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Analysis and evaluation of capital expenditures on environmental protection in Poland

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Rutkowska-Podołowska M., Węglarz M. **Analysis and evaluation of capital expenditures on environmental protection in Poland**

Now, in the era of increasing environmental problems growing importance of sustainable development, which is the only route to achieving economic growth. The ultimate goal of environmental policy is to achieve and maintain good environmental status. That is why it is so important for economic development are capital investment in environmental protection. Now, in the face of the increasing number of investments in environmental protection an important role allocated to them spending.The article presents a brief description of investment expenditures. The aim of the paper is to analyze expenditure on investments for environment protection in Poland in the years 2010-2014, to evaluate the effects of expenditures that were made. In the article statistical data were analyzed for the period 2010-2014; in terms of the structure of investment in environmental protection. The total expenditures have been growing for the years, but the structure of investments has been changed, some expenditure is growing (e.g. Protection of air and climate) and others are decreasing (eg. wastewater management and water protection). The areas of analysis were wastewater and protection of water, air and climate, waste management and investments in Poland, according to sources of financing. In the next part of this paper, the evaluation of the investment for environmental protection was carried out. Evaluation of investments was made based on the results achieved in the field of wastewater management and water protection, and protection of air and climate. The results of the research were presented in conclusions.

Key words: region, investments, environmental protection, investment expenditure

Introduction

Recent developments of the last century, which took place in Poland, such as: the transformation of the system, the inclusion of Polish in the European Union, and the need to meet European ecological standards and at the same time promoting the concept of sustainability meant that special significance took the implementation of environmental investments. In the face of ever-increasing economic development and the increasing number of investments in environmental protection, the outlays allocated to them play an important role. One of the main problems of the theory of the economics of environmental and economic policy issues, in particular environmental policy is to assess the amount of necessary expenditures for environmental investment [1, p. 152]. Discussion and analysis in the field of investment will be a contribution to science.
The aim of the study is to analyze investment in environmental protection in Poland in the years 2010-2014. The methodology used in the study was based on the analysis of the available literature, and on analysis of the statistical data. It uses quantitative data mainly from public statistics system, taken from: Statistical Yearbook of the Central Statistical Office, Environmental Information and labor statistics. The statistical analysis used data for the period 2010-2014, and for comparison the effects of investment data for the years 2000 and 2005.

The essence of investment

The ultimate goal of environmental policy is to achieve and maintain good environmental status. It is therefore essential for economic development to invest capital in environmental protection. In the literature there are many definitions of the concept of investment. Not analyzing them deeper, the most important of them were presented in the paper. According to the Central Statistical Offices (CSO), the investment should be understood as such 'financial expenditure which aims to create the new fixed assets or the improvement (rebuilding, enlargement, reconstruction, adaptation or modernization) of existing capital asset items, as well as expenditures on so-called initial investments' [7]. Capital expenditures are therefore costs incurred for the completion of the investment. Capital expenditures on environmental protection are divided into fixed investment and other expenditures [3, p. 424]. Expenditures for environmental protection are only additional possible to identify expenditures that are used to protect the environment, reduce pollution or repair environmental damage, the expenses incurred for the project, which can advantageously affect the environment, but their primary purpose is not to protect environment are not included in the listed investment group [further in: 2, p. 1 and next].

Capital expenditure for environmental protection in Poland in 2010-2014

In Poland in the last five years capital expenditures allocated for environmental protection have changed slightly (Table 1). The size of expenditures on fixed assets for environmental protection in particular years is higher than 10 billion PLN. In 2010-2011 there was a significant growth in expenditures to over 12 billion PLN, in subsequent years; there has been a decrease in capital expenditure, which was a consequence of the global crisis. In 2014 in

comparison to previous year there was a significant increase in expenditures of 31.3 percent, reaching 14.2 billion PLN.

