Cutting now or buying tomorrow?

A quantitative reflection on an Italian dilemma.

by

Enzo Di Giulio

Stefania Migliavacca

Eni Corporate University - Scuola Mattei

Abstract

The aim of this paper is an investigation of the effect of the European Emissions Trading System on the Italian electricity sector and economy. In particular, a system dynamics model is built in order to study: alternative scenarios of emissions and caps; the cost for the electricity sector associated to such scenarios under different hypotheses of the carbon allowances prices; the degree of shift of such costs on households and industry. In synthesis, the paper proposes a numerical reflection on the Italian dilemma: cutting emissions through tight caps, so affecting the industry competitiveness; delaying the problem and buying carbon credits tomorrow, on the international emissions trading market, at prices which are unknown today.

Enzo Di Giulio
Eni Corporate University - Scuola Mattei
Via S. Salvo, 1 – 20097 San Donato Milanese (MI), Italy
tel. 0039.02.52057893; fax: 0039.02.520.57908
enzo.digiulio@enicorporateuniversity.eni.it;

The Italian energy landscape

As years pass, future becomes present, present becomes past. Many hypotheses are disavowed by reality, other ones are confirmed. The idea that Russia would have not ratified the Kyoto Protocol is denied by reality. In February 16, 2005 the Kyoto Protocol entered into force and, as a consequence, in less than three years, in January 2008, countries will enter into their first commitment period. This means that in 2008 we will be able to verify the realism of the past and current energy scenarios. Secondly, we will be able to verify whether declared policies and measures are realistic and concrete, or just words. In 2008, ten and six years will have passed since the first and the second plan (Cipe 1998; Cipe 2002) by the Italian Government for the reduction of greenhouse gas emissions. Words or real actions? In less than three years we will have an answer. Today, we must rely on a hint of an answer: data and energy scenarios. What do they tell us? They represent a bad situation. Let the numbers speak:

Table 1: Italy's GHG emissions

	Mton CO_2 eq.
GHGs Emissions in 1990	508.0
Kyoto Target	475.0
GHGs Emissions in 2002	554.0
GHGs Emissions in 2010 (BAU Scenario)	613.3
Target distance	138.3

As we can see, according to the Business as Usual emissions scenario presented in the last document by the Government (Ministero dell'Ambiente e del Territorio 2004), the National Allocation Plan under the EU Emissions Trading Directive, Italy emissions are about 29% over the Kyoto target. Undoubtedly, it is a huge distance. In the same document, a scenario in which some already scheduled measures are implemented is presented: in such a case, GHGs emissions would be equal to 563.7 Mton CO_2 eq., which is 18.6% over the target. In other words, the official forecast tells us, even if strong energy efficiency improvements are implemented, the Kyoto target stays far away. Such improvements include new and more efficient power plants (8.9 Mton CO_2 eq. abated), more electricity import (10.3 Mton CO_2 eq.), expansion of renewable sources (6.5 Mton CO_2 eq), the introduction of white certificates in the residential sector (6.3 Mton CO_2 eq), efficiency improvements in transportation (7.5 Mton CO_2 eq) and a certain number of CDM-JI project (12 Mton CO_2 eq). We believe that the probability of a joint realisation of the above actions is not high. However, even in the best case scenario, a 18.6% surplus exists. This would imply a massive buying of carbon credits in the international market and the need for financing it (for some estimates, see Di Giulio-Migliavacca-Vaglio 2004). Within this landscape, it must be remembered the declared expansion of coal by the most powerful electricity company (Enel) in some of its power plants. The low costs of coal render such declaration realistic, if environmental oppositions do not stop its implementation.

In synthesis, we face a situation in which as years pass the distance from the Kyoto target increases, instead of decreasing. The Government issues GHGs emissions reduction plans but their effects seem to be null. As a consequence, a need for strong carbon credits purchase emerges. Within this context, in January 2005, the European Union Emissions Trading Scheme (ETS) started. CO_2 emissions by industry and power plants over 20 MW are capped. Member countries have a certain degree of freedom in setting their caps. What the European Union requires is coherence between the countries' Kyoto target and the emissions caps. Thus, the ETS can be seen both as an opportunity to implement strict energy policies required at higher level (the EU) and as a proof of the countries' real willingness to cut their emissions. Given the above mentioned data on Italy's emissions surplus, a reasonable expectation was that the ETS could be used as a tool for implementing emissions cutting policies. Such an expectation is disavowed by reality. As showed in the next paragraph, for a number of reasons, the Italian caps are high and do not bring the country much closer to its target.

The Italian National Allocation Plan

The first draft of the Italian National Allocation Plan (NAP) was presented at the end of April 2004. Then in July, after extensive consultations, the final NAP was issued and is still under assessment by the European Commission.
As a consequence, Italy is currently excluded from the European Carbon Market started on the 1st of January 2005. This time lag could be harmful for Italian industries since the allocation scheme is still unclear and ambiguous: they do not know how many permits will be allocated for free and they still cannot buy credits on the market.
According to the last NAP submitted to the European Commission last July, the criteria used in elaborating the Government guidelines for the reduction of GHGs emissions (Cipe 2002) are the basis for the transposition of the EU ET Directive into the national legislation. In particular three elements are stressed:

- Italy is a country with high energy efficiency and low energy intensity, compared to other European countries. According to the International Energy Agency, in year 2000 the energy intensity ratio (energy consumed over national product) has been roughly 0.13 for Italy against an average of 0.18 at the EU level. This would be an evidence that Italy has

already introduced some energy efficiency measures, reducing CO_2 emissions and improving the efficiency of economic sectors. At the same time, this means that the marginal cost of national measures to further improve the performance in terms of ratio between the GDP and CO_2 emissions is higher than in other European Countries. The Italian NAP underlines that this result is even more striking because, since 1987, nuclear power plants are banned as a result of a specific voting decision.

- The competitiveness of Italian firms and the national energy security must be ensured; one of the priority of Italian energy policy is to reduce the "gap" between internal demand and national supply of electricity

- Italian firms are supposed to use credits from JI and CDM projects to comply with the EU directive.

