A Proposal for the Pollution Management Reform in Lithuania: "Pollution Currency" Approach (part 2)

Linas Čekanavičius*

docentas, socialinių mokslų daktaras
Vilniaus universiteto Ekonomikos fakultetas
Ekonomikos sisteminės analizės katedra
Saulėtekio al. 9 2040 Vilnius
tel/fax: (3702) 30 00 29
e-mail: < linas.cekanavicius@ef.vu.lt

The previously introduced idea of a universal "pollution currency" that should be used for "payments" for the right to emit specified types of pollutants into air or water (see previous volume of "Ekonomika") is developed here. It is demonstrated that the universal and transferable emission coupons (UTEC) concept actually integrates the main advantages of emission taxes and marketable pollution permits systems, while avoiding some of their less desired qualities.

3. TRANSFERABLE UNIVERSAL EMISSION COUPONS MODEL: A GENERAL DESIGN

3.1. General Features of the Transferable Universal Emission Coupons System

Universality. One type of emission coupons is valid for justification of discharges into specified environment (air or water) of *any* polluting substance on the given list.

"Pricing". Different kinds of pollutants have different "coupon-prices", based on their perceived relative impact on the environmental quality.

Transferability in space. Coupons can be traded among the sources within the established region without any limits or restrictions on their "exchange rate".

Transferability in time. Unused coupons can be saved (banked) for latter use. Being "pollution currency", their time validity is unlimited.

Administration. Total number of to-be-issued coupons will be established on the base of the targeted for certain period emission amounts for different pollutants and their relevant "coupon-prices". Once distributed[1], coupons can be traded at the market prices.

[1] Alternative distribution schemes could be so called "grandfathering", auctioning or a mixed one.

Coupons have to be submitted to the controlling authority in quantities necessarry to account for a (will be) exercised right to use the assimilative capacity of environment. The required amount of "payment" is calculated by summing up the discharges of various types of pollutants times their "coupon-price". Unused portions of advance payments can be carried forward to meet later invoices. On the other hand, sources that are temporarily short of "pollution currency" can be granted an emissions "credit", that is, limited time period extension of complete settlement of their obligations. Such credit will carry an "interest rate" (a fee) and it's availability will be subject to the environmental situation. Unless emissions credit is obtained, failure to settle "pollution account" to the specified date will incur penalty, calculated on the base of monetary value of due amount of coupons.

Quota of the reissue of universal coupons (i.e. rights to pollute) in the next period will depend on the use of pollution rights in the previous one.

Accommodation of the current policy mechanism. UTECs scheme can incorporate or adjust some selected features of current pollution management mechanism:

• The individual emission standards that are currently in force could and should be used for the calculation of an overall emissions level.

• There is no immediate need to abolish completely pollution taxes: *basic* tax rates can be retained and, if so, reflected in the market value of coupons. This could support political feasibility of reform, because even an insignificant income source would not be lost[2].

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[2] Of course, there is no real necessity for it either – in fact, preservation of taxes can bring in certain degree of confusion. Anyway, if not indexed, those tax rates will quickly cease to play any role.

More so, tax retained or not, the *relative values* of tax rates for different pollutants could be used as a basis for setting of emissions "coupon prices".

• The slightly modified marginal penalty rate calculation scheme can be adopted for UTECs system and used to penalize polluters for the emissions in excess of submitted coupons.

• The "tax free" emissions threshold (50% of maximum permissable emissions standard), stipulated by the current system, could be used as a guideline and ceiling for "grandfathering" in the *initial* distribution of permits.

• Quarterly advance payment pattern can be preserved.

• Both "tenfold the amount of evaded payments" penalty rate and liability interest rate of 0.5% per day for an overdue payments (not covered by "emissions credit") can be retained.

On the other hand, *individual* emission standards become superfluous under the UTECs scheme. That cancels any need for preferential tax rates as well: if taxes are preserved along with UTECs introduction, the same tax rate would be applicable for *any* unit of particular pollutant's discharge, covered by coupon.