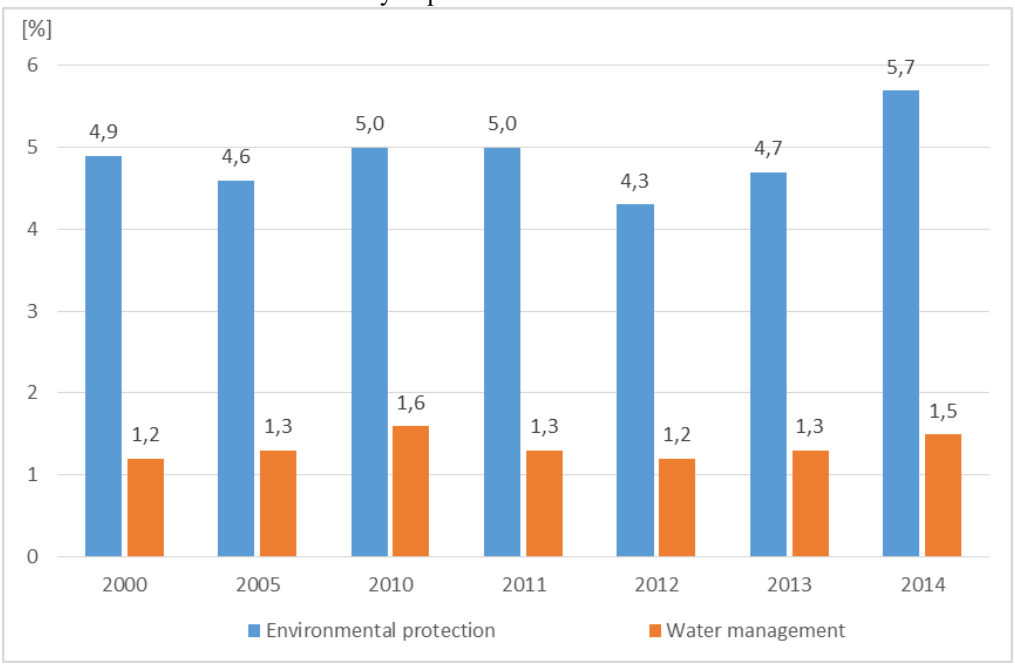
Table 1. Capital expenditures for environmental protection in 2010-2014

Specification	Year				
	2010	2011	2012	2013	2014
Total (in million PLN –current prices)	**10926,2**	**12158,2**	**10127,8**	**10851,2**	**14248,5**
Wastewater management and water protection	7206,1	6753,2	5656,7	5631,7	6304,4
Protection of air and climate	2219,4	3134,5	2319,5	2598,7	4558,4
Waste management, protection of soil, groundwater and surface water	989,4	1167,8	930,2	1408,9	2038,1
Protection of biodiversity and landscape	27,4	437,9	200,6	152,6	83,9
Noise and vibration reduction	141,6	284,0	513,8	409,5	555,3
Protection against ionising radiation	0,4	0,2	-	-	-
Others	342,0	380,6	507,0	649,8	708,4

Source: Own study based on [4, p. 400; 6, p. 382]

Since 2000, total capital expenditure on fixed assets for environmental protection has been leveled at 0.6-0.8 percent in relation to GDP. However, the total expenditures reached the highest value of 0.83 percent in 2014. In the case of water management expenditures on fixed assets, they were at the level of 0.2 percent in relation to GDP, but the biggest share of water management expenditures was reached in 2010[1] and its value was 0.25 percent [4, p. 400; 6, p. 382].

Fig. 1. The share of expenditures on fixed assets for environmental protection and water management in the investments in the national economy in percent



Source: Own study based on [4, p. 400; 6, p. 382].

