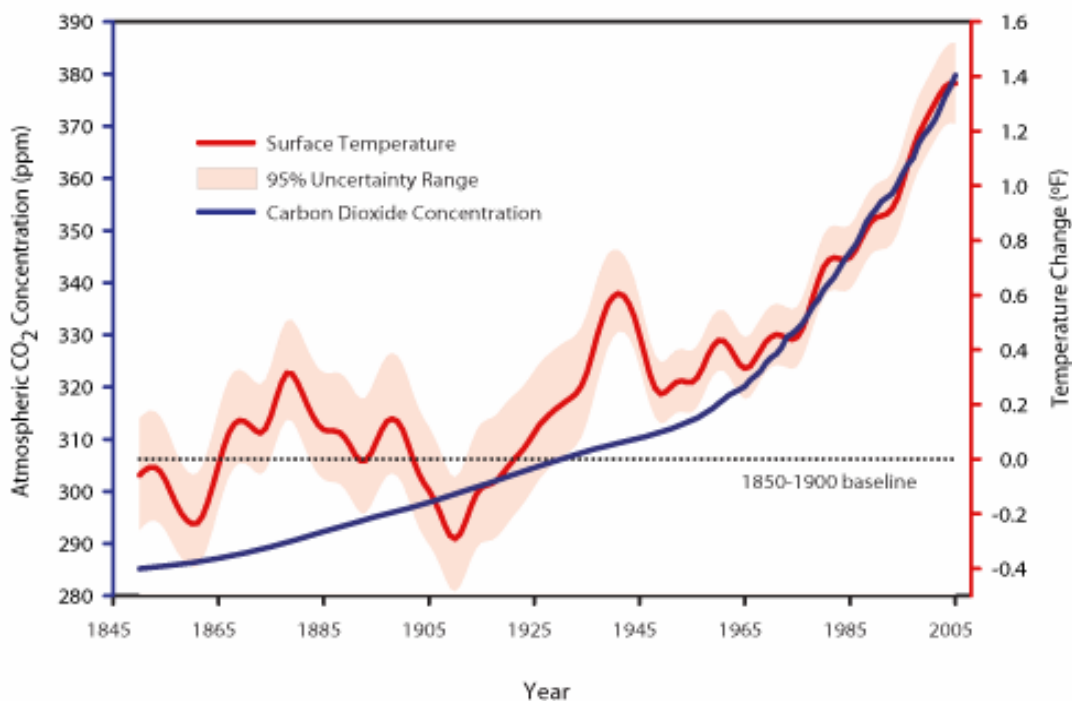


Figure 1

Source: Pew Center on Global Climate Change URL: http://www.pewclimate.org/global-warming-basics/facts_and_figures/

Despite the scientific uncertainty on the climate response to CO₂ concentration, there is wide consensus in the literature on the large effects deriving from the observed climate change, both from the biophysical and the economic viewpoint. As to the biophysical effects, the rise in the world temperature causes numerous interrelated problems such as: more frequent and more costly extreme weather events (for example storms, hurricanes, typhoons, heat waves, floods, droughts); the progressive melting of glaciers that tends to increase the sea level and thus provoke the flood of islands and lands above sea level; declining crop yields; increase in vector-borne diseases (such as malaria and dengue fever that have a particularly high impact in developing countries); ocean acidification and reduction of fish stocks; collapse of tropical rainforests; biodiversity loss and desertification. These biophysical effects, however, also imply large economic costs in terms of mitigation and adaptation policies. The economic consequences of global warming have been particularly stressed by the so-called Stern Review (2007), the report on climate change prepared by Nicholas Stern for the U.K. Treasury. Stern estimates that the cost of inaction might imply a loss of 5 per cent of global GDP per year, now and forever. Moreover, he claims that “if a wider range of risks and impact is taken into account, the estimates of damage could rise to 20 per cent GDP or more” (Stern, 2007, p.xv).

The Stern Review has had a large echo in the mass media and immediately provoked a hot debate in the literature, generating a bunch of comments and replies from several scholars (see, among the others, Nordhaus, 2007; Dasgupta, 2007, Tol and Yohe, 2006; Weitzman, 2007b). As a matter of fact, the estimations reported by Stern differ dramatically from previous findings in the economic literature. While Stern’s results call for immediate and intense intervention to reduce global warming, past studies generally supported the “climate-policy ramp” hypothesis, namely, optimal economic policies to slow global warming should imply modest emissions reductions in the short-run and sharp reductions in the long-run.²

The main reason for such different results and policy indications seems to depend upon the different assumptions on the time discount rate. Following a long-standing tradition that dates back to Ramsey (1928, p.543) who regarded pure time discounting as “ethically indefensible”, Stern (2007) is in favour of a near-zero discount rate³ since any positive discount rate ignores the large environmental costs that would occur in the distant future, therefore it is not apt for long-term, intergenerational decisions such as those concerning climate and energy policies. As Nordhaus (2007) has pointed out, however, if one adopted instead a market interest rate to discount the future, the results of the Stern Review would converge to the conclusions of the literature on the “climate-policy ramp” described above. The different assumptions underlying the existing models, therefore, play a crucial role for policy prescription as they determine different conclusions on the urgency of an alternative energy system.⁴ However, even if one optimistically takes as true the lowest estimated costs of climate change, a more determined intervention is necessary at the world and regional level to slow down global warming. For this reason, in what follows we will focus on the European climate and energy policies and on the market instruments that have been recently introduced in the EU to reduce global warming.