3.2. Potential Problems and Suggestions of Their Mitigation

3.2.1. The Spatial Problem. It arises due to the possibility of difference in local environmental impacts of the same amount of discharged emissions. This difference may be caused by the variance in sensitivity of ecosystems, physical conditions and technical characteristics of discharges, location of the

sources in respect to the pollution receptors[3]. The potential distortions of environmentally efficient allocation of control efforts are recognized as an important issues in the context of both the emission charges and the marketable pollution permits approaches.

There are two possible ways to deal with the spatial problem in case of emision charges. One is to impose a spatially (and, maybe, seasonally as well) differentiated charges. Although theoretically sound, this approach has rather weak appeal from the technical and, especially, political point of view. Explicit "tax discrimination" makes it very vulnerable to the legal disputes and litigations. Nevertheless, tax differentiation by location is used in practice: according to OECD (1977) pollution tax rates in Japan are calculated each year and they vary by location – in heavily populated areas they are up to nine times higher[4]

Another way is to resort to so called "mixed approach". That is, to "adulterate" the pure charge system by adding a twist of regulatory, quantity-based instruments, such as individual emission limits (standards). Stricter standards in ecologically sensitive areas, combined with a tough penalty for excess emissions, are bound to ensure the desired distribution of abatement efforts. Most of the currently operating in the world pollution charge systems are "mixed" (lthough not necessarily

solely because of the spatial problem). Differentiation of standards, instead of tax rates, is much more politically feasible approach.

With appropriate standards it is possible to achieve the same emissions level as under the regional tax differentiation, while imposing lesser overall burden upon polluters.

Within the class of marketable pollution permits three types of responses to the spatial problem have been offered. First, and the most straightforward one, is *zoning*, that is division of regulated territory into a number of zones, each with it's own closed permits market. Number of pollutant-specific permits, allocated to each zone, depends on the tightness of local ambient quality situation with regard to the particular pollutant. Emission trades within a zone are accomplished on a unit-for-unit basis and no trade between zones is allowed.

While such approach theoretically is capable to take care of local environmental specifics, it leads to the further segmentation of permits market, thus making the number of participants in each of them even scarcer. This could mean a new problems for a small countries with heavily concentrated industry. Lithuania is not an exception : quite a number of environmental "hot spots" host just one giant plant, which is responsible for an overwhelming share of regional pollution (like "Akmencementas", Elektrenai Power plant and others). Such situation makes it very hard to expect any palpable results from the pollution permits market.

Another type of response to the spatial problem is so called *ambient permits system (APS)*, where pollution permits are defined in terms of pollutant concentrations at the

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[3] Spatial problem does not exist in case of so called uniformly-mixed air pollutants (such as greenhouse gas), when what counts is an *agregate* level of emissions, not the place or source of it's origin.

[4] The direct rationale behind this differentiation is the need to raise sufficient funds for compensation of pollution victims. This implicit recognition of possibility to substitute compensation for unreasonably high pollution control costs is another peculiar, maybe unique, feature of Japanese environmental policy.

receptor points. Trade between polluters is constrained by the imperative that the established ambient standards are met at each receptors site. It is demonstrated by Montgomery (1972) that a market equilibrium under such provisions is generated by the least-cost solution, independently of the initial allocation of permits.

Assembling the desired portfolio of ambient permits, polluter would have to bear in mind not only it's projected emissions vector, but also the various source-specific disperse coefficients (one for each pollutant and one for each affected receptor point), plus the set of prices at each "receptor's market". The decision making under such arrangement could be expected to be extremely complicated, and "it would appear that the transaction costs for polluters are likely to be substantial under ...[this] system, although this expense may be justified, under certain circumstances, by the savings in abatement costs"[5]. So far it seems that nowhere these beneficial circumstances were found, since APS still belongs to the realm of economic theory despite that over 20 years have elapsed since it's promotion.

Modified version of the described above is proposed by Krupnick, Oates and Van de Verg: "The basic idea is to define permits in terms of emissions and to allow their sale among polluters, but not on a one-to-one basis. More specifically, transfers of emission permits are subject to the restriction that the transfer does not result in a violation of the [ambient] air quality standard at any receptor point"[6]. Thus, this *"pollution offsets"* system shifts the trade

activity from receptor-based markets into emission-based ones, cutting down the markets total number and hence implying a substantial savings in transaction costs. On the other hand, it will still entail the mandatory use of set of dispersion coefficients in trade/ sell decision making.

