SOME ASPECTS OF THE ANALYSIS OF ECOLOGICAL SAFETY OF THE INDUSTIRAL TECHNOLOGIES IN THE UKRAINE

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ABSTRACT

Some aspects of financial tools for countering climate change under flexible Kyoto mechanisms are studied. Within industry sectors and production processes, data of National GG Cadastre (period 1998 – 2005) on energy consumption and GG emissions are processed by means of an information-analytical system constructed on the Microstrategy platform. Analysis of the rating of the industrial sectors relative to saved emission allowances enables distributing investment financial flows toward development of innovative technologies with respect to the estimated contribution of each industrial sector to the emission allowances total for the country.

Keywords: Clean development, Energy efficiency, GG emission allowance units, Emission quota, Carbon market, Investment flows

1 INTRODUCTION

The current ecological situation requires efficient measures of environment protection, in particular, the implementation of environmental-friendly industrial technologies. The central idea is a sustainable development, which is to be realised, in particular, by means of Kyoto flexible mechanisms (United Nations, 1998). The mechanisms represent a financially reasonable approach to make the industrial processes' environment safe. Air pollution abatement can be achieved through improvement of industry's energy efficiency, as energy consumption is accompanied by greenhouse gas (GG) emissions. To make energy consumption more efficient, restructuring of industrial sectors is required. Such technological changes in production, processing, transportation, and consumption of energy resources are based on implementation of the Low Carbon Technologies (LCT), Environmental Friendly Technologies (EFT), and Energy Efficient Technologies (EET) being transferred within the Projects of Joint Implementation (JIP) covered by the Kyoto Protocol (United Nations, 1998). The flexible Kyoto mechanisms include GG emission permits trading, whereby quotas on emissions of basic GG are set for the countries party to the Protocol. With respect to the Kyoto Protocol, within the years 2008 – 2012, countries whose emissions are less than their permitted limits can trade saved emission units with countries that exceed their quotas. Because industrial countries can invest in projects that transfer low carbon technologies to developing and transition countries in order to create emission units for sale, it is becoming possible to join the efforts of potential investors with the aim of developing tools to realise the Kyoto Agreement mechanisms directed toward global sustainable development.

2 INFORMATION-ANALYTICAL SYSTEM ON ESTIMATION OF GG EMISSION ALLOWANCE UNITS' SAVING

2.1 Some special features of Ukrainian industrial technologies

From the point of view of energy consumption, the economics of the Ukraine is far from efficient (Kolesnichenko & Tsarenko, 2007), and so it is beneficial for the companies of other countries party to Annex I of the Kyoto Protocol to invest in the development of an energy efficient Ukrainian industry. These investments will reduce the level of the GG emissions and will allow saved emission units to count as a contribution toward global GG emission reduction. With respect to the Protocol classification, Ukraine belongs to the parties of the Protocol that are able to participate in the flexible Kyoto mechanisms (United Nations, 1998) on GG emission permits trading under clean development. Energy efficient technologies are also of great importance because of to rising prices of energy resources (Kolesnichenko & Tsarenko, 2007). With respect to the Kyoto Protocol, the overall emissions level in the Ukraine within the second phase of the Protocol realisation (years 2008 – 2012) has not to exceed the norm defined as a quintuple amount of the emissions of the basic year 1990. It is profitable for the Ukraine to have the year 1990 as a

basic one, as at that time, Ukrainian industry was functioning at full capacity with a large amount of emissions. As a result of the economic downturn after 1990, GG emissions were reduced from 926, 2 millions t CO_2 eq. in 1990 to 413, 7 millions t CO_2 eq. in 2004. In case the Ukraine in the year 2008 does not reach the emissions' level of the year 1990, it will be able to sell saved emission units to other parties to the protocol as defined in Annex 1, under the mechanism of trading of permitted emission units. Also, it will be possible to benefit from participation in joint implementation projects.

