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SUPPORT MECHANISMS FOR ENERGY EXPLOITATION OF RENEWABLE RESOURCES

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ABSTRACT

The paper identifies several support mechanisms for the energy valorization of renewable resources. In this sense, the starting point is the idea of simultaneous production of heat and electricity by using measures and mechanisms that involve the use of renewable resources. The mechanisms identified in this study can support the financing of these measures within a constantly evolving legislative and technological framework.

KEYWORDS: mechanism, energy, emissions, regulations

1. INTRODUCTION

The production of heat (with or without the simultaneous production of electricity) by using renewable resources or waste requires the use of technologies that are, for the most part, not very simple. For this reason, the investments required to set up such a project currently rise to levels higher than similar applications in the field of classical energies. Even the questionable advantage related to the much lower costs of the used "fuels" fails to raise the economic parameters to values that would quickly convince potential financiers to invest in such projects. All other classical fuels will soon follow this line. The levels reached on international stock exchanges almost daily present all-time records. At least from this point of view, classical fuels with renewable resources or waste seem a certain element, in the medium and long term.

Another aspect related to classic fuels is their depletion. All specialized statistics assure us that reserves have a limited duration and that clear solutions must be found to replace these fuels. This is yet another reason to promote renewable resources and waste recovery.

However, from the point of view of environmental protection, replacing fossil fuels becomes necessary as soon as possible. It is known that the global energy industry represents one of the largest vectors that aggravate the global warming phenomenon, with catastrophic consequences.

The elements presented above have led to actions at the global level to create mechanisms capable of supporting the financing of projects for the recovery of renewable energies and waste to produce electrical and thermal energy. These mechanisms have developed in a legislative and technological framework in continuous evolution.

2. JOINT IMPLEMENTATION

The JI mechanism allows the transfer of technology to developing countries to achieve the objectives of the Paris Agreement at minimal cost. During the COP-7 meeting, the principle of additionality was established, whereby industrialized countries are responsible for reducing their greenhouse gas emissions through local means, with the use of flexible mechanisms being made only for a part of these emissions.

JI is a project-based mechanism and allows the trading of greenhouse gas emissions that would occur if the projects were not implemented. These projects must result in quantifiable long-term benefits in the efforts against climate change [3].

A JI project is a technology transfer program that aims to reduce greenhouse gas emissions related to the production of a certain product. JI projects can be implemented in countries in transition. This involves at least two countries that have accepted emission reduction targets. The reductions from a JI project are called

emission reduction units (ERUs) and come from the country where the project is implemented (without the host). The implementation results of a JI project are represented by the transfer of ERUs from one country to another, the sum of the emissions of the two countries remaining constant.

Although the signatory countries of the Paris Agreement are responsible for achieving the proposed objectives, it would have been expected that the private sector would be the one to accelerate the use of these mechanisms. In an initial stage, the private sector was reluctant towards these mechanisms. The most important factors that led to the reluctance of the private sector were the risks associated with the early implementation of JI projects and the institutions' lack of capacity in potential host countries to analyze and approve these projects.

The essence of the functioning of the JI Mechanism is the fact that the host country sells emission reductions that will occur in the future due to the implementation of the proposed project, in the present.

3. EMISSIONS TRADING

Marginal Abatement Curves (MAC) are a mathematical model, based on marginal cost analysis, used to study the cost of CO_2 emission reductions. This model can highlight the benefits of the emissions market under the conditions set out in the Paris Agreement.

Shadow prices are a result of marginal cost analysis, considering a constraint on CO2 emissions, in a region R, over a period T. An example of such a constraint could be a 10% reduction, which must be achieved in 5 years. The shadow price indicates a cost for reducing the last ton of CO2 emissions to meet the constraint.

For a region, any emission reduction can be represented on its marginal cost curve. If several regions of the same system propose to reduce emissions at the same time, it is very possible that the shadow prices associated with these reductions will be different.

The total cost of reducing emissions can be lower if the region with the lower shadow price reduces emissions more than the one with the higher shadow price. By reducing more than it is constrained to, the region with the lower cost creates the "right to emit" or emission permit, which can be sold to the region with the higher cost of reduction. The total reduction of emissions can be achieved at lower costs when the two regions trade until the marginal costs become equal.