It is important to note that both AP and PO systems require purchase of pollution permits *ante factum* and coordination, alias approval, of these transactions by some controlling authority. Otherwise it doesn't seem possible to ensure a conscious adherence to the explicit fundamental requirement of both approaches: that any transactions among polluters does not violate the ambient quality standards at any receptor point.

Likewise, it is hard to contemplate the possibility of "banking" of unused permits under any of the system outlined above, as the defined permits would have to be strictly *period-marked*. All this significantly weakens the flexibility of both approaches, making them especially inconvenient in circumstances where economy's functioning lacks smoothness.

As it was noted in Section 2, "pollution currency" approach pursues less strict environmental quality objective than APS, POS or, for that matter, current Lithuanian pollution control policy (in fact, it is ambient--based too). Nevertheless, spatial distribution of total emissions amount still remains a problem to be considered.

Staying at the core of idea to introduce a universal pollution "currency", an obvious answer to the spatial problem is the regional differentiation of the pollution rights "prices". That is, similarly to the Japanese pollution taxation system, cited above, discharge unit

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[5] Krupnick et al. (1983). P. 9.

[6] Ibid. p. 12.

of a particular pollutant should have a higher UTEC-price in locations where an average ambient concentration of pollutant in question is notably in excess of the permitted level. One might envisage an adoption of table, linking the UTEC-price indexation coefficients with the percentile intervals of ambient standard violation. Note that in case of a single or a very few major contributors to the region's pollution by certain substance, the indexed UTEC-price could be applied directly to them, thus providing an exemption to the minor polluters. More so, coupon-price differentiation could be adjusted to embrace emissions seasonal impact variations as well.

Of course, pollution price differentiation has as little appeal in political and legal terms as tax differentiation, noted above. It could be made more feasible, and, perhaps, more efficiently administrated as well, via the decentralization of price setting procedures. That is, the rights to index the basic (uniform national) UTEC-prices would be delegated to the regional and municipal authorities. This not only would reduce the troublesome "fair pricing" responsibility burden on central environmental control institution, but would also create an opportunity for better accounting for regional specifics, including environmental awareness and preferences of local population[7].

Emissions UTEC-price differentiation approach, as described above, possesses a high degree of regulation flexibility. However, it should not be overused. To ensure the relative certainty, necessary for rational

planing and decision making, the UTEC-prices of pollutants should not be reviewed more often than once a year.

3.2.2. The Intertemporal Problem. An intertemporal transferability of pollution rights isn't something *new* neither in economic theory nor in practice. Banking of earned emission credits for future use was foreseen in U.S. EPA's emissions trading program (see Hahn and Hester (1989b). Banking of lead credits (obtained via production of gasoline with lower lead content than required by standard) was introduced in U.S. in 1985 and, apparently, was often employed by refineries (Hahn and Hester (1989a) Further on, possibility of banking of SO2 emission allowances is foreseen by the acid rain control program, launched under Clean Air Act of 1990 (Ferral (1991).

As a rule, intertemporal trading of permits both in theory and practice is considered in one direction only: that is, as postponement (banking) of emission rights, but not as an exercise of the future rights in present period[8]. This, of course, presumes the period-validity dating of permits.

The very consideration of intertemporal transferability of the right to pollute is, again, born by the desire to increase flexibility and, consequently, the economic effectiveness of the system. On one hand, it enables firms to make more rational, future-vise decisions, on another – it diminishes a total number of permit markets. Indeed, in absence of an intertemporal transferability of permits, an additional one dimension – temporal – would be added to permit trade: every year's trade would be confined to that year's dated permits market.

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[7] Again, such design is similar to the one used in Japan, where national standards have the character of a nonbinding objectives, and regional authorities are granted the power to adjust them localy (OECD (1977).

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[8] The latter should not be confused with possibility *to acquire* future emission rights in advance.

Again, as usual, the increase of flexibility and economic effectiveness of the system involves a trade-off in other properties. In case of postponement of pollution rights a precise control over limits of annual emissions is lost, because the saved permits could transform into surplus emissions in subsequent years. As a soothing remedy to this, a time "depreciation" of permits value, that is an established pattern of discounting of permit stipulated emission entitlements, is sometimes proposed.

