# Environmental Taxation Evolution in Ukraine: Trends, Challenges and Outlook

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# ENVIRONMENTAL TAXATION EVOLUTION IN UKRAINE: TRENDS, CHALLENGES AND OUTLOOK

*Recent development trends of environmental taxation in Ukraine in context of the 2011 Tax Reform are analysed. Institutional, fiscal and security challenges for green taxes evolution during economic downturn and recession are summarized. Further modernization outlook for environment-oriented fiscal instruments in Ukraine considering European experience is stated.*

**Keywords**: environmental taxes, fiscal nstruments, trends, challenges.

> "Developing a tax environment for growth and competitiveness must be the primary motive for every tax policy and reform, as we strive to return to prosperity and stability"
>
> Algirdas Šemeta, EC Taxation and Customs Union, Audit and Anti-fraud Commissioner

**The problem identification and its interconnectedness with important theoretical and practical issues.** Environmental problem has become a crusial issue of current national regulatory policy both in developed and developing countries. Despite repetitive attempts to mitigate climate change on a worldwide scale efficiency concerns remains stable due to the limited regulatory space and problems variety. Environmental issue is of great importance both on micro and macro levels, defining competitor positions, market strategies, financial, fiscal and national resource security.

Regulatory mechanism of environmental protection in EU countries was changed during last decade with shift move from command-and-control to market-based instruments and informational approaches.

OECD Environmental Devision mentions different policy instruments with which governemtns can address environmental challenges, from traditional ones, that have relied on prescriptive regulations that have limited the flexibility of firms and the range of potential mitigation measures (but have also provided clear paths to pollution reduction) to more market-based approaches:

1) **regulatory approaches:** also known as "command-and-control" approaches (CAC), these have traditionally outlined limits and/or approaches for specific industries. These can take the form of emission intensity limits, technology ordinances, or absolute emission limits. They are typically directed at individual industries or specific product characteristics and with the focus usually being on the larger operators;

2) **voluntary approaches**: governments can also work co-operatively with industrial partners to arrive at binding or non-binding agreements to address emissions, or establish programmes to which firms voluntarily can adhere, thereby reducing the need for legislation;

3) **market-based instruments (MBI)**: these instruments rely on allowing price signals to motivate firms to find the lowest-cost means of abatement by placing a value on (or at least

near) the activity causing environmental damage. These can either take the form of a tax on the pollution, a tax on a proxy to pollution, or an emissions trading system that auctions or freely distributes permits, effectively giving the holder of a permit the right to emit (or that give "credits" to polluters that reduce emissions below a predefined baseline). These permits and credits can typically be traded and banked across time periods and have very similar features and effects to taxes;

4) **subsidies**: instead of trying to induce abatement by taxing the bad, governments can also try to subsidise the good. By reducing the cost of eco-friendly actions or products, the structure of demand and supply can be influenced;

5) **information**: in addition to the approaches above, governments have also typically undertaken information campaigns to raise awareness about environmental issues. These can take the form of public-service type messages encouraging citizens to undertake green acts or provide greater information on making environmental choices in consumption, such as detailing information on energy utilisation and expected lifetime costs of certain appliances. This information, which is typically difficult for consumers to collect and compare across different options, can help overcome informational barriers and reinforce environmentally related taxation on energy, for example (OECD, 2010, P. 22).

For the purpose of this research under the "environmentally related taxes" should be understood any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance (energy products, motor vehicles, waste, measured or estimated emissions, natural resources) (OECD, 2010, P.33).

Ukraine as a developing European-oriented country leads its way through facing the environmental challenges during unpredictable global macroeconomic stance and announced in 2010 nation-wide multisectoral reforms. In this context, the environmental taxation evolution is expected (Program of Economic Reforms, 2010] to be one of the key drivers of economic modernization, affecting the corporate behavior and individual consumption (Annual Message, 2011).

The problem of adequate environmental regelatory mechanisms fine-tunning has become extremely actual, being not widespread discussed in the professional and scientific circles. The transition position between CAC and MBI approaches unables governments' effective use of all the instruments variety. Declarative announcement of environmental protection necessity should be replaced with forced, goal-oriented, quantity measured actions, based on MBI fiscal instruments potential.

**Introduction.** In spite of last decade environmental regulatory mechanisms tightening in developing countries, global financial and public finances crises and recession, deeping inequality and institutional reforms, basic environmental indicators seem to be rather unchanged, less moving toward targeted threshold, both in developing countries – Russia (Galashev 2006, Frai 2006), Ukraine (NISR 2012, Skaletskiy 2011, Yakovlev 2011), and developed – US (Barker 1998, Harrington 2012, Gayer 2006), UK (Stern 2007, Weitzman 2007), Sweden (Hassler 2010, 2012).

Environmental taxation trends and challenges are now widely discussed at the international level – by European Comission' Environmental Agency (EEA 2007, 2010, Ekins 1999, European Comssion 2011a, EEA 2011a, 2011b), IMF (Heine 2012, Miguel 2011, IMF 2008), OECD (2010), the World Bank Group (Harrington 2010, Oral 2012).

On the one hand, negative external background (liquidity deficit at a corporate sector level, fiscal stimulous programs expiring, long-term labor market ageing issue) complicates enterprise modernization and shifting towards eco-friendly production, on the other hand – long-term fiscal imbalances and strengthening international competition require from national goverments new regulatory approaches. However few countries have succeeded in climate change mitigation challenge (Sweden, Norway, Danemark, Netherlands, Belgium), both G-20

and less developed world look constrained in providing sustainable eco-development.

**Latest research and publications' overview.**

The problems of fiscal instruments in environmental regulation application are broadly observed by foreign world-famous scientists Ph. Aghion (France-USA) (Acemoglu 2012, Aghion 2012), I. Bateman (2012); P. Ekins (UK) (1999); D. Fullerton (USA) (1995, 2007, 2008); J. Hassler (Sweden) (2010, 2011, 2012a, 2012b); J. Horowitz (USA) (2003, 2006, 2009); K. Kosonen (Finland) (2012); G. Metcalf (USA) (2005). As it can be seen, the majority of the authors are from the US, UK and the Dutch Council countries, where the environmental taxation reforms had being started prior to the rest of the world – in 1990-2000. Thus, theoretical studies concerning tax policy design, instruments implementation have be replaced by empirical research works on environmental tax incidence, various effects of MBI policy action and inaction, taxes regressivity/progressivity.

On postsoviet area environmental taxation issues have been investigated less considerably and are focus primarily at policy objectives and current problems, rather than at correlation analysis of policy measures effectiveness and fiscal instruments regulatory (correctory) potential. Amongst others we'd like to mark out works of Ukrainian researches V. Vyshnevskiy (2011), O. Garkushenko (2008), Y. Skaletskiy (2011), Y. Yakovlev (2011), and Russian scientists E. Yesina (2009), R. Vesseli (2011), A. Galashev (2006), E. Reshetnikova (2011) and K. Frai (2006).

**Unsolved problems.**

Regardless long-run public discussion of environmental challenges, fiscal instruments' design and potential analysis opportunity are regareded as urgent issues that are likely to rise the next wave of societal dialogue, aimed at national environmental perception recovery. The risk of permanent cyclical wandering crises amplifies the necessity of sensitive environmental fiscal instruments fine-tunning, that would not affect general growth and social well-being.

**Research task.** The purpose of the paper is to give a brief overview of the recent development trends of environmental taxation in Ukraine in context of the 2011 Tax Reform, summarizing the institutional, fiscal and security challenges for green taxes evolution during economic downturn and recession. At a conclusion of research an outllok for further modernization of environment-oriented fiscal instruments in Ukraine considering European experience is suggested.