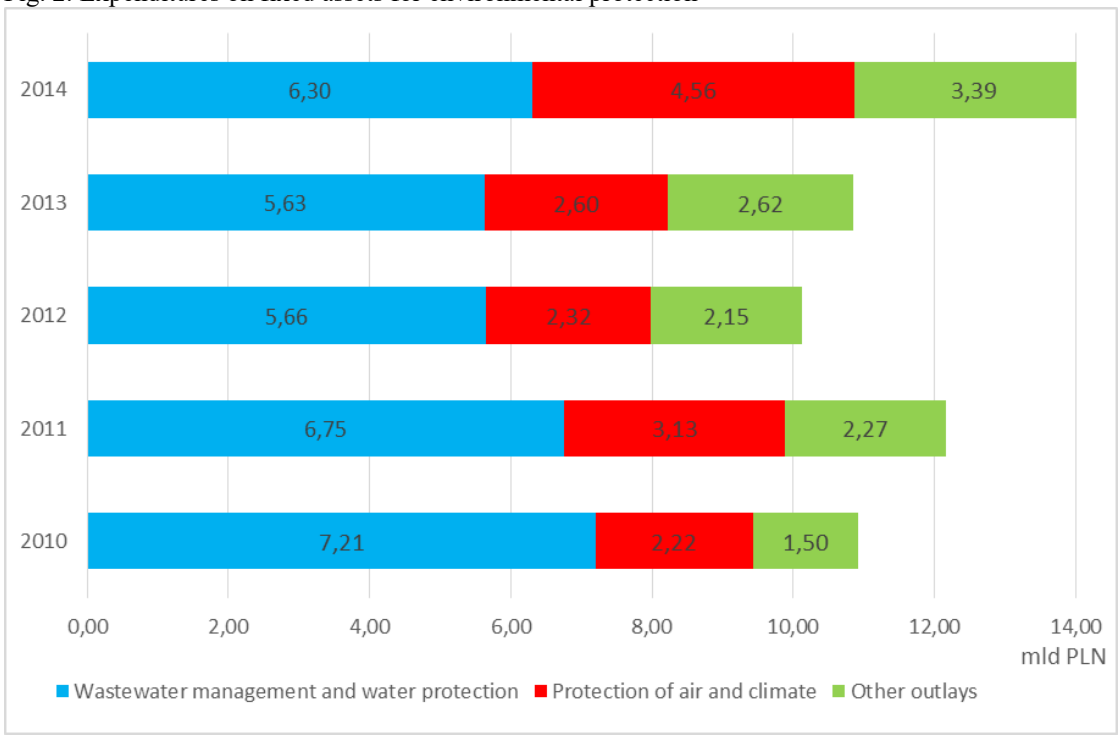
Over the last several years (since 2000), the share of expenditures on fixed assets for environmental protection and water management in the total investments in the national economy was at about 5 percent for the protection of the environment and slightly above 1 percent in the case of water management. Detailed percentages were shown in Figure 1, based on data form Central Statistical Office (CSO).

The growth of expenditures for environmental investments has been observed in Poland since 2010. The largest expenditures on fixed assets have been taken on wastewater management and water protection. In comparison with 2010 we can observe expenditures decreasing by 13 percent in favor of increasing expenditures for protection of air

[1] Data from years 2005, 2010, 2011, 2012 i 2013 was calculated according ESA 2010.

and climate (see Figure 2.) and waste management (see Figure 3). Capital expenditures for the protection of air and climate increased in comparison with 2000 by 105 percent.

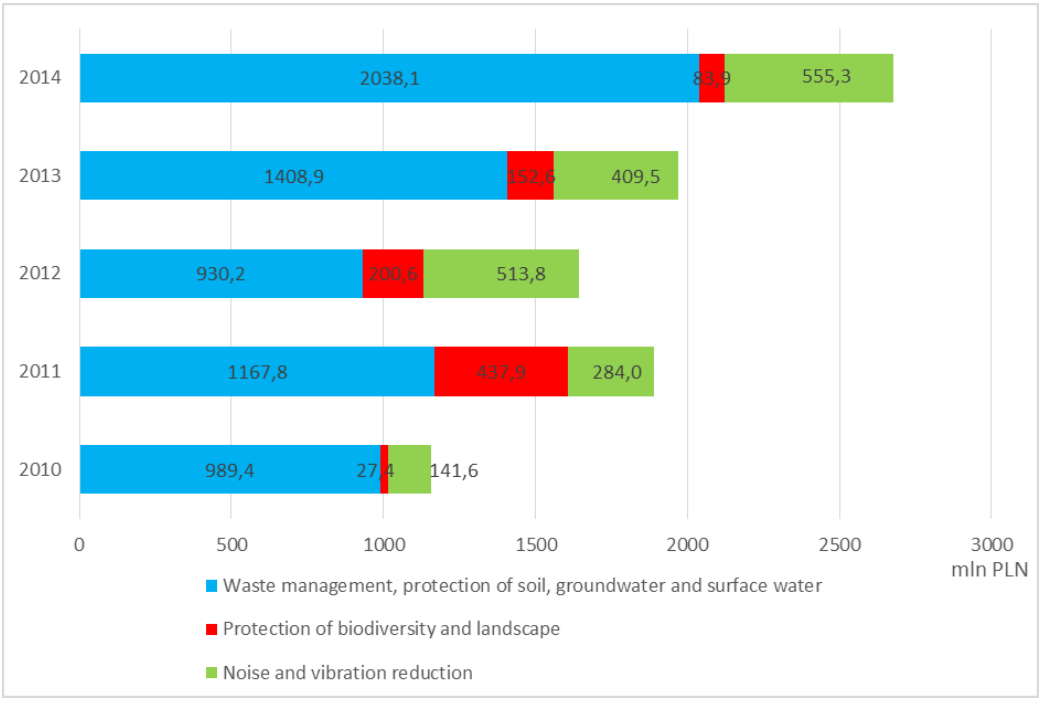
Fig. 2. Expenditures on fixed assets for environmental protection