A universal "pollution currency" by definition should not be year-dated and short-living one. Neither it should be constantly devaluated according to the preset pattern if one doesn't want to have to deal with an ever increasing coupon "inflation" Thus, a different solution should be found, probably – as close to the realm of monetary circulation as it is possible taking into account the specifics of "pollution currency"

Suggested here approach would be to reissue each year to the coupon market *only* the amount of UTECs that was collected as payment for *executed* rights to emit (or less if there is an intention of pollution's gradual reduction) during the previous year. In addition to that, coupon credits could be granted to the willing "to borrow" emission rights for the specified period and at the market regulated interest rate (which may be established, say, by competitive bids for credits). Again, the total amount of available credit should be limited by the amount of the time-deposits of unused coupons, where their owners choose to bank them rather than sell. The owners of UTEC deposits should be rewarded by some interest as well, paid on the market value of their deposits.

It seems that such a system would be able to ensure both the flexibility of the system and the keeping of each years total emissions

amount under the lid. More so, in this way controlling agency would acquire additional regulatory powers (such as, for example, opportunity of a selective coupon credit policy, oriented towards desirable spatial or interpollutant distribution of emissions), as well as a prospect of revenues from the profit margin on interest.

Another time-related issue, although rarely reffered to in literature on marketable pollution permits, is the danger of short-term "bursts", leading to the violent abuse of ambient standards. Lithuanian law on pollution taxation precludes such a threat by application to the violations of daily standard (calculated as the annual permissible amount divided by 365) the same prohibitive penalty formula that is used for the emissions in excess of the yearly standard. It is obvious that this approach could not be longer appropriate if any type of emissions trading model was implemented – the operational meaning of annual permissible emissions standard then would be lost. Nor it would be sensible to establish any substitute individual daily emission standards, for it would certainly contradict the idea of emission rights transferability.

The one possible, albeit potentially troublesome, solution to this problem might be to give a free hand to sources while establishing their legal responsibility for deductible and attributable damages done to the environment by the observed emission spikes. Theoretically, at least, this should induce polluters to avoid the accidental, let alone intended, emission bursts.

3.2.3. The Interpollutant Substitutability.
Universality of UTECs introduces a possibility of interpollutant trade-off in emissions, and, therefore, a potential problem of environmentally undesirable exchanges.

It is not a unique property of UTECs – the same feature is characteristic to a pure price instruments of pollution control, where a *real* currency is used, instead of coupons. This includes pure effluent charge systems as well. In their case the usual approach to solution of this problem is twofold: for once, effluent charges are differentiated according to percepted detrimentallity of pollutant, and second – firm-specific emission limits are established together with a higher charge rate for the excess. The latter change effectively transforms a pure price instrument into a mixed one, with elements of a quantity instrument.

A similar but not an identical regulation options are embodied in UTECs concept. An obvious one is the possibility of manipulation with UTEC-prices of the effluents. Contrary to the pure charge system where pollution scope is limited only by the economic considerations of polluters, UTECs approach presumes a *quantity-limited* emission rights. Another option, already mentioned before, is a selective coupon-credit policy. Finally, UTEC mechanism can be a constituent part of a "mixed" policy, where emissions of some especially aggressive substances are regulated by rigorous individual quotas.

3.3. *Comparative Evaluation of Policy Reform Alternatives*

The relative merits and drawbacks of UTEC approach could be better evaluated by comparison to other environmental policy reform alternatives: improved pollution taxation (PT) scheme and emission reduction credits (ERCs) approach. The comparative analysis of policy alternatives will be carried out employing the evaluation criteria highlighted in Section 2, and against the background of the Lithuanian situation.

