ENVIRONMENTAL CHALLENGES IN THE PROCESS
OF EASTWARD EXPANSION OF THE EUROPEAN UNION

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THE MARKET OF TRADABLE EMISSION RIGHTS AND POSSIBILITIES OF ITS IMPLEMENTATION IN POLAND

1. The significance of the market of tradable emission rights

The system of direct regulation, which has been functioning in the United States, came in for severe criticism at the beginning of the seventies. The primary objection raised regards the negative aspect of its high costs of implementation. The most radical criticism of direct methods of regulation of the state of environment, however, derives from the concepts which postulate extending private property rights over environmental sources and creating, by the state, a specific "market of emission rights". The latter should function according to principles similar to the ones operating in every private market. The concept of the market under consideration is based on the following three fundamental premises:

1. The system of private (individual) property rights ought to also extend over the environmental commodities and resources. This is the basic condition of removing or limiting the range of occurrence of external ecological damage in the sphere of economic utilization and/or pollution of the environment.
2. Similarly, as in the case of other commodities and production factors, in the market of tradable emission rights the principle that prices

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reflect the scarcity of a certain economic good (resource) must be taken into account. In this case, it means that the relatively rarer the 'pure' environmental resources are, the more expensive to a given economic subject the purchase of the right to burden the environment with the emission of harmful pollutants or waste should be.

3. Protection of the environment must not carried out by any means, or in an ineffective way, that is so to say at the lowest possible social cost, realized at the cost or against the market. On the contrary, its realization should be implemented through and thanks to the market. The market of pollutants and protection of the environment ought to be embedded – by introducing institutional alterations initiated by the state – into the system of market economy.

Rights of emission are a production factor just like capital installations or labor force. Not possessing such rights may mean a complete inability to function for a given manufacturer. Whoever cedes their rights of emission must decrease, at their own expense, the amount of emitted pollutants or waste.

The market of emission rights can – if it is properly designed – lead to a radical drop in the costs borne by society for protection of the environment. *There is a radical decrease in costs borne on information and transaction, which otherwise are so high in the system of obligatory and unified technological standards.* In an "ecological market economy", tradable rights of emission could be made good use of in places where they are cheaper than pollution treatment installations that would be required otherwise.

A variety of forms of markets of tradable emission rights exist The term *full market* means that:

- Permits include the full range of legally allowed (keeping within boundaries determined by emission standards or by the best available technologies – BAT or BATNEEC) levels of emission of pollution by economic subjects;
- Permits are fully tradable between the participating subjects on the market of emission rights.

The *limited (incomplete) market* means – by analogy – that both the subject of permits and range of their trading remain limited up to the sizes corresponding to the reduction of emission below the level allowed by law (in the manner mentioned above).

Area and sector market

Area market means that trading in the tradable emission rights takes place within boundaries of regions determined on the basis of particular climatic, topographic, economic (and other) criteria, where the quality of

selected environment components such as: air, water and renewable resources, is controlled. Thus, an inter-regional exchange of a specific pollutant, for which a given system of tradable rights is designed, is not possible.

Sector market means that trading in the tradable rights of emission of a determined pollutant takes place on the scale of the whole branch or section, or another selected part of industry of a given country. The sector market is based on the general assumption that localization of emission is not significant from the point of view of a given goal of ecological policy in the scope of maintenance and/or improvement of the quality of the environment. Therefore, there is no need to limit the regional range of trading within the market of tradable rights. A classic example here is offered by the market of sulphur dioxide (SO_2) emissions by systemic thermal power plants, due to an extremely large area of impact of pollution by SO_2 or other gases emitted. Similarly, the market for emissions (application) of tetraethyl lead by refineries, which process lead petrol (the latter market was successfully realized in the USA at the turn of the seventies and eighties, allowing the refinery industry to considerably lower the costs of a switch from lead to lead-free petrol) is an example of a sector market.

2. USA's and Europe's experience in implementing markets of tradable emission rights

As far as the implementation of a system of tradable emission rights is concerned, it seems that the American experience is the most significant. The possibility of sectoral trading in the tradable permits for SO_2 and NO_x emissions was introduced in November 1990 by the power of the Act on Air Protection (Clean Air Act Amendments). This system was an element of the program to limit acid emissions. The aims of the program were the following:

1. Limiting the negative impact of acid emissions through the reduction of the annual emissions of SO_2 by 10 million tons, as well as of emissions of NO_x by two million tons in comparison with 1980;
2. reaching this level of reduction at the lowest costs by means of traditional methods, as well as a system of trading in emission permits.

The direct **aim** consisted in making companies of public utility (power plants) select more a cost-effective manner of emissions reduction. The **elements** of the system were the following:

1. netting (facilitating trading between emitters inside one organizational unit);

2. offset – transactions drawn between various companies (cession of the saved surplus of emissions after liquidation or modernization of installations resulting in a decrease in emission);
3. bubbles – emission caps;
4. banking – depositing of rights.

The efficiency of the program was evaluated in a different way: some authors claim that it did not bring about a decrease in emissions, or if so only to an negligable degree [Klassen, 1994], others, on the other hand, judge that it improved the quality of the air due to [Tintenberg, 1984]: facilitating the attainment of more rigorous norms; encouraging depositing rights, which were not utilized; providing a financial "premium" in return for the reduction of emissions.