2.2 Problem posting

Ecological efficiency of innovative industrial technologies is of great importance. This efficiency, the macroeconomic situation of the country as well as solving global warming problems are substantially characterised by GG emission level dynamics. We are interested in the analysis of some aspects of sustainable development tools: improvement of financial mechanisms of countering climate change, planning of the global financial flows as a measure of GG emission abatement, development of efficient and adequate international measures to prevent climate change, as well as adaptation of the industrial sectors to the new ecological conditions and requirements.

Ecological efficiency of the industrial technologies implemented is to be estimated based on certain indicators from ISO 14031 standards, which regulate the form of information representation concerning results of the control of the ecological aspects of innovative technology. These indicators include: overall energy consumption, GG emissions, material resources consumption costs, water resources consumption, etc. The rate of innovation activity of the industrial sectors is defined by the ecological efficiency of the technologies of these industries, and an approach to distribute corresponding financial flows initiated by saved emission units is introduced.

2.3 Basics of the approach

Indicators of ecological efficiency of the industrial technologies are constructed based on the data on energy consumption levels of industry sectors within the reporting period, by fuel types, and by GG emission levels, which in turn characterize the energy consumption level. By means of graphical representation of the data, and further tools, the dynamic of energy efficiency is analyzed annually (how emission levels and energy consumption levels correlate, what expenses enterprises and industry sectors have, etc.), and the corresponding distribution of financial flows is constructed.

Emission limits by industry sectors (enterprises, regions) are defined on the basis of the emission norms introduced. Quantitative estimates of industry sectors' participation in emission units saving are converted into monetary equivalents based on CO_2 market prices. Specific rates of ecological efficiency of innovative industrial technologies within industrial sectors are defined as the ratio of saved emission units to quotas (various GG) for the industry sector, and analogously, for the enterprise, as the ratio of GG emission units saved at the enterprise to limits on emissions (various GG).

2.4 Mathematical modelling

The averaged norm of GG emission on each fuel type is defined as

$$V_i^{norm} = \frac{1}{J}\sum_{j=1}^{J}\frac{V_{ij}}{E_{ij}k_i}, \tag{1}$$

where i = 1,2,K fuel types, j = 1,2,K industry sectors, V_{ij} is the GG emissions (CO_2 eq) at industry j while i-th is the fuel type burned, E_{ij} is the energy amount obtained while the i-th fuel type is burned, consumed by industry sector j, and k_i are the measure units matching the coefficient.

Emissions by industry sectors are:

$$V_j = \sum_{i=1}^{I} V_{ij} \ . \tag{2}$$

GG emission quotas in the country are:

$$V = V^{Kyoto} - \sum_{j=1}^{J} V_j \ , \tag{3}$$

where V_j is the amount of emissions (CO_2 eq) within the sector *j,* and

V^{Kyoto} is the norm defined by the Kyoto Protocol (constitutes 4,604,184,663 tonnes CO_2 eq).

The emission norm of an industry sector *j* is defined as:

$$V_j^{norm} = \sum_{i=1}^{I} V_i^{norm} \cdot E_{ij} \ . \tag{4}$$

The GG emission quota consumption rate by an industrial sector *j* is:

$$V_j - V_j^{norm} \begin{cases} > 0, & overconsumption \\ = 0, & norm \\ < 0, & \epsilon \quad free \quad quotas \end{cases} \ . \tag{5}$$

The share of an individual industry *j* in saving of emission units within the whole amount of free quotas in the country (for $j = j \cdot \max\{0, -sign(V_j - V_j^{norm})\}$) is:

$$P_j^{direct} = \frac{\left| V_j - V_j^{norm} \right|}{V} \ . \tag{6}$$

The pay off for an industry *j* that has exceeded its emission allowances level is:

$$P_j^{indirect} = P_j^{direct} \cdot \sum_{j=1}^{J} \max\{0, sign(V_j - V_j^{norm})\}(V_j - V_j^{norm}) \ . \tag{7}$$

Financial flows initiated because of saving of emission allowance units are distributed with respect to the contribution of the industry sector to emission units saved.