3. The EU climate and energy policies

The EU has played a leading role in promoting and implementing an international agreement to reduce climate change. In this regard, following the ratification of the Kyoto Protocol on 31 May 2002, the EU-15 committed to an overall CO₂ emissions reduction target of 8 per cent by 2008-'12 with respect to the 1990 levels, allowing different national emissions target within the EU to account for the different economic and environmental conditions of its member countries in the benchmark year 1990 (see table 1).⁵ Although many experts evaluated the Kyoto Protocol commitments as just a first step in the right direction and certainly insufficient to stop global warming, most member states and the EU overall, however, are still distant from that target and a

long way is still to go to achieve the standards that were required by the Kyoto Protocol. This clearly emerges from figure 2 that reports the distance from the Kyoto goal of the EU-15 and its members.⁶ The green lines in the figure refer to those “virtuous” countries (one third of the EU-15 members) that managed to go beyond their target, reducing CO₂ emissions more than initially required by the Kyoto Protocol, while the orange lines show what we can call “the Kyoto gap”, namely, the current distance from the Kyoto target characterizing the other countries and the overall EU-15. While Italy, for instance, had committed to cut CO₂ emissions by 6.5 per cent with respect to the 1990 according to the Kyoto Protocol, such emissions did not decrease so far and actually further increased in the meantime thus enlarging the gap from the Kyoto goal up to 9.9 per cent. It is interesting to notice that – if we exclude Sweden – all the EU countries that were allowed to increase emissions by the Kyoto Protocol to account for their low GDP level in 1990, actually emitted even more than originally allowed, thus further contributing to the Kyoto gap of the overall EU-15.

The current distance from the Kyoto target, requires a deeper analysis of the EU directives and energy policies that have been proposed so far to achieve the goal in order to evaluate whether the required emissions cut could be fulfilled in the (hopefully not distant) future. In this regard, since the beginning of the century the EU has adopted two Climate Change Programmes (2000 and 2005) and two important directives that deserve particular attention: the Directive 2003/87/CE (“*Emission Trading*”) and the Directive 2004/101/CE (“*Linking*”). The Emission Trading Directive introduced also in Europe carbon emission permits, a market instrument that had been already used with some success in the US. As it is well known, the aim of this instrument is to create a market and an artificial price for the pollution of public environmental goods (such as the atmosphere) that can otherwise be used for free. The creation of a market price generates an incentive to adopt a more environmental friendly technology to avoid the cost of purchasing the permits. The EU Directive allowed each member State to establish a national emission scheme to determine the initial allocation criteria of emission permits and the share allocated to selected sectors in two

trading phases (2005-'07 and 2008-'12).⁷ Once the emission permits are allocated by single countries, their trading is allowed within the EU, so that a firm in a given European country that needs for its activities more permits than those at its disposal can purchase them from a firm in another country that has permits in excess of its needs and intends to sell them. The EU Directive (art.16), moreover, established penalties equal to 40€ (in the first trading phase: 2005-2007) and 100€ (in the second phase: 2008-2012) per tonne of CO₂ emitted in excess of the allowances at disposal.

The Emission Trading Directive has been subsequently modified by the so-called “*Linking*” Directive (2004/101/CE) that allowed for the use in the European Emission Trading Scheme (EU-ETS) of emission credits deriving from Clean Development Mechanism (CDM) and Joint Implementation (JI) projects. In other words, the emission credits obtained by reducing emissions outside the EU can be transformed into emissions permits to be used within the EU-ETS, thus “linking” the latter system to the CMD and JI projects (which explains the name of the Directive).

The introduction in the EU of an ETS and its subsequent connection to worldwide implementation projects represents an important change in the European energy policy towards the more intensive use of market-based policy instruments. This change goes in the direction of the US energy policy that has traditionally been more market-oriented than the European one, thus incidentally reducing the conflict between the opposite viewpoints of the EU and the US on how to implement the Kyoto Protocol (or a possible follow-up), although many other problems remains to be solved before the US can be expected to ratify an international agreement in this field. However, it is possible to identify several open issues that may adversely affect the functioning of the EU-ETS. The first problem concerns the allocation criteria that have been used so far. As a matter of fact, emission permits have been given mainly for free on the basis of the firms’ historical emission levels using a grandfathering allocation system. This criterion, however, tends to preserve the *status quo*, reducing the firms’ incentive to adopt more environmental friendly technologies. Moreover, it may create potential disparities in the permits market between large firms (that receive many initial

permits to maintain their activity level) and small-medium enterprises. For these reasons, it may be preferable to adopt an auction system as initial allocation criterion.⁸ Whether carbon permits are given away for free or sold by the government through an auction system, this will not affect the market-clearing price that emerges in a competitive market.⁹ The two allocation methods, however, can have very different distributional effects according to how the auction revenues are used and whom the permits are grandfathered. In a grandfathered system scarcity rents go to the recipient of permits, while in an auction system the government collects these rents as revenues that can be used to reduce the deficit and/or cut distortionary taxes. Therefore, while the method of allocation of carbon permits does not affect their price (since it influences neither their demand nor their supply), it will determine who is going to pocket the extra revenues, whether potential emitters or taxpayers¹⁰. Moreover, the government entries generated by the auction system could be used to promote R&D in environmental innovation and the diffusion of better technologies, with a potential double-dividend effect in terms of higher economic growth and lower environmental damages.¹¹ Finally, as some authors have argued (cf. Cramton and Kerr, 2002), another attractive feature of an auction system is that it may entail lower administrative costs and lower delays in the implementation with respect to grandfathering. The latter system, in fact, often implies long negotiations between the government and the interest groups that invest much time and resources in lobbying activities in order to obtain the highest possible number of initial permits.