**Main material disclosure.**

The 2010-2011 Tax reform in Ukraine was the result of broad national economy modernization plan, announced by the President V. Yanukovich at the beginning of his fisrt election term. The second stage of the reform (after the Tax Code of Ukraine implementation effective form the January, the 1st 2011) expected to run over the environmental taxation reform by introducing ecological tax instead of the environmental pollution charge (Program of Economic Reforms, 2010, P.13). The tax was designed to consolidate various resource and ecological charges and fees, with tax base widening and serious tax rates revision.

In praise of Ministry of Finances of Ukraine, ecological tax was included in the Tax Code and started to be administered at the beginning of the 2011 with the transition period of 2 years (for 2011 tax rates amounted for 50% of statutory rate, 2012 – 75% and from 2013 – 100%). Two years later we'll try to give the first estimate of environmental tax reform, admitting its positive and negative sides.

**The positive effects of the 2011 Tax Reform are the follows:**

1) tax base broadening for air, water and land pollution activities;

2) tax rate substantial increase and differentiation due to toxic range and type of pollutive substance;

3) ecological tax mobilization on the polluted territories (implementation of the 'polluter pays' principle) with revenue sharing between general government and municipalities.

Hovewer, reform revealed the number of negative issues:

**1) tax rates groundlessness.** Statutory ecological tax rates were increased on average from 6 to 14 times (table 1), without statement of the necessity for such upsurge). At the same time they still remain to be lower the rates, applied in the EU countries (table 2).

*Table 1*

**Statutory (nominal) ecological tax rates dynamics in Ukraine in 2010-2012***

| Pollution type | Statutory (nominal) tax rate, € per ton | | | Tax rates marginal growth,% | |
|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2011 to 2010 | 2012 to 2011 |
| **air pollution from stationary sources** | | | | | |
| NOx | 7,37 | 106,73 | 114,92 | 1 347,54 | 7,68 |
| benzpiren | 9 383,13 | 135 869,14 | 146 298,96 | 1 348,01 | 7,68 |
| $CO_2$ | 0,28 | 4,02 | 4,32 | 1 354,25 | 7,47 |
| nickel | 297,24 | 4 304,02 | 4 634,40 | 1 348,02 | 7,68 |
| styrol | 53,82 | 779,37 | 839,15 | 1 347,97 | 7,67 |
| **depending on the class of the danger** | | | | | |
| 1 | 52,72 | 763,37 | 821,95 | 1 348,01 | 7,67 |
| 2 | 12,07 | 174,83 | 188,25 | 1 347,98 | 7,68 |
| 3 | 1,80 | 26,05 | 28,09 | 1 349,39 | 7,84 |
| 4 | 0,41 | 6,03 | 6,48 | 1 354,25 | 7,47 |
| **air pollution from movable sources** | | | | | |
| leaded petrol | 0,41 | 5,94 | 6,40 | 1 333,18 | 7,60 |
| diesel fuel | 0,41 | 5,94 | 6,40 | 1 333,18 | 7,60 |
| **water pollution** | | | | | |
| nytrogen | 4,84 | 70,10 | 75,45 | 1 348,83 | 7,63 |
| mineral oil | 28,48 | 412,41 | 443,99 | 1 348,12 | 7,66 |
| nitrites | 23,78 | 344,32 | 370,70 | 1 348,00 | 7,66 |
| nitrates | 0,41 | 6,03 | 6,48 | 1 354,25 | 7,47 |
| sulphates | 0,14 | 2,01 | 2,16 | 1 354,25 | 7,47 |
| phosphates | 3,87 | 56,03 | 60,33 | 1 347,48 | 7,67 |
| chlorides | 0,14 | 2,01 | 2,16 | 1 354,25 | 7,47 |
| **waste utilization in the water objects (depending on the class of danger)** | | | | | |
| 1 | 7,60 | 61,19 | 65,86 | 704,73 | 7,63 |
| 2 | 0,28 | 2,23 | 2,40 | 706,16 | 7,79 |
| 3 | 0,07 | 0,56 | 0,60 | 709,32 | 7,68 |
| 4 | 0,03 | 0,22 | 0,24 | 690,36 | 7,58 |

*Notes*: * - environmental charge in 2011 was substituted with environmental tax; ** - tax rates are given without indexation coefficient.

*Source*: author calculations.

Tax rates undervaluation is likely to attract investment in "bad" activities due to tax competition benefit (but environmental further loss).

*Table 2*

**Nominal environmental tax rates in EU countries and Ukraine in 2012**

| Country | Nitrogen oxydes (NOx), €/kg | Electricity , % | Landfill waste, €/ton | Motor oil, €/litre | Diesel, €/litre |
|---|---|---|---|---|---|
| Denmark | 0,67 | 8,85 | 63,8 | 0,32 | 0,428 |
| Finland | n.a. | 0,87 | 30 | 0,087 | 0,364 |
| Germany | n.a. | 2,05 | n.a. | 0,061 | 0,47 |
| Italy | 0,21 | 0,47 | 25,8 | 0,403 | 0,423 |
| Netherlands | n.a. | 11,14 | 85,5 | 0,245 | 0,365 |
| Norway | 1,85 | 1,26 | 52,1 | 0,168 | 0,474 |
| Sweden | 5,18 | 2,8 | 40,9 | 0,378 | 0,408 |
| UK | n.a. | 0,53 | 44,9 | 0,126 | 0,63 |
| Hungary | 0,43 | n.a. | 23 | 0,337 | 0,347 |
| Poland | 0,11 | n.a. | 24 | 0,054 | 0,296 |
| France | 0,06 | n.a. | 9,2 | n.a. | 0,428 |
| Turkey | n.a. | n.a. | n.a. | n.a. | 0,607 |
| *Ukraine* | *0,11* | *3* | *0,1* | - | *0,2* |

*Notes: n.a.* – data is not available, for differentiated tax rates the maximum one is stated.

*Source:* authors calculations, based on State Statistics Service of Ukraine (2011, 2012b), OECD (2010).

**2) disability of tax incidence calculation due to statistics shortage and its disconnectdness with revenue indicators.** National statistics service started new environmental taxation observations only from 2011, that disables comparative retrospective analysis of tax reform. In addition, national environmental goals, amended in 2011 are extremely ambicious and require far more effective fiscal instruments but many objectives do not have quantitive indicators of assessment (targeting).

European Environmental Agency indicates *four* EU key environmental policy priorities (that are covered with 113 various indicators):

1) better implementation and further strengthening of current environmental priorities;

2) coherent integration of environmental considerations across sectoral policy domains;

3) dedicated management of natural capital and ecosystem services;

4) transformation to a green economy (EEA, 2012, P.17).

Unlike, Ukraine in the Law "On State Ecological Strategy of Ukraine for the period by 2020" announces *seven* main environmental policy goals (that are covered with less than 20 targeted indicators) requiring, in our opinion, investment over 60% of GDP, that according to current revenue dynamics (table 3) will be covered in 30 years (not 8 as projected).

Ukrainian environmental policy goals are:

**1. Increased society ecological awareness.** *The first goal matches next objectives:*

- non-government ecological social organizations project and implementation involving 2% financing support threshold of State Environmental Protection Fund general expenses by 2015 and 3% - by 2020;

- local government assistance in inexhaustible management and eco-friendly technologies implementation, setting up in the each region experimental-information and educational centers aiming to support these objectives;

- public support for the creation and development of energy efficient communities, and introducing such technologies by 2015.

