Estonia Latvia Programme
European Union
Linking Estonia and Latvia
Part-financed by the European Regional Development Fund

Assessing socioeconomic significance of water use for the WFD river basin management planning

ESTONIAN STUDY REPORT

Developed by EL Konsult

2013

Aim of this report paper

Objectives of the task can be formulated as follows:

1. To describe the methodology used to assess significant uses in river basin management plans for Koiva river basin;
2. To elaborate a common proposal for methodology and criteria for identification of the significant water uses;
3. To elaborate an overview on significant water uses in the Koiva river basin district.

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1. Key issues for assessing the significant water uses

The primary objective of the economic analysis of water uses is (i) to assess **how important water is for the economy and socio-economic development of the river basin**, and (ii) to **pave the way for the assessment of significant water uses and analysis of disproportionate costs.**

(i) The **economic analysis of water uses** is used to construct the general economic profile of the river basin and of its key water uses and significant pressures in terms of:

- Economic analysis of water uses, e.g. collating information for significant water uses on gross income, turnover, number of beneficiaries, agricultural and industrial area or employment, etc as considered relevant;
- Stressing the importance of water for economic and regional development and the evidence of this importance provided in existing economic strategies and plans;
- Areas designated for the protection of *economically significant aquatic species*, as input into the register of protected areas required under *Article 7* and *Annex IV* of the Directive.

These general economic indicators will be computed at the **scale of the river basin or river basin district**. For economically significant aquatic species, further desegregation according to location within the river basin may be provided consistently with the maps prepared for *Article 7*. This analysis is mainly based on easily available statistics and information. Specific approaches may be used to transform existing information (often available for administrative regions or water service areas) to the scale of the river basin or river basin district.

(ii) In parallel, the economic analysis of water uses needs **to pave the way for the assessment of the significant water uses** and related understanding of the likely tradeoffs and conflicts between socio-economic development, environment and water protection that can be fed into the public information and participation process regarding the development of river basin management plans.

The indicators computed are similar to the ones listed above, complemented with variables and indicators that are specific to the significant water uses identified for the river basin considered, e.g. cropping pattern for specific irrigated schemes that impose high pressures on water resources, turnover and main products of industrial sub-sectors that are highly polluting rivers, etc. However, the computation scale or desegregation level is the **area linked to a given significant pressure or to specific economic sectors/sub-sectors.**

Overall, the analysis should remain proportionate and not entail extensive collection of new data, i.e. dealing primarily with clear conflicts/water management issues based on information of relevance to

significant water uses. The spatial scale or region at which the analysis should be undertaken will be defined by both the analysis of pressures and impacts developed for the characterisation of the river basin, and the outcome of the participation process and stakeholders input/request for specific further desegregation.

2. Results from the 1st RBMPs

Estonia (from the Koiva RBMP)

Assessment of economic importance of water use was based on the review of the shares of different economic sectors in water use. The main sectors in terms of water use in the Republic of Estonia are: households, mines, manufacturing industry, energy sector, agriculture and fish farming (except generation of hydropower). Table 2.1 provides an overview of larger water users in Estonia.

Table 2.1 ***Consumption of water by Estonia's largest water users in 2003 and 2007 (EEIC)***

Water use	Water use in 2003		Water use in 2007	
	m m^3/y	Share, %	m m^3/y	Share, %
Households	42.4	3	44.4	2.3
Mining	215.0	13	197.2	10.4
Industry	43.1	3	34.3	1.8
Energetics	1 231.9	77	1 545.8	81.6
Agriculture	4.1	0	4.1	0.2
Fish farming	63.2	4	63.2	3.3
Others	6.2	0	5.8	0.3
Total	1 605.9	100	1 894.8	100.0

Source: Estonian Environment Information Centre, 2008

The economic sectors that use water play an important role in Estonian economy, both as creators of added value and as employers. In 2004, the turnover of Estonia's major water users constituted around 12 % of the total business turnover and, on average, these companies employed 12 % of the labour force employed by businesses. The shares of turnovers in economic sectors with significant level of water use are shown, by river basin districts, in Table 2.2.[1]

Table 2.2 Total turnover of businesses and turnover of sectors with significant level of water use by river basin districts in 2003

[1] http://www.envir.ee/295059

River basin district	All businesses		Sectors with significant level of water use	
	Turnover (m EEK)	Share in total turnover of businesses (%)	Turnover (m EEK)	Share in total turnover of businesses (%)
Western Estonia	178 535	79	14 861	8.2
Eastern Estonia	47 307	21	12 583	26.6
Koiva	791	0	0	0
TOTAL	**226 633**	**100**	**27 444**	**12.1**

The table indicates that there are no businesses with significant level of water use in the Koiva river basin district. Table 2.3 provides an overview of employment, by river basin districts, in all businesses and in businesses with significant level of water use.

Table 2.3 Employment in all businesses and in sectors with significant level of water use by river basin districts in 2003

River basin district	All businesses		Sectors with significant level of water use	
	Employees (no.)	Share (%)	Employees (no.)	Share in total number of employees (%)
Western Estonia	191 555	70	25 214	13.2
Eastern Estonia	79 249	29	21 335	26.9
Koiva	1 555	1	0	0
TOTAL	**272 360**	**100**	46 549	**17.1**

The businesses in the Koiva river basin district provide jobs to only 1 % of all employees in businesses and, as there are no businesses with significant level of water use in the Koiva rive basin, the share of employees is also 0 %. Consequently, an analysis of industrial water use in the Koiva river basin district has not been conducted.

The water use of Estonian households connected to a public water supply system has significantly decreased over the past decade, dropping to an average of 100 l/d/p in 2003. At the same time, the water use in Estonian households per person is considerably below the European average – 150 l/d/p. The water use of Estonian population is also significantly lower than the corresponding indicators in Scandinavia – e.g., 200 l/d/p in Finland. The water use l/d/p- litres per day per person has increased, on average, by 5 % over the past 15 years in developed European

countries, while the water use in Eastern Europe has dropped by around 18%. A summary of the projected water use of Estonian residents is shown in Table 2.4.