A second problem with the current EU-ETS concerns possible inconsistencies between this system and the National Allocation Plans (NAPs) of the emission permits. During the first trading phase (2005-'07), most NAPs allocated a number of emission permits that was inconsistent with the Kyoto target, going well above the upper bound originally established for each member state by the Kyoto Protocol (Gilbert et al., 2004; Sijm, 2005). The over-allocation of allowances by the NAPs was largely responsible for the sharp fall in the spot price of the emissions permits observed during the first period. A similar over-allocation occurred also in the second phase, when the European

Commission had to intervene on 11 of the 12 original NAPs proposals (with the only exception of the UK), reducing the total number of emission permits that were originally allowed by each state.

The creation of too many allowances by member states was mainly due to political pressure on the governments from interest groups who wanted to receive more permits. However, defining a binding cap turned out to be difficult for most member states also because there was strong uncertainty on the actual emissions level that had to provide the baseline data to set the cap and because “installation data had to be assembled in great haste to meet the tight implementation deadlines” (Ellerman and Joskov, 2008, p.32). The over-allocation of allowances to emitters and its price consequences have largely contributed to the recent decision to abolish the NAPs in the next trading phase (2013-2020), replacing the decentralized structure of the EU-ETS with a centralized cap-setting process.

Empirical evidence suggests a third problematic aspect that arises with the application of the EU-ETS, namely, the extreme market price volatility. As a matter of fact, the price of CO₂ emission permits tripled in the period January-July 2005, then more than halved in just one week during April 2006 (when new data were released reporting emissions levels substantially lower than expected) and subsequently declined to zero over the next year. Several reasons may have contributed to the price volatility observed in that period (Ellerman and Joskov, 2008). In the first place, the verified emissions data were released relatively late, leaving participants little time at disposal to adjust their expectations to the new information. In the second place, restrictions on banking between the first and the second trading phases prevented arbitrage from reducing the price difference between the first and the second period allowances.¹² Therefore, it may be argued that the dramatic price volatility described above was mainly due to the price discovery on a new market and to the mistakes initially done by policy-makers in the trial period, that was intended to provide a sort of learning phase for a successful use of the ETS in the following periods. Extreme price volatility, however, is not always limited to the initial phases of cap-and-trade systems. This is clearly shown, for instance, by the extreme price fluctuations of the sulphur dioxide allowances that

occurred in the US between 2004 and 2006, long after the start-up of that programme (that was introduced in 1993), as well as by the recent evolution of the price of the carbon permits in the EU-ETS that more than halved in a few months (from above 27 €/tonne in June 2008 to 13.25€/tonne as of 15 January 2009). This explains the existing concern for further price fluctuations in the EU-ETS in the future. High market instability, in fact, generates uncertainty among the agents that may discourage their investments in more environmental friendly technologies. If the agents expect that the price of carbon permits may suddenly decline in the future, they will prefer to keep on using the old polluting technology rather than shift to a new, less polluting but more expensive technology.

Finally, the penalty system established by art. 16 of the Emission Trading Directive described above sets up a price cap in the EU market. If the price of carbon emission permits rises above the fee, then the agents will obviously prefer to pay the fee. In other words, if the price cap is binding, then the demand of carbon permits will tend to zero, leading the economy to a corner solution with no emission permits. The penalty can obviously be increased to avoid this risk as the price of carbon permits rises.¹³ However, one can find opposite reasons that lead to keep the penalty constant and thus introduce a price ceiling in the market. In the first place, if the penalty becomes very high, it might also lose its credibility and thus generate time consistency problems. As a matter of fact, if the penalty becomes extremely high, the firms may reasonably expect that the fee will not be applied as this would cause non-compliant firms to close up and thus increase unemployment in the country, generating high social costs that the local authority may not be willing to face. In the second place, if we let the penalty grow with the carbon price, then a similar non-compliant behaviour would be punished more or less heavily depending on the price fluctuations, what may raise doubts on the equity of the sanction. Finally, a price ceiling might provide a useful “safety net” against possible mistakes by policy-makers. The latter, in fact, often lack sufficient information on the firms’ abatement costs when establishing the emission cap. A price ceiling, therefore, may prevent abatement costs from rising above what is socially optimal and in this sense a penalty system might be a useful instrument against upward price fluctuations. If so,

however, it would be reasonable to introduce in the market also a lower bound for the carbon price to prevent that possible flaws in the policy design (such as a too high emissions cap) may reduce the carbon price below what is socially optimal. Stated differently, if one accepts the idea that some form of market regulation would be desirable to correct the possible inefficiency of a cap-and-trade system, then we might consider to set not only a ceiling but also a floor on the carbon price that prevent potential polluters from paying too much (too little, respectively), that is, more (less) than socially optimal.