The National allocation plan is elaborated on these base principles.

Preliminary framework

Before illustrating the specific content of the plan, it could be useful to sum up the Italian emissions framework. Table 2 gives an overview of Italy's GHGs emissions by sector.

Table 2: Italy GHGs emissions by sector

	GHG Emissions ($MtonCO_2eq$)			
	1990	2000	2010 trend	2010 ref
A) ENERGY USE	**412.4**	**444.5**	**518.3**	**480.7**
A1) Energy Industries, of which:	127.6	151.6	201.3	175.3
-thermoelectric	110.5	134.2	182.1	156.1
-refineries	17.1	17.4	19.2	19.2
A2) Manufacturing industries and construction	89.6	78.0	83.6	83.6
A3) Transportation	104.4	124.4	142.1	136.8
A4) Residential and tertiary	70.7	72.9	74.1	67.8
A5) Agriculture	9.2	8.9	9.6	9.6
A6) Others (fugitive, military, distribution)	10.9	8.7	7.6	7.6
B) NON ENERGY USE	**95.6**	**99.4**	**95.0**	**95.0**
B1) Industrial processes (mineral and chemical industries)	40.9	45.4	51.0	51.0
B2) Agricolture	40.4	40.3	36.1	36.1
B3) Waste	12.6	12.4	6.9	6.9
B4) Others (solvents)	1.7	1.3	1.0	1.0
TOTAL GHG	**508.0**	**543.9**	**613.3**	**575.7**
GHG emissions for sectors under ETS (a1+a2+b1)	***258.1***	***275.0***	***335.9***	***309.9***
Of which CO_2	***210.2***	***224.0***	***279.8***	***258.1***

source: Ministero dell'Ambiente e del Territorio (2004)

The Kyoto target for Italy is 475 Mton CO_2 eq in 2010 (-6.5% from 1990 level), while for the same year the reference scenario foresees 575.7 Mton CO_2 eq (that is +13% from 1990 level). Then, in absence of any intervention, Italy should miss the Kyoto Target by around 100 Mton CO_2 eq. per year.

Determination of the total quantity of allowances and allocation criteria

The NAP contains two crucial issues: the total amount of permit to be allocated (the "cap") and the allocation criteria (at activity level and plant level).
The European Directive 2003/87/EC (EU 2003) states that "*The total quantity of allowances to be allocated for the relevant period shall be consistent with the Member State's obligation to limit its emissions pursuant to Decision 2002/358/EC and the Kyoto Protocol*".
The EU ETS refers only to CO_2 emissions from selected activities. The following table shows the CO_2 emissions reference scenario to 2010 for Italian sectors involved in the ETS. Such values should be reviewed on the basis of data collected through an ad hoc survey to be carried out at plant level (bottom up approach): such data will constitute the reference values for the final allocation.

Table 3: CO_2 emissions for activities under the ET Directive (2000 and 2010)

	Emissions year 2000 ($MtonCO_2$)	Ref Scenario year 2010 ($MtonCO_2$)
Energy Activities	**149.7**	**172.2**
- Thermoelectric	*130.6*	*149.9*
- Refineries (direct consumptions)	17.1	19.2
- Other combustion activities	*2.0*	*3.1*
Gas pipeline compressors	*1.1*	*1.7*
District heating	*0.9*	*1.4*
Production and processing of ferrous metals	**27.6**	**30.3**
Mineral industry (combustion and process emissions)	**41.6**	**48.9**
- Cement	26.8	30.8
- Lime	2.7	3.3
- Glass	4.0	5.1
- Ceramic products	3.8	4.6
- Brick production	4.3	5.1
Other activities	**5.1**	**6.7**
- Pulp and paper	5.1	6.7
Total	**224.0**	**258.1**

source: Ministero dell'Ambiente e del Territorio (2004)

To define the total number of allowances allocated for free, the Italian Government starts from the previous table data. The cap for each activity is calculated on the basis of sectorial growth rate evaluation.

Table 4: Forecasted sectors annual growth rates (2005-2007)

Sectors	Annual growth rate (2005 - 2007) [%]
Thermoelectric	*1.1 -0.6 -0.3*
Gas pipeline compressors	*4.4*
District heating	*4.5*
Refineries (direct consumption)	2.3
Production and processing of ferrous metals	0.9
Cement	1.9
Lime	2.0
Glass	2.5
Ceramic products	2.0
Brick production	1.7
Pulp and paper	2.7

source: Ministero dell'Ambiente e del Territorio (2004)

As a consequence, the total quantity of allowances to be allocated in the period 2005-2007 is derived with a bottom-up approach, and will be respectively 239.96, 240.57 and 241.64 Mton of CO2. Table 5 shows the sectors caps.

Table 5: Total quantity of allowances to be allocated in the first period

	2005 ($MtonCO_2$)	2006 ($MtonCO_2$)	2007 ($MtonCO_2$)
Energy Activities	**159.44**	**158.75**	**158.47**
- Thermoelectric	137.80	137.00	136.60
- Refineries (direct consumptions)	19.16	19.16	19.16
- Other combustion activities	2.48	2.59	2.71
Gas pipeline compressors	1.36	1.42	1.49
District heating	1.12	1.17	1.22
Production and processing of ferrous metals	**28.86**	**29.12**	**29.39**
Mineral industry	**45.83**	**46.72**	**47.63**
- Cement	29.44	30.00	30.57
- Lime	2.98	3.04	3.10
- Glass	4.53	4.64	4.75
- Ceramic products	4.20	4.28	4.37
- Brick production	4.68	4.76	4.84
Other activities	**5.83**	**5.98**	**6.15**
- Pulp and paper	5.83	5.98	6.15
Total	**239.96**	**240.57**	**241.64**

source: Ministero dell'Ambiente e del Territorio (2004)

If we compare these values with the 1990 level of CO_2 emissions for EU ETS sectors (210.2 Mton CO_2), the Italian NAP entails that the initial allocation of allowances will keep emissions within a level which is 14% higher than the 1990 one. It does not seem to be very "consistent" with a total 6.5% reduction required by the EU Burden Sharing Agreement.
As far as plant by plant allocation is concerned, the following table the criteria used:

Table 6: Sectorial allocation criteria

SECTOR	CRITERIA
Energy Activities	Electricity: expected production Heat: historical emissions Heat and Electricity: historical production
Lime	Historical production
Steel	Historical production
Pulp and Paper	Historical emissions
Ceramic products	Historical production
Brick production	Historical emissions
Cement	Historical production (clinker)
Refining	Historical emissions
Glass	Historical emissions

source: Ministero dell'Ambiente e del Territorio (2004)

The most peculiar issue is that the power sector will receive emissions permits on the basis of the expected production. This is due to the deep change which affects this sector: in particular, many new plants are being built, some old ones are being refurbished and a liberalised electricity market is moving its first steps. Allocation rules foresee, for plants producing electricity, a forward looking main component and a change of regime component. Actually, the allocation is based on the plants capacity and on forecasts by technology mix (combination of technology and fuel type) of both hours of operation and specific emission factors. Nevertheless, an ex-post revision is admitted. For example, if the real hours of operation result different from forecasted, permit allocation will change by an ex-post correction factor.

This is exactly one of the controversial issues: the Commission does not admit ex-post revisions in order to avoid any ambiguity about the total amount of allocations. The Italian Government's argument leading to this choice is "the need to ensure both security of supply in the energy sector and proper consideration of the radical ongoing transformation process of the electricity sector together with its repercussions on the national energy system." (Ministero dell'Ambiente e del Territorio, 2004).

As a matter of fact, Italy is undergoing a process of privatization-liberalization-regulation in the energy sector, especially as regards power generation.

The Italian electricity demand is fast growing while national generation capacity is not enough to meet the needs. In 2004 around 15% of the net electricity demand was covered by import. Moreover, a new power exchange mechanism entered into force by the 1st of April 2004. In such a fast-changing scenario, referring to historic emissions (or production) could be misleading.

For heat production, plant level allocation will be based on historical emissions, while for plants producing simultaneously electricity and heat, allocation will take into consideration their role within the national electricity system and thus the balance between electricity and heat production.

Table 7: Comparing National Allocation Plans

	Austria	Belgium	Denmark	Finland	France	Germany	Ireland	Italy	Netherlans	U.K.	Spain	Sweden
Share in total EU emissions 2002	2%	4%	2%	2%	13%	25%	2%	13%	5%	15%	10%	2%
Kyoto target	-13%	-8%	-21%	0%	0%	-21%	13%	-7%	-6%	-13%	15%	4%
GHG Emissions 1990 MtonCO2eq	78.3	146.8	69.0	76.8	558.4	1218.2	53.4	508.0	212.0	734.6	285.7	72.9
Kyoto target MtonCO2eq	68	135.8	55	76.8	558.4	962.0	60.3	475.0	199*	653.0	328.5	75.8
GHG Emissions 2002 MtonCO2eq	84.6	150	68.5	82	554	1016	69	554	214	635	399	70
BAU 2010 MtCO2eq	84.4	150.1	80	89.9	594.0	977.8	68.61 (2006)	613.0	239.0	572.0	307.0	n.a.
EU ETS sectors' share in total emissions 2005-2007 (%)	40.9	45.0	50	62	na	58.5	32.7	42.9	59	46	40	31
CO2 forecasted emissions from EU ETS sectors, annual average 2005-2007 (A)	34.7	67.5	38.5	46.4	126.5	499.0	23.2	257.48 (trend Scenario) 244.46 (ref. scenario)	95.4	247.5	182.6	20.2
Annual average quantity of allowances to be allocated (B)	32.7	63.3	33.5	45.5	125.2	499.0	22.5	240.5	98.3	245.0	172.3	22.9
Total quantity of allowances to be allocated	98.9	188.8	100.5	136.5	371.1	1497.0	67.0	722.0	285.9	736.0	516.8	68.7
CAP share (B/A)	0.94	0.94	0.87	0.98	0.99	1.00	0.97	0.93 (trend Scenario) 0.98 (ref. Scenario)	1.03	0.99	0.94	1.13
NAP reduction with reference to BAU scenario	-6%	-6%	-15%	-2%	-1%	0%	-3%	-7% (trend scenario) -1.7% (ref. Scenario)	3%	-1%	-6%	11%

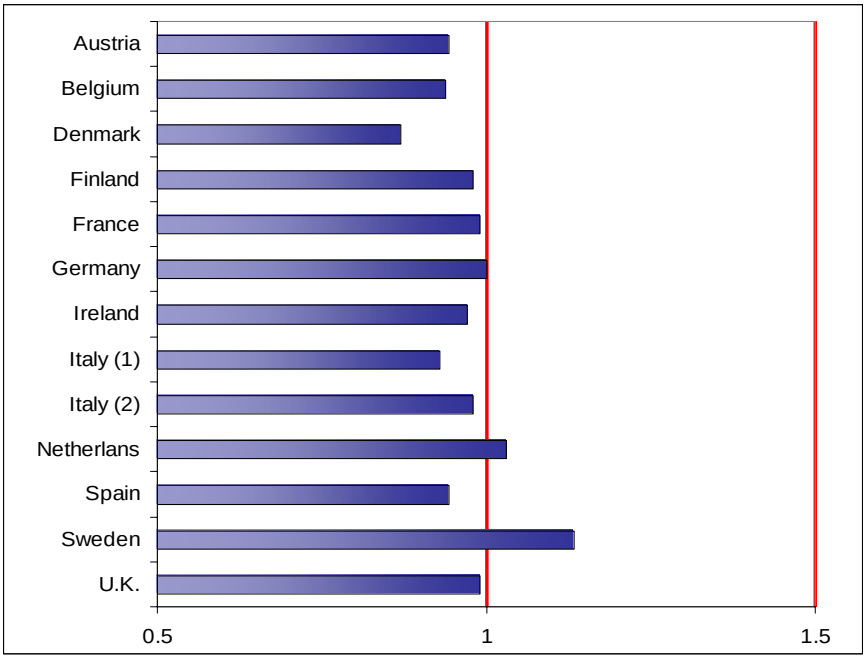
It could be useful to compare the Italian NAP with the other ones. Albeit every Member Country has a different background (in terms of economic structure and energy policy), this comparison could help us to better evaluate the Italian situation. Yet it is not easy to bring all the NAPs back to the same scheme. Table 7 collects data from NAPs and other documents, trying to compare as clear as possible different country frameworks. This table provides us

with a synthetic view of the countries situations and their use of the ETS. Three points are worth noting:

- behind Germany and U.K., Italy is, together with France, the third country for carbon emissions in the EU;
- its Kyoto target (-6.5%) is not the highest: Germany and Denmark (-21%), U.K. (-13%), Austria (-13%) and Belgium (-8%) have stricter target, at least in percentage terms;
- emissions in 2002 are, for Italy, 17% over the target. Other countries are characterised by a similar situation: Denmark (+25), Austria (+24%), Spain (+21%), Ireland (+14%). On the contrary, other countries are in a better situation: Sweden (-8%), U.K. (-3%), France (-1%), Germany (+6%), Finland (+7%).

A further point which must be stressed concerns the ratio between the annual average allocated allowances and forecasted emissions for the ET sectors (Fig. 1).

Fig 1: Ratios between the cap for EU ETS sectors and the business as usual scenario (BAU CO2 emissions in 2005-2007=1)



Italy (1): Trend Scenario; Italy (2): Reference Scenario

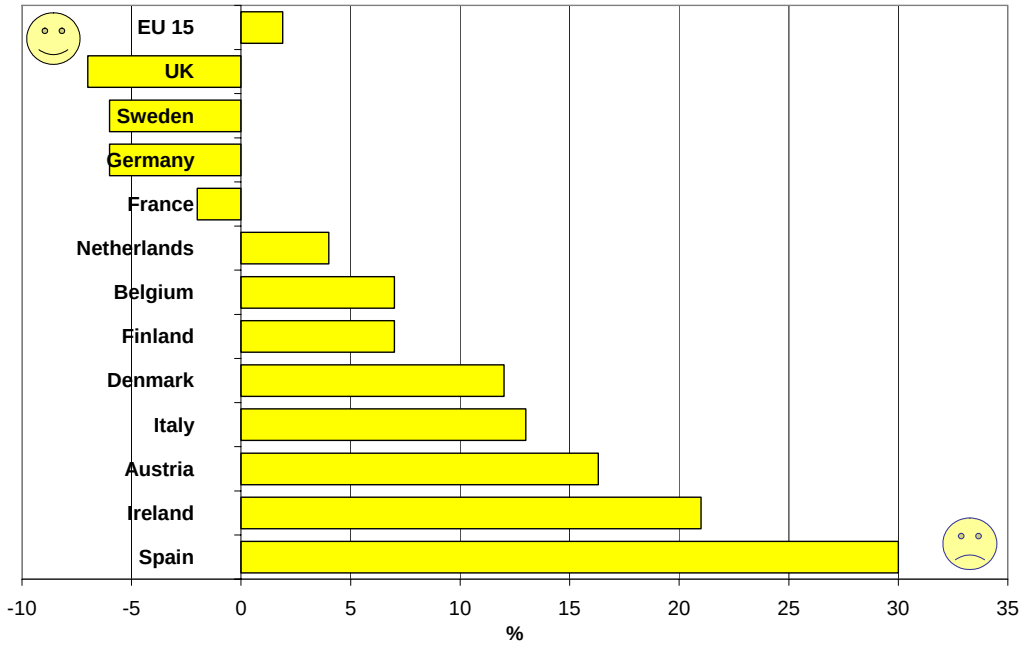
This ratio gives us an idea of the caps' tightness. It can be seen that, a part from Denmark which reacts to its heavy situation with a strong cut (-15%) in sectors which contribute to 50% of the total emissions, the other countries

Some comments on the relationship between caps and distances from the Kyoto targets are worth noting. The European Commission warned governments that they must create scarcity (establish short positions) for the carbon market to work, but there are some doubt whether the European Commission has the political will to enforce that. Hence, until final decisions about the caps are taken (the Commission is still assessing four plans), policy and regulatory issues will play a key role in price developments.

In order to illustrate how reduction targets set by the National Allocation Plans may affect the required reduction targets, we may compare historical emissions data for Member States with the targets set for each country under the Kyoto Protocol. The EU as a whole committed itself to reduce greenhouse gas emissions by 8% compared to 1990 levels. This target was then distributed among Member States according to the so-called Burden Sharing Agreement, where different targets were set for each of the different Member States (EU15) as shown in the second row of the previous table.

Germany and Denmark were assigned the most 'ambitious' targets, with reductions of 21% each from 1990 levels. In comparison, countries like Spain, Ireland and Sweden were allowed to increase their emissions, due to expected economic growth, by 15, 13 and 4 per cent, respectively.
By comparing emission levels in years 1990 and 2002, the latter representing the latest official emissions inventory, one may then calculate the distance to targets for each Member State.
The European Environmental Agency (EEA) calculates every year the DTI (distance target index). This index measures the deviation of actual emissions in 2002 from a (hypothetical) linear target path between 1990 and 2010. A positive value suggests an under-achievement by 2002 and a negative value an over-achievement in 2002. The DTI is used as an early indication of progress towards the Kyoto targets. It assumes that the countries meet their targets entirely on the basis of domestic policies and measures.
As shown in Figure 2, only UK, Sweden, Germany and France had already reached their targets in year 2002.

Figure 2: distance from Kyoto target in 2002 (DTI)



Source: our elaboration on EEA data

In comparison, countries like Spain, Ireland, Austria and Italy had emissions that stood above their Burden Sharing Agreement target. Moreover, emission levels in some of these Countries are expected to increase further in coming years, and then the distance to target will increase even more in the absence of additional policy instruments.
Comparing the DTI with caps, it could be said that, in general, there is not a correlation between the “Kyoto position” and the NAPs’ stringency. Nevertheless, it must be recognised that some countries that are far away from Kyoto target, e.g. Spain, Austria, Denmark and Belgium, to some extent caught the ETS opportunity to reverse their emission situation, by fixing caps quite lower than the BAU scenario. On the contrary, Ireland and Italy are not characterised by a similar strategy. For Italy, if the reference scenario has a high degree of probability, then the emissions cut is indeed very low (-1.7%).