Source: Own study based on [4, p. 400; 6, p. 382].

Moreover, the investment in waste management, protection of soil and groundwater and surface water increased significantly by 106 percent, compared to year 2000. A significant increase in expenditures allocated to the waste management was observed in 2014, expenditures compared with previous year increased by 44 percent. Since 2010, it has been observed that the share of investment on other areas of the environment was negligible and ranged from PLN 1.5 billion to PLN 2.6 billion (see Figure 2). Only in the last year we can observe a significant increase in expenditures by 21 percent. In the last three years the reduction of noise and vibration had the largest share in other areas of environmental protection (see Figure 3). Expenditures on this kind of activity are at the level of 500 million PLN. In contrast, expenditure on the protection of biodiversity and landscape have been very differentiated in years, the largest value was in 2011 and amounted to 438 million PLN, but in 2014 the value amounted only to 84 million PLN.

Fig. 3. Expenditure on fixed assets for environmental protection in selected areas



Source: Own study based on [4, p. 400; 6, p. 382].

Expenditures on environmental investments by source of financing

In Poland, the investments are financed from domestic sources which are the primary source of financing investment in environmental protection on one hand, and foreign sources on the other. Domestic sources of financing investment in environmental protection are divided into: budget and private funds. Among the funds from the state budget we distinguish: funds of central and local government, and among the private funds we distinguish: investors own funds, credits and loans and funds for environmental protection. The most important national sources are domestic credits and loans, ecological funds, the state budget and local budgets.
The share of the state budget in financing environmental projects (Table 2) increased up to 2011, but in 2012 decreased by 0.6 percent, in 2013 by 2.7 percent and in 2014 by more than 4 percent finally, reaching the level of co-financing from 2010. The share of capital expenditures on environmental protection by the local government was at the same level.

Table 2. Expenditures on fixed assets for environmental protection by sources of financing in Poland

Specification	2010	2011	2012	2013	2014
Total	**10926,2**	**12158,2**	**10127,8**	**10851,2**	**14248,5**
	[%]				
Own funds	44,15	47,67	47,95	50,58	50,66
of which gmina funds	16,70	13,92	12,35	11,64	9,46
Funds from the state budget	0,79	8,20	7,61	4,91	0,86
from voivodship budgets	1,17	0,41	0,69	0,61	0,35
from powiat budgets	0,43	0,31	0,36	0,12	0,15
from gmina budgets (share)	1,23	1,30	1,17	1,41	0,87
Funds from abroad	22,08	18,49	20,82	22,13	19,19
Ecological funds (loans, credits and grants)	13,88	12,70	13,94	12,47	15,86
Domestic credits and loans, including bank credits and loans	13,81	7,04	6,13	6,41	9,21
Other funds, including non-financed expenditures	2,45	3,87	1,32	1,37	2,86

Source: Own study based on [4, p. 402; 6, p.384].

Own funds of enterprises used to finance environmental investments account for almost half of all funds (within the range 44.2-50.6 percent.). It should also be stressed that currently loans play a minor role in financing investment in environmental protection and rank in the range of 6.1-9.2 percent. What's more, compared to 2010, their share in 2014 decreased significantly, by as much as 4.6 percent. Ecological funds play an important role in financing environmental investments, their share is in the range 12.5-15.9 percent. Foreign funds also play an important role in financing, their share is at approx. 20 percent. In different years the share varied from 18.5 to 22.1 percent. Among foreign funds we should mention first of all EU funds and other foreign resources. What is important, a growing trend of financing environmental protection is being observed in these measures points. It should be understood as primarily a consequence of the financial assistance that Poland obtains mainly from the structural funds and the Cohesion Fund.
Table 3 shows the structure of expenditure on fixed assets in environmental protection by groups of investors. The key group are enterprises whose expenditures have been gradually increasing, in 2014 almost reached the level of 70 percent. The second group is the municipalities (communes), unfortunately they share in expenditures systematically decreased from 41 percent in 2010 to 23 percent in 2014. This is a decrease of as much as 18 percent. The share of budgetary units increased to 2012 and now dropped to 7 percent.