The problems that affect the application of the Emission Trading Directive have led to several revision proposals. In particular, the following three main changes have been set forth: (i) the extension of the EU-ETS to further industries (for example aluminium and ammonia) and gases (nitrous oxide), (ii) a unique EU emission permits ceiling (rather than 27 different national ceilings) that decreases every year during the third trading phase (2013-2020), (iii) higher share of emissions allocated through auctions rather than grandfathering, along with the harmonization of the allocation rules when permits are instead given for free.

All these proposals seem rather desirable. The extension of the ETS can produce a thicker market of carbon permits, thus reducing the potential lack of transactions and of competition that constitutes one of the main application problems reported in the literature on tradable permits (cf. Hahn 1984, Hagem and Westkog, 1998). As to the harmonization of the emission permits ceilings and the allocation rules, this may help to reduce the consistency problems described above that may occur between the EU energy policy and the one pursued by single member States. In this direction seems to go the Directive on energy taxation (2003/96/EC) that sets a minimal taxation level on electricity and energy products in all member States. Finally, also the adoption of an auction rather than grandfathering as allocation criterion may improve the functioning of the ETS. In this case, however, particular attention should be devoted to the design of the auction as this may play a crucial role for the success of the system (Cramton and Kerr, 2002). As a matter of fact, if the auction is not properly designed it may favour a few large firms that initially buy most of the

permits for strategic reasons. This problem is certainly more likely to occur in small, local markets rather than in the EU-ETS for carbon emissions that covers thousands of firms across different sectors. However, market concentration and the potential abuse of market power may arise even in similar contexts with many firms, as it emerges from the experience of the UK ETS, the world's first large-scale GHG trading scheme that was launched in April 2002. In the UK ETS, although the number of participants was very high (approximately 1400 firms in over 40 industrial sectors the first 3 years), sales were very concentrated, with the four largest sellers accounting for 65.7 per cent of total sales (Smith and Swierzbinski, 2007). Interestingly enough, all four largest sellers entered the UK ETS as a result of an auction in 2002 which allocated a budget for abatement subsidies.¹⁴ According to Smith and Swierzbinski (2007), the observed concentration on the permits supply side is likely to reflect the concentration in the auction outcome where some firms might have coordinated their behaviour to manipulate the auction price. The UK experience, therefore, may provide important insights for the EU-wide carbon trading scheme, suggesting that the issue of market concentration should not be neglected in the auction design even in the EU ETS despite the large number of potential participants.

4. The EU renewable energy policies

The other main route beyond the ETS that the EU has followed so far to come closer to the Kyoto targets is given by the progressive shift of the energy system towards renewable sources. While the ETS can be interpreted as an application of the “polluter pays principle” (which does not exclude pollution but aims at internalizing its negative effects), the increasing attention to renewables moves in the direction of an alternative zero-emissions energy model.

As pointed out by Kolev and Riess (2009) in this book, the promotion of renewables and energy efficiency can reinforce the emission reductions achieved by the ETS system if it is applied to sectors not covered by the scheme. However, supporting these policies in the ETS sectors may

end up simply decreasing the demand of the emission permits and thus their price without generating additional emissions cut, if the supply of emission permits is kept constant at a given carbon emissions level. Therefore, Kolev and Riess (2009) argue that the promotion of these policies in the ETS sectors should be seen as a substitute rather than as a complement to the ETS and can be justified only for non-climate-change reasons (such as reducing energy-import dependency).¹⁵

The steps of the transition towards an alternative energy model have been determined by two main Directives, the one on renewables (2001/77/CE) and the other on biofuels (2003/30/CE). The first Directive established that renewable energy sources (solar, wind, biomass, geothermal and so on) should have increased up to 21 per cent of electricity consumption and 12 per cent of all energy consumption by 2010. In 2005, however, the share of renewables on electricity and energy consumption was still 15 per cent and 6.38 per cent, respectively, so that the original target is unlikely to be reached. A similar argument applies to the Directive on biofuels¹⁶ (2003/30/CE) whose past target for the year 2005 (biofuels growing up to 2 per cent of total transport fuels by 2005) was largely missed (only 1 per cent being reached in the EU-25 by that year) and the future target for the year 2010 (5,75 per cent of total transport fuels) seems rather unlikely to be achieved.

The recent European Commission's Communication "*Limiting global climate change to 2 degrees Celsius. The way ahead for 2020 and beyond*" looks even more ambitious than the Directives mentioned above. This Communication (published on 10 January 2007, and subsequently approved by the EU Council, on March 8-9, 2007) establishes the EU unilateral commitment to cut GHG emissions by 20 per cent by 2020 with respect to 1990 (or by 30 per cent if a global agreement on climate change will be reached). Moreover, the EU commits to increase energy savings by 20 per cent by the year 2020 and to raise by the same year the share of renewables on total energy supply up to 20 per cent.

