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Bachelor Thesis

Water Scarcity- Consumption of Water in Europe

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Affirmation

I declare that the bachelor thesis on topic: "Water Scarcity- Consumption of Water in Europe" was written individually by me, by the help of specific literature and other sources which are included in the review of used material, and by the help of consultations with supervisor Ing. Petr Procházka, MSc, Ph.D.

In Prague 29th April 2011

Signature

Acknowledgement

I would like to thank the supervisor, Ing. Petr Procházka MSc., Ph.D., for his willingness to help me, when I hung with my Bachelor Thesis. He helped me in many ways, and he was very nice and friendly, even in time of stress just before submitting it. Thank you.

Water Scarcity- Consumption of Water in Europe

Nedostatek Vody- Spotřeba Vody v Evropě

Summary

In this bachelor thesis, on the topic of Water Scarcity- Water Consumption in Europe, the consumption of water is analysed for three fundamental, and for water consumption, major sectors.

In the first section, consumption of water by European households is researched. In order to compare water consumption across Europe, an indicator of consumption of water per capita in selected European countries in the course of three years is created. Also, a comparison of median and arithmetic average of water consumption is provided so as to lay out a better measure of central tendencies. Furthermore, for the household sector, the percentage of the value in individual countries on the total consumption of all these countries is calculated. Finally, minimum and maximum water consumption by a country is provided to show the extent of water saving efficiency.

In the second and third part of this thesis, similar analysis is conducted for irrigation and industrial use while in former case, average consumption per hectare of irrigated land is calculated and in the latter case, total consumption by industry for cooling purposes is compared across European continent. Results from all sections show significant differences across countries in terms of water use patterns while, at the same time, comparison of the countries shows significant reserves for improvement of water consumption.

Keywords: water, irrigation, household, cooling, consumption, Europe, Water pollution

Souhrn

V této bakalářské práci na téma Nedostatek vody - Spotřeba vody v Evropě analyzuje spotřebu vody pro tři základní a významné sektory.

V první části je zkoumána spotřeba vody v evropských domácnostech. Za účelem porovnání spotřeby vody napříč Evropou, je vytvořen ukazatel spotřeby vody na obyvatele ve vybraných evropských zemí v průběhu tří let. Srovnání mediánu a aritmetického průměru spotřeby vody je poskytnuté proto, aby se rozložily a lépe měřily centrální tendence v datech. Pro sektor domácností, se navíc počítá procento hodnoty v jednotlivých zemích v celkové spotřeby všech těchto zemí. A konečně minimální a maximální spotřeba vody v zemi, je poskytnuta, aby ukázala rozsah účinnosti úspory vody.

V druhé a třetí části této práce probíhají podobné analýzy pro zavlažování a průmyslové využití, zatímco v prvním případě se vypočítá průměrná spotřeba na hektar zavlažované půdy a v druhém případě je celková spotřeba v průmyslu pro účely chlazení srovnávána napříč evropským kontinentem. Výsledky ze všech sekcí ukazují významné rozdíly napříč zeměmi z hlediska způsobů použití vody, ve stejné době, srovnání významných zemích ukazují rezervy pro zlepšení spotřeby vody.

Klíčová slova: voda, zavlažování, domácnost, chlazení, Evropa, Znečištění vody

CONTENT

1 Introduction

Water is very important medium for humans being. In addition it is not important just for humans, but also for nature as whole. Without water biosphere cannot exist. So let´s think about that. It is very important to save water, isn´t it?

This topic has been chosen, because it is a much discussed issue in these days. It is a very big problem for people. Problem of water scarcity is a global problem. World population is about 7 billion people and it is still increasing. More people imply more food consumption which means that there will be more need for water irrigation. More cars and increase in number of factories operating with old technology (particularly in China and India) requires more water for industrial use. Also biofuels are very bad issue for consumption of water. To produce one litter of biofuels, about two thousand and five hundred litters of water are needed. Europe is an important continent as it accounts for almost 1/10 of global population and much of global economic output. Therefore, Europe is chosen to be analysed so that the following aspects are tackled. Which are the biggest sections of water usage and which countries are the biggest consumers of water in appropriate sector. In this thesis, three largest consumers of water among sectors were identified. In the first section is provided analysis of water used in households, in the second is water used in agriculture for irrigation, and in the third section what has chosen, is provided analysis of consumption of water in industry exactly for cooling in industry.

2 Objectives of thesis and methodology

Little bit was adumbrated in the introduction part. There is written something about sections where is water consumed. It should to show in which countries is consumption of water on the highest level in household, agriculture- irrigation, and industry- cooling. These are the three biggest sectors of water consumption. Firstly is very important to know, how many people are living in each country, then how much water they consumed every year and in the end comparison of these two operations. In this bachelor thesis will be seen divergences of water consumption between every single year and also It is going to present extreme values, that's mean the biggest consumer compare to the smallest consumer. Every operation what is named above is for each sector except industry. In this sector is found only amount of water consumed in appropriate years 2003, 2005, and 2007. There are no information about amount of factories or enterprises. Is presented only, what amount of water selected countries used for cooling in industry.

In the first sector has chosen consumption of water in households. Are written down just countries in which are available information about consumption of water and number of people during whole years 2003, 2005, and 2007. Then are put these three years into one graph and compare them. Is compared consumption of water in households per capita. Next step was comparing extreme values as the biggest consumer with the smallest one. After these processes is there presented the median average and arithmetic average to know, if tendency of water consumption is increasing or decreasing. And as the last part of households section is done comparison of percentage of total amount of water consumption in every country during three years. This percentage is in arithmetic version.

The second section, consumption of water in agriculture for irrigation, is exactly the same like households section. Are done only two operations which are little bit different. This analysis was looking for information about sizes of irrigated land and then for amount of water used for irrigation. Every other process is the same, but data are different and comparison of water consumption for irrigation is per hectare.

And the last section, called consumption of water in industry for cooling. Is found only data with consumption of water during 10 years and it has chosen 3 years 2003, 2005, and 2007. Data about the number of factories or enterprises which are using water for cooling weren't found. In this part of this bachelor thesis is presented only consumption of water for cooling as total amount, not water used per factory. And the every other graph is the same like in the other sectors, but only in total amount.

So these are my objectives and methodology of this thesis.

3 Literature overview

3.1 Water scarcity

"Water scarcity can be defined in a number of ways and how one defines it has implications for policy."[1]

"Water is an essential resource for life and good health. A lack of water to meet daily needs is a reality today for one in three people around the world. Globally, the problem is getting worse as cities and populations grow, and the needs for water increase in agriculture, industry and households. This fact file highlights the health consequences of water scarcity, its impact on daily life and how it could impede international development. It urges everyone to be part of efforts to conserve and protect the resource."[2]

3.2 Hydrologic Cycle

"Let´s start with water cycle or hydrologic cycle. The hydrologic cycle is a conceptual model that describes the storage and movement of water between the biosphere, atmosphere, lithosphere, and the hydrosphere. Water on our planet can be stored in any one of the following major reservoirs: atmosphere, oceans, lakes, rivers, soils, glaciers, snowfields, and groundwater. Water moves from one reservoir to another by way of processes like evaporation, condensation, precipitation, deposition, runoff, infiltration, sublimation, transpiration, melting, and groundwater flow. The oceans supply most of the evaporated water found in the atmosphere. Of this evaporated water, only 91% of it is returned to the ocean basins by way of precipitation. The remaining 9% is transported to areas over landmasses where climatological factors induce the formation of precipitation. The resulting imbalance between rates of evaporation and

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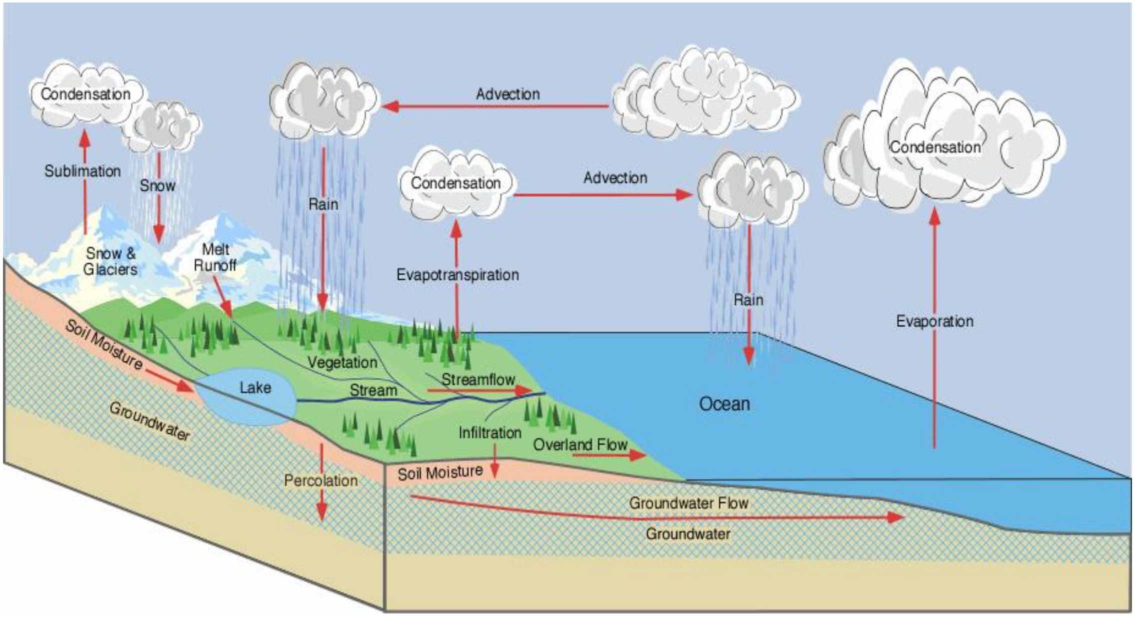
[1] ANAND, P. B., 2007. *Scarcity, Entitlements and the Economics of water in developing countries*: Edward Elgar Publishing limited. ISNB 978 1 84376 768 8 [cited at March 30, 2011]

[2] WORLD HEALTH ORGANISATION. *10 facts about water scarcity* [online]. [cited at March 10, 2011] Accessible at: <http://www.who.int/features/factfiles/water/en/>

precipitation over land and ocean is corrected by runoff and groundwater flow to the oceans."[3]

Figure 1. Hydrologic Cycle



Hydrologic Cycle (Source: PhysicalGeography.net)

As we can see hydrologic cycle is everywhere. One time water goes up from ocean by evaporation and fall down in rain to lakes. Second time water evaporate from lakes and fall down by rain to rivers or soil. And also water is everywhere around us. Groundwater which goes to ocean by ground, by soil, glaciers, rivers, lakes…many sources of water and every one are finishing their paths in the ocean. And ocean is sending water back per physical phenomena like evaporation, snow precipitation and rain precipitation.

"Water is more or less constantly moving and changing from one state to another (solid, liquid, or vapour/gas) while interacting with the physical processes present in the atmosphere, lithosphere, and biosphere. These changes and movements of water are linked together in the hydrologic cycle. Components of the hydrologic cycle include

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[3] Hubbart Jason A. (Lead Author); Pidwirny Michael (Contributing Author); Panikkar Avanish K (Topic Editor) "Hydrologic cycle". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth March 6, 2010; Last revised Date February 23, 2011; Retrieved March 4, 2011] <http://www.eoearth.org/article/Hydrologic_cycle>

water vapour and clouds in the atmosphere, but also include liquid surface waters (oceans, lakes and streams) on continents as well as groundwater. Other important components of the hydrologic cycle include glacial ice held on continents, and water contained in biomass. Plants and animals are about 70% water, by volume. Water evaporates in enormous quantities from the oceans and then falls as precipitation either on land or ocean. That portion which falls on land evaporates, is transpired by plants, runs off, or infiltrates by some measure. Between the various stages of the hydrologic cycle, water moves between temporary storage areas often called reservoirs. These movements are controlled by climatic conditions, which include rain, snow, wind, and other meteorological processes. Eventually, all water ends up back in the ocean."[4]

This paragraph is interesting, because it says, that water has many kinds of form exist in. for example liquid (lakes), solid (glaciers), vapour (geysers).