Table 3. Expenditures on fixed assets for environmental protection by groups of investors in Poland

Specification	2010	2011	2012	2013	2014
Enterprises	55,70	51,84	55,62	60,60	69,57
Gminas	41,05	37,44	31,86	28,53	23,26
Budgetary units	3,25	10,72	12,52	10,87	7,17

Source: Own study based on [4, p. 402; 6, p.384].

Evaluation of investment in environmental protection

Evaluation of investments was made based on the results achieved in the field of wastewater management and water protection, and protection of air and climate. In the field of wastewater management we evaluated the number of sewage treatment plants servicing cities and villages (Table 4) and basic data on cities and villages served by water supply, sewerage and sewage treatment plants (Table 5). In the area of water protection we evaluated the quality of water delivered to residents (Figure 4). In terms of air protection there was evaluated total emissions of major air pollutants (Table 6) and emissions from the road transport (Figure 5).
The total number of wastewater treatment plants is systematically increasing, although in 2014 we can observe decline in growth of the number of sewage treatment. This is due to the fact that almost 94 percent the urban population is served by sewage treatment plants. It is also preferable that the number of mechanical wastewater treatment plants is reduced in favor of biological wastewater treatment plants and wastewater treatment plants with increased biogenes removal.

Table 4. Wastewater treatment plants servicing cities and villages

	Total	Cities				Villages			
		total	Mecha-nical	Biolo-gical	with increased biogene removal	total	Mecha-nical	Biolo-gical	with increased biogene removal
2000	2475	965	53	656	256	1510	86	1254	170
2005	2993	949	17	546	386	2044	71	1624	349
2010	3196	855	7	452	396	2341	53	1863	425
2011	3223	822	5	427	390	2401	53	1902	446
2012	3278	808	5	417	386	2470	54	1972	444
2013	3344	794	1	405	388	2550	42	2066	442
2014	3361	787	1	399	387	2574	25	2107	442

Source: Own study based on [4, p. 196; 6, p.189].

The number of cities served by water supply, sewerage and sewage treatment plants has increased from 880 in 2010 to 913 in 2014. The population of cities benefiting from above networks is steadily increasing, and in 2014 for the sewerage network, amounted to 20.7 million people, while the sewerage system in rural areas servicing 15.3 million people. Much better indicators of the number of people using the sewage network and wastewater treatment plant are achieved in urban areas than rural areas where these indicators in 2014 reached respectively a level of 89.3 percent and 93.9 percent. While the corresponding figures for rural areas in 2014 amounted to 37.4 percent in both cases [4, p. 207; 6, p.200].

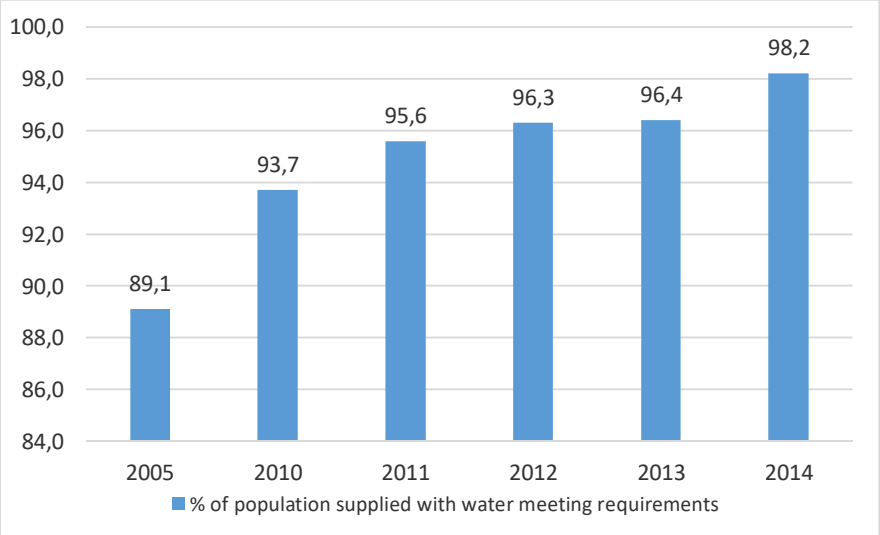
Table 5. Cities and villages served by sewage network and wastewater treatment plants.