This Communication, commonly named the "20-20-20 plan", is certainly attractive as it conveys a clear goal that can easily catch the attention of public opinion and the mass-media. But

the question that should be asked is whether and to what extent this commitment is reliable. If one looks at the unsuccessful attempts to achieve less ambitious environmental targets in the past years, we are inclined to believe that *a fortiori* this more stringent goal might be missed in the future, especially because the “20-20-20” plan deals with a near future. The more so, since the current global financial crisis might lead the EU to postpone intervention, giving lower priority to the environmental issues in the next few years. This consideration does not deny the important step forwards that the EU has done in these years in developing renewable energy sources. As a matter of fact, the electricity production from renewable sources has rapidly increased in Europe from the 1990s onwards. And the EU currently plays the role of world leader in several renewable energy markets such as the wind power market in which 60 per cent of all firms are European ones. However, the share of primary energy supply from renewable resources increased very slowly in the EU countries that are member of the Organisation for Economic Cooperation and Development, passing from 6.8 per cent in 1990 to 7.6 per cent in 2003, and is expected to remain well below 10 per cent in 2010.

The speed of the transition process from exhaustible to renewable resources is obviously affected by the price gap between them. It is generally argued that a more rapid transition to renewable resources has not occurred so far since the cost of producing energy from exhaustible resources is well below the correspondent cost from most renewable resources. Thus, for instance, a recent study carried out on more than 130 power plants in several countries (IEA, 2005a) finds that the lowest cost of generating electricity from traditional (coal-fired and gas-fired) power plants ranges between 25 and 45 United States dollars (US\$) per megawatt-hour (MWh), whereas the correspondent cost is about 150 US\$/MWh for solar plants.¹⁷

This argument would be perfectly sound if the market price could signal the true scarcity of the resources. In reality, however, the market price signal may be distorted by several factors (Borghesi, 2008; Borghesi and Vercelli, 2008). In the first place, it does not take into account the oligopolistic nature of FF markets (especially in the case of oil and natural gas). In the second place,

the market price does not account for the negative externalities deriving from the production and consumption of FF. If this was the case, according to the estimations of the Stern Report the market price of FF should be much higher than it is today and one cannot exclude that in this case renewable resources could already be competitive with the exhaustible resources so that the transition process should be much accelerated. Finally, most government subsidies are still mainly directed to FF rather than to renewable resources, although more attention has been devoted to subsidising renewable resources in the last few years. If the energy subsidies were progressively shifted from exhaustible to renewable resources, this might contribute to increase the price of the exhaustible resources and simultaneously decrease that of the renewable resources, thus potentially reducing the current price gap that induce to postpone the transition towards renewable resources.¹⁸

The above mentioned distortions in the market price signal might have slowed down so far the transition to an alternative energy system. The speed of this transition process, however, is not the same within Europe but shows large differences across the EU countries. In the case of photovoltaics, for instance, almost 90 per cent of the whole production capacity installed in the EU in the year 2006 occurred in only one country (Germany). Surprisingly enough, very sunny countries such as Spain, Italy and especially Greece lag much behind in the investments specifically devoted to this renewable resource. Similarly, the share of biofuels over total transport fuels show huge differences in Europe where Germany plays again the role of market leader (its share being more than 187 times that of the Netherlands that had a similar target) and is the only European country that managed to go beyond its national target.

These considerations call for both an acceleration and an harmonization of the transition process towards renewable resources. In particular, it would be desirable to adopt binding targets for single member States as well as to harmonize the national standard and certificate systems. Moreover, a normative framework is needed for the heating and cooling sectors that account for about 50 per cent of the energy final consumption in the EU. The normative framework should also be reinforced in the transport sector as far as the adoption of renewable energies is concerned.

Finally, in order to speed up the transition towards alternative energy sources it would be of crucial importance to reduce the uncertainty on the reiteration of the renewable energy policies by member States. In fact, at the national level the environmental and energy priorities have shown to be very sensitive to the prevailing political orientation. As a consequence, government changes can result in abrupt policy changes in the promotion of renewable energies that may discourage the agents from investing in this field.

5. Concluding remarks: credible goals for “incredible” results

The current global warming process poses serious problems not only for its biophysical effects, but also for its potentially vast economic consequences. Economists, however, are deeply divided on the costs and the urgency of intervention to reduce climate change, as shown by the reactions recently provoked by the Stern Review. Whatever the estimated costs of intervention, a more rapid transition from the current fossil fuel economy towards an alternative energy system seems highly desirable to set free from the unavoidable future scarcity and the current pollution problems that come along with the use of fossil fuels. In the case of Europe, moreover, shifting to a different energy model could provide the additional large benefit of reducing the present EU dependency on costly energy imports and the vulnerability of energy supply that often comes from politically unstable world regions (such as OPEC countries in the case of oil, or Russia and Iran for gas imports). This aspect may explain the increasing efforts of the EU in developing alternative, pollution-free energy sources and the leading role that the EU has played at the world level in the endeavour to reduce CO₂ emissions. Despite these efforts, however, much remains to be done to increase the role and improve the performance of the renewable energy sources, as well as to achieve the minimal CO₂ reduction requirements originally set by the Kyoto Protocol.

As to the CO₂ emissions reductions, the creation of a European ETS is probably the most important change in the EU energy policy after the ratification of the Kyoto Protocol. Although this

system can potentially increase emissions abatement, its design and functioning should still be improved in many respects. In particular, a well-design auction system for the initial allocation of carbon permits might perform better than the grandfathering system mainly adopted so far that tends to preserve the existing situation and may generate entry-barriers to new competitors. Moreover, the National Allocation Plans should be fully consistent with the EU-ETS to reinforce the credibility of the European CO₂ reduction efforts.

