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Simultaneous attainment of energy goals by means of green certificates and emission permits

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Abstract

We discuss the analytical effects of introducing emission permits and green certificates and the corresponding quotas as regulatory mechanisms to, respectively, reduce emissions from electricity production and ensure a certain deployment of renewable energy.

The different case studies in this paper show that both instruments can be used in order to reach an emission goal or a goal of renewable energy. However, the combination of these instruments and the way they are used, is shown to be important for the price faced by consumers.

It is shown that the effect on the consumer price is not an unambiguous increase with the introduction of a green quota. There is a choice between quotas leading to a lower consumer price and quotas leading to a higher consumer price. As a result of this it is shown that it is always optimal to reach a renewable energy deployment goal by the use of green certificates. However, to reach an emission goal it is sometimes most favourable, with respect to consumer prices, to use green certificates and sometimes to use emission permits.

JEL: D50; Q28; H21; O21

Keywords: Renewable energy; Emission permits; Green certificates; Regulatory mechanisms; Electricity; Consumer prices

1. Introduction

During the last decade electricity markets in the European Union (EU) and several other countries around the world have experienced a transition from regulated to liberalised markets. One of the driving forces of this liberalisation is a desire to maximise the efficiency of the electricity supply industry and thereby bring down consumer prices (European Commission, 1997a).

Coincident with the liberalisation process, a growing focus is on environmental and renewable energy goals. The EU has incurred an obligation to reduce its emissions of greenhouse gases under the United Nations Framework Convention on Climate Change and the Kyoto Protocol (European Commission, 1997b, 2001). At the same time the EU has ambitious energy goals with respect to promotion of electricity from renewable energy sources (European Commission, 2000).

Thus, the EU has three parallel goals, among many other goals: to bring down consumer prices, to reduce emissions, and to promote electricity from renewable energy sources. To realise the last two goals in a liberalised electricity market, the design and regulation of policy measures and incentive schemes have to be in accordance with market principles, keeping in mind that consumer prices should be kept at a minimum. The newest regulatory measures are frameworks for tradable emission permits and for tradable green certificates (European Commission, 2000, 2001).

The desired political goals can be reached by the use of an emission quota and a green quota in connection with both tradable emission permits and tradable green certificates. This is to say that the quotas are the regulation instruments, whereas the certificates and permits are the means that are used by the market actors to fulfil quotas.

In setting such goals in order to regulate the different markets, it is necessary to consider interactions between

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the contributing markets and thus the effects of different goals. Increased use of renewably based power production results in lower thermal production; this leads to a decrease in the total amount of emissions. Therefore, besides ensuring a desired percentage of renewable energy, the green quota has the positive effect that a smaller percentage of power production discharges emissions. The green quota will therefore help lower emissions and consequently function as the emission quota.

Likewise, an introduction of an emission quota would favour renewably based power, since the additional cost of purchasing permits adds to the cost of producing thermally based power. Thereby, the costs of some thermal production technologies lie above renewably based technologies. As a result, the market share assigned to renewably based power production increases (see Fig. 5).

This paper deals with the issue of reaching two goals using these two regulatory mechanisms. The goals are to reduce emissions, and to promote electricity from renewable energy sources. The focus in this paper will be on the difficulty of having both an energy policy goal and an environmental policy goal, and at the same time minimising consumer prices, in a case where the regulatory instruments affect each other and thereby the attainment of the specified goals.

This is an analytical paper. It starts with a discussion of goals, quotas, green certificates, emission permits, and the corresponding markets. It then discusses the use of one instrument to reach one goal. The discussion is then enlarged to deal with two instruments to reach one goal and finally to two instruments to reach two goals simultaneously. The paper ends with a discussion of the different observations made through the previous sections.

2. Energy goals and quotas

There are a number of distinct energy policy reasons for supporting the development of renewable energy technologies (European Commission, 2000):

- security of supply: In markets dominated by imported fuels, e.g. natural gas, regional deployment of renewable energy technologies implies a higher degree of security of supply in the region;
- their potential contribution to diversify and make a sustainable energy supply side;
- recognition of the environmental benefits of renewable energy technologies, i.e. the contribution they make to meeting current and longer-term climate change targets for the reduction in emissions of greenhouse gases;
- developing future renewable industries, and ensure long-term economic viability;
- generation of jobs.

Many of these are externality goods. The crucial feature of externalities is that people value these goods that are not sold on common markets. In order to extract the benefit of externalised goods, governments often establish different systems in the form of detailed regulation through central planning or taxes, following an assumption that the goods are public goods. Another way is to create separate markets and services in order to force value setting on the goods. The markets for tradable emission permits and for tradable green certificates are such markets.