	Cities		Villages			
	served by		Length of the main sewage network in km	Connections leading to residential buildings in thous.	Wastewater treatment plants	
	sevage network	Wastewater treatment plants			total	of which with increased biogen removal
2000	845	801	16222	259,4	1452	1353
2005	881	857	36821	598,0	2044	1973
2010	898	873	55566	906,3	2341	2288
2011	905	901	63551	1015,5	2401	2348
2012	906	903	69785	1102,9	2470	2416
2013	906	904	75290	1182,2	2550	2508
2014	911	910	81367	1279,0	2574	2549

Source: Own study based on [4, p. 207; 6, p.200].

The length of the sewage network in 2014 in rural areas in comparison with 2000 has increased fivefold and the connection leading to the buildings has increased six fold. Such significant growth of connections was translated into a three-fold increase in the number of people using the sewage system. Water quality in facilities inspected by the Ministry of Health has significantly improved. In 2005, in less than 81 percent audited objects, the quality of water met requirements. In 2014, this ratio reached 98 percent. The corresponding values for the number of people have been shown in Figure 4. The values in the figure indicate what percentage of the population receives water that meets quality requirements. In 2014, 1.8 percent of the population receives water of poor quality.

Fig. 4. Quality of water supplied to population for consumption



Source: Own study based on [4, p. 208; 6, p.203].

In case of protection of air, key issue is the emission of pollutants and greenhouse gases. The data presented in Table 6 shows that the smallest effect was achieved in terms of reducing carbon dioxide and carbon monoxide and particulates. Compared to 2000, in 2014 there was an increase in carbon dioxide emissions by 1.1 percent and carbon monoxide emissions by 8.3 percent. In contrast, there was a large reduction in sulphur dioxide emissions by as much as 41.6 percent. Emissions of nitrogen oxides in the same period were reduced by 5.5 percent and the particulates was reduced by 8.3 percent.

Table 6. Total emission of main air pollutants in Poland

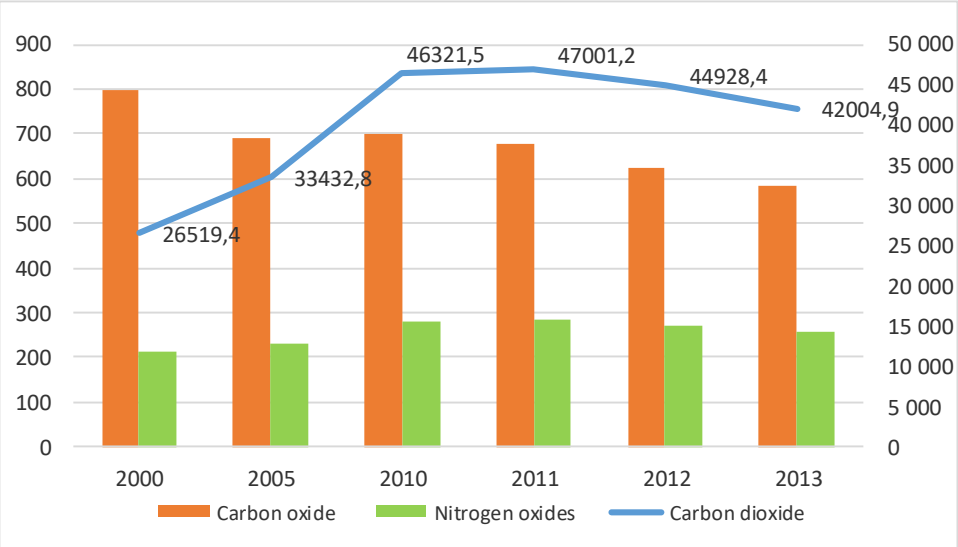
	2000	2005	2010	2011	2012	2013
	in thousand tonnes					
Sulphur dioxide	1451	1217	937	910	853	847
Nitrogen oxides	844	851	861	851	817	798
Carbon dioxide	319 483	323 586	336 695	330 309	320 862	322 900
Carbon oxide	2655	2754	3019	2916	2818	2876

Volatile non-methane organic compounds	865	870	937	938	913	919
Ammonia	284	272	271	270	263	263
Particulates	444	471	449	414	428	407

Source: Own study based on [4, p. 228; 5, p. 229; 6, p.221].

