



The impact of the implementation of selected EU water directives on households' sustainable consumption in Poland

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Abstract

The paper presents a prognosis of the consequences for Polish households as a result of the transposition and implementation of two EU directives: on urban wastewater treatment (91/271/EEC) and on the quality of drinking water (98/83/EC). The existing estimates of implementation costs for the analyzed directives were used to estimate this impact. The analysis of average water consumption per capita in Polish households in the period 1990-1999 was conducted. In the next step the analysis of the current burden on households due to water and wastewater charges was carried out. Next, using the prognosis of increase in real incomes of the population and demand reactions for price changes as well as the estimates of financial resources indispensable for implementation of the directives, the necessary increase of prices for water provision, receipt and treatment of wastewater were estimated. This information allowed the estimation of new burdens for household budgets. The direct and indirect influence of the implementation of the directives on households' sustainable consumption was analyzed.

1 Introduction

Polish aspiration for European Union membership has imposed a huge challenge on the country, that is, the challenge of meeting the requirements of the EU law, including environmental protection directives. It can be expected that the Polish accession process and implementation of the EU directives will allow the economy to enter the sustainable development path. The goal of this paper is to



present the influence of the process of integration of Poland with the EU on domestic water consumption. The purpose was reached through conducting the calculations aimed at the estimation of the consequences related to the implementation of the directives on urban wastewater treatment (91/271/EEC) and of the directive on the quality of drinking water (98/83/EC) for the condition of household budgets in Poland. The level of burden imposed on these households constitutes a significant indicator describing the capability of implementation of the analyzed directives, and precisely, indicating the minimum amount of time necessary for the implementation of the requirements of these regulations. The final indicator of the burden on household budgets will depend not only on time devoted to the implementation of the analyzed directives, but also on the scale of financial aid granted by the EU within the framework of pre-accession, and later – structural funds. Therefore, the calculations presented here can create a good platform for discussion on justification of transitional periods that Poland is applying for, and of the amount of the expected financial aid within the context of social acceptability.

2 The costs of implementation of the directives: on urban wastewater treatment and on the quality of drinking water

The total financial burden related to the necessity of implementation of the requirements related to the directive 91/271/EC was a topic of several research projects (performed among others within the framework of the DISAE project and of the World Bank project). As a result, currently it is considered that the costs of compliance with this directive are assessed in a relatively precise and definite manner. The best available estimates have been included in the document [7].

Table 1: Financial burdens resulting from implementation of the requirements of the directive 91/271/EC on urban wastewater treatment, billion EURO

	Investment outlays	Annualized investment outlays	Operation and Maintenance costs	Total annualized costs
Wastewater treatment plants	2,80	0,39	0,29	0,68
Sewer systems	6,30	0,84	0,08	0,92
Total	9,10	1,22	0,37	1,60

Among the presented figures, the most significant is the total annualized cost representing the actual annual financial burden, which results from implemented investments. This amount will have to be generated as amounts paid by the users in the form of additional fees for water and sewerage services. Due to the fact that these calculations are related exclusively to municipal users (not taking into account industrial loads discharged to the sewer systems), this value reflects well



hypothetical future burdens. However during the further analysis the following factors should be taken into account:

1. Full compliance with the requirements of the directive 91/271/EC is planned to be achieved in the year 2015, and from this moment on one can refer to such a level of burden. Until then the burden will be increasing linearly.
2. In the situation of a high burden on households' budgets, the use of public aid is justified. The practice applied in some EU Member States, namely excluding the amount of received aid from the financial burden of amortization, is allowable. This factor results in a decrease of prices of services.
3. The amount of burden that is presented relates also to rural areas, and covers both construction/expansion of wastewater treatment plants, and expansion of sewer systems.
4. Distribution of the presented burdens across particular households is highly uneven. It results from a very diversified level of technological advancement of the existing wastewater treatment plants, as well as from a diversified level of development of sewerage systems. Both these levels have direct impact on the required scope of investment, and therefore, on the level of burden imposed on current and future users.