The effectiveness of the program may be evaluated positively, although the cost savings did not concern all the forms of the program in an equal way:

- Netting and bubbles allowed saving administrative costs, as well as costs within the very firms (most of the savings were attained on netting transactions and their source was, among others, the fact that the requirement of reviewing subjects did not exist);
- Offset transactions brought about certain savings, which however were not assessed;
- Banking yielded little saving, mainly due to a small number of transactions.

Problems of implementation stemmed chiefly from bureaucratic impediments created by the administrative authorities (a relatively long period of preparations for starting the program, and frequent changes resulting from it, a long period of awaiting the acceptance of a transaction), and also from relatively high transaction costs referring to trading between firms.

An attempt at implementing this solution was undertaken in the Netherlands. In 1990, the national government of this country and the 12 administrative districts signed a sector agreement with the union of producers of electrical energy (SEP) and with four non-associated ones. The agreement concerned reduction in SO_2 emissions (up to 18 tons by the year 2000) and NO_x (to the amount of 30 tons in the same year). The method of solution assumes implementation, by SEP, of a global (for all units) bubble, with the assumption that:

- the current emission norms will be binding for the existing power plants;
- more rigorous norms of emission, determined on the basis of agreement, will be binding for newly established power plants.

It is estimated that in comparison with implementing stricter, but standardized emission levels, the saving on costs will amount to 50%.

A similar solution was applied in reference to refineries. The agreement drawn between the Ministry of Environment and refineries assumed decreasing the overall emission from this sector by 36 tons annually.

In order to achieve this level of reduction it was assumed that a limit of 1000 mg SO_2/m^3 of waste gases should be. The limit referred to the quantity of raw materials and to the process of emission from particular refineries. This meant that if the individual limit of emission was met, certain emitters within each refinery could exceed it and others – might not come up to it. Increasing the amounts of oil processed in refineries requires raising that average standard, since otherwise, it would not be possible to achieve the assumed limit of annual emission. That happened in 1993 and it was imperative that the average standard be decreased from 1000 to 800 mg.

The method based on the concept of an individual bubble for refineries may be called the method of averaging emissions within individual companies.

The ecological effectiveness of this solution can hardly be evaluated explicitly. With a rise in oil processing it is possible to maintain the emission level of 1980, but, simultaneously, a drop in the average emission standard occurs. However, there exists an awareness that emissions can be brought below that limit. From the administrative point of view, the system seems easy to apply (issuing a uniform standard for refineries). Consequently, the administrative costs of the system may be low and refineries may obtain considerable saving.

In 1984, Denmark also accepted a legal regulation, which, with reference to SO_2 emission from power plants, imposed a limit on the emissions to a maximum of 125 thousand tons in 1995. In 1987 it was assumed that in the year 2005 this would be 85 thousand tons. In June 1993 the limits were reduced (116 thousand tons in 1995 and 73 thousand tons in 2000).

The method of trading is founded on the concept of a national bubble for power plants. The basis of the solution rests on establishing emission quota.

Annually, the Minister of Environment fixes the emission quota for the following eight years on the basis of plans sent in by energy producers. In this system two groups of producers (companies) participate. The quota for the first four years is determined in reference to particular years, it is acceptable to exceed the annual limit by 10% provided that the cumulative top levels for a four-year period are not exceeded. Since that may concern both companies, the decision on the assignment of the annual limit of excess is left to them. They may transfer the emission reductions between each other.

It is an important element of the system that while establishing the emission quota, imports of electrical energy are also taken into account. Net import of energy should lead to decreasing the emission quota for Danish companies. A rise in the net export of energy cannot lead to a rise in the quota, because this would stand in opposite to the directive concerning large objects of energetic combustion.

The system may be assessed to be effective at attaining ecological goals as it encouraged companies to apply differentiated technical methods of reduction of emissions. During the first years the companies lowered emissions to 10% below the fixed quota. Unfortunately, cost saving was not assessed. Due to the existence of a "soft budget constraint" in the case of Danish electrical power engineering, it is difficult to explicitly assess the efficiency (costs saving) on the national scale. In comparison with emission standards, the system does not seem easier on the institutional-administrative side.

On the other hand, in Germany, the basis of the offset system depends on two binding rules inn the law on environmental protection: the clause of restoration and principle of compensation. They allow for executing **offset transactions**. The clause of restoration is applicable to the construction of new power plants in an area where standards of air quality are not observed. This clause does not allow constructing plants, even though they might satisfy emission standards. However, according to technical executive regulations of 1974, they could be established on condition they replaced installations of the same kind and also when the new installation did not belong to the same company owning the ones already existing in the area.

In the regulations modified in 1983 it was accepted that a restoration of the existing installations should give rise to the implementation of offset solutions. Transactions of this sort might be applied, if they led to a reduction in the average annual concentration in the area and also when the new installation met emission standards.

The principle of compensation was introduced in 1986 as a result of technical executive regulations. According to the latter, the existing installations were to be modernized, in order to satisfy more rigorous emission standards, usually over a five-year period. The period of improving air quality could be extended to eight years, if the undertakings aimed at the reduction of emissions in the existing installations should secure a greater global reduction in comparison with the one possible in consequence of applying reductions in each company separately. Compensation could be only applied in reference to the installations working in the same geographical area and also for the same pollutants (or ones of com-

parable impact). Thus, the principle of compensation may be applied, following a prior reduction of emissions.