Having an environmental policy, e.g. emission reduction, which is distinct from energy policy, e.g. a regional renewable energy development policy, can cause problems of regulation in order to attain the desired goals. The inter-relatedness in the economy between environment and energy can work to the disadvantage of the environment simply because politicians tend to compartmentalise issues.

These subjects introduce two problems in achieving both a certain renewable energy deployment as well as lower emissions. First, which social values do the goals represent? Do they only cover lower emissions from greenhouse gasses or do they also cover security of supply, other emissions, low consumer prices, agricultural politics, etc.? Secondly, which mechanisms should be used in order to reach the desired goals? It is crucial that the regulator is aware of the social benefit and thus the reason to introduce environmental as well as energy goals.

In the EU, it is the responsibility of each member state to implement regulatory mechanisms in order to obtain both a lower level of emissions and more renewably produced electricity (European Commission, 2000, 2001). There is a desire to attain common systems, but there is no predetermined way to do it. However, there is a tendency towards the use of tradable emission permits to reach the desired emission goal and of tradable green certificates to reach the desired renewable energy deployment.

3. Tradable green certificates and tradable emission permits

The main idea of a market for green certificates is to ensure a politically planned deployment of renewable energy technologies under liberalised market conditions.

In a system of green certificates, the green power producer sells electricity to the grid, and at the same time receives a corresponding number of green certificates. These certificates are financial assets and tradable.

In addition to the physical power market, they can be sold in an organised financial market established for green certificates, and thereby realise an additional payment to the producer for the green power generated. As a result of this, the price obtainable to the producer for the renewably based electricity will be the sum of the market-based settling prices for physical power and green certificates.

There are various ways to determine the demand for certificates. Some countries set a purchase obligation on the production side and some on the consumer side (Lorenzoni, 2001; Voogt et al., 1999). This paper focuses on the consumer obligation.

In any case a desired share of renewable electricity can be obtained by setting the appropriate quantity of green certificates. In the case of demand obligation, the quantity of green certificates is determined as a share of demand corresponding to the green quota.

The idea of a market for tradable emission permits is to ensure a lower level of emissions in an economically efficient way. The tradable emission permits are issued on the basis of source emissions. Permits issued to electricity generators allow them to emit up to a specified level of emission (the individual emission quota), with the total number of issued permits equal to the national limit on emissions (the total emission quota).

Generators that reduce emissions below their allowed level can sell excess emission permits, which can be purchased by other generators for whom it is more cost-effective to purchase permits at the prevailing market price than to reduce emissions.

4. The interacting markets

The markets in question in this paper involve three different kinds of actors, as illustrated in Fig. 1. First, the consumer purchases physical power on the power market and certificates on the certificate market. Second, the renewably electricity based producers provide the green certificate market with certificates equal to the amount of power they produce; in addition, the renewably based power is sold at the power market. Finally, the thermal producers deliver physical power to the power market; at the same time they are obliged to have a number of emission permits corresponding to the amount of emission following their power production.

It is assumed that the thermal producers' supply of power reacts positively on the power price and negatively on the emission permit price.

The price faced by the renewable producers is the sum of the green certificate price and the power price. It is assumed that the supply of renewably based power and the price on certificates is positively correlated with the faced price, i.e. an increase in the price faced leads to an increase in the supply.

The consumer will purchase physical power on the power market and certificates on the certificate market. The power price plus the green quota times the green certificate price determines the total price faced by the consumer.

All three kinds of actors trade on two distinct markets: the physical power market and one of the two additional markets. This leads to several interconnections between the actors, through market prices, which influences the effects from the regulation instruments (Amundsen and Mortensen, 2001; Jensen and Skytte, 2001a, b; Hindsberger et al., 2002).

In this paper, the regulatory instruments are the two quotas. The interactions between the certificate, permit and power markets result in the possibility of using both instruments in order to reach an emission goal or a goal of renewable energy. However, the combination of these instruments and the way they are used are shown to be