"Air can only hold a certain amount of water vapour. The amount depends largely upon temperature. Hotter air can hold more water vapour than colder air. When air is saturated with water vapour, the water vapour condenses into droplets of water, forming clouds. When the droplets gain enough mass, they fall to the ground as rain or snow. Water that falls as snow or rain evaporates, sublimates, runs off the ground surface (runoff) or soaks into the ground (infiltration). Whether the water runs off or infiltrates is controlled by a number of mechanisms including precipitation rate, soil water content, slope and vegetation. With increased rates of precipitation, runoff rates tend to increase. In extreme cases, rapid cloudbursts of precipitation can result in flash floods and potential landslides. Prior to rainfall, the relative amount of soil water content can dictate the amount of water that soil can hold before saturation. Generally, more water will infiltrate into dry soil than into a wet soil, and more water will run off steeper slopes than off moderate slopes. The presence of vegetation can counteract this process by holding more water than the hill slopes would by themselves. Hillsides that have undergone timber harvest or have been burned will often suffer severely from mudslides and flooding. Runoff processes within the hydrologic cycle include

[4] Hubbart Jason A. (Lead Author); Pidwirny Michael (Contributing Author); Panikkar Avanish K (Topic Editor) "Hydrologic cycle". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth March 6, 2010; Last revised Date February 23, 2011; Retrieved March 4, 2011] <http://www.eoearth.org/article/Hydrologic_cycle>

streamflow and groundwater flow, each of which eventually results in flow to ocean reservoirs. Lakes and streams may occur in low points of the landscape due to streamflow, or where the groundwater table emerges above the surface. Other contributors of the runoff process include melting of glacial ice, and calving of icebergs into the sea. On a global basis, precipitation exceeds evapotranspiration over continents, and evaporation exceeds precipitation over ocean reservoirs, while excess water moves from continents to oceans as runoff. The ratio of precipitation rate to evaporation rate can vary dramatically between regions. For example, in tropical rainforests, precipitation may greatly exceed evapotranspiration."[5]

It is logic, that evaporation is much higher above ocean reservoirs than above land. Water which falls down on the continent soak into soil and excess water goes back to ocean. Of course, that for example in Africa, they have opposite situation, there evaporation exceeds precipitation. From hydrologic cycle it is not far to pollution of water.

3.3 Water Pollution

"Water pollution is usually caused by human activities. Different human sources add to the pollution of water. There are two sorts of sources, point and nonpoint sources. Point sources discharge pollutants at specific locations through pipelines or sewers into the surface water. Nonpoint sources are sources that cannot be traced to a single site of discharge."[6]

"Water pollution is the contamination of natural water bodies by chemical, physical, radioactive or pathogenic microbial substances. Adverse alteration of water quality presently produces large scale illness and deaths, accounting for approximately 50 million deaths per year worldwide, most of these deaths occurring in Africa and Asia. In China, for example, about 75 percent of the population (or 1.1 billion people) are without access to unpolluted drinking water, according to China's own standards. Widespread consequences of water pollution upon ecosystems include species mortality, biodiversity reduction and loss of ecosystem services. Some consider that water pollution may occur from natural causes such as sedimentation from severe rainfall

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[5] Hubbart Jason A. (Lead Author); Pidwirny Michael (Contributing Author); Panikkar Avanish K (Topic Editor) "Hydrologic cycle". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth March 6, 2010; Last revised Date February 23, 2011; Retrieved March 4, 2011] <http://www.eoearth.org/article/Hydrologic_cycle>

[6] LENNTECH. *Where does water pollution come from?* [online]. [cited at March 30, 2011] Accessible at: <http://www.lenntech.com/water-pollution-faq.htm>

events; however, natural causes, including volcanic eruptions and algae blooms from natural causes constitute a minute amount of the instances of world water pollution. The most problematic of water pollutants are microbes that induce disease, since their sources may be construed as natural, but a preponderance of these instances result from human intervention in the environment or human overpopulation phenomena."[7]

It is unbelievable how many people are going beyond this world because of polluted water. We have everything but people still die by silly reasons. I think in Africa they have enough water, but they have no money for reduce pollution in it and this is mostly reason of their death. And China is full of dirty, ill and people how don´t care about hygiene. May be these few things reason to their polluted water? They don´t care, this is the problem. I think if we have some area with polluted water what we can´t drink, we would like, or we will fight for clean fresh water to us. China has money but nothing else, doesn´t care about people who live there.

"Water pollutant sources can be grouped into two super categories: a) point sources which can be attributed to discrete discharge from a factory or sewage outfall and b) non-point sources that include agricultural runoff, urban storm water runoff and other area wide sources. Many of the common inorganic chemical water pollutants are produced by non-point sources, chiefly relating to intensive agriculture and high-density urban areas. Specific inorganic chemicals and their major sources are: monopotassium phosphate, ammonium nitrate and a host of related phosphate and nitrogen compounds used in agricultural fertilizers; heavy metals (present in urban runoff and mine tailings area runoff). However, some inorganics such as chlorine and related derivatives are produced chiefly from point sources, ironically employed in water treatment facilities. Moreover, some of the large dischargers of heavy metals to aquatic media are fixed point industrial plants."[8]

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[7] Hogan C Michael PhD. (Lead Author);McGinley Mark (Topic Editor) "Water pollution". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth July 31, 2010; Last revised Date November 5, 2010; Retrieved March 7, 2011 <http://www.eoearth.org/article/Water_pollution?topic=58075>

[8] Hogan C Michael PhD. (Lead Author);McGinley Mark (Topic Editor) "Water pollution". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth July 31, 2010; Last revised Date November 5, 2010; Retrieved March 7, 2011 <http://www.eoearth.org/article/Water_pollution?topic=58075>

There is many ways to polluting water. Mainly from cars (we don´t know how to storage dangerous liquids), agricultural plants (water flush away fertilizers from field).

"Improper storage and use of automotive fluids produce common organic chemicals causing water pollution are: methanol and ethanol (present in wiper fluid); gasoline and oil compounds such as octane, nonane (overfilling of gasoline tanks); most of these foregoing discharges are considered non-point sources since their pathway to watercourses is mainly overland flow. However, leaking underground and above ground storage tanks can be considered point sources for some of these same chemicals, and even more toxic organics such as perchloroethylene. Grease and fats (higher chain length carbon molecules such as present in auto lubrication and restaurant effluent can be either point or non-point sources depending upon whether the restaurant releases grease into the wastewater collection system (point source) or disposes of such organics on the exterior ground surface or transports to large landfills, both of which last two cases lead to non-point release to water systems. The most significant physical pollutant is excess sediment in runoff from agricultural plots, clear-cut forests, improperly graded slopes, urban streets and other poorly managed lands, especially when steep slopes or lands near streams are involved. Other physical pollutants include a variety of plastic refuse products such as packaging materials; the most pernicious of these items are ring shaped objects that can trap or strangle fish and other aquatic fauna. Other common physical objects are timber slash debris, waste paper and cardboard. Finally power plants and other industrial facilities that use natural water bodies for cooling are the main sources of thermal pollution."[9]

How we can stop polluting water? Reduce fertilizers or ride to work on bike instead of drive cars? In this time it is not possible. So we have to invite some magic ingredient what will be mix with fertilizers or dangerous liquids from cars, or factories and then

[9] Hogan C Michael PhD. (Lead Author);McGinley Mark (Topic Editor) "Water pollution". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth July 31, 2010; Last revised Date November 5, 2010; Retrieved March 7, 2011 <http://www.eoearth.org/article/Water_pollution?topic=58075>

will dangerous liquids more kind to water than now. It can be some idea, I don´t know, I´m not scientist or expert, but it can be as I said.

"Non-point source control relates chiefly to land management practices in the fields of agriculture, silviculture, mining and urban design and sanitation. Agricultural practices leading to the greatest improvement of sediment control include: contour grading, avoidance of bare soils in rainy and windy seasons, polyculture farming resulting in greater vegetative cover, and increasing fallow periods. Minimization of fertilizer, pesticide and herbicide runoff is best accomplished by reducing the quantities of these materials, as well as using application times removed from periods of high precipitation. Other techniques include avoidance of highly water soluble pesticide and herbicide compounds, and use of materials that have the most rapid decay times to benign substances."[10]

As we can see in article above, best way how to reduce polluting water is reduce dangerous materials in fertilizers, it can works I think, but agriculture not to say food, will be more expensive. On the other hand, if we want to eat, we have to pay for it.

"The chief water pollutants associated with mines and quarries are aqueous slurries of minute rock particles, which result from rainfall scouring exposed soils and haul roads and also from rock washing and grading activities. Runoff from metal mines and ore recovery plants is typically contaminated by the minerals present in the native rock formations. Control of this runoff is chiefly derived by controlling rapid runoff and designing mining operations to avoid tailings either on steep slopes or near streams. In the case of urban stormwater control, the most important methods are achieved in urban planning by use of minimal net surface runoff of impermeable surfaces. This is not merely a simply geometric design issue of avoiding sprawl and minimizing paved surfaces, but also a strategy of incorporating holding ponds into landscaping and use of bioswales and permeable pavers. At an operational level, the use of native plant and xeriscape techniques reduces water use and water runoff and also minimizes need for

[10] Hogan C Michael PhD. (Lead Author);McGinley Mark (Topic Editor) "Water pollution". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth July 31, 2010; Last revised Date November 5, 2010; Retrieved March 7, 2011 <http://www.eoearth.org/article/Water_pollution?topic=58075>

pesticides and nutrients. In regard to street maintenance, a periodic use of streetsweeping can reduce the sediment, chemical and rubbish load into the storm sewer system."[11]

Here is briefly described water pollution. What are chief water pollutants, what we supposed to do for reduce dangerous liquids, materials in water and so on. Now I will write something about water consumption, we know something about hydrologic cycle, kinds of water (rivers, groundwater, icebergs…), also about pollution but water abstraction is still hidden for us, so go ahead.

3.4 Kinds of Water Use

3.4.1 Domestic Use of Water

"Many rural residents still obtain safe water from untreated private wells, but urban residents are usually supplied with water from complex and costly water purification facilities. Extending and merging of urban communities have created problems in the development, transportation, and maintenance of quality water supplies. A relatively small amount of freshwater-roughly 8 percent of the global total-is withdrawn for domestic municipal requirements. In regions experiencing rapid population growth, such as Asia, domestic use is expected to increase sharply by year 2000. About 60 percent of water used for domestic purposes is returned to rivers as waste-water."[12]

What will be the number of freshwater abstraction in 10 years? I suppose 10 percent, because more people, more factories. Let´s see some domestic activities in which we use water for example in North America.