The directive on the quality of drinking water has not been an object of such scrupulous research. Nevertheless, some estimates have been performed [3]. The input data used for calculations within the framework of the above mentioned project will be even more useful here than its final outcomes. Additional cost of purification of drinking water characterized with unsatisfactorily low quality parameters, together with appropriate monitoring of this quality is estimated at the level of 0.1 euro/m³. This value can be used as an approximation of additional increase in water price, because the rate of return of the operators is limited to a few percent.

The DISAE report estimates the amount of drinking water which is not consistent with the requirements of the directive 80/778/EEC in municipalities at the level of 64.1%. It can be assumed that this amount in relation to the requirements of the directive 98/83/EC, which is entering into force, is not lower. This indicator can be multiplied by the number of households using water supply systems.

3 Current burdens imposed on households due to water and wastewater charges

Burdens imposed on households due to water and wastewater charges are not the subject of systematic research of statistical offices. This does not mean, however, that there is no information available allowing the estimation of this level. Survey questionnaires constitute the first of the two methods that are in use. Such surveys are systematically carried out in Poland by the Institute for Household Management in Warsaw on a sample covering urban population. Figure 1 presents the share of expenditures for purchasing water and for sewage collection for different types of households.

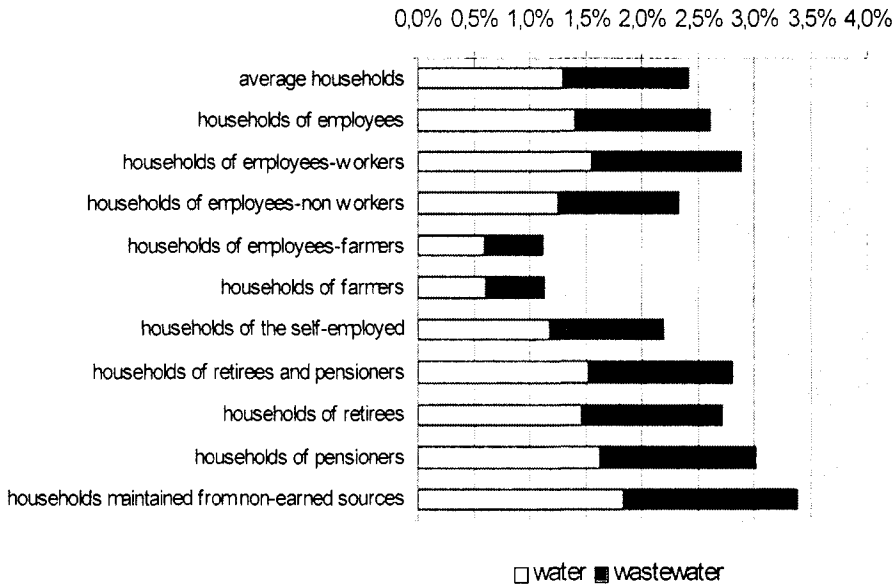


Figure 1: The share of expenditures for purchasing water and for sewage collection in disposable incomes for different types of households, Poland 1999

The second method is to compare the average use of water in households (which is published by the Main Statistical Office, GUS) with the average disposable income per capita calculated for the specific types of households. Both methods, however, are charged with various errors. Survey questionnaires report higher than actual use of water, and the second method assumes the same level of water use in all types of households.

Moreover, both methods give a statistical picture describing the situation in the year for which the research was carried out, whereas a dynamic approach to the burden imposed on households is important. Notable changes in the average water use level have a significant impact on the level of expenditures. The average water use in households per capita is presented in Figure 2.

It should be underlined that such a significant decrease of consumption results not only from increased prices for water provision and sewerage services. Change of the method used for imposing charges for water and sewerage services is also important. In Poland replacement of flat rate with uniform volumetric charge supplemented in some cases with a small fixed component is observed.

The average values presented at the Figure 2 give some approximation of the situation in Poland. Financial context however seems to be incomplete without description of local differentiation of prices for purchasing water and wastewater. It is presented in the Table 2.