From the point of view of **ecological effectiveness** both solutions (the clause and the principle) are evaluated as positive and neutral. It is estimated that cost savings obtained as a result of application of the principle of compensation was small. There is a lack of data to evaluate the administrative requirements. The clause of restoration is limited because:

- the marginal influence of an installation on the concentration in an area is lower than 1%;
- marginal emissions are covered by "offset" in the same area;
- it assumes starting a new installation following an improvement in the existing ones.

Moreover, new installations cannot be used, if this led to exceeding the norms of air quality in the given area.

The principle of compensation was made use of in 50 out of 1,700 cases satisfying initial conditions. This resulted from important limitations: a one-year period for the acceptance of restoration plans and the small dimensions of the area where offset could be applied. The fact that requirements related to the global reduction in emissions are stricter in comparison with reduction achieved by means of emission norms seems to matter considerably. Furthermore, in the case where a new firm would like to dispose of more than one pollutant, there is a necessity of a number of offset exchanges.

3. Solutions designed in Poland

The so-called "Chorzów experiment" was a good example of introducing a local bubble [Elaboration on the methodology..., 1996]. This solution was implemented in practice. Within the experiment, the option of tradable rights of SO_2 emissions for stationary sources of combustion was also taken into account. It was considered as an element of an integrated strategy of air protection and included elements of a program of fixed deposits (banking) and trading in the rights of emissions for stationary sources [Ibid., p. 117] Another solution, based on a concept of a regional bubble, was the so-called Opole pilot implementation programme for SO_2 emission tradable permits in the energy sector (power plants and heating works).

The system of tradable rights was to replace the administrative-legal one of environmental protection existing in Poland. The object was to propose a mechanism, which could secure, in a more effective way, the achievement of the aims of state ecological policy.

The point of reference for the activities connected with SO_2 emission reduction is made by the requirements imposed by the norms in the ordinance issued by the Ministry of Environmental Protection, Natural Resources and Forestry (MOŚZNiL) of 1990. Both projects underlined that together with the implementation of a system of tradable emission rights, the emission norms imposed on sources of fuel combustion for power engineering should be replaced by a complex program of limiting SO_2 emissions from all the sources of the pollutant, including technological ones. It is vital, however, that the proposed system should require "stiffening and a more rigorous execution of both realizing programs of limiting emissions and imposed duties and principles" [A Project of a System..., p. 5, 1995].

Implementation of the policy of limiting air pollution needs the creation of a countrywide and regional program of pollution reduction. The National Program for Reduction of Emissions is a many-year program (lasting at least ten years) aimed at decreasing the emissions of selected polluting substances and determines, as agreed with a given Voivod, the level of reduction for each Voivodship (Region). On the other hand, the regional program specifies in detail the national program of reduction of emissions. According to it, they are directions of alterations in emission levels which are determined, but not aims.

The basic element of the system is a differentiation of pollution sources in the area with regard to their burden on the environment, as well as determining the measure of the burden. The index of noxiousness is the measure of emitter noxiousness determined for the given polluting substance, which takes into account the physical parameters of the emitter such as:

- its localization and the range of activity,
- current level of pollutant emission,
- concentration in the air,
- sensitivity of the surroundings to this substance.

The class of noxiousness is made by a set of emitters having a similar influence on emissions into the environment. Inclusion of the emitter into a given class is done on the basis of the index of noxiousness.

Each class of noxiousness has an exchange index ascribed to it. The exchange index is an integer assigned to a class, which assesses the mutual influence of emitters belonging to various classes of noxiousness to the environment.

This method, called "a method of indexes of exchange", is based on the circulation of an equivalent charge instead of real emission. It is calculated as the product of the given amount of the real charge and the exchange index. In order to purchase the necessary amount of rights, it is necessary to

purchase such an amount of the equivalent charge to be received. The demanded amount of rights expressed in the real charge (the mass of polluting substance emitted into the air is calculated as a result of the charge by its own exchange index [A Project of a System..., 1995, p. 9].

An the effect of the transaction is a reduction in emissions. A high exchange index for the most burdensome units encourages the reduction of emissions (one can then have a greater number of units of the equivalent charge at disposal to transfer further). The purchasers, if only they possess a lower exchange index, obtain, eventually, the possibility of increasing emissions according to the real charge. A reduction in the real level of emissions is thus uncertain, since the most burdensome units are offered the most encouragement to reduce emissions.

The system includes, however, two kinds of protection against excessive purchase of the rights:
- emission levels determined in emission norms must not be exceeded;
- the amount of pollution emitted into the air cannot be exceeded before entering the system of tradable emission rights; the amount is determined in the so-called 'Initial charge'.

Any legal of civil subject may be participants in trading. However, availing oneself of purchasing rights requires satisfying certain conditions:
- possessing a decision on permissible emission into the air,
- being granted an individual index of noxiousness,
- obtaining a starting decision on emissions which determines: the initial charge, the amount of assigned (free of charge) tradable rights of emission for particular years (according to the regional program of reduction), the exchange index and also permissible emission (kg/h) for each work alternative, as well as the rights and obligations of the subject within the system.

In the system, there exists only one type of rights which are subject to transactions. Tradable rights are expressed as units of a real charge on the polluting substance. In the year for which they are issued, they allow the emission of a given amount of pollutants into the air. In the case the rights are not used in that year, they may be deposited for the following ones. The rights are granted for 10 years, nevertheless the level of pollution permitted decreases (or remains stable) with each year, depending on the regional plan of reduction of emissions.