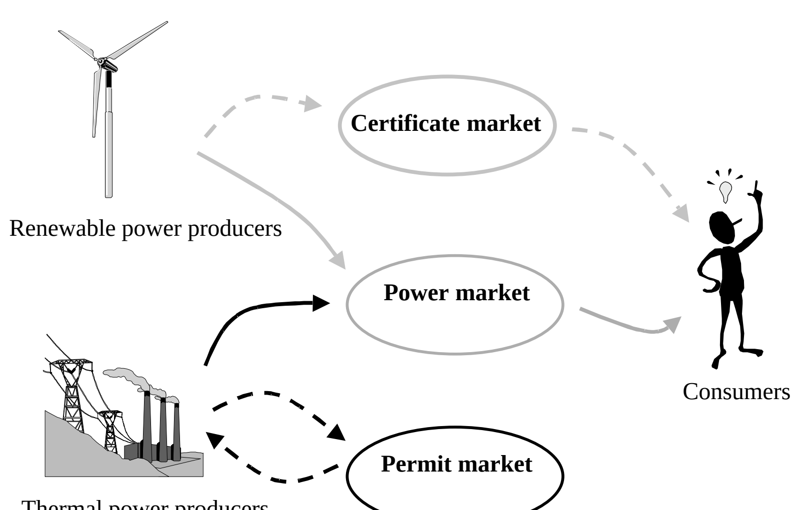

Fig. 1. The three markets included in the policy discussion.

important when environmental policy and energy policy have related goals.

5. Attainment of a single goal

The main purpose of the two quotas is to reach lower emissions with the emission quota and more renewably based electricity with the green quota. But both quotas can be used to achieve one goal only, e.g. the green quota can be used to decrease the amount of emissions, as the two instruments are to some extent substitutes for each other. That is, an increased use of renewably based power production will oust thermal production on the power market and thereby decrease the total emissions from power production.

Likewise, an introduction of an emission quota will favour renewably based power, since it increases the costs of thermally based power and consequently the power price. Renewably based power thereby becomes more competitive on the common power market.

6. Renewable energy goal with the green quota

We start with a case study using the green quota solely in order to reach a renewable goal, i.e. with no consideration of emissions or goals other than the deployment of renewable energy.

In a conventional power market without any regulation, all technologies supply power at common market conditions. This is illustrated in Fig. 2 with one common supply curve that contains both thermal and renewable electricity productions. In order to simplify the illustration, it is assumed that all the renewable energy technologies (dotted line) are more expensive[1] than the conventional thermal technologies (bold line).

We assume constant demand, i.e. an inelastic demand curve (the vertical line in Fig. 2).

The equilibrium price[2] and quantity are determined at the balance between demand and supply (p_e and Q). Since the part of the supply curve representing the renewable energy technologies lies to the right of the equilibrium quantity, none of the produced electricity is based on renewable energy sources.

In order to reach a deployment of renewable energy technologies, it is necessary to regulate. Using a green quota (K_c) implies that at least K_c percent of the demand, thus also of the total supply, is based on renewable energy sources. In other words, $(1-K_c)Q$ is the amount of thermally based electricity produced (q'_T) and K_cQ is the amount of renewably based electricity produced (q'_R) (see Fig. 3).

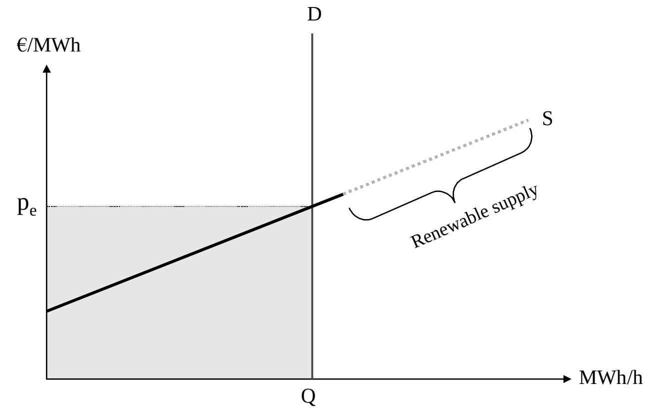

Fig. 2. Market without regulation.

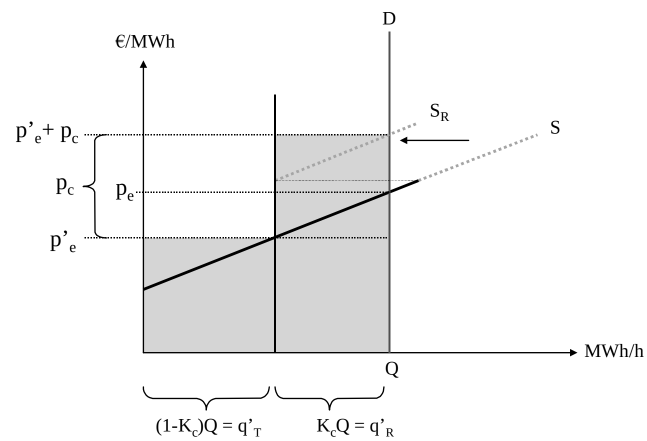

Fig. 3. Market with regulation using the green quota.