"Domestic activities in highly developed nations require a great deal of water. This domestic use includes drinking, air conditioning, bathing, washing clothes, washing dishes, flushing toilets, and watering lawns and gardens. On average, each person in

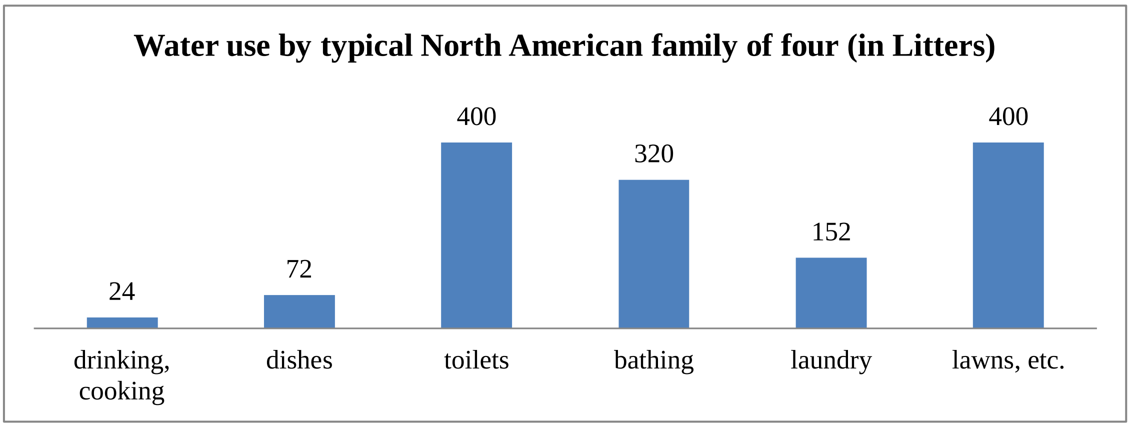
[11] Hogan C Michael PhD. (Lead Author);McGinley Mark (Topic Editor) "Water pollution". In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth July 31, 2010; Last revised Date November 5, 2010; Retrieved March 7, 2011 <http://www.eoearth.org/article/Water_pollution?topic=58075>

[12] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management, Domestic use of water*, fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 287-290]

North American home uses 300-400 litters of water each day. Most of this domestic water is used as a solvent to carry away wastes, with only a small amount used for drinking."[13]

You can see it on the graph below. Of course, that this data are just average, it depends on location, season. There are many factors of consumption water, when we are in location with high number of precipitation, that's logic, that we will save more water to gardens and lawns. Some families live on country side, and they can have dry toilet, so they don´t need water for flushing toilet. In these days, we have many systems how to save water in homes, wash machines, on toilet we have two levels of flushing with 3 litters and with 5 litters. But consumption of water is still big in USA, because of low price of water.

Figure 2. Water Use by Typical North American Family of Four (in Litters)



Own illustration 1, source of data:

"Yet all water that enters the house has been purified and treated to make it safe for consumption. Until recently, the cost of water in almost every community has been so low that there was very little incentive to conserve, but increasing purification cost have raised the price of domestic water and it is becoming evident that increased costs do tend to reduce use. Natural processes cannot cope with the highly concentrated wastes typical of a large urban area. The unsightly and smelly results present a potential health problem for the municipality. Cities and towns must provide for both the domestic water supplies and the treatment of the wastewater following its use, and both

[13] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management, Domestic use of water,* fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 287-290]

processes are expensive and require trained personnel. The major problem associated with domestic use of water is maintaining an adequate, suitable supply for growing metropolitan areas. Demand for water in urban areas sometimes exceeds the immediate supply, particularly when domestic supply consists of local surface water. During the summer, water demand is high, and precipitation is often low. More domestic water is wasted than consumed. This loss, nearly 20 percent of the water withdrawn for public supplies (mainly through leaking water pipes and water mains), is amazingly large. Another major cause of water loss has been that of public attitudes. As long as water is considered a limitless, inexpensive resource, there will be little effort to conserve. As the cost of water rises and attitudes toward water change, so will usage and efforts to conserve."[14]

Let´s have a look to 2 biggest differences. In one side Germany and in the other side USA. Germany has nearly to triple price compare to consumption, and USA has double water abstraction compare to price. I think, that price of water is really important, people have to know, that we have a problem, so we have to send prices of water up, then will people save water more than now.

3.4.2 Agricultural Use of Water

"The major consumptive use of water in most parts of the world is for agricultural purposes and principally for irrigation. In the 1980s, for example, irrigation accounted for nearly 80 percent of all the water consumed in North America. The amount of water used for irrigation and livestock continues to increase throughout the world. Future agricultural demand for water will depend on the cost of water for irrigation; the demand for agricultural products, food, and fibre; governmental of new technology. In some areas, irrigation is a problem, because there is not a supply for water nearby. In some place, water must be piped hundreds of kilometres for irrigation. Because most of the world consumptive use of water results from irrigation, it is becoming increasingly important to modify irrigation practices to use less water."[15]

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[14] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management, Domestic use of water,* fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 287-290]
[15] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management, Agriculture use of water,* fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 290]

Also we can expect increasing price of food, because when price of water for irrigation will increase, logic thing is, that farmers will be in pressure and they have to raise prices of food. In problem of Global Water Scarcity it is good process, because, when will be prices of water in addition food high, people will think about their money budgets and they will start save money, so they will start save water.

"Water loss from irrigation can be reduced in many ways. Increasing the cost of water will stimulate conservation of water by farmers just as it does home owners. Another method is to reduce the amount of water-demanding crops grown in dry areas, or change from high water-demanding to lower water-demanding crops. Planting wheat or soybeans instead of potatoes or sugar beets reduced the amount of water required. Switching to trickle irrigation also reduced water loss. With trickle irrigation, a series of pipes are placed on the ground with openings strategically placed so that when water flows through the pipe, it delivers a particular quality of water to the individual plants. This method delivers the water directly to the roots of the plants, rather than flooding entire fields. Although used extensively in greenhouses, trickle irrigation is generally too costly for large agricultural operations."[16]

We can planting crops which are not so water-demanding but I think, that we can simulate weather, for example southern countries but crops will be grow in northern countries with moisture soil, that's mean they will not need so much irrigation like before.

"Methods that do not use as much water as flooding irrigation and that are not as expensive in terms of labour and equipment as the trickle method include furrow irrigation, corrugation irrigation, overhead irrigation, and subirrigation. Each of these methods has its drawback and advantages as well as conditions under which it works well. Irrigation requires a great deal of energy. Estimates indicate that 40 percent of the energy devoted to agriculture in Nebraska is used for irrigation. Increasing energy costs may force some farmers to reduce or discontinue irrigation. In addition, much of western Nebraska relies on groundwater for irrigation, and the water table is dropping

[16] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management, Agriculture use of water,* fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 290]

rapidly. If a water shortage develops, land values will decline. Land use and water use are interrelated and cannot be viewed independently."[17]

3.4.3 Industrial Use of Water

"Water for industrial use accounts for more than half of total water withdrawals. Ninety percent of the water used course by industry is for cooling. Most industrial processes involve heat exchanges. Water is a very effective liquid for carrying heat away from these processes. For example, electric power generating plants use water to cool stream so that it changes back into water. If the water heated in an industrial process is dumped directly into a watercourse, it significantly changes the stream´s water temperature. This affects the aquatic ecosystem by increasing the metabolism of the organism and reducing the water´s ability to hold dissolved oxygen. Industry also uses water to dissipate and transport waste materials. In fact, many streams are now overused for this purpose, especially watercourses in urban centres. The use of watercourses for waste dispersal degrades the quality of water and may reduce its usefulness for other purposes. This is especially true if the industrial wastes are toxic. During the past 30 years, many nations have passed laws that severely restrict industrial discharges of wastes into watercourses."[18]

Factories use water their manufacturing. That's good, because they take cold water from stream and after its use they give it back to the stream but in hot form. I see big problem, when they are using water in streams for transport of chemicals as waste from their factories. And it is plain enough, that after this process we cannot use water from the stream anymore. They can do it when they will have some sewage plant built on this stream.

[17] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management*, *Industrial use of water,* fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 292-293]

[18] ENGER D. Eldon, Smith F. Bradley. *Environmental Science* chapter 15 *Water Management*, *Industrial use of water*, fifth edition. McGraw-Hill, 1995. [cited at March 10, 2011; page 292-293]

3.4.4 Global Perspective

Table 1. Global Perspective

Characteristic	Industrialized Countries	Developing Countries
	Water Use	
Water Use Per Capita	Heavy per capita usage. Highest usage per capita is in U.S., Canada, and Switzerland. Usage is stabilizing.	Small per capita use. Water usage increases as living standards go up.
Where Is Water Used	Mostly for industry and agriculture, followed by domestic use.	Mostly for irrigated agriculture, especially in Asia, followed by industry, then domestic use.
Access to Water and Sanitation	Water and sanitation generally available. Only small population increases are expected.	Large segments of the population do not have safe drinking water and sanitation services. A rapidly growing urban population will create an increasing demand for water and for sanitation.

Pollution Control		
Domestic Wastewater	Most countries treat domestic wastes. In Central European countries, lack of sewage treatment system is a serious problem.	Almost all urban sewage is discharged.
Industrial Wastes	Strictly regulated in most industrialized countries, but pollution exist from discharges made up to 100 years ago. Some accidental spills. In Central Europe, industrial wastes laced with heavy metals and toxic chemicals have caused river quality to deteriorate dramatically and the Black and Baltic seas to become heavily polluted. Acids lakes and rivers are a problem in North America and Europe.	Largely untreated. A significant and growing problem. Problems with acidification developing in Southern China and tropical Africa.
Land Use Runoff	Fertilizers and pesticides are a continuing problem. Soil washed from agricultural and urban areas and oil from city streets pollute rivers.	Uncontrolled use of fertilizers and pesticides is creating a growing health problem. In areas of heavy deforestation soil erosion leads to sediment-clogged rivers.

Own illustration 2, source of data: [5]

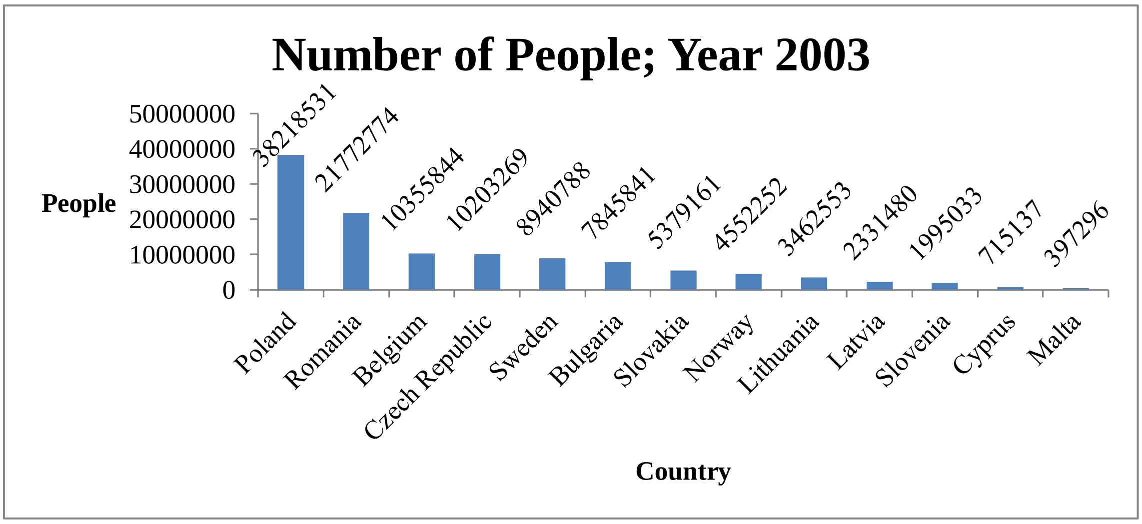
4 Analysis

In this following part is analysed European consumption of water for irrigation, for households and industry. It is not make for whole Europe, just for some countries, because some countries from Europe have data about consumption of water nowhere. The found countries are in period of three years 2003, 2005, 2007. First of all are 13 countries with database about Consumption of water in households (Belgium, Bulgaria, Cyprus, Czech Republic, Latvia, Lithuania, Malta, Norway, Poland, Romania, Slovakia, Slovenia, and Sweden), which will be compared with number of people in each country. Finally will be seen consumption of water in households per capita. Then are 12 countries with database about consumption of water for irrigation (Belgium, Bulgaria, Cyprus, Czech Republic, Greece, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and Sweden), which will be compared with size of farmland in each country. In final will be seen consumption of water for irrigation per hectare. In addition exist 12 countries with database about consumption of water in industry (Belgium, Bulgaria, Croatia, Finland, France, Hungary, Poland, Romania, Spain, Sweden, Switzerland, and Turkey). These countries have available data only for consumption of water in each country, not number of factories. Compute in this case is limiting by amount of found data.