The initial assignment of the rights is one of the major problems. At the moment of launching the system, the existing units are granted the rights on a free of charge basis. They are distributed to particular emitters according to their emission needs (as the mean of annual charges of pollutants emitted into the atmosphere during the whole period of activity, however not longer than the last three years prior to the unit being

included into the system). These rights are assigned for individual years over a period of ten consecutive years.

However, the assignment of the rights varies in dependence on the fact of a subject being included into the system realizing investments serving the purpose of reducing emissions. These units, which will complete the realization of the investments after implementation of the act determining the principles behind the system of tradable rights of emission, may count on being granted a set of rights that corresponds in its scope to the emission needs of the last three years before completion of the emission limiting investments [A Project of a System..., 1995, p. 14].

The System of Emissions Filing is a solution proposed in the Opole project, which is meant to facilitate the control of emission in a year. This solution "may partially replace installations of continuous measurements of emissions" [Ibid., p. 28]. This system possesses the form of the Certified Company Bank of Emissions and the certification is based on the currently existing system of controlling documentation submitted by organizational units with the aim of issuing them a decision on the permissible level of emission. Such control is to consist of determining the appropriateness of characteristic amounts deposited into the bank of values, as well as checking if technological conditions correspond to those specified in the relevant administrative decision.

The system of tradable rights is equipped with a mechanism which makes a departure from the established rules unprofitable. A subject that, in any given year, emits more pollutants than allowed by its rights is liable to punishment. The severity of the latter is ten times the market price of the additional amount of rights which the subject would have to possess. On the other hand, a subject that emits more than is permitted from the starting charge is liable to a punishment equal to the price twenty times greater than the one of the equivalent charge on the surplus emissions resulting from the starting charge. In the case that the requirements established by the decision on permissible emissions are not met, the subject is punishable by sanctions identical to those applied in the present system, preserving the right to suspension if investments directed at eliminating the causes of imposition of the punishment are duly implemented [Ibid., p. 27].

Charges for emitting pollutants into the air are sustained. The system assumes the possibility of resignation from collecting, charges which result from the emission of polluting substances into the air, which should not occur prior to a positive evaluation of its implementation and which should encompass all the organizational units operating in the area covered by the system [Designing the System..., 1996].

The system designed was not implemented as a pilot one (as it was intended by the ordering side) due to the lack of instruments required to carry it out at a time of changes being introduced into the legal system. The pilot implementation was changed into a simulation scheme.

Assessing the effectiveness, one can point to some conclusions following from the simulations carried out:

1. The use of the exchange index stimulates emission distribution in the right direction; the charge was reduced by emitters of high maximum exchange indexes, whereas purchasers were non-noxious emitters;
2. The mean annual costs of reduction were decisively the highest under the command-and-control approach, while in the "market" one they were slightly lower than the ones in the auction approach;
3. The mean annual costs of reduction were lower in the "index-free" approach (both for the market and auction variants);
4. The assumed level of SO_2 reduction was not achieved in all the approaches:
   - With an assumed reduction of 51%, the command-and-control approach secured a 52% reduction, and the remaining ones 53–58% (the highest for the auction one without the index),
   - With an assumed reduction of 75%, the command-and-control approach secured a 83% reduction, the market one – 69% (variant without the index) or 72% (the one with the index), while the "auction" approach secured, in both variants, an 83% reduction of emissions;
5. The mean and maximum concentrations of SO_2 in the area of influence at a 51% reduction were at the same level as in the command-and-control approach and the one without the index, whereas they were lower in the one with the index; at a 75% reduction, the command-and-control approach yields the highest concentration levels, while under the other two approaches – levels remain close to each other.

On the basis of the simulations carried out as part of the Opole Project and concerning the functioning of the market, certain conclusions can be drawn for the project for a permit system:

1. Taking into account the reduction in costs, the best solution seems to be the market system, with the reservation, however, that this solution may prove not fully effective when assuming a high degree of reduction (however it is sufficient for reduction of 50%).
2. The differences in expenditures for individual variants amount to approx. 20%.
3. The higher the emission reduction, the smaller the differences between expenditures according to different variants of this scheme.

4. Applying the principle of authorisation auction rises the reduction costs, but in the case of the highest assumed degree of reduction, the effectiveness is higher than the assumed one.
5. Applying exchange indicators increases the reduction costs, but does not bring significant differences concerning the degree of reduction.
6. The stricter the reduction program is, the smaller the differences in the final ecological effect among the individual variants of the system [Designing the system..., 1996, p. 44].

5. Cap and Trade – modification of the American system

According to the *Cap and Trade* system discussed, every emission source has to fulfil two requirements. The first and somehow basic one is the permit [non-assignable emission limit], which is considered as individual permission. This permit may be expressed in physical terms (e.g. in tons of defined substance), as a part of the global emission or as an environment load per production unit.

Permit distribution is mostly politically conditioned [Comp. Implementing an emission..., 1997, p. 26]. Environmental damages caused by acid rains because of SO_2 emission, are considered to be scientifically proven. This was a general foundation for the establishment of the program for reduction in annual domestic emission. Emissions were shared amongst particular subjects in the energetic sector. At the same time, this program joined the program for global emission reduction.