Table 2.4 Projected water use of Estonian residents in 2003

Projected water use of Estonian residents	2003
Number of inhabitants in Estonia[48]	1 356 045
Inhabitants in the Koiva river basin district (estimate)	7 490
Share of inhabitants connected to a public water supply system in Estonia, %	83 %
Share of inhabitants not connected to a public water supply system, %	17 %
Share of inhabitants connected to a public water supply system in the Koiva river basin district, %	31 %
Average water use of inhabitants connected to a public water supply system – litres/day/person	100
Average water use of inhabitants not connected to a public water supply system – l/d/p	100
Volume of water used through public water supply systems – m m^3/a	40.5
Volume of water used through independent consumption – m m^3/y	9.2
Total water use - m m^3/a	49.7

According to estimates, there are some 280.8 thousand bovines and 329.8 thousand pigs in Estonia (Agricultural Census, 2001) and they require an estimated 24.4 million cubic metres of water per year.

3. Comparison of the the methodology used to assess significant uses in river basin management plans for Gauja/Koiva river basin

Aim of the analysis

Aim of the analysis was the same in both countries, which was the following: to assess how important water is for the economy and socioeconomic development of the river basin district (RBD). The assessment shows significant waters uses and their socioeconomic significance.

In Latvia the assessment of socioeconomic significance of water uses provided also necessary information for justifying the heavily modified water bodies.

The main elements/steps of the analysis

Estonia

The most important economical sectors (NACE) that use water were identifyed. The analysis was based mainly on the analysis of water use data of Statistics Estonia. Based on the data of Estonian Commercial Register the turnover and number of employees of the companies who classified under the identified sectors were analysed and this part of the analysis was already on the riverbasin level.

Latvia

The analysis builds on assessments of pressures in the RBD – uses (sectors) causing significant pressures are included. Each use is analysed from its operation and socioeconomic significance point of view (data on specific operation and socioeconomic indicators were collected and provided).

Specific methodological isuses

Estonia

The socioeconomic significance of water use was assessed at the RBD scale. Where socioeconomic statistical data were available on administrative scale (municipality, district, region) they were recalculated to the RBD scale.

Latvia

The socioeconomic significance of water use was assessed at the RBD scale. Where socioeconomic statistical data were available on administrative scale (municipality, district, region) they were recalculated to the RBD scale. The area of the RBD (calculated applying GIS) was used as basis for recalculating data for agriculture and forestry, while the number of inhabitants of the RBD was used for extrapolations in all other cases. GIS data were used where available (population and Corrine Land Cover for the 1st river basin management plans, livestock GIS layer is now available too). Maps presenting socioeconomic figures are used to show the heterogeneity of the RBD.

The main data sources

Estonia

The study used data that were collected from the following organizations - Statistics Estonia, Estonian Water Companies Association, the Estonian Ministry of the Environment, Commercial Register.

Latvia

Research “Populated sites of Latvia” (GIS layer with cities and settlements including number of inhabitants for each city/settlement), Corrine Land Cover GIS layer, Central Statistical Bureau, Employment state agency, State forestry authority, Agriculture data centre, Harbour authorities, Ministry of Economy, Official reports of the state electricity producing company “*Latvenergo*” and other.

The main outcomes

Estonia

The RBMP includes overall socioeconomic characterization of the RBD (number of inhabitants, proportion of inhabitants served with centralised sewage services, employed population by important water user sectors, turnover, etc) by important economical sectors.

Latvia

The RBMP includes overall socioeconomic characterization of the RBD (number of inhabitants, population density, GDP total and per capita, Value Added and employed population by branches of economy, total number of employed population and unemployment rate, average salary).

The section on socioeconomic significance of water use provides assessments for specific sectors – water uses. All the sectors creating significant pressures in the RBD were analysed (this was the only specific criterion for selecting "significant water uses"). Specific water uses that depend on good water quality or quantity are not included.

Assessment for each water use (sector) includes:

- Summary on the pressure(s) from a sector (e.g. tons of N and P from the sector);
- Characterisation of "operation" (based on sector-specific indicators, e.g., proportion of inhabitants served with centralised sewage services, size of agricultural land, output volume, number and profile of the industrial companies, number of HPP, No of ships and cargos' volumes);
- Socioeconomic significance of a sector (based on common socioeconomic indicators e.g. value added, employment, export value).

Economic sectors/activities assessed:

- Households (rate and number of population served with centralized water supply and sewerage services, income of inhabitants);
- Agriculture (total land area and structure used for agricultural, sown area by crop types, crop and livestock production, number of farms, their size (economic and by area), proportion of agricultural production for sale and for own consumption);
- Forestry (forest and forestry areas, their ownership type, amount of wood production and total wood stock, value and contribution to the foreign trade balance);
- Industry (Added Value incl. contribution into the total AV of RBD and Latvia, number of enterprises and employed persons by branches of industry, nationally – contribution of the sector to export and foreign trade balance);
- Hydroelectricity production by HPP (number and capacity of HPP, amount of produced electricity, contribution to the total produced and supplied electricity);
- Harbours and related activities (harbour "profile", number of served ships, cargo turnover, types of cargos, fishing and yacht activities, No of enterprises by business types).

4. Proposals for methodology and criteria to be used for identification of the significant water uses

Proposed criteria for significant water uses: significant water uses are all economic sectors, that create significant impact on water status.

Proposals for methodology are brought as following:

1) To identify important economical sectors of water users;
2) To identify if there are any economical sectors, that are not water users, but are creating a significant impact on water status (based on the list of pressures) with it's activity. If there are any, then add them to the analysis.

