



**LAKE
BAIKAL
FOUNDATION**

**Course "Water Resources Management", Lecture 3:
Specificity of the Water Sector determining the need to
regulate it; Technical, Sanitary, Environmental &
Economic Regulation**

This lecture was prepared as per request from the Lake Baikal Foundation and delivered in Nov. 2022 to students of the "Global Challenges Management (Management of changes)" bachelor programme at the Academy of Economy and Public Administration

Course Program

Date	Format/Quantity	Teacher / Topic
7/11	In person - 2	V. Palagin L1. Integrated Water Resources Management at the national and trans-boundary levels. Balance of needs and interests, Unity in Diversity. Water security concept. L2. Water-related national legislation (Water Code, law on WSS etc.) and international: legally binding agreements (Conventions and Protocols, SDGs, EU Directives) and voluntary instruments (e.g. OECD Recommendation on Water).
14/11	Online -1 14.00 – 15.20	A. Martusevich L3. Specificity of water sector and the need for water sector regulation (environmental, technical, sanitary-epidemiological, economic / tariff)
	Online -1 15.40 – 17.10	V. Palagin L.4. Водная стратегия РФ (международный аспект)
21/11	Online - 2 14.00 – 15.30 15.40 – 17.10	A. Martusevich L5. Strategic and mid-term planning for water resources and systems. S1. Implementation mechanisms (Incl. Monitoring and Evaluation.), and the role of private sector participation (PSP).
29/ 11	In person - 3 14.00 – 15.30	V. Palagin S2. Water sector regulation in Russia: key elements, eventual gaps. Alternative approaches to Environmental regulation: BAT, discharge norms (MACs, TAEs etc.) and the overall pollution load on water objects.
	15.40 – 17.10	S 3. Detailed analysis of the federal projects on Baikal, Volga, WSS; links with programmes in other sectors - agriculture, forestry, municipal waste management.
	17.20 – 18.50	S4.Trans-boundary (TB) agreements on water for which Russia is a Party. Detailed analysis of TB water issues & water co-operation (incl. on multi-purpose water infrastructure). Conflict resolution in Water management, and practices in Central Asia.
6/12	In person - 3 14.00 – 15.30	V. Palagin L6. Water Policy instruments and the role of Economic instruments for water management: tariffs, taxes (and state support); and transfers. Ultimate and repayable sources: the role of state support and the financial sector.
	15.40 – 17.10	S5. Case study of economic instruments and assessing their effects/impacts. Cost effective and counter productive state support measures. The role of sound tariff policy.
	17.20 – 18.50	S6. Risks and uncertainty. Managing key risks in (or impacting) the water sector. Resilience concept and the impact of climate change and the growing volatility of climatic parameters on water resources and systems.
9/12	Online – 1 15.40 – 17.10	L V. Palagin L*. Зеленое управление Sustainable and Inclusive Green Development and Circular Economy concepts. Water, food and energy security nexus.
12/12	Online - 2 14.00 – 15.30	A. Mertusevich L.7. Knowledge and information base for decision making, and useful decision support tools: monitoring and statistics data; scenario analysis and water policy outlook; modelling; various guidelines and recommendations.

Objectives

This lecture discusses *specificity of the water sector* (focusing on municipal water supply and sanitation irrigation) largely determining the need for, and forms of, regulating it, including Technical, Sanitary & Hygiene, Environmental (ENV) and Economic regulation - the latter incl. anti-monopoly and tariff regulations.

Importantly! The regulation significantly impacts the costs of water services.

Understanding of these specificities is very important for both: government official and civil servants, municipalities and local self-governance bodies, as well as consumers & general public.

Indeed, eventual lack of knowledge or undersnading often generates misunderstanding or even political resistance to measures objectively required, while a good understanding, on the contrary, allows elaborating a sound and coherent approach to regulation as well as better compliance with the effective laws and regulations, rules and procedures.