Even in the case of the renewable policies, despite the leading role played by the EU in this field, there remains much scope for further improvements. Although the goals in terms of carbon emissions reduction and renewable energies were missed so far and are very likely to be missed by the end of the reference period, the “20-20-20” EU plan established even more ambitious targets to be reached by 2020. This policy that keeps on raising up the target and postponing the deadline, however, is hardly credible. It looks pretty much like the behaviour of a jumper in a pole-vault competition that keeps on raising up the height of the pole aiming at the world record although she misses even the first attempts at lower levels. This (hopefully wrong) impression is somehow reinforced by the recent claims at the last G8 meeting in Hokkaido (Japan) that aim at halving carbon emissions by 2050. This long-run objective that was originally proposed by the European Commission (2007) is certainly of crucial importance to prevent the massive disruption of the global climate system. But it looks again as an even more ambitious target that is further postponed in time, the achievement of which appears rather unlikely at present given the failure to reach the much easier goal set by the Kyoto target. This energy policy seems to recall similar very ambitious targets recently set by the United Nations’ Millennium Development Goals (like, for instance, halving extreme poverty and the proportion of people who suffer from hunger by 2015) that are provoking some critiques for the extreme difficulty in achieving or even –in some case- getting close to the desired result.

The inability to achieve intermediate results may pose serious time inconsistency and credibility problems that are well-known and well-described in other areas of the economic

literature such as monetary economics (Kydland and Prescott, 1977; Barro and Gordon, 1983). The attempt to avoid these problems have also guided the European monetary policy and its effort to “tight her own hands” underlying the Stability and Growth Pact. The recent difficulties to achieve the monetary goals and the consequent revision proposals of the Stability Pact should induce the EU to adopt feasible goals even for its energy policy in the future. Otherwise, credibility problems might hinder the capacity to reach concrete results. For instance, if agents believe the EU energy and emission targets will not be seriously pursued, they could decide not to buy carbon permits since they may expect that the authority will not be able to monitor polluting emissions or that the penalty system will not be applied. If so, the demand and the price of carbon permits in the EU-ETS might decrease to very low levels, thus reducing the firms’ incentive to invest in different production technologies and costly renewable energies. In other words, credible goals are probably necessary if we are to achieve “incredible” (that is, unexpectedly good) results in the emission reductions in the next few years.

Acknowledgments

I would like to thank seminar participants at the EUI Alumni Conference “*EU environmental policy and governance: the challenge of climate change and beyond*” (European University Institute, 20-21 June 2008) and a referee for stimulating comments and suggestions. A special thank to Andrea Rossi for useful indications on reference material.

References

Barro, R. and D. Gordon (1983) ‘A Positive Theory of Monetary Policy in a Natural Rate Model’, *The Journal of Political Economy*, vol. 91, No. 4, 589-610.

Borghesi, S. (2008) ‘From Hubbert to Kuznets: on the sustainability of the current energy system’, *International Journal Global Environmental Issues*, vol. 8, No.4, 425-444.

Borghesi, S. and A. Vercelli (2008) *Global Sustainability* (New York: Palgrave-Macmillan).

Bovenberg, A.L. and L.H. Goulder (2002) 'Environmental taxation and regulation' in A.J. Auerbach and M. Feldstein (eds.), *Handbook of Public Economics*, vol. 3, ch. 23, 1471-1545, Elsevier.

Cramton, P. and S. Kerr (2002) 'Tradeable Carbon Permit Auctions: How and Why to Auction Not Grandfather', *Energy Policy*, 30, 333-345.

Dasgupta, P. (2007) 'Commentary: the Stern Review's Economics of Climate Change', *National Institute Economic Review*, 199, 4-70.

Ellerman, A.D. and P.L. Joskov (2008) *The European Union's Emissions Trading System in perspective*, (Arlington, VA: Pew Center on Global Climate Change).

European Commission (2007), "*Limiting global climate change to 2 degrees Celsius. The way ahead for 2020 and beyond*" (Brussels: European Commission).

Gilbert, A., J.W. Bode and D. Phylipsen (2004) *Analysis of the National Allocation Plans for the EU Emissions Trading Scheme* (London: Ecofys).

Hagem, C. and H. Westkog (1998) 'The Design of a Dynamic Tradeable Quota System under Market Imperfections', *Journal of Environmental Economics and Management*, vol.36, No.1, 89-107.

Hahn, R.W. (1984) 'Market Power and transferable Property Rights', *Quarterly Journal of Economics*, 100, 753-765.

Hanemann, M. (2008) *The economics of climate change revisited: why the hurry?*, University of California, Berkley, mimeo.

IEA – International Energy Agency (2005a) *Projected Costs of Generating Electricity – 2005 Update* (Paris: OECD/IEA).

IEA – International Energy Agency (2005b) *Renewables 2005, Global Status Report. Renewable Energy Network in the 21st Century* (Paris: IEA).

IPCC - Intergovernmental Panel on Climate Change, (2007), *Fourth Assessment Report*, (Geneva, Switzerland: IPCC).

Kelly, D. and C. Kolstad (1999) 'Integrated Assessment Models for Climate Change Control', in H. Folmer and T. Tietenberg (eds.) *The International Yearbook of Environmental and Resource Economics: 1999/2000: A Survey of Current Issues*, (Cheltenham, U.K. and Northampton, Mass: Elgar), pp.171-197.