Prior to the introduction of the green quota the power price (p_e) was determined at the total quantity (Q). Splitting the market in two implies that the new power price[3] (p'_e) is determined at the quantity $(1-K_c)Q$. Thereby, the introduction of a green quota causes the power price to decrease from p_e to p'_e.

The rest of the market K_cQ is covered by renewable energy (illustrated by the renewably based supply curve S_R in Fig. 3). Since the cost of these technologies is higher than the new power price p'_e, the renewably based producers receive the remaining part of the cost in form of the green certificate price, i.e. $p_cq'_R$. In other words, the total price faced by the renewable energy producers is $p'_e + p_c$.

The consumer cost of purchasing the quantity Q is illustrated by the hatched areas in Figs. 3 and 2 with and without regulation, respectively. In order to find the

[1] One can think of the renewable energy as new deployment at long-term costs compared with short-term cost for the existing technologies that are presently supplying the power market.

[2] The equilibrium price equals the marginal cost of the marginal supplier.

[3] The cost of the marginal supplier at the quantity $(1-K_c)Q$.

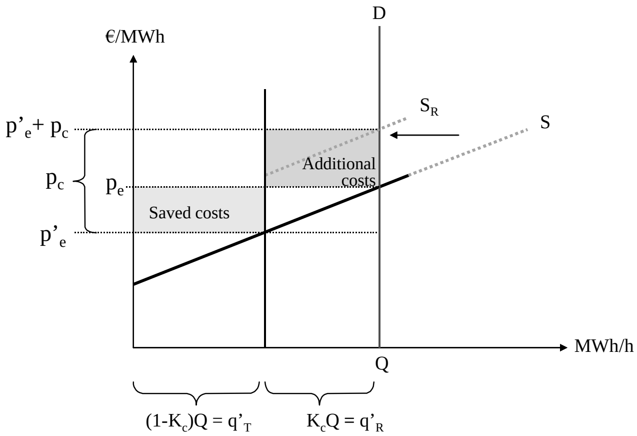

Fig. 4. Change in consumer cost of introducing a green quota.

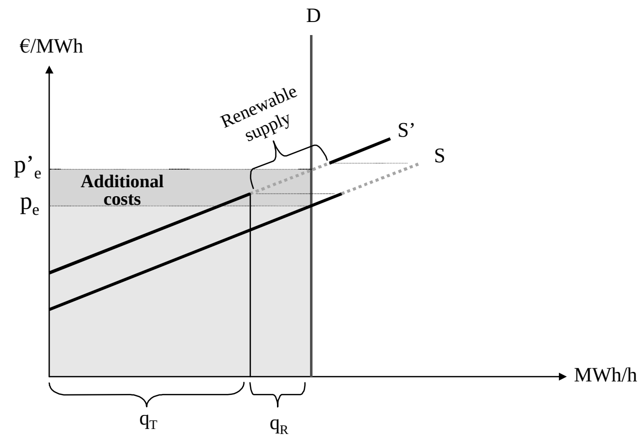

Fig. 5. Market with regulation using the emission quota.

change in the consumer costs of introducing the green quota, one can compare these two areas (see Fig. 4).

There is a cost saved by lowering the power price, and an additional cost following the use of renewable energy technologies instead of thermal energy technologies. This is illustrated in Fig. 4. The sizes of these two areas depend on the slope and level of the two supply curves (S and S_R) as well as the size of the quota (K_c).

It is ambiguous as to whether the additional cost is larger than the saved cost. Therefore, the consumer costs can either increase or decrease, as a result of introducing a green quota.

Since the consumed quantity (Q) is constant, an ambiguous result with respect to total consumer cost implies a corresponding ambiguous result with respect to the consumer price (p_e versus $p'_e + K_c p_c$). That is, the effect on the consumer price following an introduction of green certificates, is NOT an unambiguous increase; there is a possibility of lowering as well as increasing the consumer price. For more detailed discussion of the ambiguous consumer price effect see Jensen and Skytte (2001b).

This result is the cornerstone in the discussions of the effects of regulation discussed below. The focus in this paper will be on the difficulty of having an energy policy goal and an environmental policy goal, and at the same time minimising consumer prices, in a case where the regulatory instruments affect each other and thereby the attainment of the specified goals.

7. Emission goal with the emission quota

In order to reach an emission goal, one can use the emission quota. This implies an introduction of an additional cost to all the thermal producers, when purchasing emission permits.