While the above analysis suggest that, due to high distances form targets, there should be allowances scarcity, the National Allocation Plans released till now paint a much different picture. In aggregate, the National Allocation Plans appear to represent an allowed EU-25 emission level that is approximately 2.7% below business-as-usual projections (ILEX 2004).

This represents a modest level of overall scarcity, but contains important elements of difference among economic sectors and in different EU Member States.
Whether a sector will be "winner" or "loser" in the ETS scheme will depend not just on how Governments decide to allocate the allowances but also on the characteristics the sector. On the one hand, companies that are only competing against other EU companies will probably be able to pass through the cost of CO_2 on consumers. On the other hand, companies that are competing on a global scale against international companies (not involved in EU ETS) will not be able to pass through the cost of CO_2 to product prices and could suffer major impacts on their competitiveness and profits.

Some quantitative reflections on Italy

Due to its size, the electricity sector will play a dominant role in the ETS. For a large part of the member states, the power sector is responsible for almost a half of the emissions by sectors covered by the EU-ETS. It is also the sector that will experience some of the most radical changes in terms of shifts in the method of generation and potentially large increases in wholesales electricity prices. Yet because of the wide diversity of generating technologies (coal, oil, gas, hydro, nuclear, other renewables) in different EU countries, the nature and the scale of the EU ETS impact would be very different across Europe. In brief the main impact of the ETS on the electricity sector will come from two interrelated factors: the methodology used by the Government to allocate allowances and the price of CO_2 that will emerge. The key elements as far as electricity prices are concerned are: the stringency of the cap and the level of pass-through of the marginal cost of emissions allowances into electricity price (both at wholesale and retail level).

In order to evaluate the costs of the ETS for Italy's electricity sector, we built a simple system dynamics model which allows easy simulations on alternative scenarios. The model focuses on the Italian power sector. Its aim is two-fold: on the one hand, we analyse what could be the effect of EU ETS on Italian electricity production cost; on the other hand, we try to quantify the consequences of this effect on industrial production cost and households' balance.
There are three building blocks, connected each other: the electricity supply block, the EU ETS mechanism and the electricity demand block. The model is very flexible and allows several experiments with alternative assumptions. Through sensitivity analysis we are able to evaluate different scenarios. The main variables that could be used to simulate different situations are shown in the Table 8:

Table 8: main model's variables

Supply	ETS	Demand
Domestic production growth rate	Emissions Cap	Pass through coefficient
Electricity import	CO_2 price	
Emissions coefficient		

In the first column there are variables related to the power generation sector: the growth rate of the domestic production (which is clearly driven by the demand), the share of import and the emissions coefficients (it represents CO_2 emissions per TWh produced and depends on the fuel mix). In the second column there is the Emissions Trading System, with two important variables: the quantity of allowances allocated to the power sector and the market price of permits. The last block concerns the demand side: the pass trough coefficient, which represents the percentage of additional cost that industry and household are burden with. To define the impact of the ETS on industry and households we have two variables: the electricity price increase and the effect of this increase on the production price index (IPP) and consumption price index (IPC).

A lot of different hypotheses could be made on these variables. For synthesis reasons, in this article we focus on three main scenarios:

- **Scenario 1**: application of the caps defined in the Italian NAP on a BAU emissions scenario (sensitivity analysis on CO_2 price and pass through coefficient)
- **Scenario 2**: a quite severe scenario, with stricter emissions cap, defined as a percentage of total emissions (sensitivity analysis on CO_2 price and pass through coefficient)
- **Scenario 3**: the worse one for the economy, with fast growing electricity demand, low import opportunities, a carbon intensive fuel mix, low emissions cap and a high CO_2 price.

Scenario 1

This scenario foresees a 2.4% growth rate for the domestic production and the full application of the Italian NAP. To start, the market price for CO_2 is fixed at 10 €/ton and we supposed that the entire additional cost is charged on industry and household. The following table sums up the main result

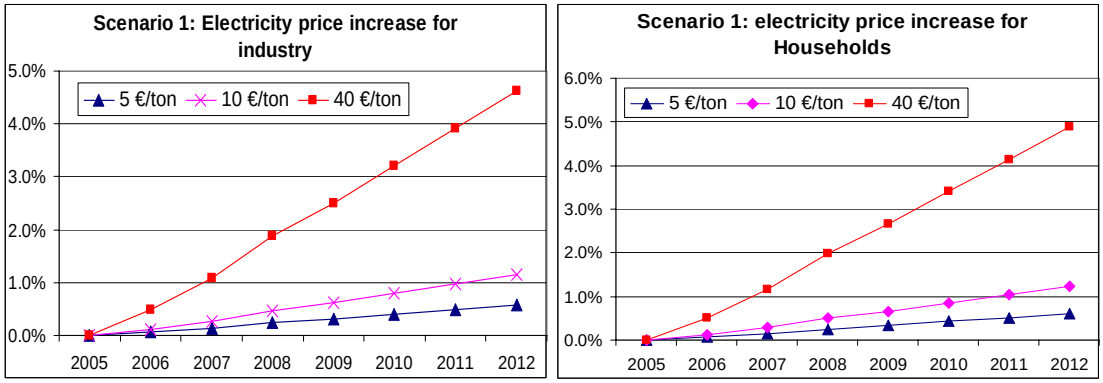
Table 9: Scenario 1 – results (CO_2 price: 10€/ton)