Kolev, A. and A. Riess (2009) 'Europe's carbon emissions-trading scheme and its energy and industrial policy implications: heretical insights from basic economics' in Bongardt A., Torres F. and von Homeyer I.

Kydland, E. and E.C. Prescott, (1977) 'Rules Rather than Discretion: The Inconsistency of Optimal Plans', *The Journal of Political Economy*, Vol. 85, No. 3., 473-492.

Nordhaus, W.D. (2007) 'A Review of the Stern Review on the Economics of Climate Change', *Journal of Economic Literature*, Vol. XLV, 686-702.

Parry, I.W., R.C. Williams and L.H. Goulder (1998) 'When can carbon abatement policies increase welfare? The fundamental role of distorted factor markets', *Journal of Environmental Economics and Management*, 37, 52-84.

Ramsey, F. (1928) 'A mathematical theory of saving', *Economic Journal*, 38, 543-559.

Smith, S. and J. Swierzbinski (2007) 'Assessing the performance of the UK Emission Trading Scheme', *Environmental and Resource Economics*, 37, 131-158.

Sijm, J. (2005) 'The interaction between the EU emissions trading scheme and national energy policies', *Climate Policy*, 5.

Stern, N. (2007) *Stern Review: The Economics of Climate Change* (Cambridge, UK: Cambridge University Press). URL: www.sternreview.org.uk.

Stern, T. and U.M. Persson (2007) 'An Even Sterner Review: Introducing Relative Prices into the Discounting Debate'. *Review of Environmental Economics and Policy*, forthcoming.

Tol, R. and G.W. Yohe (2006) 'A Review of the Stern Review', *World Economics*, 7, 233-50.

Weitzman, M. (2007a) 'Structural Uncertainty and the Value of Statistical Life in the Economics of Catastrophic Climate Change', *NBER Working Paper 13490*, (Cambridge, MA: NBER).

Weitzman, M. (2007b) 'A Review of the Stern Review of the Economics of Climate Change', *Journal of Economic Literature*, 45, 686-702.

World Bank (2005) 'Technical and Economic Assessment Grid, Mini-grid & Off-grid Electrification Technologies', Energy Unit, Energy and Water Department,

[URL:siteresources.worldbank.org/INTENERGY/Resources/CEPCO2006.ppt](http://siteresources.worldbank.org/INTENERGY/Resources/CEPCO2006.ppt)

Country	Target 2008-2012
Austria	-13%
Belgium	-7,5%
Denmark	-21%
Finland	1990 levels
France	1990 levels
Germany	-21%
Greece	+25%
Ireland	+13%
Italy	-6,5%
Luxembourg	-28%
Netherlands	-6%
Portugal	+27%
United Kingdom	-12,5%
Spain	+15%
Sweden	+4%

Table 1: European CO₂ emission targets according to Kyoto protocol (EU-15)