Environmental effectiveness. In each separate case – taxes, ERCs or UTECs – a different environmental objective is set. In case of pollution taxes the goal, as it is formulated currently in Lithuania, is to keep the ambient concentrations at or under the maximum permissible levels. ERC system requires not to exceed the total emission limits for every single pollutant. Finally, UTECs scheme presumes the overall limit on all emissions. Clearly, in terms of environmental quality PT scheme's target is superior to the other two, and UTEC approach is the least demanding in that sense. If, however, to take into account that the pollution problems in today's Lithuania are not the binding ones, and that the margin of error in emission levels does not seem to be a dangerously tight one either, the relaxation of regulatory stringency appears to be acceptable. Especially, if it could lead to a generous offset in other terms.

All three systems in principle are capable to ensure achievement of their stated environmental objectives; in all three cases this would be achieved by the rigorous penalties for an over-standard (PT) or over-permit (ERC, UTEC) emissions. However, only pollution taxation, and only *if* the tax rates are kept close enough to an efficient level, can provide implicit incentives for further decrease of pollution[9].

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[9] "Implicit" means – without additional intervention from controlling agency. In a high-inflation reality, however, this won't be possible: tax rates will be in constant need of adjustment. In this sense, PT system doesn't differ too much from the other two permit-based schemes, where pollution control level could be regulated by the issued permits (coupons) quantity changes and, in case of UTECs, some other means as well.

Economic efficiency. The main question here is the propensity of policy induced forces to stimulate the least-cost achievement of established environmental goals. The well known (see, for example, Bohm and Russel (1985), Montgomery (1972)) theoretical conditions for a cost-minimizing allocation of pollution control efforts in a competitive market are characterized by the equation of marginal control costs among all pollution sources, exercising such control. It could be shown that, under traditional assumptions[10], UTEC system satisfies the conditions for the least-cost distribution of pollution control burden.

Let us denote E as a policy targeted aggregate, all-pollutant emissions limit. A corresponding amount of universal emission coupons is charge-free distributed among the polluting firms, where each source initially gets q_i^0 quota of coupons ($i = 1 \dots m$) and

$$\sum_{i=1}^{m} q_i^0 = E.$$

Let us further assume the existence of a competitive coupons market, where price-taking firms can buy or sell their coupons in order to achieve the least-cost compliance with the environmental regulations. Transaction costs are assumed to be neglectable, and the penalty levels for non-authorized emissions – prohibitive. Thus, *total* environmental cost of compliance for firm consists of pollution control costs *plus* coupon

purchasing expenses or *minus* gains from their selling[11].

Under these assumptions, each polluter's ($i = 1 \dots m$) decision problem, in formal terms, is described as:

$$\min_{e_{ij}} \left[\sum_{j=1}^{n} c_{ij}\left(e_{ij}\right) + p\left[\sum_{j=1}^{n} k_j e_{ij} - q_i^0 \right] \right],$$

$$e_{ij} \geq 0, j = 1 \dots$$

where e_{ij} defines amount of j pollutant discharged by polluter i ($i = 1 \dots m$, $j = 1 \dots n$) $c_{ij}(e_{ij})$ – costs of pollution control at source i, necessary to keep j pollutant's emissions at the level e_{ij}; k_j is an established "coupon-price" of a unit of emissions type j; and p is a market price of a coupon. Following the customary pattern, we assume the convexity of pollution control cost functions, as well as $c_{ij}(e_{ij})$ and it's second derivative being positive, first derivative – negative.

The solution of this problem is:

$$\frac{\partial c_{ij}\left(e_{ij}\right)}{\partial e_{ij}} + p \cdot k_j \geq 0, \;\; j = 1 \dots$$

$$e_{ij}\left[\frac{\partial c_{ij} e_{ij}}{\partial e_{ij}} + p \cdot k_j \right] = 0, \;\; j = 1 \dots$$

$$e_{ij} \geq 0, j = 1 \dots n.$$

The set of optimum conditions indicates that the marginal costs of control for each pollutant will be equated among all sources that are carrying out less than total phase-out of it's emissions; and that zero level of emissions will be achieved at those sources and for those pollutants for which the marginal costs at any level of control are lower

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[10]Usually such analysis is simplified by either implicit or explicit abstraction from spatial and intertemporal problems. However, the same results could be obtained for more complex cases as well, say, involving ambient concentrations (Montgomery (1972).