The above solution allowed the environmental administration to more efficiently reduce global emission than it was possible while using the traditional system of trade. Using the second solution, the administration could reduce the main emissions during commercial transactions, employing a suitable offset ratio, as to the permits, the annual corrections were possible.

Apart from the permit, each participant has an emission permit considered more restrictive than a non-assignable limit [Żylicz, 1999, p. 156], which may be the subject of the free trade. The emission source may purchase a considerable number of transferable rights, however it cannot receive permission for the actual emission, until it fulfils the non-assignable emission conditions.

Non-assignable permit and assignable permissions are treated as a formal system of pressure [Ibid.]. This resulted in the departure from the idea applied before, namely: emission reduction credits. This first solution consisted of using environmental banks, also known as the banks

of issue. Not all the surplus pollution reductions, but only a specific part of them were subject of the trade. This is determined together with the validity period by the local EPA agenda. Emission reduction credits constitute an economic equivalent of the surplus reduction, excluding the fact that most of the reduction credits must always be lower than the achieved physical reductions, which is a condition for entering them in the books [Czaja, Fiedor, Jakubczyk, 1997, p. 75]

From the point of view of the polluting party, the distinction between limit and right to emission may be treated as an additional complication. However, there are also specific benefits of this system.

Firstly, environmental administration is released from examining the general effect of particular transactions, because there are legal and administrative limitations preventing high emission in specified micro-regions.

Moreover, in the system of double permission not only the potential polluting party may purchase the right to emission, as potential demand comes from government and non-government organisations and even individual citizens as well [Żylicz, 1999, p. 157]. This solution was not present in the previous system, where it was possible to fully trade the emission, although as far as coherence is concerned there were no serious obstacles for the participation of the subjects mentioned above.

Even though, broadening the circle of potential purchasers is connected with the system of double permissions. They have to be treated more like a type of "social" completion of this system. Leaving the part of the rights to emission in the state of "dormancy", additional subjects express their preferences concerning the quality of atmospheric air. Such acting activates the demand part of the market and helps to keep prices at an appropriate level. However, it has to be remembered that additional subjects purchasing rights to emission cannot use them in broadly understood economic purposes and this "dormancy" is the only form of possession.

In 1990 the Clean Air Act Amendments (CAAA) allowed the implementation of the Acid Rains Program in the USA. The idea of this program was a reduction in the emission of the gases causing these rains coming from the electro-energetic sector by 10 Mt (or by 50%) [Ellerman, 1998, p. 6].

The implementation of the program was divided into two stages:

During the **first** stage (1995–1999) the indirect SO_2 emission limit was distributed among 263 power units. These units, having a global power of 88 GW, belonged to 110 power plants owned by 61 economic subjects. This group was administratively appointed, as it comprises units whose emission exceeds 2,5 kg of sulphur dioxide per tonne of British Theoretical Standard Fuel (BTSF) and which may be numbered among middle-sized units (over 100 MW).

During the **second** stage which began in 2000, all power units heated by solid fuels are being incorporated into the program for limiting the annual emission of SO_2 to 9 Mt by the year 2010.

The Acid Rains Program assumes that the limitation of sulphur dioxide emission will be a continuous process. As a result, year by year the level of allowed limits for individual units has decreased. During the period of 1995–1999 the limit for the 263 participants dropped from 7,1 Mt down to 6 Mt.

During the second stage, concerned with incorporating new subjects to the project, the annual nation-wide limit was raised up to 9,48 Mt.

Emission limitation is the most important among several crucial issues of the project. The geographical range and subject of the trade were expanded. This is presented Table 1.

Table 1. Crucial issues

Emission Targets	Decrease in the annual emission from electro-energetic sector by 50%
Geographical Range	The whole area of the USA
Subject of the trade	Permission for SO_2 emission.

Source: Tradable permits for air pollution control: the US experience. In: *Implementing domestic tradable permits for environmental protection.* OECD 1999, p. 34.

No geographical or time limitations were approved. The permissions may be stored in the form of a specific safe-deposit for future use. The original version of the project suggested forming trade sub-regions.

Among the subjects authorised to pilot transactions the following have been distinguished: Power plants, brokers, fuel suppliers and other groups. Some of the suppliers of strongly sulphurous coal, began, as a part of trade permissions, the process of reducing the pollution level, which in the light of the whole program should increase the demand for their coal.

The institutions concerned with trade should have access to information about prices, especially during the first stage of the program. These sources include information about earlier transactions, systematic brokers' reports and the list of prices from EPA auctions.

As to the enforcement of the law, the system worked on an annual basis. If a given individual sold the rights to emission, but did not perform the necessary reduction, he was charged with financial and administrative sanctions. The financial penalty amounts to $2500 for every tonne over the acceptable limit, the administrative penalty meant decreasing the limit for the next year by the number of tonnes over the acceptable

limit. This penalty level followed from the initial price simulation which was predicted to be $300–800 per tonne. The penalty was to be at least triple the worth of the transaction unit.

As far as the reinforcement of participation in the system is concerned, the solution applied allows the subjects to participate voluntarily. However, they will be obliged to participate in the 2nd phase and transactions of the 1st phase. As a result, the systematic growth of the number of this type of subjects has been observed.