Starting this case study with Fig. 2, with a market without regulation, the effect of introducing the emission quota is illustrated in Fig. 5. All thermal producers face an additional cost which shifts the thermal supply curve upwards according to the additional costs from S to S'. Thus, the renewably based producers are better off. This is illustrated in Fig. 5, where some of the renewable power producers are to the left of the demand curve, as well as some of the thermal power producers being to the right of the demand curve.

The amount of ousted thermal based power relates to the corresponding decrease in emissions (cf. the emission quota).

In this case, the price faced by the consumer equals the power price. Therefore, the consumer price change from p_e to p'_e. This is an unambiguous increase since the marginal power supplier has a higher cost than that without regulation.

8. Renewable energy goal with two regulatory instruments

Instead of using the green quota only, the political planner can also combine the use of both quotas in order to reach a renewable energy goal.

In this case study the political planner has three possible combinations of the regulation instruments in order to achieve the desired goal of renewable energy. He can use the green quota solely, the emission quota solely (as in the sections above) or a combination of both. These possible combinations of the quotas are shown in Fig. 6.

The green quota is represented on the horizontal axis and the emission quota is on the vertical axis. Any combination of these two can be selected to reach the desired renewable energy goal. Given a low renewable energy deployment goal, there is no need for regulation, since the power market can achieve the goal without any kind of subsidies, i.e. both the emission permit price (p_p)

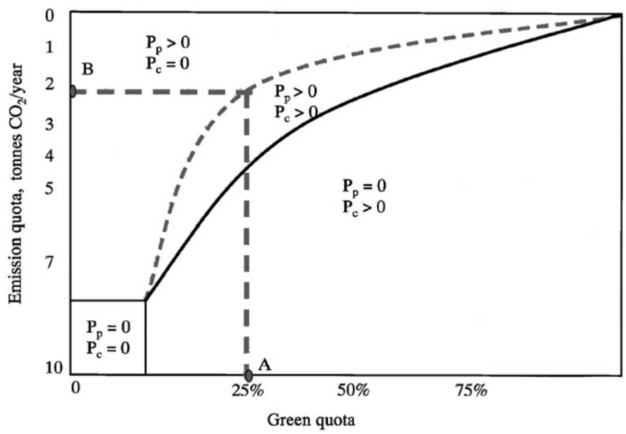

Fig. 6. Attainment of renewable energy goal. The broken, straight lines indicate combinations of the two quotas that imply 25% renewable energy of the total power consumption.

and the green certificate price (p_c) are zero (lower left corner in Fig. 6).

The rest of the combinations can be divided into three areas: one where the emission permit price is greater than zero and the certificates price equal to zero; one where the emission permit price and the certificate price both are greater than zero; and finally one where the emission permit price is zero and the certificate price is greater than zero.

With every combination of instruments (quotas) there is a resulting level of renewable energy. The broken, straight lines in Fig. 6 show all the points where the resulting level of renewable energy is 25%. All the points above and to the right of the broken lines lead to more than 25% renewable energy. That is, setting a harsher emission quota than 2 tonnes CO_2 always leads to an attainment of the energy goal no matter the green quota. Likewise, setting the green quota above 25% obviously leads to at least a fulfilment of the goal of 25%.

In Fig. 6, the horizontal, broken line in the upper left corner represents a case where the emission quota is enough to reach the desired goal of 25% renewable energy. Thus, on the horizontal line the certificate price is zero as long as the green quota is below the goal of 25%. When the green quota is set at the goal of 25% the certificate price rises above zero. The negative correlation between the two prices results in a decrease in the emission permit price. That is, in a small area in the middle of the figure both prices are above zero, i.e. both mechanisms are used in order to fulfil the goals. In other words, with a slacker in the emission quota on the vertical, broken line the emission quota is no longer enough to reach the goal.

At some time the emission quota is lowered so much that the emission permit price is zero, i.e. the area where the green quota is sufficient to achieve the goal of 25% renewable energy.

It is the political planner's job to find the optimal use of the two quotas. In this case we look at the optimal situation to the consumer, that is, minimising the consumer price (the price faced by the consumer).

The dotted lines in Fig. 7 show iso-price lines of the consumer price at different combinations of the quotas. The consumer price is constant in the areas where only one quota is used to reach the goal, since this quota and thereby its price are kept constant. The consumer price only changes when the quotas are changed; that is, in a small area in the middle of the figure. Therefore, the choice of quotas depends on the correlation between the consumer price and the quotas within this area. The correlation between the emission quota and the consumer price is unambiguous; going vertically, upwards (tightening the emission quota) implies a higher consumer price. This corresponds to the discussion of Fig. 5.