The main source of sulphur dioxide emissions is a commercial and industrial power and precisely sulphur dioxide is released mainly in the combustion processes in the production and transformation of energy and combustion processes in industry and outside the industry (households). Nitrogen oxides are mainly emitted during the combustion processes in the production and transformation of energy and during road transport. The biggest source of carbon emissions are households (57.3 percent) and road transport and combustion processes in the industry. The similar situation take place in case of particulates emission [6, p. 222]. The main source of carbon emissions is the energy or fuel combustion and emission of volatile fuels. In this area, the most serious dioxide source of emission is the energy industry (56 percent) and transport (14.3 percent) [6, p. 224].

Fig. 5. Pollutants emission from road transport facilities in thousand tones



Source: Own study based on [4, p. 234; 6, p.227].

The emission of the main pollutants from the road transport is shown in Figure 5. The left axis indicates the emission of carbon monoxide and nitrogen oxides while at the right- marked carbon dioxide. The reducing of pollutants emissions from road transport is not effective. The slight decrease in carbon dioxide emissions took place in years 2010-2013, but there was not reached the emission level of 2005. The development of the Polish economy is strongly correlated with the intensity of road transport what is not beneficial to the environment.

Conclusions

The results presented in this article have shown changes in investment expenditures in 2010-2014. They show that over the analyzed years, investment in environmental protection underwent varying tendencies. The most important are investments in environmental protection are mainly used for wastewater management and water conservation. It noted also should be noted that in the analyzed period, investment in waste management, protection of soil and groundwater and surface achieve higher growth.

The empirical studies presented in this article have shown changes in investment expenditures in 2010-2014. They show that over the analyzed years, investment in environmental protection underwent varying tendencies. The most important are an investment in environmental protection is mainly used for wastewater management and water conservation. It noted also should be noted that in the analyzed period, investment in waste management, protection of soil and groundwater and surface achieve higher growth. Based on the analysis of the structure of sources of financing environmental investments in the period states that the most important source of financing of innovative activity were own funds of industrial enterprises. Oscillate in the range of approx. 44-51 percent. Quite important is the share of funds coming from abroad and from environmental funds, while the least important are the funds from the central budget (0.12-0.43 percent). However, it is important that there is a real possibility of obtaining capital that funds coming from abroad and from environmental funds, as well as (to a lesser extent) from domestic credits and loans.

Improving the quality of the natural environment, reducing its pollution is one of the main tasks undertaken for environmental projects. On the basis of the obtained results we can say that better results were achieved in the field of wastewater management and water protection than in the field of the protection of air and climate. The smallest effects was achieved in terms of reducing carbon dioxide and carbon monoxide and particulates. In year 2014, emission of carbon monoxide and particulates is higher than in 2000, and the main sources of emission is road transport and households. In the case of carbon dioxide, the main source of emission is energy, it is fuel combustion, and in this area the most serious source of emission is energy industry and transport.

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Рутковска-Подоловска М., Венглларз М.

, АНАЛИЗ И ОЦЕНКА КАПИТАЛЬНЫЕ ЗАТРАТЫ НА ОХРАНУ ОКРУЖАЮЩЕЙ СРЕДЫ В ПОЛЬШЕ

Резюме

В настоящее время, во времена нарастающих экологических проблем, всё большее значение имеет равномерное развитие, которое является единственным способом достижения экономического роста. Главной целью экологической политики является достижение и поддержание хорошего состояния окружающей среды. Именно поэтому столь важными для экономического развития являются инвестиционные вложения в охрану окружающей среды. Теперь, в лице растущего числа инвестиций в охране окружающей среды, необыкновенно важную роль играют предназначенные на нее расходы. В статье представлена их краткая характеристика, а затем проанализирована их величина в последующих годах, таких как 2010-2014. Работа состоит одинаково как из теоретической части, так и эмпирической.

Целью данной работы является, с одной стороны анализ инвестиционных расходов на охрану окружающей среды в Польше в 2010-2014 годах, с другой стороны оценка последствий расходов, которые были произведены.