**2. Environmental position improvement and increasing environmental protection.** *The second goal matches next objectives:*

- increasing environmental protection via introduction by 2015 complex approach on risks valuation, prevention of natural disaster and consequences minimizing due to Johannesburg Actions Plan:

*air* - reduction of air pollution with stationary sources by 10% and 25% by 2015 and 2020 respectively from the basic level; national economy energy sector structure optimization by low-carbon energy sources utilization increase up to 10% in 2015 and 20% in 2020, greenhouse emissions decrease with accordance to national liabilities in Kyoto protocol;

*water resource protection* – new water-protective facilities construction and reconstruction as well to decrease (basically organics, NOx, phosphates) water pollution by 15% by 2020, insufficiently cleansed sewage decrease up to 20% by 2020;

*land and soil protection* - cropland area decrease up to 5-10% by 2020;

*forest protection* - forest area broadening to 17% by 2020;

*geological environment and subsoil* – introduction of ecologically safe subsoil utilization technologies and land reclaiming by 2020 on the minimal area of 4300 hectares;

*waste and dangerous chemicals* – 70% of landfill providing at a specialized and ecosafe polygons by 2015, share decrease of compounding waste with safe biological degradation by 15% by 2020; 1,5 times increase of waste recycling by 2020.

**3. Safe environment achievement for human health.** *The third goal matches next objectives:*

- surface water safety for 90% of communities with less than 250 ths habitants, centralized water supply normative compliance by 2015;
- hygien quality drinking water compliance with 70% of rural communities by 2020.

**4. Ecological policy integration and integrated ecological management system development.** *The fourth goal matches next objectives:*

*in transport sector* – noise control shields deployment near the communities with less than 500 ths habitants by 2015 and by 2020 for communities with less than 250 ths habitants; public transport share increase up to 25% by 2020;

*in agriculture* – improvement of conditions for the ecologically oriented and agricultural organics technologies introduction through doubling from the basic level the area of their exploitation by 2020;

**5. Bio and landscape diversity decrease suspending and ecological net formation.** *The fifth goal matches next objectives:*

- national econet adjustment to the level (41% of the country territory), that is necessary for the national ecosecurity, introduction of bio and landscape diversity environmental protection measures by widening natural protected area up to 10% by 2015 and 15% by 2020;

**6. Providing of balanced ecological nature management.** *The sixth goal matches next objectives:*

- 10-year framework policy for sustainable consumption and production Conception preparation and authorization in 2012 due to Johannesburg Actions Plan, the Strategy and national actions plan design and implementation by 2015;
- energy efficiency in manufacturing improvement by 25% by 2015 and 50% by 2020 through the introducing alternative technologies in power industry;
- renewables' volume increase up to 25% by 2015 and 55% by 2020;
- organics farming area share increase up to 7% by 2020.

**7. Regional ecological policy enhancement.** *The seventh goal doesn't matches objectives with quantity measures* (Strategy 2020).

*Table 3*

**Environmental taxes revenue dynamics in Ukraine during 2008-2012**

| Group of Environmental Taxes ** | 2008 | | 2009 | | 2010 | | 2011 | | 2012* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | € bln | % of total | € bln | % of total | € bln | % of total | € bln | % of total | € bln | % of total |
| Energy | 1,20 | 45,58 | 0,88 | 48,08 | 0,98 | 48,09 | 1,23 | 51,84 | 1,13 | 56,00 |
| % of TotRev*** | 3,11 | x | 3,49 | x | 3,29 | x | 3,21 | x | 3,76 | x |
| % to GDP *** | 0,98 | x | 1,04 | x | 0,95 | x | 0,97 | x | 1,28 | x |
| Transport | 0,51 | 19,53 | 0,26 | 14,23 | 0,36 | 17,63 | 0,28 | 11,82 | 0,16 | 8,06 |
| % of TotRev | 1,33 | x | 1,03 | x | 1,21 | x | 0,73 | x | 0,54 | x |
| % to GDP | 0,42 | x | 0,31 | x | 0,35 | x | 0,22 | x | 0,18 | x |
| Pollution | 0,15 | 5,81 | 0,11 | 6,11 | 0,18 | 8,98 | 0,26 | 10,95 | 0,21 | 10,58 |
| % of TotRev | 0,40 | x | 0,44 | x | 0,61 | x | 0,68 | x | 0,71 | x |
| % to GDP | 0,12 | x | 0,13 | x | 0,18 | x | 0,21 | x | 0,24 | x |
| Waste | 0,51 | 19,29 | 0,06 | 3,54 | 0,13 | 6,15 | 0,21 | 8,69 | 0,17 | 8,56 |
| % of TotRev | 1,32 | x | 0,26 | x | 0,42 | x | 0,54 | x | 0,57 | x |
| % to GDP | 0,41 | x | 0,08 | x | 0,12 | x | 0,16 | x | 0,20 | x |
| Emission | 0,00 | 0,00 | 0,30 | 16,64 | 0,15 | 7,15 | 0,00 | 0,00 | 0,00 | 0,00 |
| % of TotRev | 0,00 | x | 1,21 | x | 0,49 | x | 0,00 | x | 0,00 | x |
| % to GDP | 0,00 | x | 0,36 | x | 0,14 | x | 0,00 | x | 0,00 | x |
| Resource | 0,26 | 9,78 | 0,21 | 11,40 | 0,25 | 12,01 | 0,40 | 16,69 | 0,34 | 16,80 |
| % of TotRev | 0,67 | x | 0,83 | x | 0,82 | x | 1,04 | x | 1,13 | x |
| % to GDP | 0,21 | x | 0,25 | x | 0,24 | x | 0,31 | x | 0,38 | x |
| Noise | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| % of TotRev | 0,00 | x | 0,00 | x | 0,00 | x | 0,00 | x | 0,00 | x |
| % to GDP | 0,00 | x | 0,00 | x | 0,00 | x | 0,00 | x | 0,00 | x |
| ***TOTAL EnvTaxes*** | ***2,64*** | ***100,00*** | ***1,82*** | ***100,00*** | ***2,04*** | ***100,00*** | ***2,37*** | ***100,00*** | ***2,01*** | ***100,00*** |
| % of TotRev | 6,82 | x | 7,27 | x | 6,85 | x | 6,20 | x | 6,71 | x |
| % to GDP | 2,14 | x | 2,17 | x | 1,98 | x | 1,88 | x | 2,29 | x |

*Notes*: * - 9months 2012 cumulative data; all figures are converted in Euro (due to official exchange rate at the latest banking day of a year); ** - energy (6,7,8,9,12,13); transport (1); pollution (14,15,16); waste (10); resource (2,3,4,5); emissons (17): 1-Car-owner tax (effective till 01.01.2011); 2-Charge for special use of forest resources; 3- Charge for special use of water; 4-Subsoil utilization fee; 5- Other natural resources utilization fee; 6-excice on petrol production; 7- excice on mineral oil production;8-import excice on petrol; 9- import excice on mineral oil products; 10- excice on mineral oil products., vehicles and tyres; 12-target charge on the heat-and-power production; 13-target charge on natural gas consumtion; 14-environmental tax; 15-environmental charge (effective till 01.01.2011); 16- environmental fund; 17-emission trading schemes revenue; *** - TotRev – total revenues of State Budget of Ukraine (with local budgets); GDP – Gross Domestics Product of Ukraine:

*Source*: authors calculations, based on Ukrainian State Statistics Service and Ministry of Finances of Ukraine data.