Figure 1 illustrates how a beneficial effect is achieved in the case of a transaction with CO2 emission reductions. Assuming that there are two regions, R_1 and R_2, that are each constrained to reduce the amount of emissions denoted q_1 and q_2, respectively, in the absence of any market, the sum of the reductions for the two regions will be $q_1 + q_2$. The marginal costs at which these reductions will be achieved will be, for each region, p_1 and p_2. The total cost of reducing CO_2 emissions for the two areas will be given by the sum of the surface areas AOQ1 and BOQ2. When the market opens, the two regions can trade. As a result, an equilibrium price p will be established, corresponding to a smaller reduction (q1') for region R1, respectively, a larger reduction (q2') for region R2 [4].

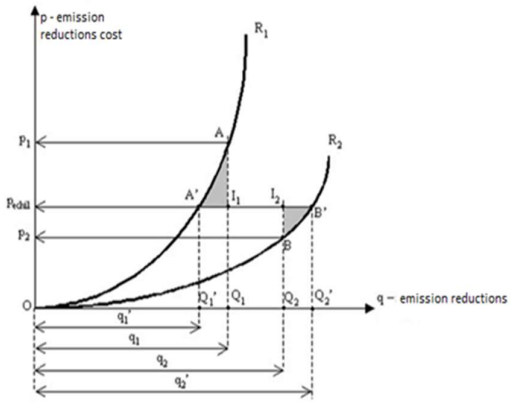

Fig.1 The benefit of the transaction between two regions, R1 and R2, subject to the constraints: q1 – CO_2 reduction for R_1; q2 - CO_2 reduction for R_2

The sum of the reductions for the two regions will remain constant (q1' +q2'=q1+q2), a condition imposed by the initial constraints. The total cost of the reductions, for the case of the existence of the market, will be given by the sum of the areas of the surfaces A'OQ1' and B'OQ2'

The possibility of selling or buying these permits is illustrated in Fig. 2. MAC curves are the basis for determining the demand and supply of emission permits in any market. The dotted line represents the amount of CO2 that must be reduced for a region, in accordance with the Paris Agreement. In the absence of the market, the intersection of this line with the MAC curve will determine the marginal cost.

If the emissions market exists, the region can buy or sell emission permits, depending on the relationship between the market price and the marginal cost, as follows:

- if the market price is lower than the marginal cost, the region will be able to sell emission permits;
- if the market price is higher than the marginal cost, the region will be able to buy emission permits;
- areas that do not have constraints (e.g.: ex-

Soviet countries) are a special case; the marginal cost of reducing their emissions is very low, so they will only be suppliers of permits on the market, at any positive price.

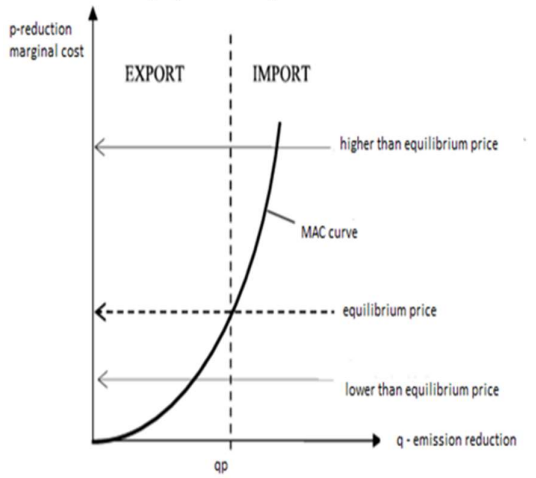

Fig. 2 Determining the possibility of selling or buying emission permits for a region.

Developed countries are all buyers of permits, because the market price for them is lower than their marginal costs of abatement. The ex-Soviet countries are the ones that will capture 90% of the permit sales market. A calculated equilibrium price, if the market were completely open to all actors, would be $127/ton, as shown in Fig. 3.

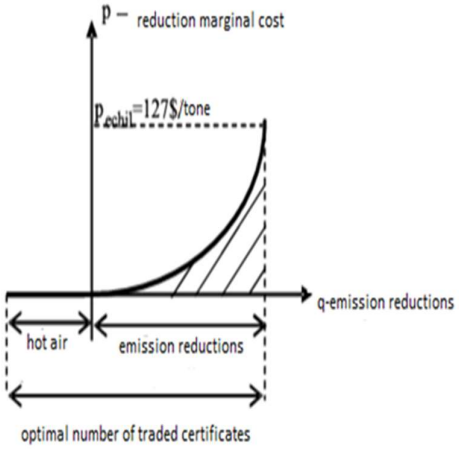

Fig. 3 Graphical determination of the amount of "hot air"

4. GREEN CERTIFICATES

The Green Certificate (GCC) is a document certifying that a quantity of 1 MWh of electricity comes from renewable sources and has been delivered to the grid. The green certificate has, in theory, unlimited validity and can be traded separately from the electricity associated with it, on a bilateral contract market or on the centralized green certificate market.