В статье были использованы в основном данные из системы публичной статистики, прежде всего из: Статистического Ежигодника ЦСУ (Центрального Статистического Управления), Информации по Охране Окружающей Среды и Статистических Работ. В статистическом анализе использованы количественные данные, измерянные в период 2010-2014, с точки зрения структуры инвестиций в сфере охраны окружающей среды, также для сравнения инвестиционных эффектов были учтены статистические данные за 2000 и 2005 года. Результаты исследований представлены в виде таблиц и рисунков.

В первой части работы было обсуждено сущность инвестиционных расходов и указано на их важность. Принято, что для данной статьи через инвестиционные расходы следует понимать расходы, понесенные на реализацию инвестиций. Расходы на охрану окружающей среды, такие как расходы в долгосрочные активы и другие, являются лишь дополнительными, возможными до идентификации, которые предназначены для защиты окружающей среды, уменьшения загрязнения окружающей среды или

предотвращения вреда окружающей среде, при этом расходы, понесенные в рамках проекта, могут с пользой влиять на окружающую среду, но их основной целью не является защита окружающей среды которая не включена до перечисленных груп инвестиционных расходов. В следующей части работы проанализирован объем инвестиционных расходов предназначенных на охрану окружающей среды в выбраных годах по отношению к ВВП. Затем указано на то, что на протяжении нескольких лет общие расходы растут, при этом инвестиционная структура была изменена. Анализировались различные группы, такие как управление водными ресурсами, управление отходами, защита почвы и грунтовых вод, защита поверхностных вод. В следующей части этой статьи, была рассмотрена доля расходов на природоохранные инвестиции согласно источникам финансирования. Было подчеркнуто, что некоторые из расходов растут (например, защита воздуха и климата), в то время как другие снижаются, например, управление сточными водами и охрана водных ресурсов. Более того, анализированными областями были водостоки и охрана воды, воздуха и климата, управление отходами, также инвестиции в Польше, согласно источникам финансирования. В последней части даных исследований была проведена оценка использованых инвестиций для защиты окружающей среды, которая возникла на основе результатов, достигнутых в сфере управления сточных вод, защиты воды и воздуха, а также защиты климата. Кроме того, в работе также указано на источник эмиссии, такие как:

• диоксид серы - указано, что диоксид серы выделяется в основном в процессах сгорания в области производства и трансформации энергии, а также в процессах сгорания в промышленности и за её приделами,

• оксиды азота - в основном, выделяются в процессах сгорания в области производства и трансформации энергии, а также во время автомобильных перевозок,

• оксиды углерода - их главными источникам являются домашнее хозяйство, автомобильный транспорт и процессы сгорания в промышленности,

• пыль - главным источником выбросов углекислого газа является энергия.

Кроме того подчеркнуто, что в Польше, в исследуемом периоде, наблюдается незначительное увеличение финансирования инвестиций, при этом от 2010 года наблюдается увеличение финансирования на природоохранные инвестиции. Найбольшая группа состяла из доли инвестиционных расходов на управление сточными водами и охраны водных ресурсов. В Польше, инвестиционные расходы бывают, с одной стороны, финансируемые за счет внутренних источников средства: бюджетые, например средства центральных и местных органов власти и частного сектора, как: собственные средства инвесторов, кредиты и займы, а также фонды охраны окружающей среды, которые являются основным источником финансирования инвестиции в охрану окружающей среды и иностранных источников, с другой стороны. В окончании констатировано, что продемонстрированные в данной статье эмпирические исследования показали изменения, которые происходили в инвестиционных затратах в 2010-2014 годах. Подчеркнуто, что очень важную роль исполняют природоохранные инвестиции. Указано на главные источники финансирования инвестиций в охране окружающей среды, обращенно внимание на их особенную роль. Больше того, подчеркнуто, что в исследуемом периоде самым существенным источником финансирования инновационной деятельности были собственные средства промышленных предприятий. Система финансирования охраны окружающей среды является составляющей экологической политики, целью которой есть предоставление средств, необходимых для реализации и соблюдения принципов длительного развития. Исходя из того, что окружающая среда является национальным достоянием, её состоянием должны быть заинтересованы все участники процесса упревления хозяйством.

Ключевые слова: регион , инвестиции, охрана окружающей среды, инвестиционные расходы

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