The correlation between the green quota and the consumer price is ambiguous. Increasing the green quota (going to the right in the figure) implies a higher or lower consumer price (cf. the discussion of the relation between consumer cost and green certificates) (Fig. 4).

The lower line in Fig. 7 shows the case where the correlation between the consumer price and the green quota is negative, i.e. an increase of the green quota implies a lower consumer price. The upper line shows the case when this correlation is positive.

If the political planner only uses the green quota and not the emission quota, the green quota is set equal to the goal (point A in Figs. 6 and 7). If the emission quota is the only regulation instrument used, it is set at 3 tonnes CO_2 (Point B in Figs. 6 and 7), which leads to a corresponding percentage of renewable energy at 25%. Since the consumer price is higher to the right and above the dotted lines, there are no combinations of

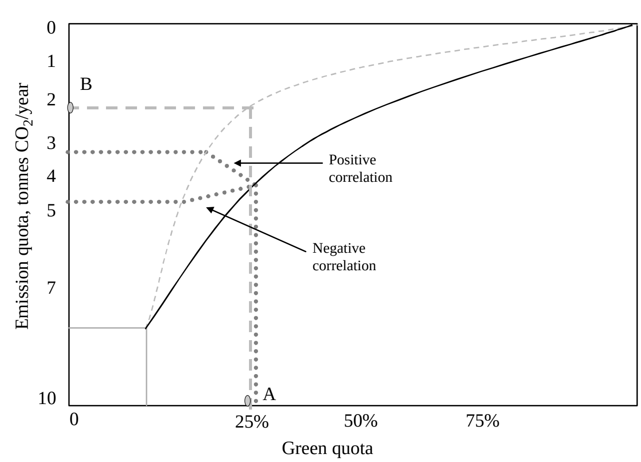

Fig. 7. Consumer prices with achievement attainment of renewable energy goal at 25%.

instruments still achieving the renewable energy goal that leads to lower consumer price than at the point A.

This means that in order to achieve a renewable energy goal only, and at the same time minimise consumer prices, it is always optimal to choose the green quota solely as the instrument to achieve the goal.

9. Emission goal with two regulatory instruments

In this case study we look at an emission goal at 3 tonnes CO_2 emissions only, i.e. no consideration of renewable energy goals.

Again, the political planner has three possible combinations of the regulation instruments in order to achieve 3 tonnes of CO_2 emissions. These possible combinations of the quotas are shown in Fig. 8. The only difference from Fig. 6 is the bold lines showing all the points where the resulting level of emissions is 3 tonnes CO_2. All the points above and to the right of the line lead to lower emissions. That is, setting a harsher emission quota than 3 million tonnes CO_2 always leads to an attainment of the emission goal no matter the green quota. Likewise, setting the green quota above 30% leads to a fulfilment of the emission goal.

In order to find the optimal solution with respect to consumer prices we look at Fig. 9, which shows iso-price lines for the consumer price. At the point C, where the emission quota is set equal to the goal, we have a consumer price equal to the price at the dotted iso-price lines. Comparing this price to the price at point D, in the case where the correlation between the consumer price and the green quota is negative (upper dotted line), it is optimal to use the green quota to achieve the emission goal, because the point D lies to the left of the iso-price line with negative correlation, i.e. the consumer price in point D is lower than in point C. However, with positive correlation (lower dotted line) we do not obtain the same result. Here the emission quota is optimal, because the point D lies to the right of the dotted lower line. This implies a higher consumer price in point D than in point C.

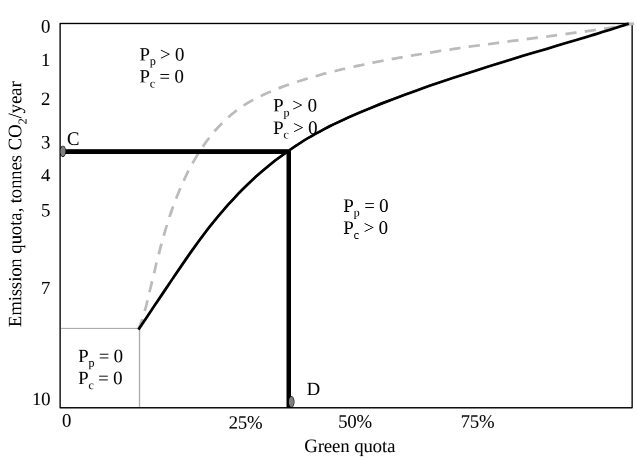

Fig. 8. Attainment of emission goal at 3 tonnes CO_2.