Considering the brought proposals Estonia should widen the definition of water use (based on the wateco quidance document) and should take also into account in the analyse the economic sectors that are creating significant pressures - not only analyse the economical importance of the use of water supply and sewage service and their consumers. The last proposals are also taken into considerition in the analysis brought in the following chapter.

5. Assessment of the significant water uses in Estonia

The analysis of evaluating the economic importance of water use includes the following steps:

1) To define the providers of water use and water service by fields of activity;
2) To define the socioeconomic impact related to water use;
3) To define economically important types of water.

Following the requirements of European Commission's guideline no 1[2] the results of analysis are also presented on the watershed level.

The content of definitions of terms "water use" and "water service" used in this paper conforms to Water Act[3] and they are defined as follows:

- "water use" means all services and other activities with significant impact on water status as defined in § 3[18] of Water Act.

[2] https://circabc.europa.eu/sd/d/cffd57cc-8f19-4e39-a79e-20322bf607e1/Guidance%20No%201%20-%20Economics%20-%20WATECO%20%28WG%202.6%29.pdf

[3] https://www.riigiteataja.ee/akt/122122012024

- “water services” includes all the services provided for households, state and local government agencies, public and private institutions and natural persons:
    a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater;
    b) wastewater collection to sewerage system and wastewater treatment, discharge of waste water to recipient.

On the following figure the definitions of water use and water service are shown graphically.

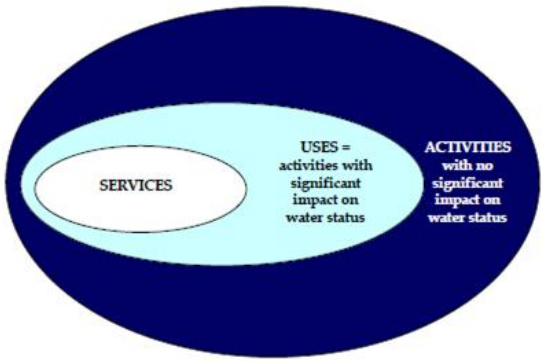

Figure 3.1. Water use and water service

Also important terms are the following used in this paper[4][5]:

Cooling water - water used to bind and remove heat. The main recipients of the cooling water are large power plants in Ida-Virumaa (Balti Power Plant of Ltd Narva Power Plants and Estonian Power Plant).

Mining water - the amount of water pumped from the mines and quarries.

Seawater - the amount of water abstracted from the Baltic Sea in a year.

Mineral water – one of groundwater types. Mineral water contains minerals or other dissolved substances giving water its flavor or therapeutic properties.

Surface water - permanently or temporarily standing or flowing water in body of water or water (except sea water) contained in snow or ice set.

Groundwater – the free water contained in the Earth's crust which may accumulate in the wells and seep into surface waters.

Storm water and drainage – water with natural origin drained by drain, that is not a sewerage.

Water abstraction – amount of surface water and groundwater abstracted in a year. The water abstraction from wells founded to detached houses where special permit from abstracting water is not required are not included to water abstraction.

Water discharge – discharge of waste water into a recipient.

Waste water - water that has been used discharged to recipient.

[4] *http://pub.stat.ee/px-web.2001/Database/Keskkond/06Loodusvarad_ja_nende_kasutamine/10Veekasutus/KK_47.htm*
[5] *https://www.riigiteataja.ee/akt/122122012024*

Statistics Estonia has significantly narrowed the definition of water use compared to the same meaningful concept in the Water Act (including Water Directive), reflecting under water use only the water abstraction and distribution to water users - that is specifying the field of activity of water use. The following analysis uses data from Statistics Estonia to specify the field of activity of water use, not to describe the whole water use.

The analysis has been prepared based on data from 2011 to ensure the comparability of characteristics at the time. To determine the field of activity the classification of NACE 2008 is used.

Water use in Estonia as a Ahole

Descriptive data on type of water and water use originates from database of Statistics Estonia and from Environmental Investment Centre. The data reflects only licensed water-abstractors' water abstraction and distribution of water consumers. Operating permit (permit for special use of water or integrated environmental permit) must be applied for when abstraction of groundwater exceeds 5 m³ and abstraction of surface water exceeds 30 m³ per day. The data doesn't include the water abstraction from wells founded to detached houses where special permit from abstracting water is not required.

Table 3.1 Water abstraction in 2011, by type of water and watershed

WATER TYPE	Ida-Eesti watershed (%)	Koiva watershed (%)	Lääne-Eesti watershed (%)	ESTONIAN TOTAL (%)
Mining water	0,051%	0,000%	0,945%	0,081%
Quarry water	0,185%	0,000%	1,416%	0,227%
Seawater	0,272%	0,000%	0,000%	0,262%
Mineral water	0,000%	0,000%	0,000%	0,000%
Surface water	98,321%	0,000%	18,721%	95,611%
Groundwater	1,170%	100,000%	46,150%	2,706%
Storm water and drainage	0,000%	0,000%	0,000%	0,000%
Artificial body of water	0,002%	0,000%	0,000%	0,002%
Public water	0,000%	0,000%	32,767%	1,111%
TOTAL	**100,000%**	**100,000%**	**100,000%**	**100,000%**

In 2011 about 96% of water was abstracted from surface water (most of it was cooling water for Narva Power Plant), 3% was pumped from groundwater and only 1% from water plumbing (most of it was water abstraction by Ltd Tallinn Water). Figure 3.1 provides a graphical illustration of the different sectors of water use during the period from 2005 to 2011. The initial data originates from Statistics Estonia.