[11] For the sake of simplicity, a "pure" UTEC system is analyzed here, that is – without no additional taxation or standardization whatsoever.

than potential revenue from selling the relevant amount of coupons at the market price. The latter here plays the role of the Lagrange multiplier and represents the shadow price of the total emissions constraint E. This is a solution that satisfies the conditions for the minimization of total pollution control costs[12]. Thus, in theory UTEC system is capable to provide the cost-effective achievement of given environmental target.

However, neither this simple model nor similar ones, traditionally used for purpose of demonstration of policy's consistency with the least-cost requirement, recognizes the role of transaction costs in market economies. As it was demonstrated by Stavins (1993), explicit incorporation of them into the model of tradable permits can significantly change the picture of it's performance: in terms of sensitivity to the initial distribution of permits, impact on permit prices, trading volumes and aggregate control costs. The general conclusion is that the higher transaction costs are – the wider can be divergence from the cost-minimizing, marginal control costs equating solution. Less permit exchange activity and, consequently, less gains from trade can be expected, making pollution control more costly. These theoretical findings are backed by the evidence from practical experience with permit trading programs in U.S. (see Hanh and Hester (1989a, 1989b), Hahn and Noll (1983), Tripp and Dudek (1989)).

Currency-like universality and divisibility of UTECs carries a high potential of transaction costs reduction. First, it totally eliminates the need to exercise a "selling one kind of permits – buying another" type of transactions – universal coupons could be indiscriminately used to buy "the right to emit" *any* type of pollutant, incorporated into program. The higher is the number of the latter – the more substantial transaction costs savings can be expected. Second, UTEC concept enables to avoid permit market's segmentation into numerous thin sub--markets – one for every pollutant – and leads to the one homogeneous and, therefore, more competitive coupon market. This will certainly facilitate market activity, dissemination of market-generated information, and a corresponding savings on transaction costs.

Finally, a positive side-effect of a higher level of competition is the lower policy's susceptibility to distortive strategy, i.e. attempt to corner permit market in course to force out one's competitors. All this makes UTEC scheme clearly superior – in the economic efficiency sense – to the traditional marketable permit systems.

Organisational feasibility. A precise comparison of different approaches in terms of their organizational feasibility requires the clear outline of the institutional and legal framework, necessary for implementation of particular policy reform[13]. However, a preliminary examination of UTEC and traditional MPP schemes suggests that the institutional requiremnts of both approaches are pretty much the same: (a) permit (coupon) control authority, that issues and

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[12] Note that in a competitive market direct benefits from coupon trade result in a zero-sum aggregate: revenues of the sellers are equal to the expenditures of buyers.

[13] These questions, as related to UTEC scheme, are not dealt with in detail in this paper.

distributes permits, collects payments for (proofs of) the right to pollute and penalties for an excess emissions, monitors and controls compliance of the emission sources with the rules of the game; under UTEC system it would also act as a "central bank", collecting coupon deposits and granting credits; (b) institutional setting of permits (coupons) exchange, i.e. permit (coupon) market.

The above cited functions of the control authority does not seem to require any sophisticated changes in the existing institutional arrangements for supervision of pollution taxation; rather shift and adjustment of them. On the other hand, permit (coupon) market is a different case – it doesn't exist under the present system.

One way to generate it would be simply to allow permit (coupon) trades to take place, leaving market development to the self--organization. However, as an available emissions trading experience shows (Hahn and Hester (1989a, 1989b)), it most certainly would be just a costly way (with initially high search and information costs) to the same outcome: one or another model of organized permit exchange, including brokerage and legal services. Thus, it seems advisable to establish a relevant formally organized permits (coupons) exchange from the very beginning.

It could be done by the legalization of emission permits (coupons) as a specific kind of tradable commodity at the stock or commodity exchange. This could be particularly promising in case of UTECs , due to their currency-comparable characteristics – homogeneity, divisibility and transferability. Such solution would enable to use the existing exchange facilities, i.a. brokerage, legal and information services.

Still another way would be to create a separate permit (coupon) exchange under the auspices of environmental control authority. In principle, the latter could also, at least initially, take on a brokerage role, as well as information provision function. Such market organization could emerge as a natural extension and development of an initial permit distribution tools, e.g. permit auctions.