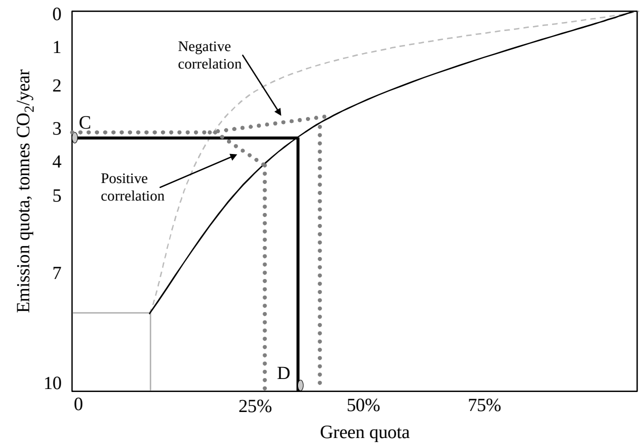

Fig. 9. Consumer prices with achievement attainment of emission goal of at 3 tonnes CO_2.

Sometimes the consumer price in the point D is lower than in point C and sometimes higher. Therefore, it is NOT always the obvious instrument, the emission quota that should be used in order to reach an emission goal.

It is also possible to use both instruments simultaneously in order to reach a desired emission goal (the area in the middle of the figure). However, it is onerous to use several mechanisms to reach one goal, when it is possible to use only one. At the same time it is not possible to obtain a lower consumer price combining the instruments to reach the goal.

The above sections have analysed the use of two mechanisms to achieve one goal only, an emission goal and a renewable energy goal, respectively. The results regarding the attainment of a renewable energy goal were not surprising. Here it is optimal, with respect to consumer prices, to use the green quota. In the case of reaching an emission goal, however, the result differs depending on the correlation between the consumer price and the green quota. If the correlation is positive the emission quota should be used, but when the correlation is negative the green quota should be used.

10. Simultaneous attainment of two energy goals

In this section, we assume that the political planner has both emission and renewable energy goals. This case study can be divided into three sub-cases. The first case is where the emission goal alone is enough to fulfil the renewable energy goal. That is, the line representing the emission goal lies above and to the right of the line representing the renewable energy goal for all combinations of quotas (one goal envelops the other). In the second case, the renewable energy goal is enough to cover the desired emission goal. In these two cases we have a situation similar to the case of only one goal, since it is only necessary to optimise along the line lying above and to the right.

In the third case, the two lines representing each of the two goals cross each other as shown in Fig. 10. This case will be analysed further in the following section in order to find the optimal quota setting for attaining the goals as well as minimising consumer prices. When the two lines cross, neither goal alone is sufficient to fulfil both goals, e.g. setting the green quota to 25% does not fulfil the emission goal of 3 tonnes of CO_2, nor does setting the emission quota at 3 tonnes of CO_2 fulfil the renewable energy goal.

The question now is which combination of quotas implies a minimum consumer price and at the same time attains the two goals, i.e. combination of instruments above or right of the two marked lines leading to low consumer prices.

As in previous sections, the correlation between the consumer price and the green quota can be either positive or negative. In Fig. 11 we have added an iso-price line of the consumer price with both positive and negative correlation.

Point E in Fig. 11 indicates the combination of quotas that occur if the quotas are determined independently. The emission quota is set at 3 tonnes CO_2, corresponding to the emission goal. At the same time the green quota is set at 25%, as for the renewable energy goal. Both iso-price lines in Fig. 11 cross this point, i.e. all combinations of instruments along these lines result in equal consumer prices.

Looking at the case with negative correlation (right and lower iso-price line), and comparing the points E and G, it is optimal to choose point G, with the green quota at 30%, as the point G lies to the left of the iso-

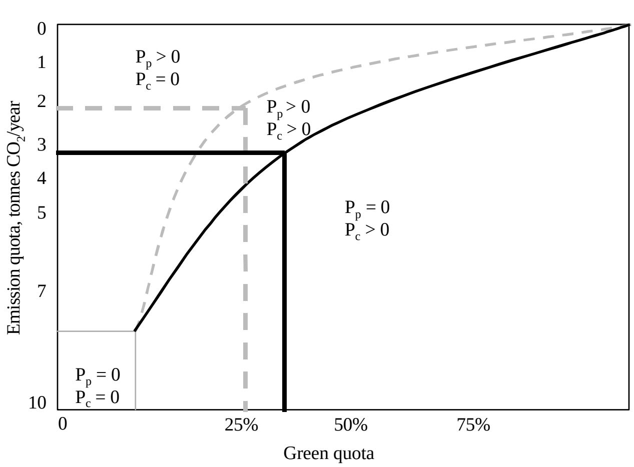

Fig. 10. Attainment of both an emission goal at 3 tonnes CO_2 and renewable energy goal at 25%.