As noted above, financial crisis may not affect environmental-related tax revenues, that broke the pre-crisis level 2012. Energy and resource payments provide the main share of revenues, resulting in 1,12% of GDP and 0,38% od GDP respectively in 2012. Emission revenues seemed to be the most volatile among environmental taxes during 2008-2012 due to greenhouse emission trade permits cotracts disruption with Japanese governement and several European companies. Nevertheless, budget revenues from environmental-related taxes in Ukraine are far less, then in EU countries (table 4).

*Table 4*

**Environmental taxes revenues in Ukraine and EU countries, % to GDP**

| Country | Energy | | | Transport | | | Pollution, waste and resource use | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2008** | **2009** | **2010** | **2008** | **2009** | **2010** | **2008** | **2009** | **2010** | **2008** | **2009** | **2010** |
| Danemark | 2,11 | 2,20 | 2,30 | 1,84 | 1,51 | 1,50 | 0,30 | 0,30 | 0,20 | 4,25 | 4,01 | 4,00 |
| Finland | 1,78 | 1,81 | 1,80 | 0,89 | 0,79 | 0,90 | 0,06 | 0,05 | 0,10 | 2,73 | 2,65 | 2,80 |
| Germany | 1,83 | 1,92 | 1,80 | 0,35 | 0,34 | 0,40 | 0,00 | 0,00 | 0,00 | 2,19 | 2,26 | 2,20 |
| Italy | 1,90 | 2,09 | 2,00 | 0,58 | 0,50 | 0,60 | 0,03 | 0,03 | 0,00 | 2,52 | 2,62 | 2,60 |
| Nether-lands | 1,92 | 2,04 | 2,00 | 2,03 | 1,23 | 1,20 | 0,54 | 0,71 | 0,70 | 4,49 | 3,98 | 3,90 |
| Norway | 1,20 | 1,30 | 1,20 | 1,07 | 1,16 | 1,20 | 0,13 | 0,24 | 0,20 | 2,40 | 2,70 | 2,60 |
| Sweden | 2,18 | 2,28 | 2,20 | 0,36 | 0,53 | 0,50 | 0,05 | 0,01 | 0,01 | 2,59 | 2,82 | 2,71 |
| United Kingdom | 1,76 | 1,94 | 1,90 | 0,51 | 0,57 | 0,60 | 0,09 | 0,08 | 0,10 | 2,36 | 2,59 | 2,60 |
| Hungary | 2,04 | 1,99 | 2,00 | 0,57 | 0,46 | 0,50 | 0,27 | 0,17 | 0,10 | 2,89 | 2,62 | 2,60 |
| Poland | 1,80 | 2,10 | 2,10 | 0,06 | 0,23 | 0,20 | 0,09 | 0,24 | 0,22 | 1,94 | 2,57 | 2,52 |
| France | 1,42 | 1,45 | 1,40 | 0,22 | 0,55 | 0,20 | 0,10 | 0,09 | 0,10 | 1,74 | 2,09 | 1,70 |
| Turkey | 2,52 | n/a | n/a | 0,82 | n/a | n/a | 0,00 | n/a | n/a | 3,34 | n/a | n/a |
| | | | | | | | | | | | | |
| ***Ukraine*** | ***0,98*** | ***1,04*** | ***0,95*** | ***0,42*** | ***0,31*** | ***0,35*** | ***0,75*** | ***0,82*** | ***0,68*** | ***2,15*** | ***2,17*** | ***1,98*** |
| *EU-27** | *1,09* | *1,80* | *1,80* | *0,46* | *0,53* | *0,50* | *0,04* | *0,10* | *0,10* | *1,59* | *2,43* | *2,40* |

*Notes*: * - average weited amount.

*Source*: authors calculations, based on the MOF data.

Thus, Ukraine has great fiscal potential of environmental taxes in all observed groups of taxes. Compared to EU-27 average level, tax revenues from energy sources can be rised at 80-100%, from transport – at 50-60% in medium term period. Special attention should be focused on the pollution/waste/resources group of environmental taxes, that gains 6,8 times more revenues, compared to EU average (0,1% of GDP). It indicates the revenue fall potential from environmental protection measures (that can be fully compensated with other revenue groups rise). In addition, this reflects the scale of horrible environmental situation in Ukraine.

Analysis of environmental protection costs (EPC) and ecological payments dynamics in Ukraine in 2002-2011 (table 5) depicts actual public support of environmental protection (less, then 1/20 of total EPC in 2011 with negative trend begining from the 2008). Besides that, the amount of actual ecological payments was inadequate with necessary financial support amount (in comparison with EU countries, table 6), worsened by low taxpayers discipline. Thereby current environmental problems are the heritage of long-term underfinancing and residuary principle of budget allocations. These facts confirm our statement of MBI urgent implementation necessity.

3) As CAC approach with dominant public share in environmental protection costs is impossible under current circumstances, the **further active introduction of market-based instruments will help to achieve announced large-scale goals, but faces the nuber of challenges**, that can be divided into two groups: direct (fiscal) and indirect (institutional and security).

**The fiscal challenges** comprise the environmental taxes basic features and the efficiency concerns. First, *taxes as automatic stabilizers tend to be procyclical* with revenue decrease during economic downturn and recession (that is currently observed in Ukraine).

*Table 5*

**Environmental protection costs (EPC) and ecological payments dynamics in Ukraine in 2002-2011, € mln.**

| Indicator | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|
| Environmental protection costs, | 641,0 | 610,2 | 579,1 | 705,6 | 944,9 | 1 024,8 | 955,7 | 891,7 | 1 156,0 | 1 771,2 |
| *incl. from state budget* | 24,6 | 19,5 | 100,1 | 144,1 | 186,7 | 181,1 | 212,3 | 206,2 | 262,5 | 101,6 |
| EPC dynamics, % y/y | 119,5 | 114 | 104,1 | 117,8 | 132,8 | 118,4 | 103,9 | 131,6 | 125,6 | 38,35 |
| Public share in EPC, % | 3,84 | 3,2 | 17,29 | 20,42 | 19,76 | 17,67 | 22,22 | 23,13 | 22,71 | 5,73 |
| Ecological payments accrued, | 45,5 | 39,0 | 33,6 | 41,5 | 52,2 | 54,1 | 112,0 | 87,9 | 101,1 | 190,6 |
| Actual ecological payments, | 16,5 | 25,0 | 23,0 | 35,7 | 46,3 | 52,8 | 95,7 | 90,3 | 98,9 | 174,8 |
| Payments/ Accrued, % | 36,2 | 64,2 | 68,6 | 86 | 88,7 | 97,6 | 85,4 | 102,7 | 97,8 | 91,71 |
| Share of public EPC, financed by ecological payments, % | 66,8 | 128,2 | 23 | 24,7 | 24,8 | 29,2 | 45,1 | 43,8 | 37,7 | 58,08 |
| Ecoligical payments as tax revenues share, % | 0,06 | 0,13 | 0,26 | 0,31 | 0,29 | 0,27 | 0,4 | 0,43 | 0,34 | 0,28 |

*Source:* authors calculations, based on Ukrainian State Statistics Service.

Thus, the revenue losses will be resulted in budget deficit broadening, actualizing the public finances security matters. Additionally, unobserved impact of environmental taxes on economic activities raises the question of additional tax incidence research, that require further national statistical and regulatory harmonization with EU standards. Second, *efficiency of fiscal instruments depends on tax administration capacities and quality*, creating the demand on the tax design, anti-fraud and shadow economy halting measures.