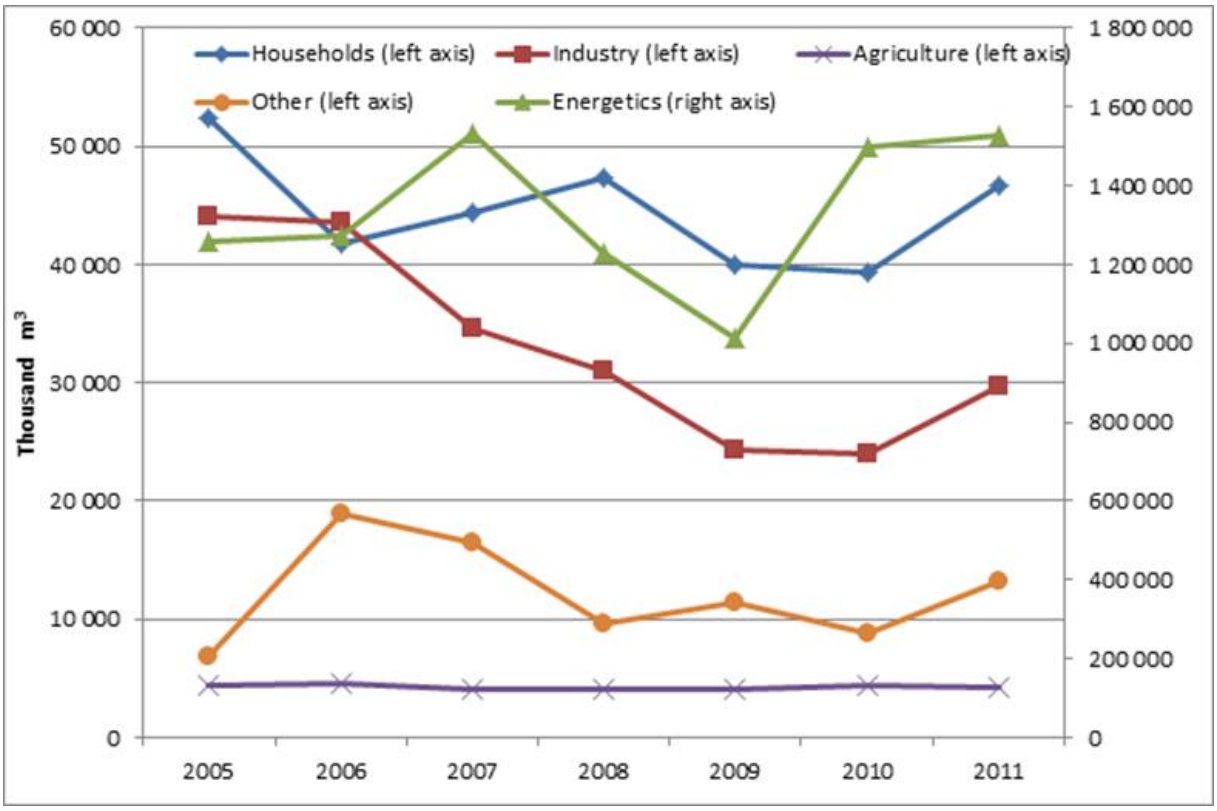

Figure 3.1 The use of water in Estonia in 2005-2011, thousand m^3 per year

The most important water user in Estonia is the energy sector, followed by households and industry. The following table shows the list of fields of activity with amount of water abstracted being more than 0,1% of the total volume of water abstracted in 2011. Additionally the table shows the fees received from operating permit for special use of water and pollution charges (water abstracted by field of activity). Data about fees of permit for special use of water and pollution charges (expulsion of pollutants into water bodies of water, groundwater and soil) originates from Environmental Board.

Table 3.2 Economically significant water abstraction by fields of activity, the fee of special permits of water use and pollution charges

Field of activity	Abstracted water (thousand m3)	Percentage (%)	Fee of special permits of water use (EUR)	Percentage (%)	Water discharges (thousand m3)	Percentage (%)	Pollution charges (EUR)	Percentage (%)
Fields of activity total	**1 877 836**	**100,00%**	**13 210 822**	**100,00%**	**1 933 030**	**100,00%**	**5 270 338**	**100,00%**
Electricity, gas, steam and air conditioning supply	1 540 507	82,04%	2 862 205	21,67%	1 534 427	79,38%	377 435	7,16%
Extraction of crude petroleum and natural gas	231 311	12,32%	5 944 053	44,99%	233 120	12,06%	1 379 996	26,18%
Water collection, treatment and supply	51 896	2,76%	2 421 401	18,33%	85 462	4,42%	2 188 172	41,52%
Manufacture of other non-metallic mineral products	14 270	0,76%	218 799	1,66%	13 797	0,71%	103 374	1,96%
Manufacture of paper and paper products	12 134	0,65%	258 705	1,96%	9 628	0,50%	386 573	7,33%
Other mining and quarrying	4 532	0,24%	86 355	0,65%	11 889	0,62%	18 546	0,35%
Manufacture of coke and refined petroleum products (including briquette)	4 405	0,23%	90 289	0,68%	1 223	0,06%	38 040	0,72%
Crop and animal production, hunting and related service activities	4 315	0,23%	292 474	2,21%	314	0,02%	29 033	0,55%
Sewerage	3 949	0,21%	292 341	2,21%	25 081	1,30%	151 987	2,88%
Manufacture of food products	3 341	0,18%	262 236	1,99%	1 261	0,07%	184 008	3,49%

** Source: Statistics Estonia, Environmental Board*

The cooling water of Ltd Narva Power Plant (employer for more than 700 employees) forms more than 99% (that is 1 522 million m³) of water used by energy sector. It is important to note that the cooling water is taken from the Narva River and lead back there without changing its chemical composition. Water does not need to be cleaned. To some extent, only the temperature of the water is changed.

As the cooling water does not cause major changes in the state of water the significant amount of pollution charges in Estonia comes from fields of activities as extraction of crude petroleum and natural gas, water collection, treatment and supply.

The following table shows that in case of most of the surface water abstraction it is a cooling water, mine water plays an important role in the mining industry, they are followed by water abstraction for water collection, treatment and supply (that is central water service). The proportion of water mentioned last is almost equally divided between surface and groundwater.