4.1 Consumption of Water in Households

In the first step it is necessary to collect data on number of people in the analysed countries. As the second step is important to collect data of water consumption in other words amount of water used into households. These two operations will be done for year 2003, 2005, and 2007. As the last thing to do will be calculate water consumption per capita of every single year and presented these three results in a graph. After these operations is the time for compare two extreme values. It is mean compare in one graph two countries. The first country will be presented as the biggest consumer and the second country will be presented as the smallest consumer of water in households per capita.

Figure 3. Number of People; Year 2003

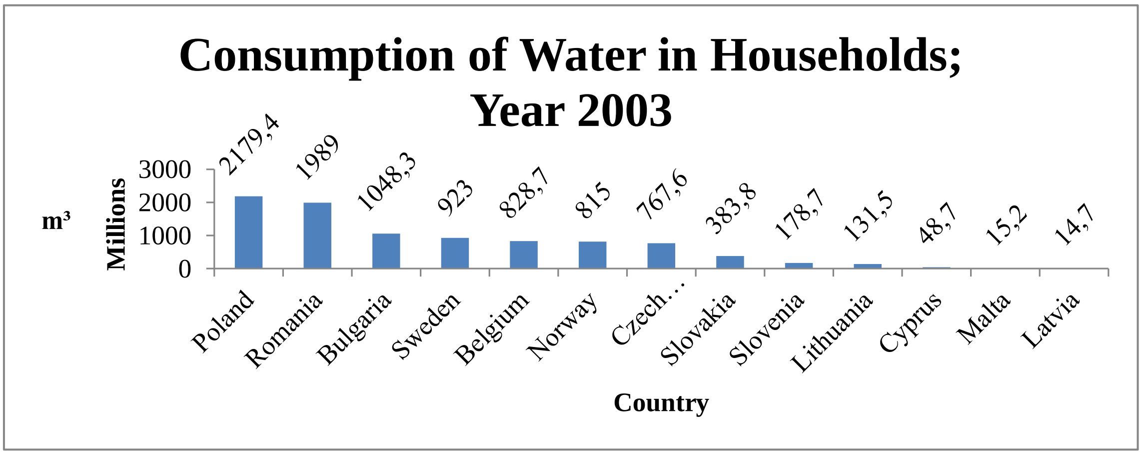


Own illustration 3, source of data: [10]

As can be seen on the graph above, Poland has the biggest number of people and Malta has the smallest NO of people. On the second graph below, can be seen little changes in emplacement.

Now have look at the graph with yearly consumption of water in named countries. Poland is still on the first place, but last place is different, now is there Latvia instead of Malta. Same places are taken by, as was said, Poland and Romania. The other positions are mixed.

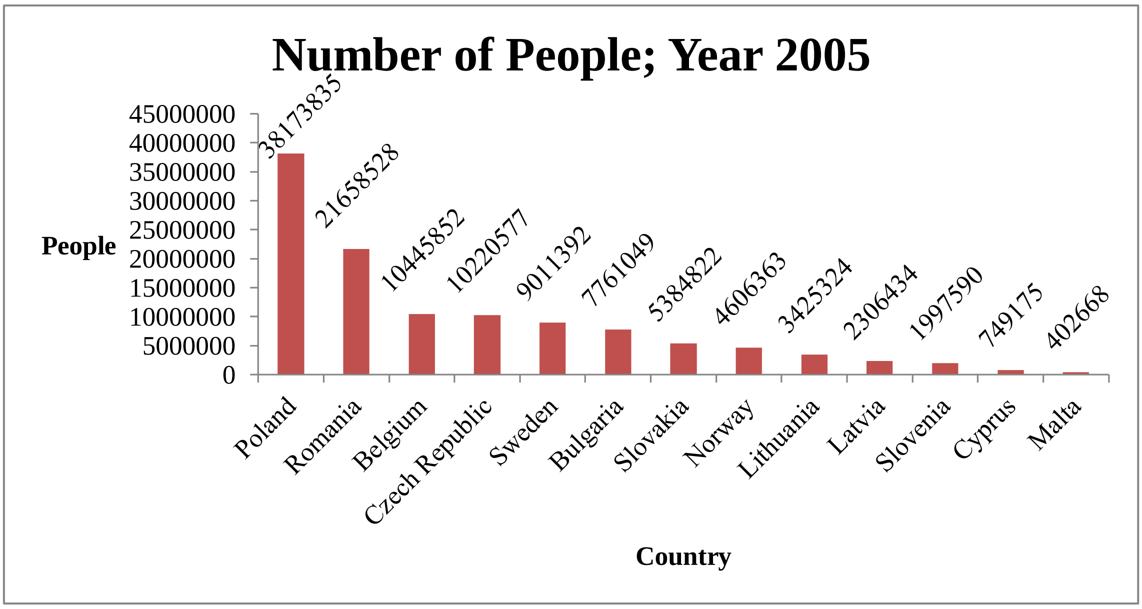
Figure 4. Consumption of Water in Households; Year 2005



Own illustration 4, source of data: [8]

Let´s start with population in our analysed countries. It is clear that positions of total population are without changes. Some changes in numbers of people, but countries are still on the same positions. It is logic, because countries have different expanses and differences between them are big. It is the reason, why this factor doesn´t change. On the graph below check the population of year 2005 in European countries which have been chosen for my analysis.

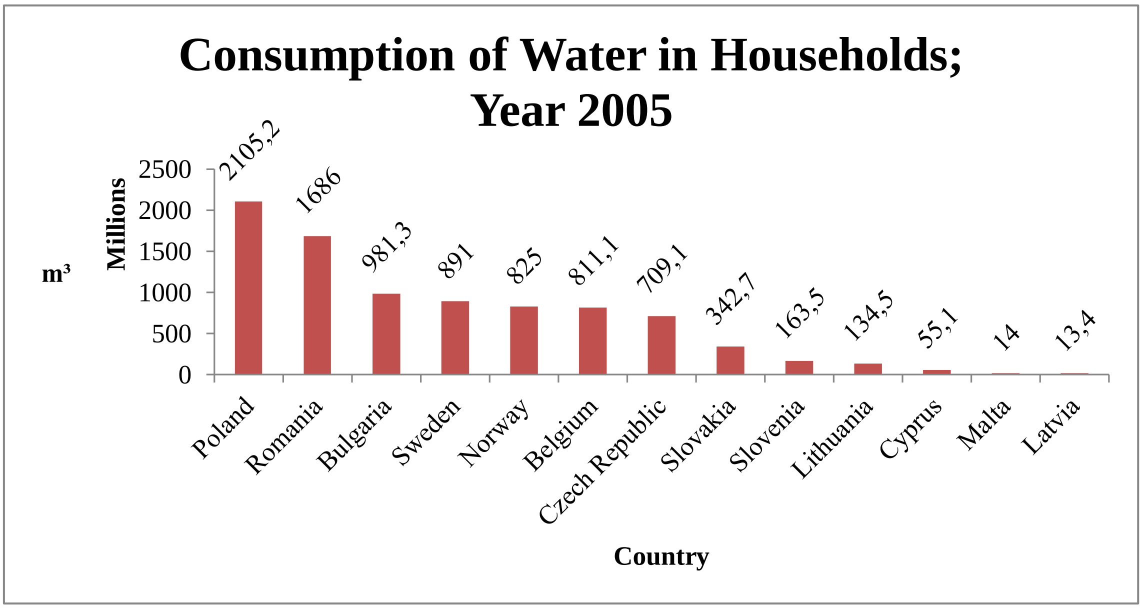
Figure 5. Number of People; Year 2005



Own illustration 5, source of data: [10]

In Consumption of Water in Households is noted one change in emplacement. In year 2003 was Belgium on the 5th place but in year 2005 is on the 6th place. And Norway was in 2003 on the 6th place and in year 2005 on 5th position. Only these two states changed their positions.

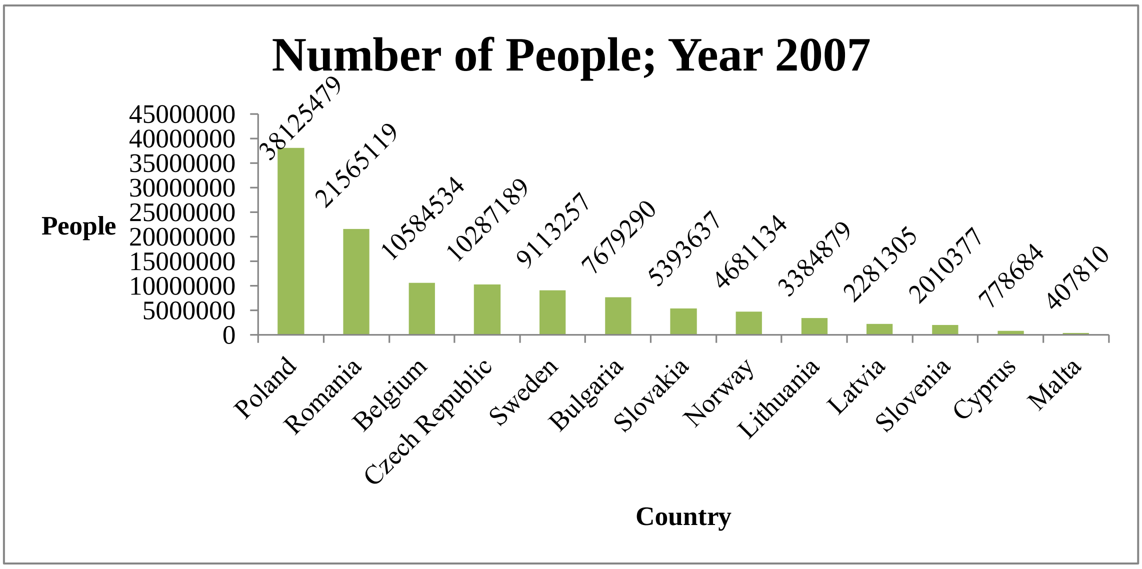
Figure 6. Consumption of Water in Households; Year 2005



Own illustration 6, source of data: [8]

In Year 2007, number of people didn´t write down any changes in emplacement of countries. It could be predictable, because changes in population are not so big.