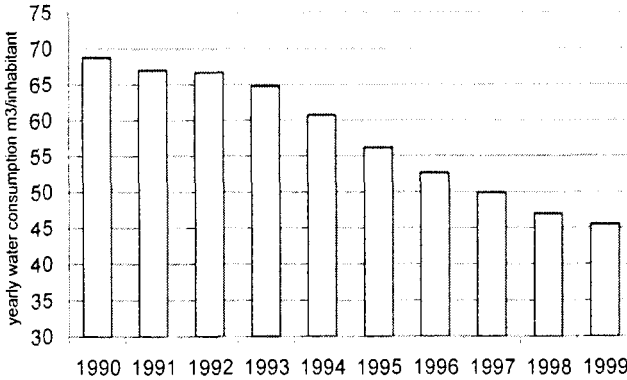


Figure 2: The average water use in households per capita, cities in Poland

Table 2: Differentiation of prices for receiving and treatment of wastewater and for provision of water to households in Poland.

Average (arithmetical) price for water provision, receiving and treatment of wastewater, EURO/m ³ 99'	0,731
Median	0,719
Standard deviation	0,102
Minimum	0,497
Maximum	0,953

4 Basic assumptions adopted for calculations

Calculations aim at assessment of the impact of implementation of two EU directives on households' budgets.

Other reasons for changes in prices of water and wastewater such as:

- Changes in VAT rates,
- Changes in the level of subsidizing water and sewer infrastructure implemented by local authorities (communes),
- Changes in the level of subsidizing water and sewer infrastructure implemented by earmarked funds,
- Changes in the rates of unit charges for water abstraction and for discharge of pollution loads, are not taken into account.

The following time periods for reaching compliance with the requirements of the analyzed EU directives have been adopted

The quality of drinking water	98/83/EC	2010
Urban wastewater treatment	91/271/EEC	2015

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Moreover, it is assumed that the process of implementation of the requirements of both analyzed directives will be linear, i.e. annualized cost will increase linearly. In spite of intensive search no results of studies aimed at estimation of price demand elasticity indicator for water in Poland were found. After the review of foreign literature the value of this indicator (in the short period) was adopted at the level of $E_p = -0.2$.

It was also assumed that both water and the service of receiving and treatment of wastewater are basic goods, and their consumption does not increase together with increase of income. Therefore, the indicator of demand elasticity of income was adopted at the level $E_i = 0$.

Distribution of disposable incomes per capita in individual types of households is based on the Main Statistical Office (GUS) data. For the year 1999 this distribution revealed the values presented in Figure 3.

The forecast for increase in incomes is based on the experience of Spain and Portugal during the last 10 years. The prognosis for Poland, prepared in 1998, was very far from the actual changes, the situation is unstable, and therefore an extrapolation of the Polish trends seems to be incorrect. Based on Eurostat data, real growth of incomes was assumed at the level 1,43% per year. In the calculations, the annualized burdens resulting from reaching compliance with both directives have been adopted as exogenous values. Calculations were carried out for total burden due to costs of both directives. This was possible because the fee for receipt of wastewater for treatment is calculated for a 100% of the amount of purchased water, in most cases with no fixed fee component.