Table 3.3 The water abstraction by significant water use of fields of activities, by type of water

Field of activity (NACE 2008)	Ground-water	Mining water	Surface water	Seawater	Mineral water
Fields of activity total	**45 770,57**	**252 989,91**	**1 574 735,37**	**4 329,91**	**10,26**
Electricity, gas, steam and air conditioning supply	3 624,14	0,00	**1 532 625,58**	4 257,61	0,00
Extraction of crude petroleum and natural gas	173,94	**231 136,68**	0,00	0,00	0,00
Water collection, treatment and supply	**23 863,96**	0,00	**28 032,03**	0,00	0,00
Manufacture of other non-metallic mineral products	289,29	13 093,83	887,07	0,00	0,00
Manufacture of paper and paper products	31,14	0,00	12 102,42	0,00	0,00
Other mining and quarrying	300,50	4 213,17	18,21	0,00	0,00
Manufacture of coke and refined petroleum products (including briquette)	360,23	4 045,17	0,00	0,00	0,00
Crop and animal production, hunting and related service activities	4 278,87	0,00	36,19	0,00	0,00
Sewerage	3 949,46	0,00	0,00	0,00	0,00
Manufacture of food products	3 323,96	0,00	17,38	0,00	0,00

The following table presents the characteristics describing the economic results of 10 most important fields of activity for volume of water abstraction. The table does not reflect the data of extraction of crude petroleum and natural gas for data protection principle reasons[6]. While the food industry uses only 0.18% of the water pumped out in Estonia, the socioeconomic value through the creating jobs is very important In Estonia – it is providing work for more than 12.5 thousand people.

[6] *Official Statistics Act §34 and §35*

Table 3.4 The economic characteristics of 10 most important fields of activity for volume of water abstraction in 2011

Field of activity (NACE 2008)	Nuber of companies	Number of employees	Output value, thousand euros	Added value, thousand euros	Sales revenue, thousand euros	including non-residential sales, thousand euros
Fields of activity total	**61 983**	**395 839**	**28 019 321**	**9 428 049**	**46 226 765**	**16 594 963**
Electricity, gas, steam and air conditioning supply	220	5 614	1 054 054	475 111	1 875 451	93 158
Extraction of crude petroleum and natural gas	1	.	.	.	.	.
Water collection, treatment and supply	75	1 225	109 362	75 696	94 819	0
Manufacture of other non-metallic mineral products	194	3 705	355 599	115 483	381 277	157 068
Manufacture of paper and paper products	46	1 343	200 828	55 771	213 215	165 436
Other mining and quarrying	43	.	.	.	.	.
Manufacture of coke and refined petroleum products (including briquette)	5	.	.	.	.	.
Crop and animal production, hunting and related service activities	1 288	9 337	566 045	245 219	565 294	70 495
Sewerage	34	.	.	.	.	.
Manufacture of food products	382	12 556	1 138 684	216 737	1 267 671	436 964

** Source: Statistics Estonia*
*** Note: . - The disclosure of data not possible for data protection principle reasons*

Table 3.5 10 most important fields of activity for volume of water discharge in 2011

NACE explanation	Ida- Eesti watershed	Koiva watershed	Lääne- Eesti watershed	TOTAL	Percentage
Fields of activity total	**1 836 522**	**75**	**96 433**	**1 933 030**	**100,00%**
Electricity, gas, steam and air conditioning supply	1 534 187	0	240	1 534 427	79,38%
Extraction of crude petroleum and natural gas	233 120	0	0	233 120	12,06%
Water collection, treatment and supply	23 255	18	62 189	85 462	4,42%
Sewerage	14 326	0	10 755	25 081	1,30%
Manufacture of other non-metallic mineral products	13 777	0	20	13 797	0,71%
Other mining and quarrying	2 313	0	9 575	11 889	0,62%
Manufacture of paper and paper products	0	0	9 628	9 628	0,50%
Public administration and defence; compulsory social	7 240	50	152	7 441	0,38%
Waste collection, treatment and disposal activities;	2 400	0	32	2 432	0,13%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and	2 260	0	108	2 368	0,12%

The division of wastewater of first ten fields of activity for volume of water discharge between watersheds is shown in Table 3.5. 95% of Estonia's total water discharges concentrated in East-Estonian watershed, again in relation to energetics and resulting from Narva Power Plant operations. Also most of the pollution charges come from East-Estonian watershed but rather in relation to industrial mining (NACE/2008 06 - extraction of crude petroleum and natural gas, including mining of oil shale). From the last mentioned the major water users are AS Eesti Energia Mining (about 3150 employees, economic value added 7.1 million euros) and OÜ Kiviõli Chemical Industry (almost 700 employees, most of them residents of Kiviõli city). The value added coming from mining the oil shale is not disclosed by Statistics Estonia for data protection principle reasons[7], but the value added of the entire mining industry in 2011 was about 155 million euros and output value was 368 million euros, employees slightly fewer than 5000.

[7] *Official Statistics Act §34 and §35*

Incrementally to Narva Power Plant and Eesti Energia Mining analyzed above in the field of activity of energy sector the development of hydropower with modest water abstraction must be mentioned. The Estonian hydropower resource is modest. The percentage of electricity produced in hydroelectric plant is only 3% from the whole electricity produced from renewable sources.

Although Estonia in terms of average drain (250.000 m^3/km^2 in a year) is in relatively water-rich region, the fragmentation of water resources aggravates the use of hydropower. When assessing the Estonia's hydropower resource it is feasible to observe separately Narva River which is comparable to total reserve of all the other Estonian rivers and its use is a great interest in terms of high energy. For the most part there are small grades in Estonia suitable for use found in many rivers across the country. Pärnu River has a great potential with series of compact drop points in its middle course, some of them with power range up to few megawatts. Kasari River conditions are generally unfavorable due to the low marshy shores, but it still presents some grades with few hundred kilowatts on the sub-routine. On the Peipsi Lake watershed there are grades with capacity about 100 kW on many rivers (Suur and Väike Emajõgi, Suislepa, Ahja, Võhandu, Piusa etc.). Noticeable is the potential of Põltsamaa (Paala) River, especially in the area of Põltsamaa town[8].