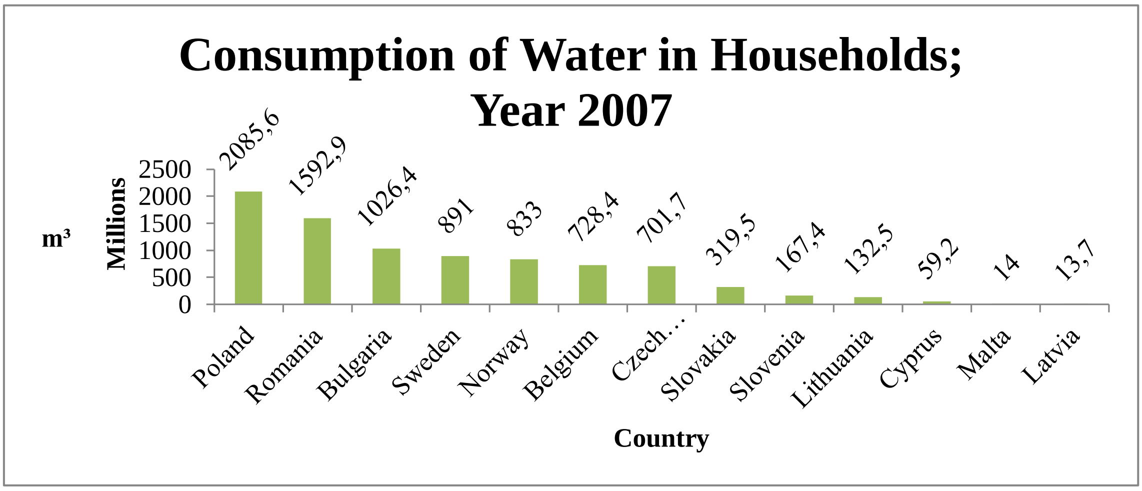
Figure 7. Number of People; Year 2007



Own illustration 7, source of data: [10]

As it is presented in the graph of Consumption of Water in Households in year 2007, it is quite same like in year 2005. Two years are not so much for dramatic changing in consumption of water.

Figure 8. Consumption of Water in Households; Year 2007



Own illustration 8, source of data: [8]

4.1.1 Comparison of Water Consumption in Households per Capita in Years 2003, 2005, 2007

In the first step, have to be water consumption in households divided by number of people.

Mathematical formula:

$$CWH_{CAPITA} = \frac{\mathrm{CWH}}{\mathrm{NP}}$$

CWH Consumption of Water in Households

NP Number of People

CWH_{CAPITA} Consumption of Water in Households per Capita

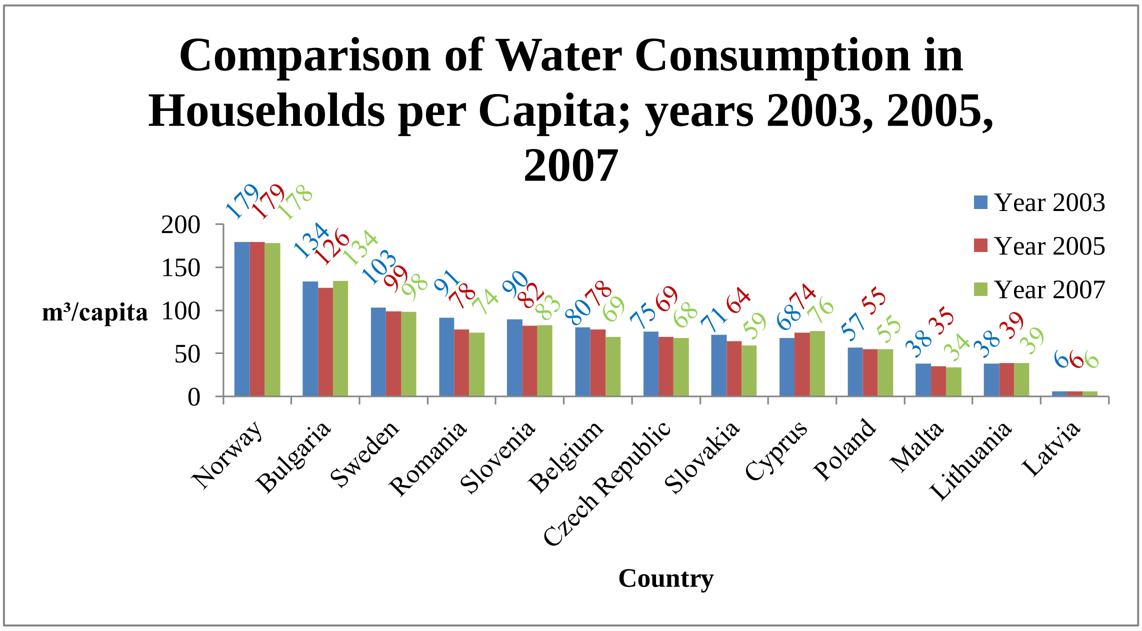
In the second step, have to be the results presented in the graph. In the graph is compared year 2003 as a blue line, year 2005 as a red line and year 2007 as a green line. There are shown the differences between these three years. Let´s start with Norway. There can be seen, that in 2003 and 2005 is consumption of water per capita on the same level and in year 2007 consumption goes down. In Bulgaria it is different. In year 2003 is amount of consumption high, year 2005 it fell down and in last year 2007 it is also on high level. Sweden, Romania, Slovenia, Belgium, Czech Republic, and Slovakia are on the normal level. Consumption in these countries goes down except Slovenia. There is same problem like in Bulgaria. First year high, second year is consumption on low level and year 2007 is again on high level.

There are some changes in positions between Romania and Slovenia. Cyprus is on 7th place in year 2005 and in year 2003 is on 9th place. Also there are some changes between Lithuania and Malta. Look at the Norway and Latvia. These states have same number in year 2003 and also in year 2005. Bulgaria fell down but not so much as for example Romania. Two countries in this graph have bigger number of water consumption in year 2005.

Very interesting fact is, that Poland, which has the biggest NO of people and the biggest yearly consumption of water in households is on the 10th position now. Norway which was in NO of people on the 8th position and in yearly consumption of water it was on 6th position now is Norway on 1st place with very big headstart 45 cubic meters before the others. The other places are relatively without changes. Look at the Norway and Latvia. Norway´s consumption is close to be 30 times bigger than Latvia´s consumption.

Look at the Cyprus where can be seen very weird fact. Year 2003 was Cyprus very good in consumption of water, because it was the smallest number. Second year was different from the other countries. Amount of water consumption was higher instead of lower. And in last year 2007 it was also on high level. It is sure, that it is depend on prices of water. And from this graph can be clean, that prices of water for households in Cyprus fell down, because consumption of water went up. One more interesting situation is in Latvia. In this country people take water in same amount during years 2003, 2005, and 2007.

Figure 9. Comparison of Water Consumption in Households per Capita; Years 2003, 2005, 2007



Own computation 1, source of data: [8], [10]

4.1.2 Median and arithmetic average

Average for every single year is also done. There can be seen median average of years 2003, 2005, 2007, and arithmetic average of these years. First of all, what is median?

"Median is type of average, found by arranging the values in order and then selecting the one in the middle. If the total number of values in the sample is even, then the median is the mean of the two middle numbers."[19] Arithmetic average is "*a number calculated by adding together several figures and dividing by the number of figures added"*.[20] Computation of these averages was done in Microsoft Excel and it was calculated for consumption of water in households per capita.

[19] INVESTOR WORDS. *Median* [online]. [cited at March 15, 2011] Accessible at: <http://www.investorwords.com/3030/median.html>

[20] ECONOMICS DICTIONARY. *Arithmetic average* [online]. [cited at March 15, 2011] Accessible at: <http://www.economics-dictionary.com/definition/arithmetic-average.html

Table 2. Comparison of Median and Arithmetic Average of Water Used in Households per Capita

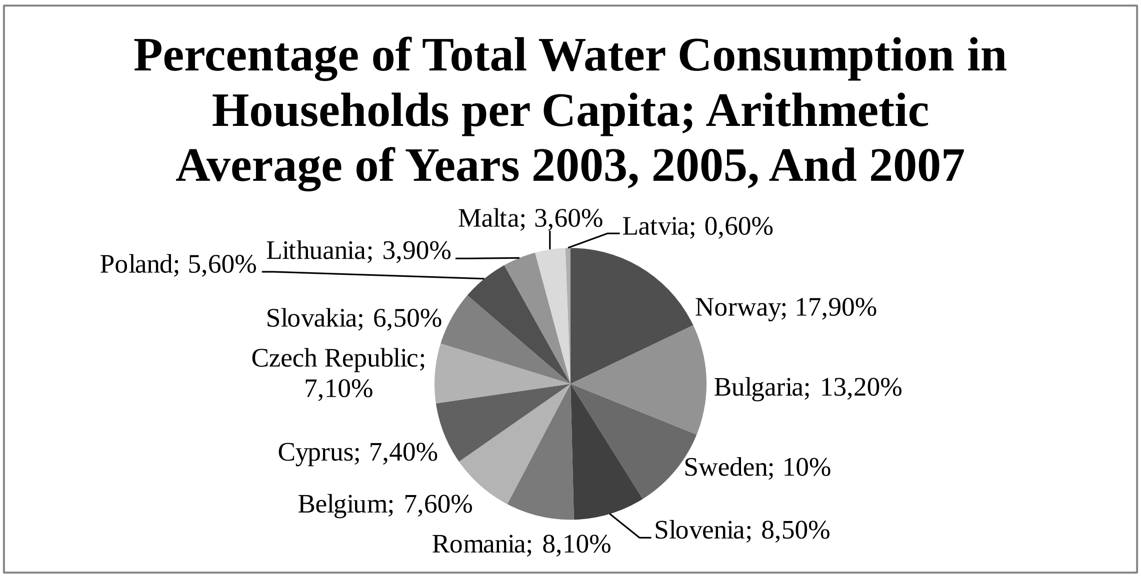
	2003	2005	2007
median average	75 m^3/capita	74 m^3/capita	69 m^3/capita
arithmetic average	79 m^3/capita	76 m^3/capita	75 m^3/capita

Own computation 2, source of data: [8], [10]

It is very nice to see this table above, because is seen, that consumption of water goes down every year. Median average fell rapidly down in year 2007, but in arithmetic average were big changes in year 2005. When is between median and arithmetic average big divergence, that means, there are big skips between years. Median gives you the most frequent value, but arithmetic average gives middle value of appropriate data. On the table 2. is seen, that in year 2005 in divergence smaller then in year 2003, but in year 2007 is divergence between averages bigger than in the first year, this means, that skips between consumed amount of water are very big, it is evoked by size of every single country.

In this graph below, is presented percentage of total water consumption in households per capita during three years. The graph is made by thirteen countries from which each country is added together every simple year. It is mean, calculation of three years together in every country. From these results is done the percentage of each country from total water consumption of these thirteen countries. There is percentage of arithmetic average. It is good to know which country is on which position, that Norway has 17,9% of total water consumption in households and it is the biggest consumer.

Figure 10. Percentage of Total Water Consumption in Households per Capita; Arithmetic Average of Years 2003, 2005, And 2007

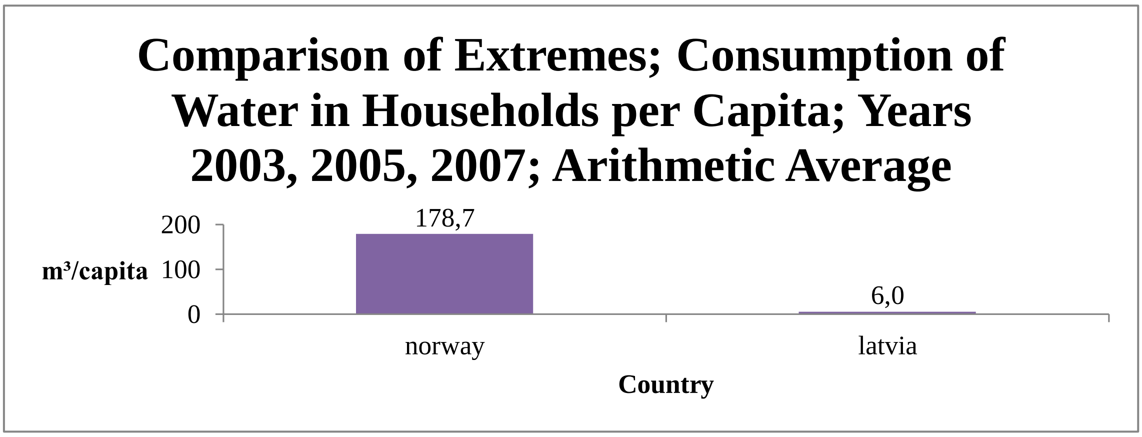


Own computation 3, source of data: [8], [10]

4.1.3 Comparison of Extremes; Consumption of Water in Households per Capita; Years 2003, 2005, 2007; Arithmetic Average

Have a look on the graph below where is comparison of extremes. It is compared because can be seen the big difference of amount of water consumption which people in Norway and people in Latvia. There is an arithmetic average of three years 2003, 2005, and 2007. On the graph were selected the biggest consumer where is Norway on first place for whole three year and the smallest consumer, where Latvia takes last position during all three years.