Year	Domestic Production	CO2 Emissions (1)	CO2 cap (2)	GAP (1)-(2)	Mwh final cost	Mwh cost increase*	Electricity price increase for industry*	Electricity price increase for households*	IPC impact	IPP impact
	Twh	*Mton CO2*	*MtonCO2*	*MtonCO2*	*Euro*	%	%	%		
2005	308.2	147.0	147	0.01	30	0.00%	0.00%	0.001%	0.000%	0.000%
2006	315.7	148.8	146	2.84	30.09	0.30%	0.12%	0.127%	0.002%	0.005%
2007	323.3	151.6	145	6.63	30.21	0.68%	0.27%	0.289%	0.003%	0.012%
2008	331.1	154.8	143	11.81	30.36	1.19%	0.47%	0.499%	0.006%	0.021%
2009	339.2	158.1	142	16.05	30.47	1.58%	0.63%	0.664%	0.008%	0.028%
2010	347.4	161.0	140	21.01	30.60	2.02%	0.80%	0.850%	0.010%	0.036%
2011	355.8	164.2	138	26.19	30.74	2.45%	0.98%	1.037%	0.012%	0.044%
2012	364.4	167.6	136	31.62	30.87	2.89%	1.16%	1.223%	0.015%	0.052%

* respect to 2005

In the first period (2005-2007) the emissions are quite near to the cap. The electricity average production cost, which is assumed to be 30 €/MWh, increases only by 0.68% from 2005 to 2007. The effect on electricity prices is moderate: +0.27% in the industrial sector, +0.29 for residential sector. In terms of IPP and IPC increase we calculated 0.003% and 0.012% respectively.
In the period 2008-2012 the ETS sectors is supposed to emit around 161.1 Mton CO_2/year and the allowances allocated should be around 140 Mton CO_2/year. The gap that will be covered buying ET permits is around 21.3 Mton CO_2/year.
The first remark is that starting from a production cost of 30 €/MWh in 2005, the increase is 2.9% in 2012. The electricity price would increase by 1.16% and 1.22% in 2012 respectively for industry and household sectors.

Fig 3: Scenario 1 – Electricity price increase (referring to 2005 prices)



These graphs summarize the impact of EU ETS on Italian electricity prices, both for industry and for residential sector. We would like to remind that Italian energy prices are generally higher than in other European Countries. However, a part from the 40€/ton CO_2 scenario, the estimated increase is quite moderate (around 1% in 2012 with a CO_2 price of 10€/ton, 0.5% with a 5€/ton CO2 price).

Scenario 2

In this second scenario we assume that the emissions cap for the power sector is set in terms of percentage of the forecasted emissions. In particular we start with a 80% cap. This means that, for the year 2005, the sector cap is set at 117.6 Mton, being CO_2 emission from power industry around 147 Mton. It is a large reduction if we compare it to the Italian NAP cap (-7% of the trend scenario). The main results for production and emissions are the following:

Table 10: Scenario 2, main results

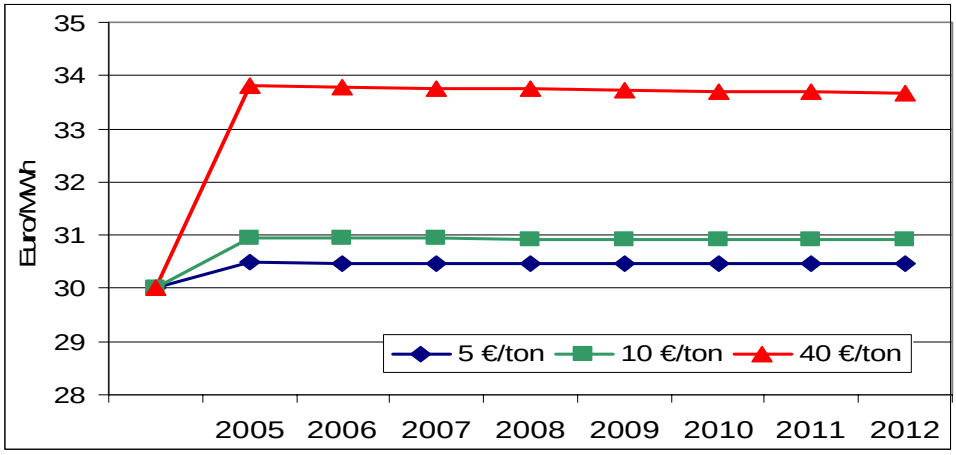
Year	Domestic Production	CO2 Emissions (1)	CO2 cap (2)	GAP (1)-(2)
	Twh	*Mton CO2*	*MtonCO2*	*MtonCO2*
2005	308.2	147.0	117.6	29.4
2006	315.7	148.8	119.1	29.8
2007	323.3	151.6	121.3	30.3
2008	331.1	154.8	123.9	31.0
2009	339.2	158.1	126.4	31.6
2010	347.4	161.0	128.8	32.2
2011	355.8	164.2	131.4	32.8
2012	364.4	167.6	134.1	33.5

Electricity production cost (€/MWh)

Year	5 €/ton	10 €/ton	40 €/ton
	Euro	*Euro*	*Euro*
2005	30.48	30.95	33.82
2006	30.47	30.94	33.77
2007	30.47	30.94	33.75
2008	30.47	30.93	33.74
2009	30.47	30.93	33.73
2010	30.46	30.93	33.71
2011	30.46	30.92	33.69
2012	30.46	30.92	33.68