**Institutional challenges** are two-fold and comprise the need in further public institutions reform, reinforced by national demand model reconsideration. "Bad" (bureaucratic and corrupted administrative and regulatory authorities) institutions create demand for unofficial economy and social explosure risks. Low life level decays ability for "clean goods" consumption, that are getting regarded as luxury in the developing countries. Thereby low purchasing capacity forces citizens to consume cheap, environmental aggressive, goods. Inelastic demand on "bad goods" shifts fiscal burden on the most vulnerable groups of taxpayers, increasing inequality. Besides that, deregulation of energy and transport sectors as a prerequisite of MBI efficiency in current political and social conditions in Ukraine is doomed to failure.

As seen from table 7, ecological tax upsurge havn't solved the air emission problem, as the average pollution volume tends to grow form 376 tones in 2009 to 502,0 tones in 2011, that is 33,8% increase, similar situation is with $CO_2$ emissions volume, that can be explained with

increased demand for cheap coal instead of costly imported natural gas.

*Table 6*

**Environmental protection investment and current expenditure by sector in EU, € mln.**

| Country (latest year available) | Industry | | Specialized producers | | General government | |
|---|---|---|---|---|---|---|
| | Total investment | Total current exp. | Total investment | Total current exp. | Total investment | Total current exp. |
| EU-27 (2009) | 11 671 | 40 138 | … | … | … | … |
| Belgium (2007) | ... | ... | 764 | 2 685 | 316 | 1 276 |
| Bulgaria (2008) | 203 | 212 | 104 | 94 | 108 | 101 |
| Denmark (2008) | … | … | 721 | 2 411 | 170 | 1 080 |
| Germany (2007) | 1 840 | 8 250 | 4 120 | 15 420 | 1 830 | 5 860 |
| France (2008) | 1 531 | … | 6 290 | 21 959 | 2 717 | 5 988 |
| Italy (2009) | … | 11 870 | 1 823 | 13 486 | 3 290 | 9 094 |
| Hungary (2009) | 90 | 266 | 128 | 456 | 95 | 86 |
| Netherlands (2007) | 462 | 1 414 | 507 | 2 436 | 1 711 | 6 700 |
| Poland (2009) | 1 173 | 1 530 | 172 | 3 164 | 981 | 526 |
| Sweden (2008) | 420 | 701 | … | … | … | … |
| UK (2008) | 2 471 | 2 702 | … | … | … | … |
| Norway (2008) | 588 | 612 | … | … | 465 | 1146 |
| ***Reference note:*** | | | | | | |
| ***Ukraine (2011)*** | ***557*** | ***1 112*** | ***…*** | ***…*** | ***61*** | ***40*** |

*Notes: … - data is not available.*

*Source*: State Stastics Service of Ukraine 2012, p. 523; EU, 2011, P. 182.

Namely stationary sources carbon dioxide emission increase caused worsened environmental statistics (table 8).

*Table 7*

**Environmental pollution indicators dynamics in Ukraine during 2008-2011**

| Indicator | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|
| Number of entities-air pollutants by stationary sources (incl. $CO_2$) | 10729 | 10446 | 9312 | 8696 |
| Average pollution by 1 entity, tones | 421,7 | 376,0 | 443,7 | 502,9 |
| Total volume of pollution release by stationary sources, mln. tones | 4,5 | 3,9 | 4,1 | 4,4 |
| Total volume of pollution release by movable sources, mln. tones | 2,7 | 2,5 | 2,5 | 2,5 |
| $CO_2$ emission volume, mln. tones | 209,4 | 185,2 | 198,2 | 236,0 |

*Source*: State Stastics Service of Ukraine 2011, 2012b.

Liquidity constraints (high credit rates, absence of public support) resulted in hazardous waste problem (table 9). In a country with 46 mln. of habitants, there are only 2 (two) incinerating factories (Kyiv and Dnypropetrovsk) with the 70% of overfilled landfills throughout the country.

Tax rates increase for toxic waste havn't solved the problem of ground pollution as well (table 9). On the contrary, the waste balance at end of the 2011 year on the special objects and areas and on the entities territory increased at 1,2 bln tones comparing to the end of 2010. So,

the next steps should be made on the utilization side – only tax incentives to recycling and incinerating plants can solve the problem of waste.

*Table 8*

**Air pollution rejections and CO2 emission volume in Ukraine during 2008-2011**

| Year | Air pollution rejections | | | $CO_2$ emission | | |
|---|---|---|---|---|---|---|
| | Total, ths tones | including | | Total, mln. tones | Including | |
| | | Stationary sources | Movable sources | | Stationary sources | Movable sources |
| 2008 | 7210,3 | 4524,9 | 2685,4 | 209,4 | 174,2 | 35,2 |
| 2009 | 6442,9 | 3928,1 | 2514,8 | 185,2 | 152,8 | 32,4 |
| 2010 | 6678,0 | 4131,6 | 2546,4 | 198,2 | 165,0 | 33,2 |
| 2011 | 6877,3 | 4374,6 | 2502,7 | 236,0 | 202,2 | 33,8 |

*Source*: State Stastics Service of Ukraine 2013.

*Table 9*

**Waste balance indicators in Ukraine during 2008-2011, ths tones***

| Year | Produced | Utilized and recycled | Burned | Removed to the special objects and areas | Balance at end of the year on the special objects and areas and on the entities territory |
|---|---|---|---|---|---|
| 2008 | 2 301,2 | 918,9 | 32,2 | 1 066,3 | 21 017,2 |
| 2009 | 1 230,3 | 825,9 | 15,8 | 333,2 | 20 852,3 |
| 2010 | 419 191,7 | 145 710,7 | 1 058,6 | 336 952,2 | 13 267 452,0 |
| *incl*. waste of the I-III hazard level | 1 659,8 | 642,4 | 16,5 | 306,3 | 20 587,7 |
| 2011 | 447 641,2 | 153 687,4 | 1 054,5 | 277 106,8 | 14 422 372,1 |
| *incl*. waste of the I-III hazard level | 1 434,5 | 597,5 | 15,6 | 138,5 | 19 509,4 |

*Notes*: * – data for 2008-2009 is available for the waste of the I-III hazard level; since 2010. – for the waste of the I-IV hazard level.

*Source*: State Stastics Service of Ukraine 2013.

Financial deficit issue depicts security challenge both on demand and supply side. The lack of innovative (but primary expensive) technologies on supply side compels to further territories contamination, boosting infections, soil and water pollution. The law demand on recycling technologies (due to higher primary costs) keeps foreign investors out and makes the environmental problems unsolved.

**4) inadequacy of ecological tax revenues and indispensable nature preserving costs, their structure.** Capital investment and operational costs on nature preserving activities in Ukraine (tables 6, 10, 13) are critically deficient and are 2-10 times less, than in developed EU countries. Additionally, public investments are incommensurable relative to any revied country.

This leads us to the question of informational mechanism efficiency. Inherently, tax base broadening and tax rates increase led to expected taxpayer behavior – due to environmental taxation fiscal burden increase corporate sector in 2011 tripled capital investment and doubled capital repair costs (from € 47,3 mln. to € 80,8 mln.), while government almost halved the ex-

penditures in 2011 shifting the burden on the private sector.