Figure 11. Comparison of Extremes; Consumption of Water in Households per Capita; Years 2003, 2005, 2007; Arithmetic Average

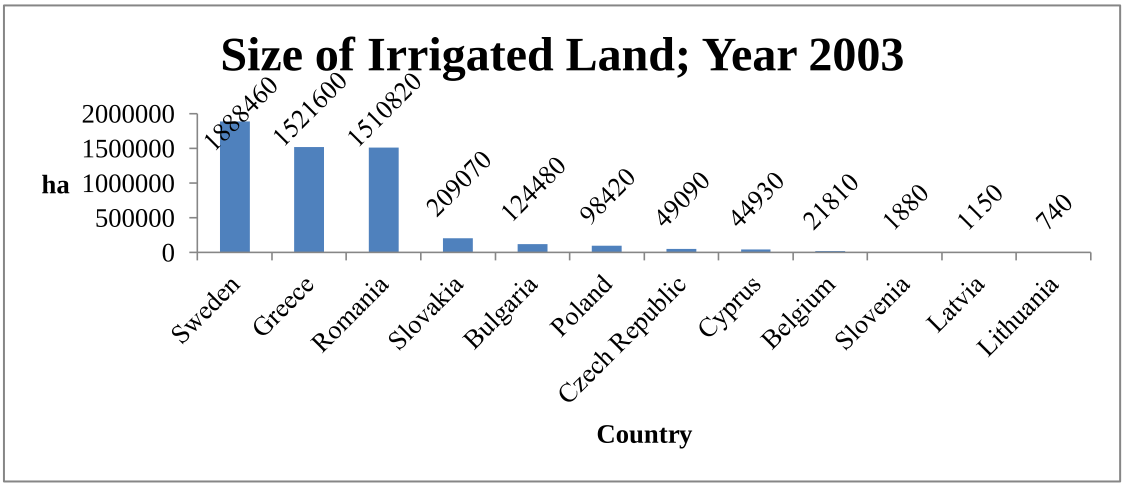


Own computation 4, source of data: [8], [10]

4.2 Consumption of Water For Irrigation

Now is here sector of agriculture called Irrigation. This part of analysis is similar to previous part. There are three years again, but only 12 countries (Belgium, Bulgaria, Cyprus, Czech Republic, Greece, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and Sweden). About each country have been found information as a size of irrigated land and amount of water what is consumed for irrigation. Then were calculations where I calculated extent of consumed water with size of irrigated land. Let´s have a look on first graph which is about size of irrigated land and which is below.

Figure 12. Size of Irrigated Land; Year 2003

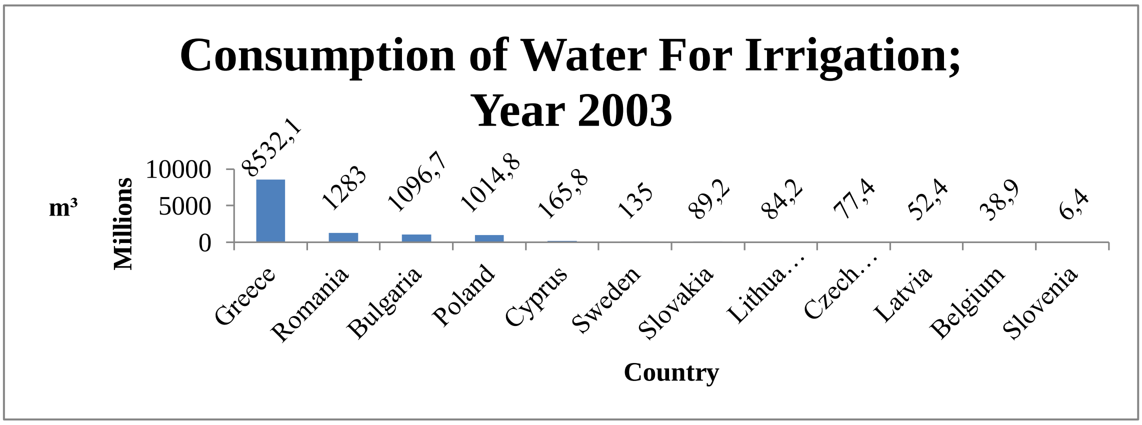


Own illustration 9, source of data: [9]

From graph above is appropriate, that size of irrigated land is depend on size of country. For example Sweden or Greece are big countries, it is the reason, why they have huge land for irrigation. On the other side Latvia or Lithuania are small countries, so they have logically small size of irrigated land.

On the second graph of year 2003 is seen water usage for irrigation. In this case is very simple answer, why are on the first places countries like Greece and Romania. These countries are very big and their location is on the South, where is very hot and dry weather during whole year. So they have to use water for irrigation much more, than for example Czech Republic, or Slovenia, where weather is rainier. Also look at the size of irrigated land between Greece and Slovenia. Greece has 810 times bigger farmland, than Slovenia. Then look on the graph with water consumption for irrigation, can be seen, that Greece consumed 1333 times more cubic meters of water than Slovenia.

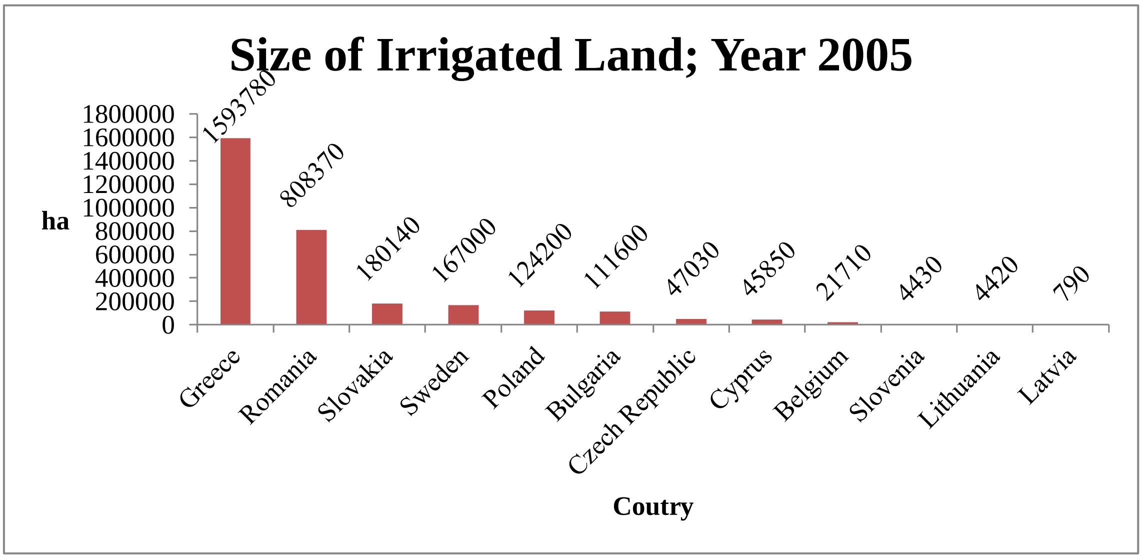
Figure 13. Consumption of Water For Irrigation; Year 2003



Own illustration 10, source of data: [7]

In this year can be seen some changes in sizes of farmland. Czech Republic, Cyprus, Belgium, and Slovenia stay on the same places like in 2003. Other countries noted some changes. First place is not occupied by Sweden but by Greece. Sweden is in year 2005 on the fourth position. It is very big difference, isn´t it?

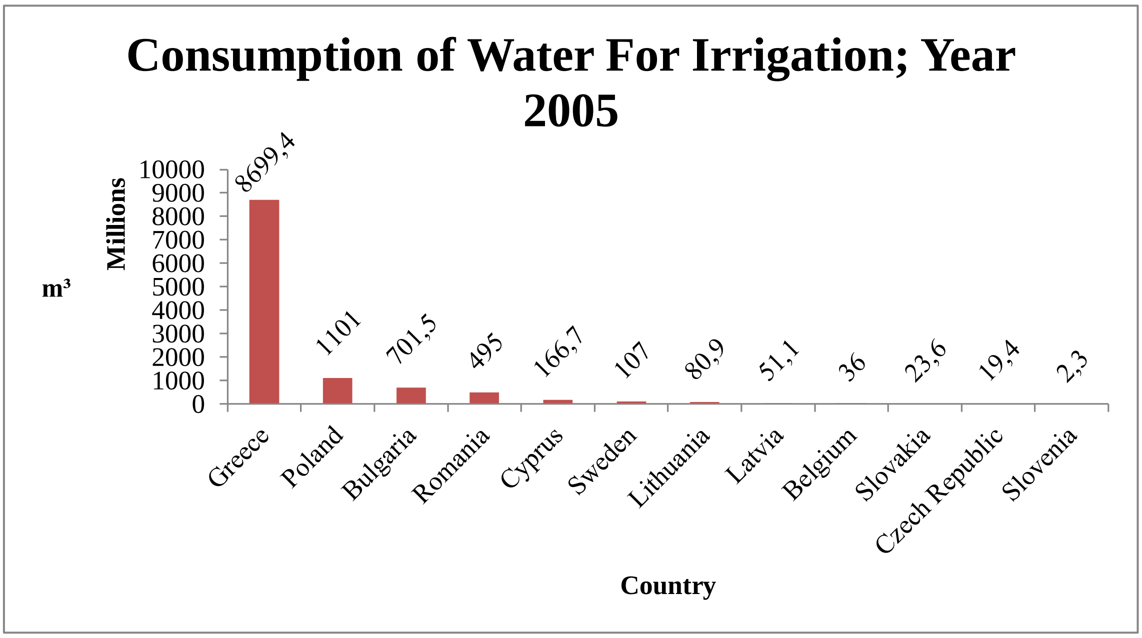
Figure 14. Size of Irrigated Land; Year 2005



Own illustration 11, source of data: [9]

Greece is still on the first place and Slovenia takes the last position. Check it on the graph below. Also Bulgaria, Cyprus, and Sweden didn´t move. Slovakia noted big jump from seventh to tenth place, Czech Republic from ninth to eleventh place. Just these two countries went down with consumption of water. The others stayed on the same, or went to up. It is effected by prices of water and weather. When is somewhere very hot season, fields have to irrigated so much and when is water for irrigation cheap, fields can be irrigated so much.