Romania has set its indicative target for 2030 of 76%, representing the share of electricity from renewable sources in gross domestic electricity consumption. For each year, mandatory quotas were established by law that electricity suppliers had to offer to the consumers served.

A GCC can be the subject of a single transaction and is considered "consumed" when the supplier uses it to prove the fulfillment of its own mandatory quota. The trading value of the GCC is established through competitive mechanisms specific to the two markets, within the price scale established by the Competent Authority. The transfer of CV from the seller's account to the buyer's account is made by the OPCV, any transfer being registered in the CV Register.

Considering the average annual trading price of green certificates of 149.26 RON, it results that the level of support from which producers of electricity from renewable sources benefited in 2015 was approx. 1.136 million RON, i.e., 260.7 lei/MWh (0.026 RON/MWh).

E-SRE producers use the amounts allocated for investments in promoting renewable energy sources. The CO2 emission avoided through the production of E-SRE, which benefited from the support system, was approx. 12.442 million tons.

This system is currently applied in seven EU Member States, namely Belgium, the United Kingdom, Italy, Poland, Sweden, Romania, and, most recently, in Bulgaria.

From the analyses carried out at the European Union level on the countries that use the mandatory quota system combined with the trading of green certificates to promote E-SRE, the following can be found [5]:

• green certificates are issued in 5 countries by the Regulator and in 2 by the Transmission and System Operator;

• the validity of green certificates is theoretically unlimited in Sweden and limited in the rest of the countries;

• in general, the obligation (mandatory quotas) to purchase VC is on suppliers, except for Sweden and the Netherlands, where the obligation is placed on consumers, and Italy, where the obligation is on producers;

• except for Belgium, in the Wallonia area, the price of E-SRE is the same regardless of the type of VC from which the electricity is produced;

• except for Italy, in all countries that use the green certificate system, the price varies between predetermined minimum and/or maximum values. The average annual trading price of VC varies between €25/CV in Sweden

and €103/CV in Belgium, the Wallonia region;

• in Italy, the average price of PV has increased continuously.

• except for England, where international trade in PV is not allowed, in the rest of the countries regional trade in Belgium, import in Italy and the Netherlands, and export in Sweden are allowed.

In Romania, the issuing body of PV is the Transmission and System Operator.

The lifetime of PV is theoretically unlimited. The obligation to purchase E-RES is the responsibility of electricity suppliers. E-RES producers are obliged to offer on the market all PV they hold as long as, at the level of one year, the annual supply of PV is lower than the annual demand for PV, with the exception of producers who also hold an electricity supply license and use their own PV to meet their mandatory annual quota.

5. CONCLUSIONS

Currently, there is no mechanism for subsidizing the production of thermal energy based on waste or renewables, like the one implemented to produce electricity [1].

The simplest way of subsidizing would be the one related to the use of green thermal energy: the creation of an ecological steam network, biogas, and a biogas filtration station are examples of subsidies. The amount invested is found to multiply by 10 times in savings related to the avoidance of greenhouse gas emissions [2].

A subsidy of €1.5/kWh, produced by a waste treatment plant of 100,000 tons/year, which produces 1700 kWh/tone, represents €2.6 million/year, respectively a value of €26 million over the operating period.

There are several reasons that lead to the need for national action on the production and use of green thermal energy:

a) public safety and health;

b) stimulating economic actors and local communities to consider the external effects of the use of green thermal energy, especially the greenhouse effect;

c) better functioning of local authorities in the effort to manage the community and its needs;

d) better management of public money, as efficiently as possible;

e) compliance with the rules of competition on the market.

There are also a number of means to implement a system of stimulating the production of green thermal energy:

a) negotiating European regulations and directives;

b) using economic instruments such as fiscal policies or subsidies;

c) national regulations to set quantitative limitations;

d) establishing a legislative framework that allows communities to act better together to carry out these projects;

e) establishing a legislative framework that would lead waste producers towards these projects;

f) regulations that would oblige gas suppliers to purchase green thermal certificates in national interest, under pre-established market conditions;

g) regulations that would oblige consumers of fossil fuels for the exclusive production of heat to pay certain environmental taxes.

The role of regulators, especially ANRE (*Romanian Energy Regulatory Authority*) and ANRSC (*National Regulatory Authority for Public Utility Services*), is vital in the development of projects for the production and use of green thermal energy. These regulations must be in line with regional and local development plans regarding waste management and with strategies for the valorization of renewable resources.

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