*Table 10*

**Capital investment and operational costs on nature preserving activities in Ukraine, € mln.**

| Source of funding | 1996 | 2000 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| 1 Capital investments and operational costs, *incl.* | 1 163,15 | 641,17 | 1 579,66 | 1 018,92 | 1 246,38 | 1 771,14 |
| 1.1 Capital investments | 224,40 | 120,48 | 484,09 | 279,79 | 262,18 | 617,91 |
| 1.2 Capital repair | 100,00 | 46,39 | 105,01 | 50,99 | 47,28 | 80,80 |
| 1.3 Operational costs | 938,75 | 520,67 | 1 095,56 | 739,13 | 984,21 | 1 153,23 |
| 2 Environmental abatement costs dynamics, y/y | … | 119,5 | 125,6 | 90,9 | 118,6 | 140,8 |
| 3 Public share in environmental costs, %, *incl.* | 8,8 | 9,2 | 21,4 | 24,6 | 11,4 | 7,0 |
| 3.1 Capital investment, % | 7,5 | 7,9 | 19,0 | 20,5 | 8,7 | 4,4 |
| 3.2 Operational costs, % | 1,3 | 1,3 | 2,4 | 4,1 | 2,7 | 2,6 |

*Source:* State Stastics Service of Ukraine 2011, P. 524.

Since 2011, State Statistics Service of Ukraine counts the capital investment and operational costs on nature preserving activities in Ukraine by source of funding (table 11). It is seen, that public sector and institutional investors (with EU and the World Bank Group as a leading ones) priority is facilities modernization (€ 60,6 mln. opposite to € 40, 96 mln. and € 145,68 mln. to € 1,29 mln. of operational costs respectively), while corporate sector was focused in exploitation of existing facilities (with operational costs in 2,77 times higher the capital expenditures).

*Table 11*

**Capital investment and operational costs on nature preserving activities in Ukraine by source of funding, 2011**

| Source of funding | Capital expenditures | | Operational costs | | Total | |
|---|---|---|---|---|---|---|
| | € mln. | % of a total | € mln. | % of a total | € mln. | % |
| **1 Public, *incl.*** | 60,589 | 9,8 | 40,961 | 3,6 | 101,550 | 5,7 |
| 1.1 State budget, *incl.* | 27,297 | 4,4 | 30,101 | 2,6 | 57,398 | 3,2 |
| 1.1.1 Environmental protection fund | 6,111 | 1,0 | 1,834 | 0,2 | 7,946 | 0,4 |
| 1.2 Local budgets, *incl.* | 33,292 | 5,4 | 10,860 | 0,9 | 44,153 | 2,5 |
| 1.2.1 Environmental protection local funds | 24,853 | 4,0 | 3,882 | 0,3 | 28,736 | 1,6 |
| **2 Private, *incl.*** | 557,327 | 90,2 | 1 112,261 | 96,4 | 1 669,588 | 94,3 |
| 2.1 Corporate sources | 411,650 | 66,6 | 1 110,971 | 96,3 | 1 522,622 | 86,0 |
| 2.2 Other sources | 145,676 | 23,6 | 1,290 | 0,1 | 146,966 | 8,3 |
| **Total** | 617,915 | 100,0 | 1 153,223 | 100,0 | 1 771,138 | 100,0 |

*Source:* State Stastics Service of Ukraine 2012.

The structure of investment (table 12) shows the pollution intencity level, with air and soil seen to be most affected by externalities (table 13). It should be admitted the crusially low level of investment in biodiversity and environmental R&D during analysed period.

*Table 12*

**Environmental protection capital expenditures and operational costs structure, %**

| Type | capital expenditures | | | | operational costs | | | |
|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2008 | 2009 | 2010 | 2011 |
| Air protection | 39,6 | 41,9 | 41,3 | 39,3 | 16 | 12,9 | 12,7 | 12,3 |
| Water cleansing | 24,8 | 29 | 26,5 | 11,2 | 47,2 | 53,6 | 48,6 | 44,8 |
| Waste recycling | 11,3 | 13,2 | 17,2 | 18,4 | 27,4 | 24 | 25,1 | 32,1 |
| Land, water rehabilitation | 21,1 | 13,2 | 11,6 | 9,9 | 3,4 | 3 | 4,6 | 4,9 |
| Noise protection | 1,8 | 0,8 | 0,4 | 0,6 | 0,3 | 0 | 0 | 0,3 |
| Biodiversity | 0,9 | 1,1 | 0,7 | 0,2 | 2,1 | 2,4 | 2,3 | 2,7 |
| Nuclear security | 0,2 | 0,2 | 0,1 | 19,8 | 0,9 | 1,2 | 4,4 | 0,6 |
| R&D | 0,1 | 0,3 | 0,3 | 0,2 | 0,6 | 0,6 | 0,5 | 0,4 |
| Other | 0,2 | 0,3 | 1,9 | 0,4 | 2,1 | 2,3 | 1,8 | 1,9 |

*Source:* State Stastics Service of Ukraine 2011, P.524, 525.

*Table 13*

**Ecological payments in Ukraine in 2011, € mln.**

| Type of payment | ET liabilit-ites | Actual payments |
|---|---|---|
| Air pollution, incl.: | 1 438, 051 | 1 310,885 |
| stationary sources | 1 256, 380 | 1 138,347 |
| movable sources | 181, 671 | 172,538 |
| Water pollution | 60,344 | 59,223 |
| Landfill waste | 491,652 | 455,303 |
| **Ecological tax, total** | **1 990,047** | **1 825, 411** |
| *Penalties for environmental regulations violation* | *132,781* | *18,448* |

*Source*: State Stastics Service of Ukraine 2013.

*Table 14*

**Environmental protection facilities operation settlement**

| Facility type | 1990 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Water treatment station (ths $m^3$ per day) | 343 | 414 | 30 | 110 | 52 |
| - corporate | 159 | 4 | 4 | 47 | 6 |
| - public | 177 | 410 | 26 | 63 | 45 |
| Feedback water supply systems, ths $m^3$ of water/day | 379 | 2 | 1 | 14 | 16 |
| Gas collection facilities, ths $m^3$ per hour | 3710 | 0 | 184 | 500 | 2213 |
| 4. Waste and pollutants sterilization facilities, ths tones | 0 | 0 | 3 | 11 | 50 |

*Source:* State Stastics Service of Ukraine 2012, P.526.

As seen from the table 14, dispite the tax reform efforts the level of annual environmental protection facilities operation settlement is far lower than the basic level, requiring investment increase from 1,6 (for gas collection facilities) to 6,6 times (for water treatment stations).

**Conclusions.**

1. Severe external environment and economy in transition imposed Ukraine to start unprecedent reforms just aftermath of the global financial crisis. Ecological tax together with the 2011 Tax Code adoption started the process of irreversible shift from old soviet command-and-control model of environmental regulation towards modern and effective marked-based instruments.

2. Despite partial success in tax base broadening, statutory tax rates adoption to the European level and revenue rise, Ukraine now faces fiscal, institutional and security challenges for the "green tax" reform on the way to sustainable growth and well-being, that require immediate adequate fiscal policy measures.

3. Fiscal challenge poses the question of environmental taxes efficiency and completeness. Procyclical downward tax revenue feature, forced by the demand price shock adjustment re-

quire to uncover unleashed fiscal potential of energy and transport taxes, imposing instutitional and security challenges.

4. High income inequality, together with financially constrained demand and unreformed energy, transport and utilities markets pursue the shadow economy growth, high demand on "sin" goods and further environmental damages, that are of the national security matter. The liquidity deficit unables timely corporate sector capital and operational expences on environmental protection technologies, limiting supply of innovative green goods, making their price relatively high and inaccessible for common taxpayers.