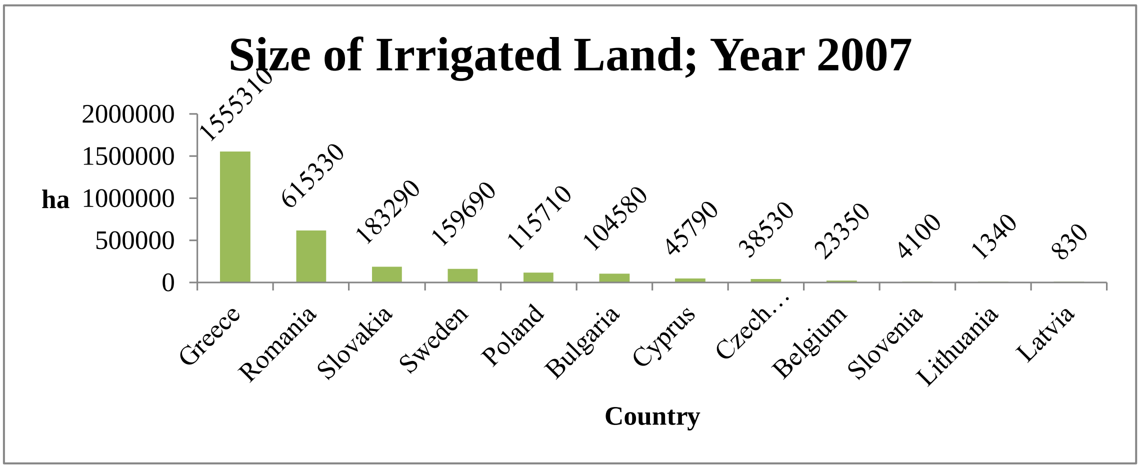
Figure 15. Consumption of Water For Irrigation; Year 2005



Own illustration 12, source of data: [7]

Sizes of irrigated land in every country stayed without changes except Cyprus and Czech Republic. These two countries changed their places between themselves, Cyprus is on seventh position and Czech is on eighth position in 2007.

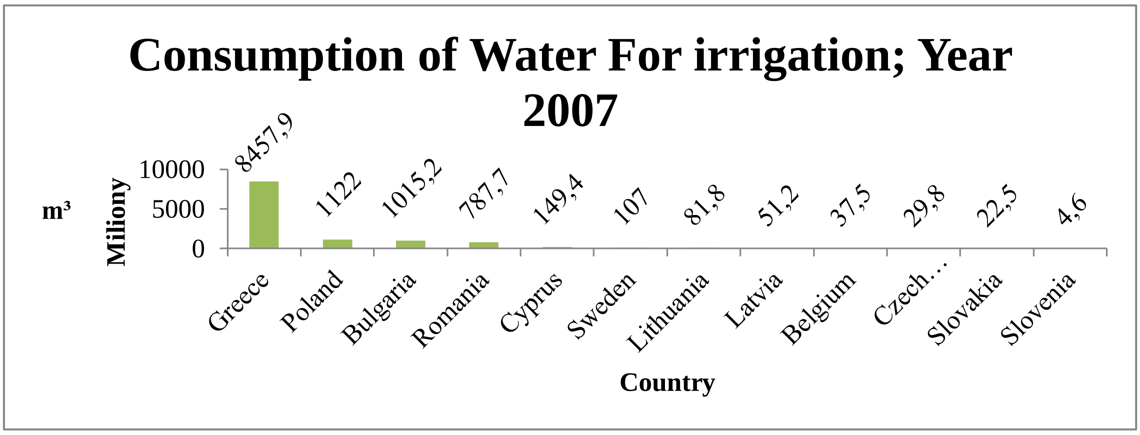
Figure 16. Size of Irrigated Land; Year 2007



Own illustration 13, source of data: [9]

In consumption of water are not changes, just Czech Republic jumped one place up and changed the position with Slovakia which went to down.

Figure 17. Consumption of Water For Irrigation; Year 2007



Own illustration 14, source of data: [7]

4.2.1 Comparison of Water Consumption For Irrigation per Hectare; Years 2003, 2005, 2007

Computations to discover data below are done again by following mathematical formula.

$$CWI_{HECTAR} = \frac{\mathrm{CWI}}{SF}$$

CWI Consumption of Water for Irrigation

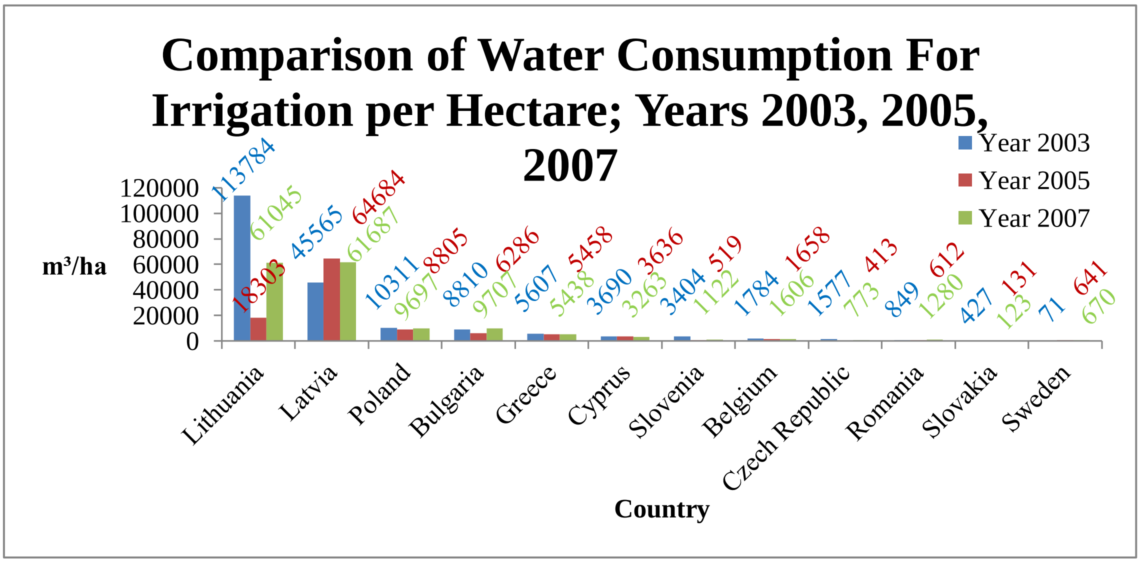
SF Size of Farmland

CWI_{HECTAR} Consumption of Water for Irrigation per Hectare

It got very prodigious results. Lithuania was in size of farmland on the last position. In water usage was on eighth place from 12 countries and now, in consumption per one hectare is Lithuania on the first position. It is effected by the smallest size of irrigated land and relatively high consumption or water. For Latvia it is the same. From the other side, Sweden has the biggest farmland, but relatively low consumption of water, because of weather, so this is reason why is Sweden on the last place.

There is also seen big divergence in Lithuania again. Year 2003 was consumption approximately 114 thousand m^3/ha, in 2005 it was 18 thousand m^3/ha, and in last year 2007 it was 61 thousand m^3/ha. Other countries are without big changes at least without that big as in Lithuania. In Latvia there were some differences between 2003 and 2005, but 2007 is quite same as previous year.

Figure 18. Comparison of Water Consumption For Irrigation per Hectare; Years 2003, 2005, 2007



Own computation 5, source of data: [7], [9]

4.2.2 Median and arithmetic average

Now is time for median average and arithmetic average of the consumption of water for irrigation per hectare per every year. Arithmetic average is one time up, one time down, because it is depend on countries consumption much more, than median average. Median average is intercepting middle values, but when is used arithmetic average, we just divide total number by number of units. Median average is better in this case, because it takes real consumption, not just an average. Computations of median and arithmetic averages are done anew in Microsoft Excel.

Table 3. Comparison of Median and Arithmetic Average of Water Used for Irrigation per Hectare

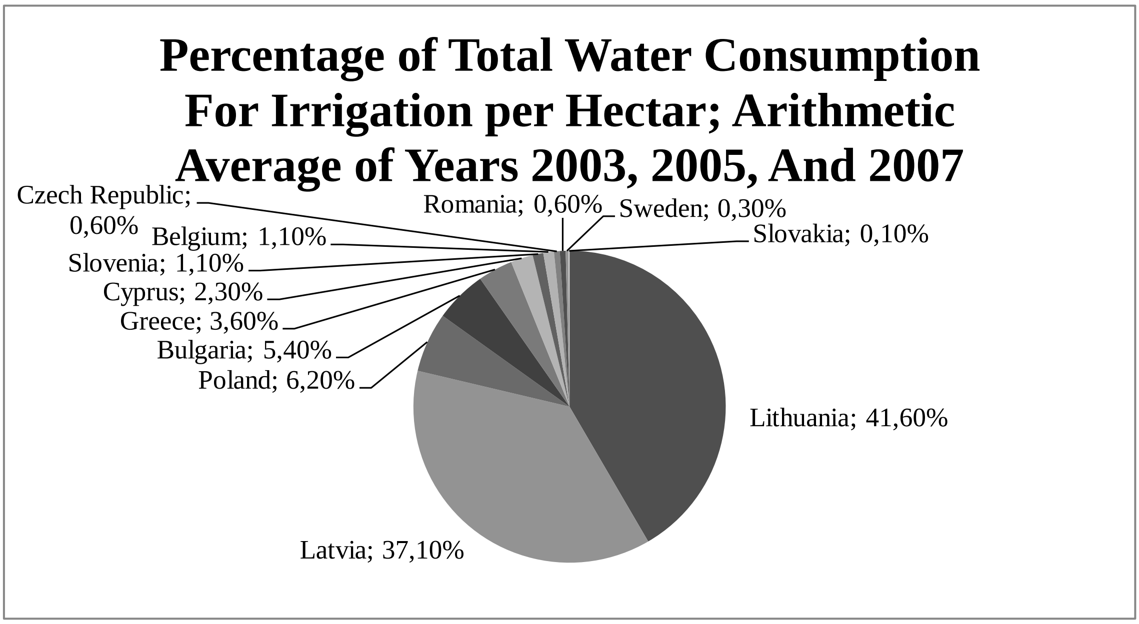
	2003	2005	2007
median average	3547 m^3/ha	2647 m^3/ha	2434 m^3/ha
arithmetic average	16323 m^3/ha	9267 m^3/ha	13034 m^3/ha

Own computation 6, source of data: [7], [9]

In the table above is presented median average with decreasing tendency in year 2003 was used 3547 cubic meters per one hectare and in year 2005 it was close to one thousand less. In year 2007 it is less than before, but the divergence is not as big as in previous year. Arithmetic average is changing every year in year 2003 is its value 16323 cubic meters in year 2005 it is close to half and in last year it is high again. So in arithmetic way it is not decreasing. Also in this table is seen, that divergences between water consumption of every single county are huge, because values of arithmetic average are near to five times bigger, than median values.

On the graph below it computed percentage of total water usage for irrigation. On this graph is seen arithmetic average of three years. It seen Slovakia with 0,1% as the smallest consumer and Lithuania as the biggest consumer of water.