In both cases one can imagine a gradual development of futures and options market on permits (coupons), enhancing assurance of the trading subjects and, thus, facilitating rational long-term decisions.

Social-political feasibility. Pollution taxation improvement is an alternative that calls for the least radical changes. Paradoxically, it can be the least politically feasible as well. The reasons for that were outlined in Section 2: tax increases are not likely to be looked upon favorably by the influential industrial lobbyists. Introduction of tradable emission reduction credits – variety of the traditional MPP's – into an existing policy pattern can also be performed quite smoothly. More important, contrary to the tax raising proposals, an increased regulatory flexibility and an opportunity to make money (either on an additional abatement efforts or on a temporary output's "wrap-up") has an obvious economic appeal to industrial agents.

Even more of the same could be said about UTECs, whose universality and divisibility increases the likelihood of cheaper trade operations and more intensive market activity. In addition to that, an increased regulatory properties of the UTEC system, similar to monetary policy instruments (adjustment of coupon emission amounts, deposit and credit interest rates) plus some more (e.g. coupon-pricing adjustment

possibility), could appease even a potential opposition to reform from the side of environmentalists. Still additional twist to the political attractiveness of UTECs could add a retainment of a basic tax rates, to be paid for emissions along with submitted coupons[14]. Finally, rather fresh Lithuanian experience with the "general rationing coupons" favorably reflects on the psychological acceptability of the system.

Flexibility, i.e. ability of policy to accommodate situation changes, can be assessed in two ways: from the points of view of regulators and regulated. The first one, "macro-flexibility", characterizes systems ability to perform successfully the tasks it was originally created for without extensive and radical changes in policy's scheme or parameters. The second, "micro-flexibility" – indicates a degree of freedom of choice, left to the polluters in their drive towards the optimal way of compliance.

As it was argued earlier, regulatory flexibility of pollution taxation scheme is severely inhibited by the need of constant tax rate adjustments to the changing environment (in broad sense of the term). Besides inflationary adjustments, that includes a frequent recalculations of a "basic" efficient tax rates to keep them in tune with the economic and technological progress, not "overshooting" the *necessary* level.

Both ERC and UTEC systems are free from this kind of troubles – their prices are generated and regulated by the market.

Although, being a quantity instrument they fix the aggregate level of pollution control for

a specified period, it could be adjusted easier and smoother than tax rates. For example, a gradual pollution reduction path could be adopted and a number of periodically issued permits determined accordingly. UTEC system allows even more flexibility – employing such tools as coupon-credits and UTEC- -pricing of pollutants.

In polluter's pursuit of the optimal control level effluent taxes provide a possibility of the direct substitution of pollutants at the given "prices", i.e. tax rates. This gives polluter higher inner flexibility compared to the case of traditional MPPs where, in order to perform the same substitution, it would have to do some trading at the permit market. On the other hand, severe penalties for an emissions in excess of custom tailored standard effectively restrict this flexibility to the relatively narrow interval, while permits extend it over individual standards. Furthermore, an option of permit banking adds a temporal dimension to the polluter's adaptability to changes.

UTEC system actually combines both features: universality and divisibility of coupons enables an easy interpollutant substitution within the source while not imposing an individual limits on coupon-covered emission levels. Add here an inbuilt opportunity of coupon banking, credits, possible trade in futures and options. Hence, it gives to polluting source a substantially higher degree of adaptability than each of the other two approaches examined here.

The highlighted above features of UTEC scheme indicate that it combines positive characteristics of both pollution charges (price-based instrument) and marketable emission permits (quantity-based instrument), i.e.:

1) *Charge-like*: a) interpollutant substitutability; b) lower probability of too stringent, hence – inordinately costly, aggregate

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[14] However, if the coupon auctioning is adopted as their distribution scheme, any propensity to retain even a nominal taxation is eliminated : the lost income from taxes will be compensated by revenues from sold coupons.

emission control levels; c) lower risk of strategic market-distortive behavior of polluters; d) higher certainty of property rights in time perspective;

2) *permit-like*: a) cap on the total amount of allowed emissions; b) ability to evade the tax rate uncertainty problem; c) individual costs saving flexibility of pollution control burden allocation among sources; d) market regulated

adaptability to the economic and technological changes, *inter allia* – immunity to the inflationary erosion of the abatement incentives.