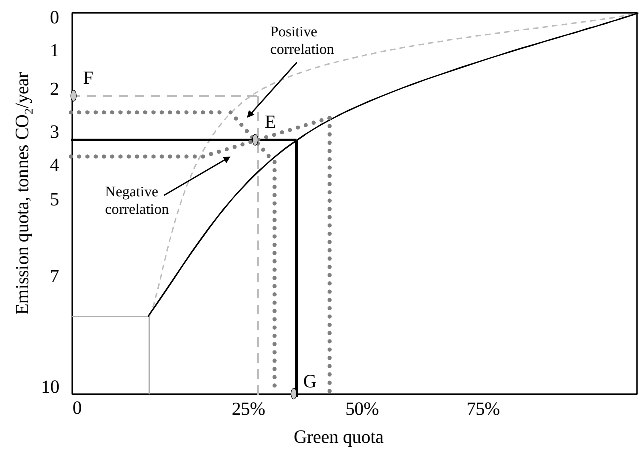

Fig. 11. Consumer price with achievement attainment of both an emission goal at 3 tonnes CO_2 and renewable energy goal at 25%.

price line. Looking at the case with positive correlation (left and upper iso-price line), and comparing the points E and G, it is optimal to choose point E, with a combination of both the green quota and the emission quota at 25% and 3 tonnes CO_2, respectively, as the point G lies to the right of the iso-price line.

The point F is always above both iso-price lines, which is why it will never be optimal to regulate only through the emission quota no matter the correlation.

The above sections have analysed the use of two mechanisms to achieve one goal only, an emission goal and a renewable energy goal, respectively. The results regarding the attainment of a renewable energy goal were not surprising. Here it is optimal with respect to consumer prices to use the green quota. In the case of reaching an emission goal, however, the result differs depending on the correlation between the consumer price and the green quota. If the correlation is positive the emission quota should be used, but when the correlation is negative the green quota should be used.

11. Final remarks

In this paper, we have dealt with the issue of reaching an emission and a renewable energy goal, respectively, using the emission and/or green quotas as regulatory instruments. The focus in this paper is on the difficulty of having both an energy policy goal and an environmental policy goal, and at the same time minimising consumer prices, in a case where the regulatory instruments affect each other and thus the attainment of the specified goals.

This is an analytical paper based on discussions of different case studies. The discussion of increasing the green quota showed that the effect on the consumer price is not unambiguously an increase. There is the possibility of lowering as well as increasing the consumer price. This result is the cornerstone of other discussions of the effects of regulation.

The case studies and discussions in this paper have been split into three groups. We have discussed the use of one instrument to reach one goal, two instruments to reach one goal, and finally two instruments to reach two goals simultaneously.

In the case studies with one goal only, an emission and a renewable energy goal, respectively, the results regarding the attainment of a renewable energy goal were not surprising. Here, it is optimal, with respect to consumer prices, to use the green quota. But in the case of reaching an emission goal the result differs depending on the correlation between the consumer price and the green quota. If the correlation is positive the emission quota should be used, but when the correlation is negative the green quota should be used.

In the case study with the use of both quotas to reach the two goals simultaneously, and with a positive correlation between the consumer price and the green quota, it is optimal to set the quotas equal to the goals for emissions and renewable energy, respectively. However, if there is a negative correlation between the consumer price and the green quota, it is optimal to use the green quota only.

In the light of these results, in a situation where the state has both an emission goal and a renewable energy goal simultaneously, it is important to consider the setting of quotas. If two different offices administrate one instrument each, the two offices can co-ordinate their determinations of the quotas or the quotas could simply be determined independently. If the correlation between the consumer price and the green quota is positive, there is nothing to gain by co-ordinating, as the optimal solution is to set the quotas equal to the goals. But in the case of negative correlation it is not optimal in this way. Here it is important that the two offices co-ordinate, because the optimal solution is to use only the green quota. Therefore, the state should co-ordinate decisions concerning energy and environmental goals, if they are aware of the total consumer price effect of introducing a green quota.

Therefore, the relationship between the use of quotas in order to achieve energy and environmental goals is of major importance for attaining desired goals. No doubt the desired minimum quota of renewably based power consumption and the maximum emission outlet are reached within the framework of individual settings of the emission and green quotas. But the most favourable setting of the quotas with respect to minimisation of consumer prices depends on the ambiguous effect of the correlation between the green quota and the consumer price.

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