5. Comparative analysis of the environmental tax revenue level in Ukraine and EU countries, together with tax rates and costs analysis allowed to conclude for further environmental tax reform outlook:

- energy and transport taxes are of unprecedentally high fiscal potential (100% and 60% rise respectively), thus requiring sectoral and public administration reforms to gain the public trust;
- tax rates hikes in 2011 (from 6 to 16 times instantly) didn't remove pollution externatilities, but significantly increased the environmental-friendly investments (30% and 227% for current and capital expenditures respectively by corporate sector). Their further increase claims creation of additional compensatory mechanisms for most vulnerable taxpayers (subsidies), together with goal-oriented fiscal incentives and additional fiscal instruments (greenhouse emission trading shemes, auctions) to corporate sector in order to meet the ambicious national environmental development strategy targets and reach the European average level of investment in ecological protection;
- environmental taxes' regulatory potential still remaines unobserved and unleashed, that require additional empirical research, based on success foreign coutnries' case studies and simulations analysis.

**Literature**


1. Acemoglu, Daron and Philippe Aghion, Leonardo Bursztyn, David Hemous. 2012. "The Environment and Directed Technical Change". *American Economic Review*, Vol. 102(1): 131-166.
2. Aghion, Philippe and Antoine Dechezleprêtre, David Hemous, Ralf Martin, John Van Reenen. 2012. "Carbon Taxes, Path Dependency and Directed Technical Change: Evidence from the Auto Industry". *NBER Working Paper*, 18596. – [Electronic resource]. – Access mode: http://www.nber.org/papers/w18596
3. Andersen M.S. and et. 2007. "Competitiveness Effects of Environmental Tax Reforms (COMETR). Final report to the European Commission" / M.S. Andersen, T. Barker, E Christie, P. Ekins, J.F. Gerald, J. Jilkova, S. Junankar, M. Landesmann, H. Pollitt, R. Salmons, S. Scott, S. Speck (eds.). – National Environmental Research institute, University of Aarhus. - [Electronic resource]. – Access mode: http://www.dmu.dk/Pub/COMETR_Final_Report.pdf
4. Annual Message. 2011. "Modernization of Ukraine – Our Strategic Choice: Annual Message of the President of Ukraine to Verkhovna Rada of Ukraine". 2011. Kyiv: The Administration of the President of Ukraine. (in Ukrainian).
5. Barker, Terry, and Johnatan Kohler. 1998. "Equity and Ecotax Reform in the EU: Achieving a 10 per cent Reduction in $CO_2$ Emissions Using Excise Duties". *Fiscal Studies*, Vol. 19, Iss. 4.: 375-402.
6. Bateman I. and J. Lamond. 2012. "Methods for valuing preferences for environmental and natural resources". Chapter in: *Solutions to Climate Change Challenges of the Built Environment*. – Oxford: Wiley-Blackwell, 2012.

7. Chiroleu-Assouline, Mireille and Mouez Fodha. 2012. “From Regressive Pollution Taxes to Progressive Environmental Tax Reforms”. *CES Working Paper*, 48. – [Electronic resource]. – Access mode: http://centredeconomiesorbonne.univ-paris1.fr/bandeau-haut/documents-de-travail/
8. Daubanes, Julien and Andre Grimaud. 2006. “On the North-South Effects of Environmental Policy: Rent Transfers, Relocation and Growth”. *Univeristy of Toulouse Working Papers*, 9.
9. Ekins, Paul. 1999. “European Environmental Taxes and Charges: Recent Experience, Issues and Trends”. *Ecological Economics*, 31: 39–62. – [Electronic resource]. – Access mode: www.elsevier.com/locate/ecolecon
10. European Comission. 2009a. Analysing the replies to the Green Paper on market-based instruments for environment and related policy purposes (SEC(2009)53 final).
11. European Comission. 2009b. “Green Paper on market-based instruments for environment and related policy purposes” (COM(2007) 140 final). Brussels: European Comission, 2009.
12. European Comission. 2011. “Energy, transport and environmental indicators”. Luxembourg: Publications Office of the European Union, 2011.
13. European Comission. 2012a. “Public finances in EMU – 2012”. *European Economy*, 4/2012.
14. European Comission. 2012b. “Tax reforms in EU Member States. Tax policy challenges for economic growth and fiscal sustainability”. 2012 report. 2012. *European Economy*, 6 (October).
15. European Environmental Agency (EEA). 2007. “Climate change: the cost of inaction and the cost of adaptation”. 2007. *EEA Technical report*, 13.
16. European Environmental Agency (EEA). 2008. “Effectiveness of environmental taxes and charges for managing sand, gravel and rock extraction in selected EU countries”. 2008. *EEA Report,* 2/2008.
17. European Environmental Agency (EEA). 2009. “Diverting waste from landfill - Effectiveness of waste-management policies in the European Union”. 2009. *EEA Report*, 7/2009.
18. European Environmental Agency (EEA). 2010. “Mapping the impacts of natural hazards and technological accidents in Europe - An overview of the last decade”. 2010. *EEA Technical Report*, 13.
19. European Environmental Agency (EEA). 2011a. “Environmental tax reform in Europe: impications for income distribution”. 2011. *European Envorinment Agency Technical Report*, 16.
20. European Environmental Agency (EEA). 2011b. “Environmental tax reform in Europe: opportunities for eco-innovation”. 2011. *EEA Technical Report*, 17.
21. European Environmental Agency (EEA). 2012. “Environmental indicator report 2012 — Ecosystem resilience and resource efficiency in a green economy in Europe”. Copenhagen: European Environment Agency, 2012.
22. Frai K. 2006. “Ecology of Energy Security – What is Important?” *Voprosy economiki,* 4: 104–113. (in Russian)
23. Fullerton, Don and Andrew Leicester, Stephen Smith. 2007. “Environmental Taxes. Mirrlees Review "Reforming the tax System for the 21st Century" Draft Paper. - [Electronic resource]. – Access mode: http://www.ifs.org.uk/mirrleesreview/
24. Fullerton, Don and Andrew Leicester, Stephen Smith D. 2008. “Environmental Taxes”. *NBER Working Paper*, 14197. – [Electronic resource]. – Access mode: http://www.nber.org/papers/w14197 .
25. Fullerton, Don. 1995. “Why Have Separate Environmental Taxes?” *NBER Working Paper,* 5380. – [Electronic resource]. – Access mode: http://www.nber.org/papers/w5380 .