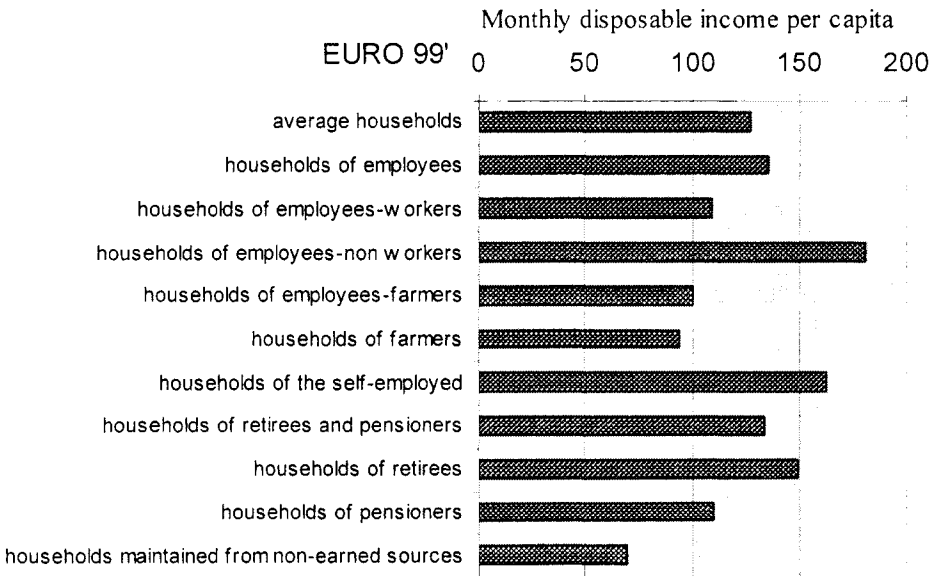


Figure 3: Monthly disposable income per capita – Poland 1999

Thus the new total price for water and sewerage was searched for. Such a price, after taking into account consumption decrease (the effect of price demand elasticity), would allow for the collection of the necessary, *a priori* adopted amount. The calculations were carried out separately for urban and rural populations. Such an approach seems to be justified because of huge differentiation of urban and rural areas from the point of view of the level of equipment in the field water and wastewater infrastructure.

Table 3: Differentiation of urban and rural areas according to the level of equipment in wastewater treatment infrastructure

	Urban areas	Rural areas
Population number (millions)	23,90	14,76
Percentage share of population using the sewer system	82,8%	9,9%
Percentage share of population served by wastewater treatment plants	78,0%	8,5%
Percentage share of population served by wastewater treatment plants with advanced removal of nutrients	23,7%	1,6%

Within the base-case scenario it was assumed that financing of the investments comes from commercial resources (domestic and foreign). In the following calculations the EU aid was taken into account in the form of pre-accession and structural funds. The scope of financial support granted by the European Union was adopted based on a working draft of the official document which sets precise future EU payments – “The National Strategy of Environmental Protection”. Because of the specific features of functioning of pre-accession and cohesion funds, two scenarios of EU support were adopted: minimum – using the resources in the lower bound envisaged by the EU, and maximum – absorption of maximum resources planned for Poland.

5 Forecast of changes in households’ expenditures and consumption caused by the implementation of the analyzed water directives

The first step in estimating the changes in burden imposed on households is calculating the changes in prices for water provision and for receipt of wastewater, and estimating the demand reactions for these changes. The estimations were made while assuming that the ultimate value results from the necessity of receiving the inflow of charges, which would guarantee implementation of all the necessary investments. These estimates are presented in the Table 4.

Indicators of price increase for water and wastewater seem to be very high, even with the EU aid. This aid has a really strategic importance for implementation of the requirements of both directives.



Table 4: Necessary price changes and resulting expenditures due to reaching compliance with the requirements of the directive on urban wastewater treatment and of the directive on drinking water quality. The outcomes for urban citizens for the year when all the requirements of both directives are met – 2015. (EURO 99')

Urban citizens Quantity and cost-related parameters of use	Scenario of non-repayable aid from the EU		
	No aid from the EU	Aid at the minimum level	Aid at the maximum level
Price increase for: water + wastewater (dp) EURO/m3	0,96	0,68	0,50
New price (covers water and wastewater) EURO/m3	1,69	1,41	1,23
Change in water use (dq) m3/y	-6,16	-4,34	-3,18
New annual water use (Q-dq) m3/person/year	40,8	42,6	43,7
The scale of price increase (water+wastewater)	231,3%	192,5%	167,9%
The average annual price increase during the subsequent 15 years (above inflation)	7,93%	5,66%	4,18%

The level of water consumption estimated on the basis of demand reaction might decrease from 2 m3/person/year to 5 m3/person/year. Such low level of water use would be a manifestation of sustainable consumption from the environmental point of view, but at the same time it would be probably socially unacceptable.