The distribution of Estonia's hydropower potential between watersheds is illustrated in Table 3.6

Table 3.6 The distribution of Estonia's hydropower potential between natural watersheds

Watershed	Area of river basin, km^2	Hydropower potential, MW
Gulf of Finland watershed	10 319	42
Narva-Peipsi watershed	56 066	208
including Peipsi basin (in Estonia)	17 928	48
including basin of Võrtsjärv	3 399	9
Väinamere-Riga gulf watershed	13 097	43
Islands	3 963	4

** Source: Opportunities for increasing the share of renewable energy sources in electricity production in Estonia, in 2003, www.mkm.ee/8098/*

Estonian rivers' theoretical hydropower resource in total is estimated to be 300 MW. Technically viable hydropower resource of Estonian rivers without Narva River can be evaluated to be up to 30 MW with average annual output of up to 200,000 MWh, in the near future with economically viable resource to be around 10 to15 MW with annual production of 70,000 to 100,000 MWh. Of this, approximately 3 MW with average annual production of approximately 17,000 MWh has already been realized[9].

The following table shows the Estonian electricity system connected to hydropower plants, with data from the transmission system operator Elering available.

[8] *Report of improvements of using of electrical energy produced from renewable energy sources in Estonia in 2005, www.mkm.ee/8098//*

[9] *Report of improvements of using of electrical energy produced from renewable energy sources in Estonia in 2005, www.mkm.ee/8098//*

Table 3.7 The hydropower plants connected to Estonian power system in 2012

Item number	Hydropower plant	Installed net output 2012, MW	River
1	Keila-Joa	0,4	Keila
2	Linnamäe	1,2	Jägala
3	Põltsamaa	no data	Põltsamaa
4	Põlva	0,23	Orajõgi (Põlva lake)
5	Poolaka mill	0,004*	Vastemõisa creek(Poolaka lake)
6	Õisu, Kaarli	0,004	Kõpu
7	Tõravere	no data	Lintsi
8	Vihula	0,05	Mustoja
9	Oruveski	0,01	Aiju
10	Kaunissaare	0,164*	Jägala

Item number	Hydropower plant	Installed net output 2012, MW	River
11	Kamari	0,5	Põltsamaa
12	Paidra	0,02	Võhandu
13	Kunda	0,33	Kunda
14	Kösti	0,075*	Tänassilma
15	Saunja	0,03	Jägala
16	Soodla	0,07	Jägala
17	Saesaare	0,097	Ahja
18	Sillaoru	0,527	Purtse
19	Raudsilla	0,008	Ora
20	Leevaku	0,2	Võhandu
21	Leevi	no data	Võhandu
22	Pikru mill	0,045	Pikru village
23	Peri	0,01	Peri creek
24	Tamme	0,158	Navesti
25	Tammiku	0,055	Jägala
26	Tudulina	0,29	Pungerja
27	Räpina watermill	0,365	Võhandu
28	Veskipaisu	0,044	

Source: The estimate of production required to meet the demand of Estonian power consumption, 2012, http://elering.ee/tootmispiisavuse-aruanded/
** Data of 2011, as data of 2012 not submitted*

The list above is certainly not definitive, in Estonia there are several working hydroelectric plants. For example, in the research ordered by the Ministry of Economic Affairs and Communications "Opportunities for increasing the share of renewable energy sources in electricity production in Estonia" (2003), in addition to the above, the following operating hydropower plants are listed:

Table 3.8 Operating hydropower plants in Estonia

Item number	Hydropower plant	Installed net output 2012, MW	River
1	Joaveski	300	Loobu
2	Kotka	160	Valgejõgi
3	Tudu	150	Rannapungerja
4	Lauküla	45	
5	Koseveski	40	Kääpa
6	Hellenurme	36	Elva
7	Vaku	30	
8	Kanaveski	20	

Source: Opportunities for increasing the share of renewable energy sources in electricity production in Estonia (2003), www.mkm.ee/8098/

Noticeable portion of the water use aside of energy and manufacturing industry is associated with public water supply and sewerage service – about 3% of total water abstraction in Estonia. In this analysis it is assumed that 100% of people living in wastewater collection area are connected to the public water supply and sewerage system - that is approximately 1,150,582 people being beneficiaries of water services. The following table shows the number of people and connectivity to public water supply and sewerage system in watersheds.

Table 3.9 Number of people connected to the public water supply and sewerage system in 2011, by watersheds

Watershed	Number of people	Number of people connected to the public water supply and sewerage system	Percentage of people connected to the public water supply and sewerage system (%)
Lääne-Eesti watershed	852 262	746 409	87,58%
Ida-Eesti watershed	495 122	401 962	81,18%
Koiva watershed	6 428	2 212	34,41%
Total	**1 353 813**	**1 150 582**	**84,99%**

Source: Population Register, Consultant

Hereafter it is analyzed by watersheds how large part of resident's net income the water and sewerage service takes in average. The analysis is based on equalized net income in 2011 given by Statistics and the assumption that the average person consumes 100 liters of water and 100 liters sewerage service a day. The ground for price of water and sewerage service is taken from summary of questionnaire compiled by Estonian Water Works Association due to December 31, 2011. Based on Estonian Water Works Association's data the highest water prices are in West-Estonian watershed (an

average of 0.96 EUR/ m^3+ VAT) and the lowest are in the Koiva watershed (an average of 0.87 EUR/ m^3 + VAT). The highest sewerage service prices are in Koiva watershed (an average of 1.43 EUR/ m^3 + VAT) and East-Estonian watershed (an average of € 1.28/m^3+ VAT). Various international recommendations and guidelines say that the cost of water service should not exceed 4% of the average household net income per member of the household. The comparison of the maximum allowable cost and the actual cost is shown in the following table. The prices are without VAT.