Figure 19. Percentage of Total Water Consumption For Irrigation per Hectare; Arithmetic Average of Years 2003, 2005, And 2007

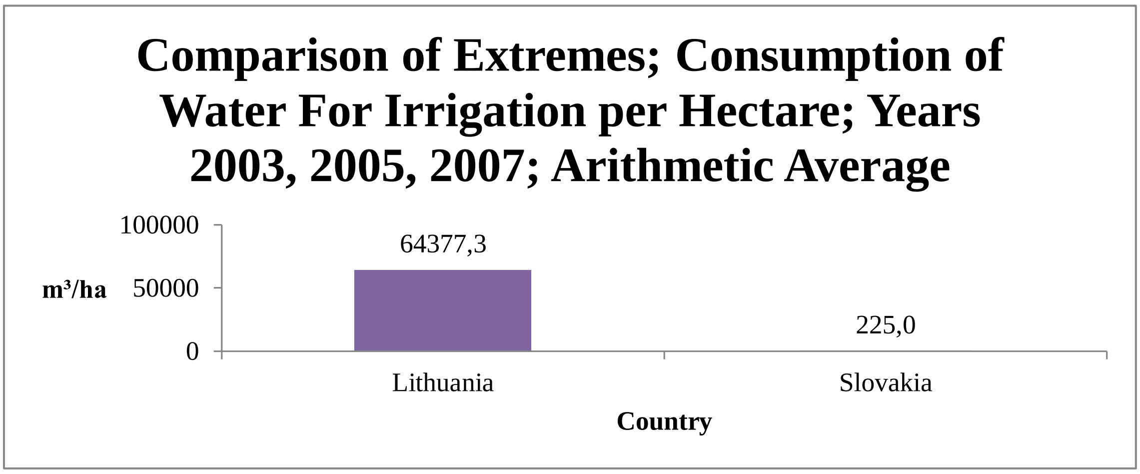


Own computation 7, source of data: [7], [9]

4.2.3 Comparison of Extremes; Consumption of Water For Irrigation per Hectare; Years 2003, 2005, 2007; Arithmetic Average

Comparison of extreme values where are taken Lithuania as the biggest consumer of water and Slovakia as the smallest consumer of water for irrigation during three years 2003 and 2005 and 2007 is on the graph below. From three values is done arithmetic average and these values are rounded to one decimal number

Figure 20. Comparison of Extremes; Consumption of Water For Irrigation per Hectare; Years 2003, 2005, 2007; Arithmetic Average



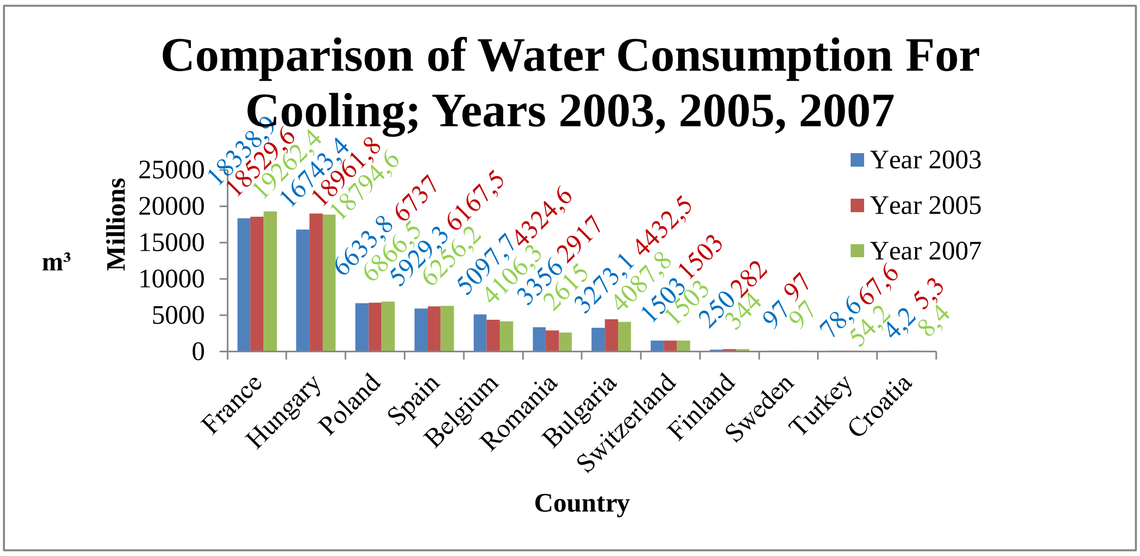
Own computation 8, source of data: [7], [9]

4.3 Consumption of Water For Cooling

In the industry sector were available just data about consumption of water for cooling. Nothing about number of factories was there. It is mean, that there are not computation to know consumption of water per factory. On the graph below is just comparison of years 2003, 2005, and 2007. In addition there are graphs presented extremes of these three years as the biggest and the smallest consumer and also percentage of total water consumption for cooling in industry.

4.3.1 Comparison of Water Consumption For Cooling; Years 2003, 2005, 2007

Figure 21. Comparison of Water Consumption For Cooling in Industry; Years 2003, 2005, 2007



Own computation 9, source of data: [6]

In the graph above are presented values of water consumption in every single year. There can be seen that in Hungary consumption is increasing as in Bulgaria or Spain. On the other side Belgium goes down with consumption of water for cooling in industry. In Sweden is amount of water consumption every year on the same value and it is 97 million cubic meters.

4.3.2 Median And Arithmetic Average

On the next graph of this analysis about consumption of water in Europe is representing percentage of total water consumption for cooling in industry in years 2003, 2005, and 2007 by the median average. If is no consumption per factory, it can be seen in total water used for cooling. Divergences between median and arithmetic average are not so huge like in previous median analysis in sector of irrigation. This means, consumption of water for cooling is not depending on size of country as much as for irrigation.

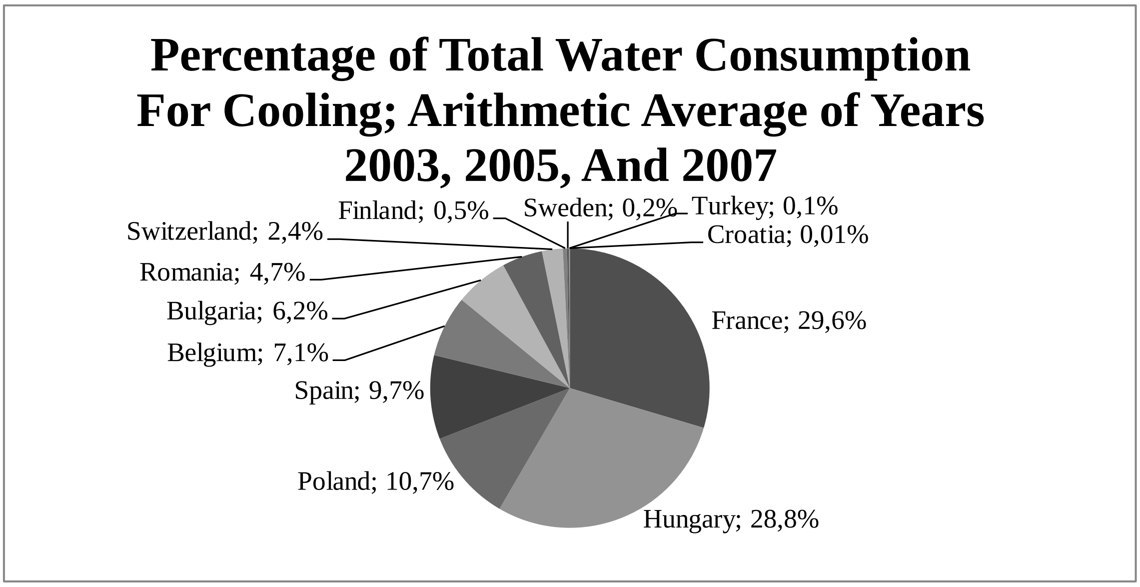
Table 4; Comparison of Median and Arithmetic Average of Water Used for Cooling

	2003	2005	2007
Median Average	3314550000 m³	3620800000 m³	3351400000 m³
Arithmetic Average	5108750000 m³	5335408333 m³	5332950000 m³

Own computation 10, source of data: [6]

In the other graph below is seen percentage of total water consumption for cooling in industry in years 2003, 2005, and 2007 by the arithmetic average.

Figure 22. Percentage of Total Water Consumption For Cooling in Industry; Arithmetic Average of Years 2003, 2005, And 2007

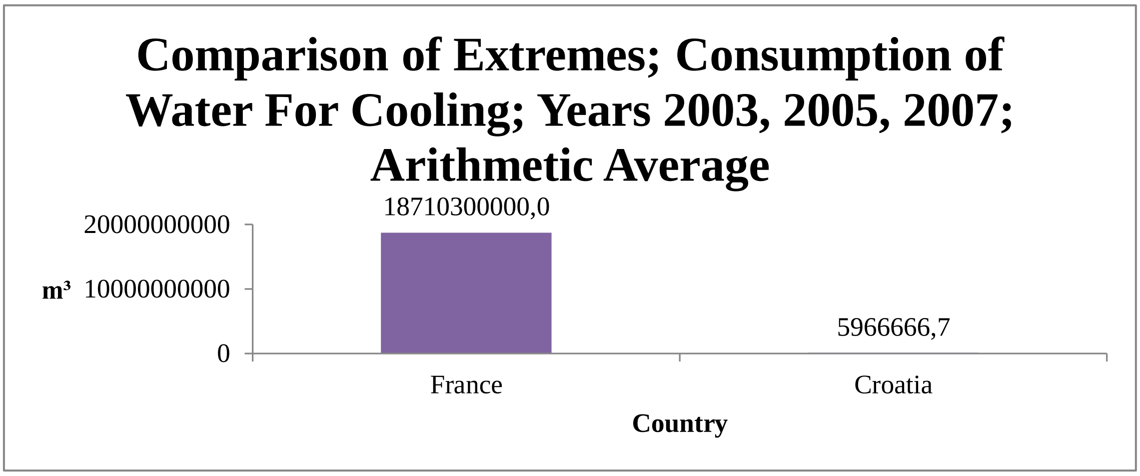


Own computation 11, source of data: [6]

4.3.3 Comparison of Extremes; Consumption of Water For Cooling; Year 2003, 2005, 2007

This graph is representing extremes values of the water consumption for cooling. It means the biggest and the smallest consumers of years 2003, 2005, and 2007.

Figure 23. Comparison of Extremes; Consumption of Water For Cooling; Years 2003, 2005, 2007; Arithmetic Average



Own computation 12, source of data**:** [6]

Every graph in this analysis has its own importance, without these graphs it is not possible to do analysis like that. It is important to have number of people and amount of water consumed by people in homes. The next step is calculating the extent of water per capita in appropriate year. In industry is important to have size of irrigated land and amount of water consumed for irrigation. Then is also simple way how to do graph with consumption of water for irrigation per one hectare. And in industry it would by the same, but there are not data about existing factories. In every sector is done comparison of extreme consumers and percentage of total water consumption in appropriate sector.

5 Conclusions

This analysis is based on consumption of water in Europe. Every graph and every table is some way connected with consumption of water. Even if is there number of people, in the final it is computed with water used in households for to knowledge of water consumption per capita.

This analyse is the path to know something about consumption of water in Europe. Exactly in Households, Agriculture- irrigation, and Industry- cooling.

In the first section is seen that in comparison water used in households of selected countries during the three years is the biggest consumer Norway with 178,7 cubic meters and the smallest consumer of water is Latvia with six cubic meters of water per capita in arithmetic average of three years. There is also comparison of median and arithmetic average. It is seen the decreasing tendency of water consumption in households per capita during three years. As the last of this section is percentual portion of total water consumption per capita in selected countries. Norway takes 17,9% of total amount and for example Latvia takes 0,6% of total amount of consumed water.

The second section tells that in consumption of water for irrigation per hectare is leader country Lithuania with 64337,3 cubic meters of water and the smallest consumer in this section is Slovakia with 225 cubic meters water consumed per hectare. Also these computations are in arithmetic average of the selected three years. Then is presented median compared to arithmetic average where median average is decreasing and arithmetic average does down and up again. And there are very big divergences between these averages, because divergence of consumption between countries is huge, and arithmetic average is just middle value between them, but median is most frequent value something in the middle. And percentual portion of Lithuania is 41,6% and Slovakia´s 0,1% of total water consumption per hectare in three years.

In the last section is analysed water usage for cooling. It is in the total numbers, because there are no information to do it per factory. In this part is seen the first place belongs to France with 187 billion cubic meters of water consumed for cooling and the last position belongs to Croatia which is close to 6 million cubic meters of water. These numbers are arithmetic average of the selected three years. Median average is one year decreasing but next one is increasing, like arithmetic average. Water used for cooling has changeful tendency. The biggest percentual portion takes France with 29,6% and the smallest part with 0,01% is Croatia´s.

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