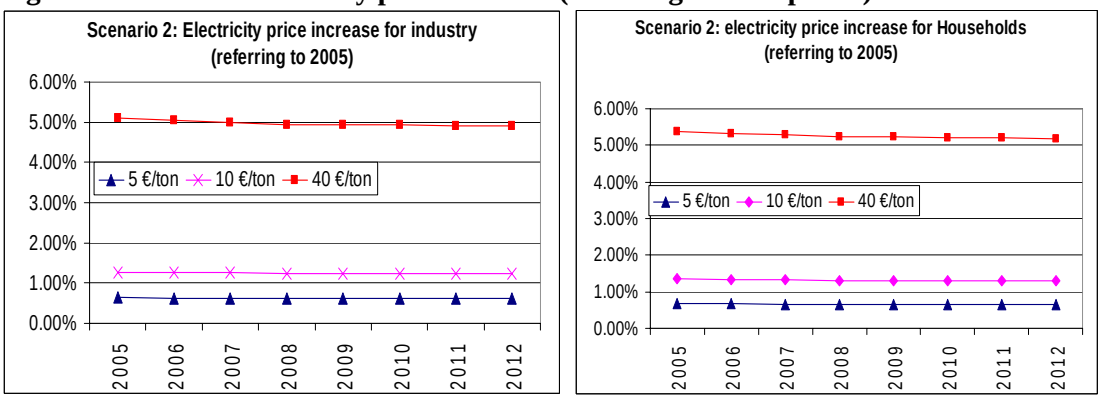
As in the first scenario, we forecast that in 2008-2012 the ETS sector will generate around 161.1 Mton CO_2/year. But in this case, the cap is lower, near to 129 Mton CO_2/year. Italy should buy yearly 32.2 Mton CO_2 to fill the gap.
As a consequence, the gap is immediately high but constant in the next years; the total expenditure "carbon shopping" is quite similar year by year. For this reason the cost and the price of electricity have a sharp increase in 2005 and then become constant in the following period.

Fig. 4: Scenario 2 - MWh production cost increase with different CO_2 prices



The trend of the electricity price increases for industry is showed in Fig. 5. Depending on the CO_2 price it ranges between 0.61%-5.09%. We obtain very similar results for the residential sector.

Fig 5: Scenario 2 – Electricity price increase (referring to 2005 prices)



Scenario 3

In this scenario we substantially modify the hypothesis on the supply side of the model. The electricity demand is supposed to grow faster than in the other scenarios (3% yearly) while import is essentially stable. So the domestic production must increase to cover the national demand. The fuel mix is supposed to be unvaried and consequently the emission coefficient (which represents the average CO_2 emission for each TWh produced) is constant rather than decreasing. The cap imposed is 137 Mton CO_2 in the first year and then gradually decreases to 100 Mton CO_2 in 2012. The main results are showed in table

Table 11: Scenario 3, main results

Year	Domestic Production	CO2 Emissions (1)	CO2 cap (2)	GAP (1)-(2)
	Twh	*Mton CO2*	*MtonCO2*	*MtonCO2*
2005	308.2	150.7	137.0	13.7
2006	317.6	155.6	129.5	26.1
2007	327.2	160.3	123.5	36.8
2008	337.1	165.0	119.8	45.3
2009	347.3	170.0	114.5	55.5
2010	357.9	175.2	109.3	65.9
2011	368.7	180.5	105.5	75.0
2012	379.9	186.0	100.0	86.0

As far as the power sector is concerned, certainly it is negatively affected by tight caps, but the hypothesis of a strong demand increase could benefit it in terms of profits. For the economy as a whole, this is clearly the worst scenario. The emission cap is very low (in 2008-2012 is around 62% of the total CO_2 emissions from the power sector) and every year, on average, this sector should buy 65.5 Millions of CO_2 permits. Considering different CO_2 market prices, the impact of ETS on electricity production cost could be illustrated in the following figures.

Figure 6: Scenario 3 - MWh production cost increase with different CO2 prices

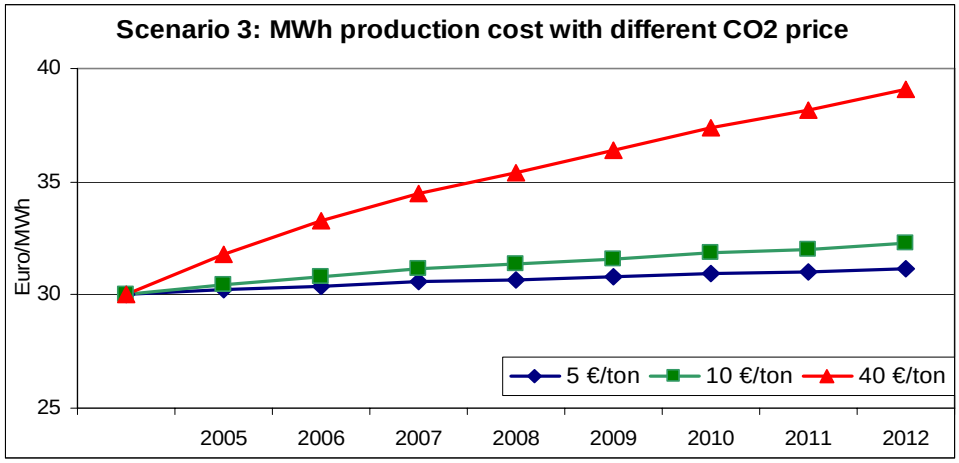
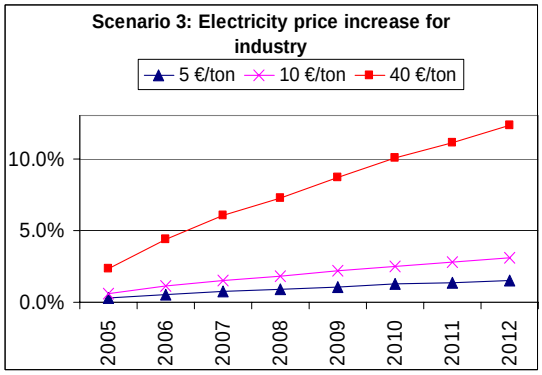
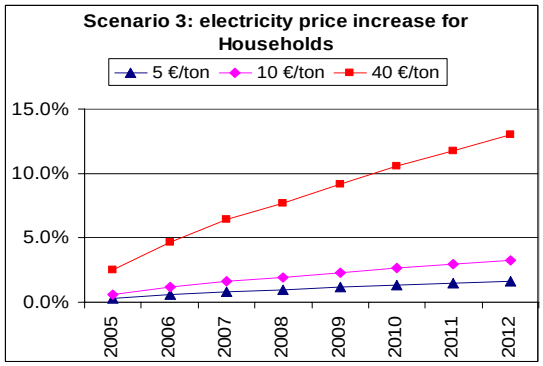


Fig 7: Scenario 3 – Electricity price increase (referring to 2005 prices)





We can see that, in this last scenario, the impact on the electricity production cost and prices is higher than in scenario 2. Nevertheless, we can see that, a part from the case of 40 €/ton

CO_2 price, which entails a 12%-13% increase in electricity prices, such an increase is never higher that 5% and, at maximum equal to 3.3%.