Table 3.10 The prices of public water supply and sewerage's water service and the cost of water services by watershed in 2011

Watershed	Average price of public water supply (excluding VAT, EUR/m^3)	Average price of public sewerage system (excluding VAT, EUR/m^3)	Cost of water services per year (EUR/person)	Average net income (EUR/person)	Cost of water services (%)	4% of net income (EUR)
Lääne-Eesti watershed	0,96	1,33	100,49	6886,09	1,46%	275,44
Ida-Eesti watershed	0,88	1,28	94,65	5993,4	1,58%	239,74
Koiva watershed	0,87	1,43	100,74	5601,21	1,80%	224,05
Total	**0,92**	**1,31**	**97,93**	**6434,39**	**1,52%**	**257,38**

Additionally to water services (water abstraction, distribution, water discharges, treatment of sewerage, etc.) there are economically important water users found in Estonia who directly do not use water in their activities, but through their actions affect the status of water. Further analysis by fields of activity on operating pressure sources to body of water the following fields of activity are seen to be economically significant water users - crop and animal production, forestry and fishing, aquaculture. The following table shows the economical characteristics of fields of activity named, characteristics describing the socioeconomic importance even more.

Table 3.11 The economic characteristics of agriculture, forestry and fishing in 2011

Field of activity	Number of companies	Number of employees	Output value, thousand euros	Added value, thousand euros	Sales revenue, thousand euros	including non-residential sales, thousand euros
Fields of activity total	**61 983**	**395 839**	**28 019 321**	**9 428 049**	**46 226 765**	**16 594 963**
Agriculture, forestry and fishing	2 476	14 089	1 106 823	441 084	1 165 760	168 405
..crop and animal production, hunting and related service activities	1 288	9 337	566 045	245 219	565 294	70 495
..forestry and logging	1 083	4 269	482 512	172 923	548 329	57 352
..fishing and aquaculture	105	483	58 266	22 941	52 136	40 558

In 2011 there were in total approximately 2,500 companies engaged in agriculture, forestry and fishing, employing more than 14,000 people, providing value added more than 441 million euros. In addition, 8,844 self-employed persons were operating in the same field, the gross profit of their business was 81 million euros. Economically most important water user (not the user of water service) in the field of agriculture is animal production (due to the volume of business' value added), on distributing its significance to watersheds the data of animal count by watersheds is used.

Table 3.12 Distribution of animal production by watershed

Watershed	Sheep (pcs)	Cattle (pcs)	Goat (pcs)	Pig (pcs)	Animal units (AU)	Percentage (%)	Area (km2)	AU/km2
Lääne-Eesti watershed	31 033	121 010	1 924	179 262	186 903	51,60%	45 375	4,12
Ida-Eesti watershed	33 603	104 800	1 009	164 107	165 788	45,77%	23 768	6,98
Koiva watershed	3 558	5 127	134	11 340	9 536	2,63%	1 335	7,14
TOTAL	**68 194**	**230 937**	**3 067**	**354 709**	**362 227**	**100,00%**	**70 478**	**5,14**

Based on the data from previous table it is confirmed that animal production is economically very important field of activity in Koiva watershed that is the smallest watershed by area in Estonia but has the highest animal unit per square kilometer.

Based on the above the economically important water use fields of activities in Estonia are the following:

• electricity, gas, steam, air conditioning supply (NACE 35);

• mining (NACE 05-09) – economically most important the extraction of crude petroleum and natural gas (NACE 06);

• water supply and wastewater management (NACE 36 and 37);

• agriculture (NACE 01);

• manufacturing: manufacture of food products (EMATK 10), manufacture of paper and paper products (NACE 17), manufacture of coke and refined petroleum products (including briquette)(NACE 19), manufacture of other non-metallic mineral products (NACE 23);

• Forestry (NACE 02);

• Fishing and aquaculture (NACE 03).

The following analysis has grouped fields of activities (based on EMTAK/2008 two-digit code) into the following fields of activities:

• Agriculture - NACE 01-02;

• Fishing - NACE 03;

• Manufacture - NACE 06-33;

• Energy - NACE 35;

• Consumer – all major fields of activities previously unnamed using water with double-digit numbers in NACE.

In order to assess the economic importance of water use the number of employees, turnover and value added are observed by fields of activity. Table 13.3 describes these indicators. Data about value added originates from database of Statistics Estonia and data about the turnover and number of employees of major water users comes from Commercial Register.

Table 3.13 Economic indicators of economically significant water users in 2011

Field of activity	Water anstraction (thousand m^3)	Fee of special permits of water use (EUR)	Water discharges (thousand m^3)	Pollution charges (EUR)	Number of employees	Turnover (million EUR)	Added value* (thousand EUR)
Consumer	52 045	3 048 717	123 694	2 702 888	1 686	118	81 060
Industry	29 744	7 008 143	274 022	2 145 708	27 531	2 452	542 800
Agriculture	4 165	292 954	314	39 626	9 960	644	245 219
Fishing		312	572	5 347	520	56	22 941
Energy	1 537 336	2 862 205	1 534 427	377 435	1 209	421	475 111
Total	**1 623 291**	**13 212 332**	**1 933 030**	**5 271 004**	**40 906**	**3 691**	**1 367 131**

** Because of Official Statistics Act §34 and §35 Statistics Estonia does not disclose the value added by fields of activity's of coke and refined petroleum products , therefore in the table for industry named on that line doesn't show value added*

The value added of companies operating in Estonia in 2011 was 9,428,049 thousand euros. In 2011 in terms of water use the added value of economically significant fields of activity was 1,367,131 thousand euros, or 14.5% of the value added given by all companies.