Analogous calculations carried out for the rural population indicate a lack of possibilities to generate the amounts which would make it possible to finance the necessary investments, even with significant EU aid. In different words, increasing the prices does not guarantee increase of incomes, because of demand reactions and because of decreasing level of purchasing services. The danger is even more realistic after taking into account that at least part of the rural population owns individual water intakes (wells), therefore the price elasticity may turn out to be even higher because of substitution of part of water demand with water from private resources.

The result of these calculations is a signal of a serious danger for the process of implementation of water and wastewater directives. It is also the signal for changing the key rules of distribution of aid resources across urban and rural areas.

Because of a lack of solutions for rural areas, further calculations have been carried out exclusively for the urban population. For calculated price changes presented in Table 4 households budgets as well as changes in burdens imposed on households due to the increase in prices for services have been analyzed.

The results indicate a relatively high level of burden imposed on most of the groups of households due to water and sewerage charges. For the year 2010 the average share of income spent on these purposes varies from 4,3% in the model



without EU aid, to 3,5% with the aid at the minimum level, and 3,1% with the aid at the maximum level. Commonly adopted maximum level of burden in the form of charges amounts to 4%, and this level may be overridden.

The increase in the share of these expenditures, of basic character, as well as the anticipated increase of different expenditures connected with the implementation of some other EU directives can lead to reduction of households' discretionary fund.

It should be noted however that the results of the calculations depend strongly on subjectively adopted assumptions such as: forecast of increase in disposable incomes and the indicator of price elasticity of demand for water and sewerage services.

Equally serious consequences may result from change in the value of price elasticity indicator. In such case, when the analyzed indicator changes from $E_p = -0.20$ to $E_p = -0.25$, the scenario of implementation of the directives without EU assistance becomes impossible. The calculations were made with very binding constrains based on the necessity to generate a constant amount of money (for necessary investment in the waste water sector) as a result of an increase of the unit price. When the elasticity is higher, the unit demand decreases and the amount of money will decrease also. Because this amount has to be constant the prices have to increase again.

The other danger may result from uneven distribution of costs across the population. The prices for water and sewerage services are being shaped in Poland by the local authorities (councils of the communes or city boards). Small operators covering single municipalities with their services are also common. In such conditions the agglomerations where infrastructure meets the requirements for both analyzed directives are not charged with significant costs due to implementation of the requirements of both directives. Consequently, the burdens, which in the calculations presented here have been distributed across the whole population, will be imposed only on a part of it. Automatically, the increase of burden per unit will be higher.

6 Conclusions

Direct and indirect influence of the implementation of the EU water directives in Poland can be considered. The first type of influence is connected with price increase as the consequence of meeting the requirements of the directives. It might lead to reduction of water use, which would make water consumption in households more sustainable, especially regarding its environmental aspect. However, the analysis of data shown in Figure 2 allows one to draw the conclusion that obtaining lower consumption level than the level observed at the end of the nineties will be extremely difficult.

An indirect influence of directive implementation is mainly based on social aspects of sustainable development. Growth of the financial burdens might reduce possibilities of satisfying some needs. The analysis of the situation in this regard in Poland reveals that the degree of needs' satisfaction in some domains such as education, dwellings, health services, is still rather low. Thus, the increase of



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expenditures on water and treatment services for approximately more than one percentage point may limit the discretionary funds of households. On a macro-scale it could influence the level of human capital which is such an important factor of sustainable development. In this light the implementation of the analyzed water directives without strong financial support from public funds could have a negative impact on implementation of sustainable development.

Despite our most rigorous efforts, the calculations presented here are charged with a significant margin of error. This results from a subjective selection of price elasticity and income elasticity for the demand for water and sewerage services, the criteria for allocation of pre-accession and structural funds, as well as from the timetable for granting the aid. Moreover, a decision was taken to select one of the lower scenarios of calculations of annualized costs resulting from implementation of both directives.

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