The SO_2 trade program has gone trough a process of far reaching evolution. The transaction volume growing in time was a significant constituent of the permit surplus. Initially, the number of transactions made directly between power-plants and between brokers and entrepreneurs was similar. With time, the number of transactions made by brokers grew to be five times as great at the number of direct transactions. Not all transactions were connected with the costs reduction strategy, since 20% is made up by broker-broker transactions, and 40% power-plant--broker transactions. Another significant group was constituted by *futures* type transactions (8-year long).

Table 2. The size of the permission trade in years 1994–1997

Year	Transfers altogether		Transfers between economic subjects*		Transfers within the subjects**		EPA tender
	Transactions	Permissions	Transactions	Permissions	Transactions	Permissions	Permissions
1994	215	9.2	66	0.9	149	8.3	0.18
1995	613	16.7	329	1.9	248	14.8	0.18
1996	1 074	8.2	578	4.4	496	3.8	0.28
1997	1 429	15.2	810	7.9	619	7.3	0.30

* Transactions between the economic subjects as: power-plants, brokers and fuel suppliers.

** Transactions between subjects, both between individual units, as well as global subject emission units (the latter case relates to technological changes resulting from the fact that several emitters, i.e. stacks, come to be replaced with a single one).

Source: Tradable... descry, cit. p. 36.

In spite of such a great number of transactions, their quantity was smaller than that expected from the simulations [Molburg, 1991]. The biggest surprise, however, was the level of the transaction prices, which year after year systematically fell.

To a certain extent, this was connected with a lower than expected cost level of pollution reduction. The analysis made by EPA showed the high variability of the costs mentioned above, which undoubtedly to

a significant degree limits the accuracy on average measures (see the table above). However, it shows the trend of prices.

The price level can be examined even more precisely, by studying the extreme cost curve, which was drawn for the period from 1990–1995 with fixed prices from the year 1995. It shows that a reduction of up to 3,5 Mt of SO_2 can be achieved with a cost of $200 per ton.

Table 3. The anticipated and real level of trading prices of emission permits

Year	The trading price of permists ($/ton)	The prices from the EPA tenders
1989*	1500	
1990*	750	
1992	250–300	
1993	130–300	157
1994	130–140	159
1995	110–140	132
1996	90	66

* Anticipated price level.

Source: Bohi and Buthraw, 1997, p. 10.

Table 4. Cost shaping depending on the reduction level in the USA companies analysed

Reduction method	Reduction in thou. of tons	Fixed costs*	Variable costs*	Total costs*	Average costs $/ton
Desulphurisation	1 754	375,0	89,3	464,4	265
Fuel change	1 709	57,2	204,1	261,3	153
The cost of both methods	3 462	432,2	293,5	725,7	210
Cost-free methods*	425	0	0	0	0
Global quantities	3 888	432,2	293,5	725,7	187

* costs in millions of dollars

** cost-free methods describe the situation when the fuel change to a less sulphurous fuel was connected with its lower market price.

Source: Ellerman et al., 1998.

5. Comparative analysis of the Opole Project with Cap and Trade

To do such an analysis of the PHARE pilot project (in this paper also called the Opole Project) and the American Cap and Trade Project

(double allowance), the most important features of the two of them are juxtaposed with each other according to eight characteristic criteria. (see Table 5).

With respect to geographical limitations, the Opole Project may be considered universal, having application in both local and nation-wide dimensions. In turn, Cap and Trade Project is strictly nation-wide. This is because in the US local projects are simultaneously carried out incorporating individual states, as well as regions chosen geographically or ecologically as a part of solutions started in the late 1970s.

In both the projects discussed the current legal system was examined separately. The Opole Project assumed the possibility of incorporating emission trading into the current legal system, and above all to the regulations in force concerning current emission. The American Project proposed total resignation from the less and less efficiently working and very expensive CAC system. Although in the Polish case certain changes in the legal regulations concerning environmental protection would be essential, far reaching legislative inertia was implicitly assumed. In the case of the US, there was a political will to combine global emission reduction with the marketing of the atmospheric air protection system.

Within the range of making the inalienable authorisations in both cases the same solution was applied. The difference was in the way of its execution. The Opole Project was willing to stay in conformity with the currently existing system of granting allowable emission decisions for purely pragmatic purposes. In the US there was a fear that unrestricted trade would excessively concentrate emissions in selected regions of the country. This is because all geographical and time restrictions were rejected.

Different methodology was definitely applied when describing the total emission range. Methodologically, the Opole System was based on *grandfathering*, which was seen in every solution. The initial ration of emission rights (carried out by means of distribution of the so-called emission tokens) would be equal to previous emission level. Furthermore, the global emission quantity would be limited according to the current emission reduction program.

The American solution assumed that all larger power units (over 100 MW) may not satisfy the norm of branch emission which is 2,5kg SO_2 from 1 BPU ton. Then, similarly to Poland, it assumed a successive reduction of the global emission level.