In terms of water use the economically significant fields with the highest value added comes from energy, agricultural and manufacture, that is a total of 92% from the economically important fields of activities. The least added value comes from fishing and aquaculture (1.68%).

Economically significant water users activities had a turnover in 2011 of EUR 3,691 million. Similarly to value added the highest turnover was also in manufacture, agriculture and energy, accounting for 95% of total water use in terms of economically important activities of turnover. Lower turnover was once again fishing and aquaculture.

The number of people working in the economically significant areas of water use was 40,906 in 2011. The most employees are working in extracting the crude petroleum and natural gas, in agriculture and in food production areas.

Economically the most important water use areas, when assessing the value added, turnover and number of employees, are energy and manufacturing industries and least important of the evaluated fields of activity are fishing and aquaculture.

Assessment of economically significant areas of water use in Koiva river basin

The most important water users in Koiva watershed are households and agricultural sector which forms 98.8% of the total volume of water abstraction, the following table shows the watershed based volumes of water use by fields of activity. In 2011, 2.6 million euros came in from fees of permits of special use of water in Koiva watershed that is 20% of volume of the whole Estonia. However, 1,24% of Estonian pollution charges (66 thousand euros) also came from Koiva watershed.

Table 3.16 Important economical characteristics describing the water use in Koiva watershed in 2011

Field of activity	Water anstraction (thousand m^3)	Percentage (%)	Water discharges (thousand m^3)	Percentage (%)	Number of employees	Percentage (%)	Turnover (million EUR)	Percentage (%)
Consumer	91,75	53,25%	74,87	100,00%	0	0,00%	0	0,00%
Industry	2,1	1,22%	0	0,00%	15	19,23%	0,91	21,77%
Agriculture	78,46	45,53%	0	0,00%	63	80,77%	3,28	78,23%
Fishing			0	0,00%	0	0,00%	0	0,00%
Energy	0	0,00%	0	0,00%	0	0,00%	0	0,00%
Total	**172,31**	**100,00%**	**74,87**	**100,00%**	**78**	**100,00%**	**4,19**	**100,00%**

The water discharge of Koiva watershed is the smallest of watersheds and water discharge lead into nature results mostly from water supply and sewerage field of activity (91,32%) which includes the water companies.

6,400 people are living in the Koiva watershed, the interconnection rate is 34%, 66% of residents are not connected. The average water tariff was 0,90 eurot/$m^{3\ +\ VAT}$ and sewerage tariff was 1,44 eurot/m^3+ VAT – that means daily consumtion of 100 takes 1,87% of residents net income.

There is 10 thousand animal unit in total in Koiva watershed, that is about 3% of the total volume. Just as in West-Estonian and East-Estonian watersheds, also in Koiva watershed breeding pigs (11 thousand animals) and cattle (5 thousand animals) is most popular. In percentage terms sheep are breed the most (4 thousand animals that is 18% of all animals) compared to other watersheds. As Koiva watershed is so small comparing it to the other watersheds the animal unit per square kilometer is the highest. That proves agriculture as field of activity to be economically important water user.

Water discharge of Koiva watershed forms mostly in water supply and sewerage sector (91%).

Summary of the economic importance of water use

The analysis of water abstraction and amounts of waste water suggests that the biggest users of water abstracted are energy and mining (including oil shale mining) fields of activity. Also important as abstracted water users are water supply and sewerage fields of activity in East-Estonian and West-Estonian watershed and in West-Estonian watershed the mining industry (including limestone and peat mines) and manufacture of paper and paper products. Further analysis of load sources of bodies of water the importance of plant and animal production, forestry, fishing and aquaculture as economically important water users rises significantly.

Economically important water users in Estonia by field of activity are the following:

- electricity, gas, steam, air conditioning supply;
- mining, most important economically extraction of crude petroleum and natural gas;

- water supply and sewerage;
- agriculture;
- manufacturing industry: manufacture of food products, manufacture of paper and paper products, manufacture of coke and refined petroleum products (including briquette); manufacture of other non-metallic mineral products;
- forestry;
- fishing and aquaculture.

By economically important water users by field of activity the highest value added comes from energetics, agriculture and manufacturing – in total 92% of economically important water users value added in total by field of activity. The lowest value added is from fishing and aquaculture (1.68%).

The turnover of economically important fields of activity was 3.691 million euros in 2011. Similarly to having the highest value added manufacturing, agriculture and energetics had the highest turnover, it was 95% of the total turnover from economically important fields of activity. Once again fishing and aquaculture had the lower turnover.

There were 40,906 people working in the economically important fields of activity. The most workers were working in extracting crude petroleum and natural gas, agriculture and manufacturing food products. For example, the last named uses only 0.18% of water pumped in Estonia, at the same time the socioeconomic importance of field of activity on creating jobs is very important in Estonia. providing work for more than 12.5 thousand people.

When assessing the value added, turnover and number of employees the economically most important fields of activity are energetics, mining and manufacturing industry and economically the least important are fishing and aquaculture.

The highest rate of connectedness to public water supply and sewerage system is in West-Estonian watershed and the lowest in Koiva watershed. The low connectedness in Koiva watershed is most likely caused by scattered settlement. At the same time the higher price of the water service is in East-Estonia watershed and lowest in Koiva watershed, the higher price of the sewerage service is in West-Estonian watershed and the lowest in East-Estonian watershed. The water and sewerage service takes the biggest portion from people’s net income in Koiva watershed.

Economically most important types of water are surface water, groundwater and mine water. Most of the surface water is used as cooling water, mine water plays important role in mining and they are followed as most significant reasons for water abstraction by water collection, treatment and supply (that is central water services). And for the last, the proportion of water abstracted is divided roughly equally between surface water and groundwater.

6. Literature sources.

[1] Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD).

[2] WATECO (2003) Economics and the environment. The implementation Challenge of the Water Framework Directive. Guidance document and accompanying documents to the guidance.

[3] Koiva RB Management Plan (2010)