Conclusions

The above analysis show that the Italian NAP does not bring the economy much closer to the Kyoto target and that, under the probable scenario of CO_2 prices around 10 €/ton, its effects on prices are moderate. In other words, the Italian Government seems to have taken a clear decision about the dilemma of cutting emissions today or buying carbon credits tomorrow: simply, the problem of meeting the Kyoto commitment is postponed.

Since our focus is the impact of EU ETS on the whole economic sector, we can summarize our results in the following table. In the model the pass through coefficient is equal to 1, therefore the entire the cost of CO_2 allowances is passed on wholesale and retail prices. The annual average increase borne by industry and households fluctuates between 0.07 and 1.54 per cent.

Table 12: Annual average increase in electricity prices in different scenarios

	INDUSTRIAL SECTOR Annual Average Increase of the Electricity price			RESIDENTIAL SECTOR Annual Average Increase of the Electricity price		
	5 €/ton	*10 €/ton*	*40 €/ton*	*5 €/ton*	*10 €/ton*	*40 €/ton*
SCENARIO 1	0.072%	0.145%	0.578%	0.076%	0.153%	0.611%
SCENARIO 2	0.077%	0.153%	0.613%	0.081%	0.162%	0.648%
SCENARIO 3	0.193%	0.385%	1.541%	0.164%	0.329%	1.316%

Considering that Scenario 1 is more likely to succeed, and a 10 €/ton CO_2 price is the more realistic hypothesis, the related increase in electricity prices is quite moderate. Yet, the Italian NAP (which is reproduced by the first scenario) is generous, especially toward the power sector, and its impact in terms of Kyoto target and derived environmental benefit may be negligible. Prices increase substantially under the 40 €/ton CO_2 price hypothesis, especially in the third scenario, while in the first and the second ones the increase is more moderate.

Somebody could claim that, even in Scenario 1, the impact on the economy could be very negative, since an increase in electricity prices around 0.5% a year can destroy the economic growth in the long run, due to a cumulative effect. Even if this can be true, it must stressed that the Italian economy has been bearing high electricity prices for many years, because of a joint effect of a monopolistic, not fully liberalised market, and high taxation. Nowadays, as the Government recognizes, Italy faces electricity prices which are the highest among EU countries. We do not want to say that, since the economy borne a burden for years, it can do it and, thus, the burden can be increased. On the contrary, we wish to stress that the fear for a negative impact on the economic growth comes just from those actors – State and electricity operators – that had a substantial role in not creating the condition for low electricity prices. As an example of such a situation, we perform a simple comparison between the price increase due to the ETS and electricity taxation. In all scenarios, even in the 40 €/ton CO_2 price hypothesis, the increase is always less than the amount of taxation. For instance, in scenario 1, for industry, depending on CO_2 prices, the price increase ranges, on average, between 2% and 12% of taxation (1%-9% for the residential sector); in scenario 2, the range is 3%-26% (3%-20% for the residential sector); finally, in scenario 3, the range grows to 5%-41% (4%-32% for the residential sector). In other words, the burden due to ETS is never higher that the burden due to taxation. This simple comparison induces us to believe that as

taxation goes down, and as the high electricity prices, and the related extra-profits of electricity companies, are reduced by the market liberalisation process, there is room for stricter carbon caps. This compensation process, in which the environmental burden substitutes the monopoly/State inefficiency one, is crucial. Without it, the national competitiveness and the whole economy run the risk of being damaged, especially if high CO_2 prices emerge in the carbon market. Roughly speaking, the final conclusion of our exercises is that we should pay for the protection of the environment and not for companies' extra-profits and State inefficiency. Arguing that this is not possible because of competitiveness reasons represents an implicit defense of a social illness.

Disclaimer

The views expressed in this paper are those of the authors and do not necessarily reflect the official position of the company they work for.

References

- CIPE 1998, "Linee guida per le politiche e misure nazionali di riduzione delle emissioni di gas serra", CIPE, Roma.
- CIPE 2002, "Revisione delle linee guida per le politiche e misure nazionali di riduzione delle emissioni di gas serra", CIPE, Roma.
- Di Giulio E., Migliavacca E. and Vaglio A. (2004), "Italy's route to Kyoto: a wishful thinking?", Proceedings of the 24th Annual North American Conference of the USAEE/IAEE July 2004, Washington, DC, USA
- Di Giulio E., Migliavacca S. and Vaglio A. 2003, "The new Italian energy policy: a forecast by the CEPRIG model", Proceedings of the 26th Annual International Conference of the International Association for Energy Economics (IAEE), Prague, June 2003.
- Ecofys (2004), "Analysis of the National Allocation Plans for the EU emissions trading scheme", Utrecht
- Econ (2004), "EU Emission Trading Scheme and the effect on the price of electricity", Commissioned by The Nordic Council of Ministers, Oslo
- European Environmental Agency (2004), "Greenhouse gas emission trends and projections in Europe 2004", EEA Report, Copenhagen
- European Union (2003). Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.
- ILEX (2004), "Impact of the EU ETS on European electricity prices", Ilex Energy Consulting, Oxford
- Klepper G., Peterson S. (2004), "The EU Emissions Trading Scheme: Allowance Prices, Trade Flows, Competitiveness Effects" Kiel Working Paper No. 1195 Kiel Institute for World Economics, Germany
- Ministero dell'Ambiente e del Territorio (2004), "Directive 2003/87/EC of 13 October 2003, establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC – National Allocation Plan", Roma.
- Royal Institute of International Affairs (2003), "EU Emissions Trading Challenges And Implications Of National Implementation"
- The Carbon Trust (2004), "The European Emissions Trading Scheme: implications for industrial competitiveness", London
- ZEW (2004), "Mission Impossible!? On the Harmonization of National Allocation Plans under the EU Emissions Trading Directive" Discussion Paper No. 04-15, Centre for European Economic Research, Mannheim, Germany