Comparing the two solutions, the advantage of the American concept has to be pointed out. To a certain extent it rewards those economic subjects, which earlier made protective [safeguarding] investments. At the start these already have serious surpluses of emission rights above their current level. In contrast, the Opole Project's subjects having highly

Table 5. Characteristic features of the Opole Project and Cap and Trade

Characteristic feature	Opole Project	Cap and Trade Project
Project's geographical dimension	Local and regional	The whole country
Project's sector dimension	Broadly understood electro-energetic sector (all subjects emitting SO_2 as a result of burning fuel)	Subjects of the electro-energetic sector
Cohesion with the current legal system	Incorporated into the current legal system	It is a new solution in comparison to the existing system (at the time of planned introduction)
Establishing off-market emission permits	There is a fixed emission permit resulting from the permission applying to the acceptable level of emissions	There is a fixed emission permit which is to prevent excessive concentration of emissions in selected regions
Establishing global emission permit	Established global emission permit will be reduced according to the national and provincial emission reduction program	Established global emission permit reduction according to the norm assuming the 2,5 kg SO_2 per BPU ton limit is not exceeded
Limiting the number of the trade participants	The system participants and the trade participants were distinguished. Only the first group is limited. The system is directed towards all economic subjects.	During the first stage some of the subjects were incorporated into the system. The rest could participate voluntarily. All emitters are obliged to take part in the second stage. The system is mainly directed towards the energetic sector.
Using conversion units	The applied exchange rate method is calculated as the product of the specific amount of actual load and the exchange rate	Substitutive conversion units were applied to some subjects participating voluntarily in the system while receiving authorisation
Payment for received authorisation	Free of charge	Free of charge
Duration of received authorisation	10 years	1 year

Table 5. cont.

Characteristic feature	Opole Project	Cap and Trade Project
The basis for receiving primary emission	*grandfathering*	Emission per BPU ton norm
The means of enforcing the law	Exceeding the emission permit results in a financial penalty amounting to ten times the authorisation price	A financial penalty ($2500) and administrative restraints in proportion to the excess emissions
Time dimension of the system	Possibility of depositing permissions	Possibility of depositing permissions and to make *futures* transactions

Source: Own research.

efficient protective investments were even punished. Installations of this type are expensive from the point of view of investment, and of cost use. Moreover, their high efficiency means that the subsequent emission limitations may be carried out only on the condition of quickly increasing marginal costs of pollution reduction. So, the more protective investments that were made by a given economic subject before the system came into force, the worse is its starting position.

Both systems were given legal and economical means to force the organizational units to obey the norms in force. The Opole Project limited itself to financial sanctions, which are calculated accordingly to the existing system of ecological penalties. The American System had in addition administrative sanctions in the form of limiting the number of possessed permits in the following year.

Both systems allowed the possibility of depositing currently superfluous emission rights. The Opole Project suggests decreasing the number of deposited permits by 20% per year. The Cap and Trade system preferred doing *futures* transactions.

Comparing the two solutions, the advantage of the American concept has to be pointed out. It is mostly connected with the fact that it was put into motion which gave the possibility to constantly eliminate the shortcomings. The Opole Project did not have this advantage and it did not reach the actual implementation stage.

6. External legal conditions

In the analysis of the external conditions, we focus only on those which bring Poland strictly defined, also as regards time, legal consequences, which means the necessity of transposition some regulations into Polish law or of realizing ecological aims, defined in international ecological agreements signed and ratified by Poland. Such an interpretation suggests that the most important legal and institutional external conditions of a market of SO_2 emission rights in the electro-energetic sector are:

- Directive 88/609/EEC together with the subsequent accompanying regulations (Directive 90/656/EEC and Directive 94/66/EC);
- EU directive concerning integrated prevention and limitation of pollution (IPPC) 96/62/ECC;
- 2nd Sulphur Protocol.

In general, it can be said that from the point of view of the projected SO_2 emission market for the electro-energetic sector, the results of Directive 88/609/EEC are analogous to those resulting from the Ministry of Environmental Protection's decrees from 12 February 1990 and 8 Sep-

tember 1998.[1] However, a more general problem arises, whether during preliminary negotiations with the EU Poland should try to consider the electro-energetic sector as the single SO_2 emitter. for which the residual emission quantity responds to the standards from the discussed Directive. This would mean that certain power-plants or electro-energetic units could at least for some time not meet those standards, but emission from the whole energetic branch would fit into the framework of the hypothetical emission resulting from them. A simple justification for such an option is that from the point of international SO_2 pollution from the Polish electro-energetic industry, including influence on EU countries (the exportation of emission from a Polish perspective, but importing from the EU perspective), localisation of the emission does not have any significance. On the other hand, accepting this option would mean a considerable widening of the potential trade range.

Obviously, as we have pointed out while discussing the consequences of the decree from 8 September 1998, in order to purchase the rights to emission (for a given emitter), the given subject has to meet requirements resulting from an Individual Reduction Plan, ensuing, in turn, from the National reduction Plan.

It is also worth remembering that the harmonisation of Polish ecological law with EU law solutions may not rely only on the transposition of the specific legal and formal solutions into the Polish legal system, but above all on accepting the commitment to realising the aims of the EU in the realm of environmental protection, as these are specified in appropriate ordinances and directives. This way, according to Directive 88/609/EEC, the recommended average level of SO_2 reduction for existing power-plants should, on the nation-wide scale in relation to SO_2 emissions in the year 1980 amount to:

- 20% until year 1993;
- 42% until year 1998;
- 57% until year 2003.