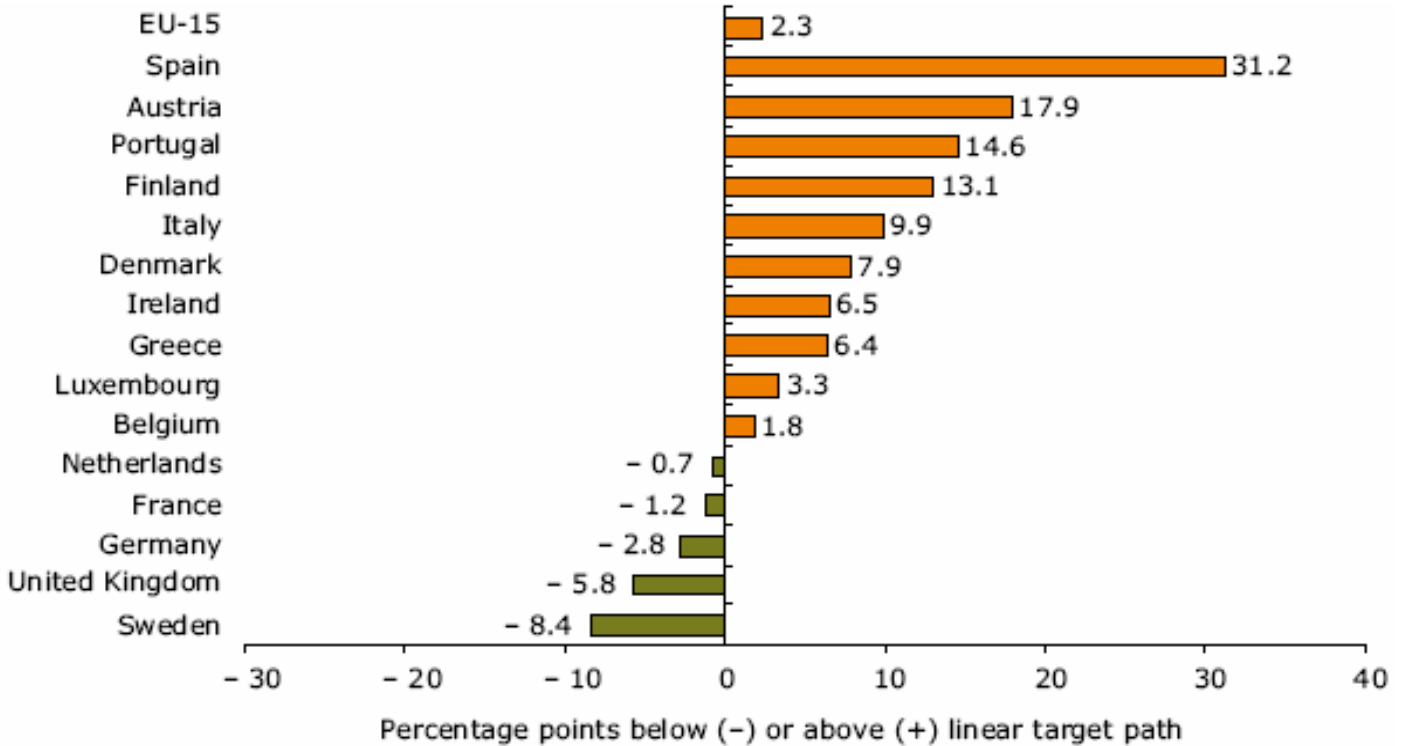


Figure 2: distance of the EU-15 from the Kyoto targets

¹ See Weitzman (2007a) for an analysis of the effects of such an uncertain climate sensitivity on the decision-making process for situations (like climate change) in which high-impact catastrophes may occur with small but unknown probabilities.

² See Kelly and Kolstad (1999) for a review of this literature.

³ The time discount actually used in the Stern Review is 0.1 percent per year.

⁴ A more detailed analysis of this issue goes beyond the scope of the present work. See also Sterner and Persson (2007) and Hanemann (2008) for a deeper discussion of the role played by discounting and other assumptions in this literature.

⁵ The 8 per cent target is obviously valid only for the 15 member states that preceded the EU enlargement in 2004. The ten countries that joined the EU in 2004 as well as Romania and Bulgaria (that entered the EU in 2007) will have to take part in the overall EU emission reduction of 20 per cent by 2020 that is planned for the post-Kyoto phase in the period 2013-2020 (see discussion below). If we exclude Malta and Cipro, however, all the new member countries were already among the Annex I Parties of the Kyoto Protocol, therefore they had previously committed to different emissions limits under the Protocol.

⁶ The values shown in the diagram indicate the percentage deviation of actual emissions in 2004 from a (hypothetical) linear path between the base-year (1990) emissions level and the target for 2010, thus measuring the current progress towards the Kyoto target.

⁷ The sectors indicated by the Directive were: energy activities (for example oil refineries); production and processing of ferrous metals; mineral industry; pulp and paper industry.

⁸ Some authors (Parry et al., 1998) estimate that the reduction cost of air emissions in the case of grandfathering is three times higher than with an auction system.

⁹ As a matter of fact, for the potential emitter what matters is the opportunity cost of using the permit, whether received for free or through an auction, that is given by the loss of the opportunity to sell that allowance in the future.

¹⁰ See Ellerman and Joskov (2008) for a further discussion of the controversial issue of “windfall profits” for incumbents, namely, additional profits earned by potential emitters to which allowances were allocated for free.

¹¹ See Bovenberg and Goulder (2001) for an analysis of the literature on the “double dividend” hypothesis, the possible uses of auction revenues and the relative performance of various policy instruments in a second best context.

¹² Such allowances were treated as two different products because of the absence of banking from the first to the second period. See Ellerman and Joskov (2008, Fig.1, p.13) for the evolution of the price gap between the first and second period allowances. Inter-period banking, however, will be allowed for the second and following trading periods, thus avoiding this major flaws that occurred in the design of the trial period.

¹³ For instance, the penalty could be kept constant at a fixed level as long as the carbon price is well below the fee (as it occurs nowadays), and set it by a given percentage above the carbon price if the latter comes close to the fee originally established. This would allow the penalty to move along with the carbon price when the latter overcomes a given threshold, ensuring that the former lies always above the latter.

¹⁴ See Smith and Swierzbinski (2007) for a detailed description of the functioning of the UK ETS and its results.

¹⁵ Notice, however, that the reduction in the demand of emission permits induced by the promotion of renewables in the ETS sectors might be counterbalanced by a progressive reduction in the supply of permits from the regulatory authority aimed at reducing emissions over time. A progressive reduction of the EU-wide cap might actually occur in the future given the long-term EU goal of

cutting CO₂ emissions by 50 per cent by 2050, though at the moment there are no formal time commitments to such a reduction.

¹⁶ As it is well known, by this term we mean any fuel from biomass, such as bioethanol, biodiesel and biogas.

¹⁷ The estimated costs, however, differ substantially across different studies according to the underlying assumptions on the discount rate, the projected prices of exhaustible and renewable resources, and the size and economic lifetime of the power plants taken into account. According to the IEA (2005b), for instance, the cost of generating electricity from photovoltaics ranges between 200 and 400 US\$ per MWh, while the correspondent cost ranges between 431,4 and 508 US\$ according to the World Bank (2005). Also notice that, if we exclude photovoltaics, others renewables are already competitive with most fossil fuel based power plants. For instance, the estimated cost of producing energy is about 30-40 US\$/MWh for large hydro power plants and about 40-60 for wind generating technologies (IEA, 2005b).

¹⁸ An increase in the subsidies to renewable energy sources, however, may also raise their demand and thus lead to an increase rather than a decrease in their price level. This is what might actually be occurring in the case of biofuels whose price has recently increased with negative side effects on the food price. I thank seminar participants at the EUI conference on for pointing this out to me.