26. Galashev A. 2006. “The Problems of Environmental Policy”. *Voprosy economiki,* 11: 111-117. (in Russian).
27. Garkushenko, Olena. 2008. “Kontseptualni zasady regulyuvannia navkolishnogo seredovishcha” [Conceptual Framework of Environmental Regulation] (monography). Donetsk: Institute of Industrial Economics. (in Ukrainian).
28. Gayer, Ted; and John K. Horowitz. 2006. “Market-based Approaches to Environmental Regulation”. *Foundation and Trends in Microeconomics,* Vol 1, no 13: 1–128.
29. Golosov, Mikhail and John Hassler, Per Krusell, Aleh Tsyvinski. 2011. “Optimal Taxes on Fossil Fuel in General Equilibrium”. *NBER Working Paper*, 17348. – [Electronic resource]. – Access mode: http://www.nber.org/papers/w17348
30. Harrington, Winston and Richard Morgenstern, Daniel Velez-Lopez. 2012. “Tools for assessing the costs and benefits of green growth: the U.S. and Mexico”. *The World Bank Policy Research Working Paper Series*, 6242.
31. Hassler, John and Per Krusell, Conny Olovsson. 2012. “Energy-Saving Technical Change”. *NBER Working Paper*, 18456. - [Electronic resource]. – Access mode: http://www.nber.org/papers/w18456
32. Hassler, John and Per Krusell. 2012. “Economics and Climate Change: Integrated Assessment in a Multi-Region World”. *NBER Working Paper*, 17757. - [Electronic resource]. – Access mode: http://www.nber.org/papers/w17757
33. Hassler, John; Per Krusell, Conny Olovsson. 2010. “Oil Monopoly and the Climate”. *American Economic Review: Papers and Proceedings*, Vol. 100, Iss. 2.: 460-464.
34. Heine, Dirk and John Norregaard; Ian W.H. Parry, D. Heine. 2012. “Environmental Tax Reform: Principles from Theory and Practice to Date”. *IMF Working Paper*, 180/12.
35. Horowitz, John Keith. 1996. “Environmental policy under a non-market discount rate”. *Ecological Economics,* Vol. 16, Iss.1.: 73-78.
36. Horowitz, John Keith. 2009. “The Income–Temperature Relationship in a Cross-Section of Countries and its Implications for Predicting the Effects of Global Warming”. *Environmental and Resource Economics*, Vol. 44, Iss. 4.: 475-493.
37. IMF. 2008. “The Fiscal Implications of Climate Change”. Washington, D.C.: International Monetary Fund.
38. Kahn, Matthew, and Matthew J. Kotchen. 2010. “Environmental Concern and the Business Cycle: The Chilling Effect of Recession”. *NBER Working Paper*, 16241. – [Electronic resource]. – Access mode: http://www.nber.org/papers/w16241
39. Kosonen, Katri. 2012. Progessivity of Environmental Taxation: Myth or Reality? *European Comission Directorate-General for Taxation and Customs Union Working Paper*, 32/2012. - [Electronic resource]. – Access mode: http://ec.europa.eu/taxation_customs/taxation/index_en.htm.
40. Kubursi, Atif; and Benoit Laplante. 2012. “The environment and the economy: From sustainability to green growth”. *Economic Research Forum Working Paper*, 722.
41. Law of Ukraine “On Enviromental Protection”No 1264-XII, June 25th, 1991. (in Ukrainian).
42. Ligthart, Jenny E. 1998. “Optimal Fiscal Policy and the Environment”. *IMF Working Paper*, 98/98.
43. Linnanen, Lassi; and Päivi Luoma, Hanna-Leena Pesonen. 2002. “Ecological tax reform—a value chain level approach”. *Business Strategy and the Environment,* Vol. 11, Iss.3.: 170–180.
44. Metcalf, Gilbert E. 2005. “Tax Reform and Environmental Taxation”. *Tuffts University Department of Economics Working Paper Series,* 519.
45. Miguel, Carlos de and Baltasar Manzano. 2011. “Gradual Green Tax Reforms”. *Universidad de Vigo and Economics for Energy Working Papers*, 4.

46. National Institute for Strategic Research of Ukraine (NISR). 2012. "Monitoring and Assessment of Environmental Risks. Analytical Report". Kyiv: 2012. (in Ukrainian).
47. OECD. 2010. "Taxation, innovation and the environment". Paris: Organization for economic cooperation and development. - [Electronic resource]. – Access mode: www.sourceoecd.org/taxation/9789264087620
48. On the approvement of National Actions Plan for Environmental Protection in Ukraine 2011-2015. The Decree of Cabinet of Ministers of Ukraine № 577-p, May 25th 2011 (in Ukrainian).
49. Oral, Isil and Indhira Santos, Fan Zhang. 2012. "Climate change policies and employment in Eastern Europe and Central Asia". *The World Bank Policy Research Working Paper Series,* 6294.
50. Program of Economic Reforms 2010-2014 "Wealthy society, competitive economy, effective state". 2010. Kyiv, The Administration of the President of Ukraine. (in Ukrainian).
51. Quiggin, John C. and John K. Horowitz. 2003. "Costs of adjustment to climate change". *Australian Journal of Agricultural and Resource Economics*, Vol. 47, Iss. 4.
52. Reshetnikova, Elena. 2011. "Methodological Approaches for Environmental Taxes Design with a Glance at Influence of Environment Contamination on Human Health". *The Proceedings of Irkutsk State Economic Academy,* 5: 11-17. (in Russian)
53. Salnykov, Mihail I. and Valentin P. Zelenyuk. 2005. "Estimation of environmental efficiencies of economies and shadow prices of pollutants in countries in transition". Moscow: EERC.
54. Skaletskiy U. 2011. "Vid zahodiv ekologichnogo zahistu do ekologichnoi polityki: shlyahy ta problemy". [From Environmental Protection Actions to Environmental Policy in Ukraine: Ways and Problems]. V. Potapenko, A. Kachynsky, U. Skaletskiy. Kyiv, National Institute for Strategic Research. (in Ukrainian).
55. Strategy 2020. Law of Ukraine «On Basic Concepts (Strategy) of State Environmental Policy in Ukraine for the period by 2020 // [Electronic resource]. – Access mode: http://zakon1.rada.gov.ua/laws/show/2818-17/ (in Ukrainian).
56. Stern. 2007. "Stern Review: The Economics of Climate Change" // [Electronic resource]. – Access mode: http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/stern_review_report.htm
57. Toman, Michael. 2002. "The Role of the Environment and Natural Resources in Economic Growth Analysis". *Resources for the Future Discussion Paper*, 71.
58. Yakovlev, Y. 2011. "Otsinka regional'nyh ecologo-tehnogennyh zagroz dlya natsional'noi bezpeky Ukrainy" [Evaluation of Regional Enviromental and Antropogenic Threats for National Security of Ukraine]. Y. Yakovlev, Yu. Skaletskiy, S. Ivanuta, L. Yakushenko. Kyiv, National Institute for Strategic Research. (in Ukrainian).
59. Yesina, E. 2009. "Environmental Taxes and Payments as the Element of Environemntal Security Financial Mechanism in Russian Federation". *Financial Research,* 22: 45-52. (in Russian)
60. Vesseli, R. 2011. "Environmental Taxation: the Framework for Russia". *Tax Policy and Practice,* 12: 40-43. (in Russian)
61. Vyshnevskiy, V. 2011. "Nalogovaya politika: metodologiya, teoriya i praktika: monografiya." [Tax Policy: methodology, theory and practice: monography]. Donetsk: National Academy of Science, Institute of Industrial Economics. (in Russian).
62. Weitzman, Martin A. 2007. "Review of The Stern Review on the Economics of Climate Change". *Journal of Economic Literature*, XLV: 703–724.
63. State Stastics Service of Ukraine 2011. Ukraine 2010. Statistical Digest. 2011. Kyiv, State Statistics Service of Ukraine. (in Ukrainian).

64. State Stastics Service of Ukraine 2012. Statistical Yearbook of Ukraine 2011. 2012. Kyiv, State Statistics Service of Ukraine. (in Ukrainian).
65. State Stastics Service of Ukraine 2012b. Ukraine 2011. Statistical Digest. 2012. Kyiv, State Statistics Service of Ukraine. (in Ukrainian).
66. State Statistics Service of Ukraine. 2013. Environmental Statistics. Operational data. // [Electronic resource]. – Access mode: http://ukrstat.org/uk/operativ/operativ2009/ns_rik/ns_u/dvsr_u2008.html; http://ukrstat.org/uk/operativ/operativ2006/ns_rik/ns_u/opap_u2005.html (in Ukrainian).