[1] In the above analysis we omit these decrees which are of rather supplementary kind in comparison to the Decree from 8 September. These are: the Ministry of Environmental Protection' decree from 18 September 1998 concerning the detailed regulations of fixing acceptable types and quantities of polluting substances, that can be introduced into the atmosphere and requirements concerning the preparation of documents essential for issuing the decision fixing the types and quantities of polluting substances allowed to be introduced into the atmosphere (DzU No 124, item 819); the Ministry of Environmental Protection' decree from 3 September 1998 concerning the methods of calculating the state of air pollution for existing and designed sources (DzU No 122, item 805) and the Ministry of Environmental Protection' decree from 28 April 1998 concerning acceptable concentrations of polluting substances in the air (DzU No 55, item 355).

Taking into consideration that the electro-energetic sector's share in overall nation-wide emission amounts to approx. 50%, this gives the following annual total emission quantities in this sector:
- 1541 thou. tons by the year 1993;
- 1117 thou. tons by the year 1998;
- 828 thou. tons of SO_2 by the year 2003 [Kudełko, p. 42, 2000].

Because in the market of transferable emission rights of SO_2 by electro-energetic subjects only some of them would take part (small power units should be excluded because of their strong, at least potentially, negative influence on the air quality), the total quantity of emission constituting the basis for the National Emission Reduction Plan would be respectively smaller. Assuming that the participation of these subject's emission amounts to 90%, by the year 2003 the level would reach 745 thou. tons.

The above reasoning directly refers to Poland's obligations resulting from the ratification of the 2nd Sulphuric Protocol. It characterises the maximum level of SO_2 emission for Poland in individual years until the year 2020.

Similarly, the quantities resulting from the reduction scale described in Directive 88/609/EEC should constitute the general basis for a National SO_2 Emission Reduction Plan, as well as for the plant programs, concerning both those participating and not participating in the market concerned.

Table 6. Limits to SO_2 emission for the commercial* power industry according to the 2nd Sulphuric Protocol (thou. tons)

Year	2000	2005	2010
Poland,	2 583	2 173	1 397
Including the power industry	1 292	1 087	699

* The notion "commercial" means in this context that the production of electricity (and/or heat) for consumption of specific industrial plants possessing power units (e.g. steel mills or copper works) is not included.

Source: Studium Rozwoju Podsystemu Wytwarzania Energii Elektrycznej w Polsce, 1994.

The IPPC Directive is a type of a framework regulation and in the future it will replace many detailed ecological EU regulations, including those applying directly and indirectly to the electro-energetic industry. It has been binding for the new installations and plants since October 1999, and will be binding from October 2007 for all economic subjects. From the point of the projected system of transferable authorisation, its two most important implications are:

1. obligatory application of BAT or BATNEEC technologies;
2. obligatory obtaining the integrated ecological permission, in order to replace the previously existing individual permits for exploiting natural resources and polluting the environment.

Polish environmental protection law so far lacks these regulations which impose application of BAT or BATNEEC technologies. Transposition of the IPPC Directive into Polish law will have to introduce this duty. This could mean that all the power units from power-plants, and heat and power generating plants will have to apply technologies securing the highest level of sulphur removal from exhaust gases, which means the best technologies of wet desulphurisation. This would imply a significant flattening of the emission reduction costs which would lead to lower interest in emission trade. Diversity of the reduction costs would be in such circumstances caused mainly by the difference in size of the power units and so this would be the basic factor which, with the common applications of BAT or BATNEEC technologies, would decide about the potential size of demand and supply of the transferable rights for SO_2 emissions in the electro-energetic sector.

The future duty of economic subjects of obtaining integrated ecological permits resulting from the IPPC Directive, may cause significant complications in the functioning of the market of transferable rights for pollution emission. For more effective evidence of these rights and control, whether the real emission fits within the framework described in the permits and in Plans for Emission Reduction in a given plant, it would be essential to have individual decisions about the acceptable level of SO_2 emission. In the act concerning environmental protection discussed earlier and prepared within the PHARE project, it was accepted that these decisions expire when the appropriate body confirms obtaining the transferable rights to emission by a given subject. Moreover, according to a new Polish environmental law (which is to come in force very soon), it is assumed "installations obliged to have integrated environmental permission, may not participate in the program of transferable rights to emission". If we connect this record with the literal interpretation of IPPC Directive, that from the year 1999 (October) all new installations and from the year 2007 all installations will be obliged to have integrated permits. This means, according to the mentioned act, that no subject in the electro-energetic sector would be able to participate in the emission market.

In the most recent act concerning environmental protection [www.mos.gow.tytul13.htm] the notion of the best available technology accordingly with the IPPC directive (Art. 195–209) was transposed into Polish law. This is done by introducing categories of integrated ecological

permits. The Minister is to define the notion of subjects, which will be obliged to obtain such a permit. In comparison to the way of putting the above directive into practice, it may be supposed that in the future it will also include large subjects of the electro-energetic sector and so the potential participants of the market of transferable permits. On the other hand, the prepared act talks about the necessity of obtaining permits for releasing gases or dusts into the air. The idea of integrated permits, theoretically speaking, excludes a situation when a given subject would have to obtain both permits. However, the discussed project of the act does not give a clear-cut solution to this problem. This may give rise to some legal (and formal) threat to the performance of the emission rights market, especially in the context of the necessity of having individual (for every installation emitting SO_2 or other gases or dusts) decisions regarding the acceptable level of emission as the basis to specify the initial pool of emission rights. It seems that, regardless of the category of the integrated permits, for the proposed market to function effectively the participating subjects will have to have individual administrative decisions with reference to the permissible level sulphur dioxide emission.

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