Thus, "pollution currency" concept actually *integrates* the important advantages of emission taxation and marketable permits systems, while avoiding some of their drawbacks.

4. CONCLUSIONS

A concise analysis of the pollution management system currently in force in Lithuania revealed that there is both the need and the room for it's reform. On one hand, the existing pollution taxation scheme is too rigid in terms of possibility of an individual pollution control maneuver and too vulnerable to the exogenic changes of socio-economic situation, on another – tempoprary reduction in pollution caused by the economic decline and the ongoing process of the transitional changes creates favourable conditions for the attempts to reform the system into a cost-effective one.

Features of current environmental policy and socio-economic situation predetermines two major goals of polution control policy reform, namely: the economization of environmental policy objectives and the provision of a market-based incentives to the efforts of subjects in search for the cheapest solution of environmental problems. To achieve the first goal the least-cost attainment of the established standard of total amount of emissions into a specified type of environment is deemed to be suitable as a modified "second--best" type of approach. The second goal limits a search for policy improvement alternatives to the few directions, that is upgrading of an existing pollution taxation scheme or it's conversion to the system based on the tradable pollution permits. Investigation of comparative

merits and shortcomings of several such alternatives of reform leads to the introduction of the model of transferable universal emission coupons (UTEC) that should be used for "payments" for the right to emit various types of pollutants into air and water, not restricted by locality and unlimited in time. Concept of UTEC is partly based on the real Lithuanian experience with the so called "general coupons" in 1991–1992, then used for rationing of scarce consumer goods.

Theoretical development, general design and analysis of the UTEC model reveals that it could be particularly promising. Namely, UTEC system manifests a unique combination of a number of positive features of both the pollution taxes and the marketable pollution permits, that is: interpollutant substitutability, high certainty of pollution rights in the future and of total amount of pollution, cost-effective flexibility of pollution control allocation among sources, increased adaptability of the system to the exogenic economic and technological changes, etc. Mathematical analysis of the pollution control burden allocative properties of the UTEC model proves their consistency with the cost-effective allocation condition. Futhermore, properties of the proposed instrument make it possible to interpret it as a kind of "pollution currency", with the consequent possibility to employ for polution

management of a number of regulatory means that traditionally are used for the monetary circulation. This helps to solve or at least to mitigate some potential problems that could be caused by the spatial, intertemporal and interpollutant universality of coupons. Fianally, UTEC model could be gradually and relatively easy grafted onto the existing pollution control system, accommodating selected features of the latter.

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Pasiūlymai Lietuvos taršos valdymo sistemos reformai : „Taršos valiutos" koncepcija (2 dalis)

Santrauka

Straipsnio tęsinyje išsamiai aptariami „taršos valiutos" modelio bruožai, pateikiama potencialių jo taikymo problemų ir pastarųjų sprendimo būdų analizė. Suprastintu optimizaciniu modeliu parodoma, kad „bendrieji taršos kuponai" tenkina būtiną optimalaus, lėšas minimizuojančio taršos kontrolės krūvio paskirstymo teršėjams sąlygą: visų taršos šaltinių ribinės kontrolės išlaidos susilygina. Detaliai nagrinėjami galimi numatomo teršalų tarpusavio pakeitimo, naujo valdymo metodo keliama potenciali grėsmė ekologiškai efektyviam taršos paskirstymui per laiką ir erdvėje, siū-lomi šios grėsmės sušvelninimo būdai. Parodoma, kad „bendrieji taršos kuponai" pasižymi daugeliu „tradicinei" valiutai būdingų bruožų, o tai atveria plačių finansų politikos arsenalo instrumentų (deponavimo, kreditavimo, emitavimo, keitimo kurso reguliavimo ir pan.) taikymo taršai valdyti galimybių.

Argumentuojama, kad „bendrųjų taršos kuponų", t. y. savotiškos „taršos valiutos", modelis sujungia svarbiausius taršos leidimų ir mokesčių už taršą sistemų pranašumus, kartu jam nebūdingi kai kurie esminiai šių taršos valdymo metodų trūkumai.