Content

0. *Tour de table (5-7')*

1. Human right to water, adoption of water-related goals by the international community (as part of MDGs and SDGs)
2. Market failures & limits: the case of the water sector
3. Specificity of the water sector, common for most countries, highlighting specificities which are a common legacy of ex-Soviet Republics (high coverage by, but low efficiency of, water services)
4. Regulation of the water sector: key objectives & main forms:
 - technical regulation (service quality, safety & cost-effectiveness)
 - sanitary & hygiene regulation: health & hygiene dimension;
 - environmental regulation: minimising ENV impacts
 - economic regulation: anti-monopoly, and tariff

Conclusions on some issues and available policy responses

Literature (additional to the main list of references)

Human right to water, adoption of water-related MDGs and SDGs

- 2000 UN Summit, MDG 7: *By 2015, to reduce by half the share of population without access to safe water and basic sanitation*

Definition: 5 lcd per capita per day from a safe water source located no farther than 1500 meters (!) from the dwelling

- 2010, the United Nations General Assembly explicitly recognized the **human right to water and sanitation** (UN GA Resolution 64/292)
- 2015 UN summit: **water-related SDGs: 6, 11, 13, 14**

SDG 6: Ensure availability and sustainable management of water and sanitation for all

SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable (covers protection against water-related hazards)

SDG 13: Take urgent action to combat climate change and its impacts (covers adapting the water sector to climate change)

SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

PLUS water is key for several other SDGs: 1, 2, 7, 15

Market failures & limits: the case of the water sector

- *failure to fully implement several principles of market economy:*
 - *non-discriminatory access to markets;*
 - *fair & effective competitions on the market (no monopoly or monopsony), freedom of making deals,*
 - *“user/beneficiary pays”,*
 - *“polluter pays” etc.*
- *Incomplete info, Assymetry of information & other market failures known from Microeconomics.*

Specificity of the water sector explains several market failures & limits

We will consider these specific features, common for most countries and focusing on those specific for post-Soviet republics, with references to examples fm Armenia, Central Asia, Moldova; and Russia, of course (a common legacy).

Specificity of the water sector, common for most countries

ON THE DEMAND SIDE:

- **Water is an essential good, having no good substitutes**

Essential good (жизненно-необходимый продукт) ==>

- human right to water and sanitation recognised by the UN GA; and
- the need to guarantee to each citizen access to water irrespectively of the behaviour of other consumers (==> specific technical requirements to WSS systems), and irrespectively of his/her expenses for other Goods & Services (**G&S**).

Absence of any good substitute (not to speak about a perfect one) ==> very limited room for indirect competition on the food&drinks market (e.g. from producers of milk, beer or Pepsi) ==> special measures to address water affordability constraints (see below)

- **the Demand for WSS services has low income and price elasticities (typical for essential G&S); and is not procyclical** (unlike the demand for real estate or luxury goods)

Over 1990ies, in many cities in EECCA the water utility (*vodokanal, in Russia*) was top 10 employer, and in some towns (e.g. in depressive *marzes* in Armenia) - **the only** employer.

On the negative side, it implies that affordability constraints become more tough when either income falls or WSS tariff increases faster than income grows.

- Further more, the demand for water in each specific settlement very much depends on:
 - demography and migration, incl labour migration (typical for many post-Soviet republics);
 - & structural reforms in the economy (e.g. water intensive enterprises & sectors)**==> high uncertainty over crisis or reform periods**

Specificity of the water sector ... - 2

ON THE SUPPLY SIDE:

- **Water supply and sanitation (WSS) represent a combination of a public and private good & service (G&S)**

Good - the amount of water a user gets from the tap

Service - ability to get water in/near his/her dwelling at any time

Public G&S are typically provided by the State to everybody for free

While consumers pay price for private G&S they consume

- **WSS - is one of the most capital intensive infrastructure sectors ==>**

- large upfront investments; and

- high O&M costs and capital replacement costs (replacing deteriorated fixed assets).

- Moreover, **fixed assets in the water sector have significant lifetime** (50-100+ years)

==> a long payback period for investment;

- **High sunk cost & transaction specificity of fixed assets** (the value of assets out of operation is much lower than their historical value on the accounting books)

==> the price of eventual mistake in making investment decision would be very high and paid over decades.

Specificity of the water sector ... - 3

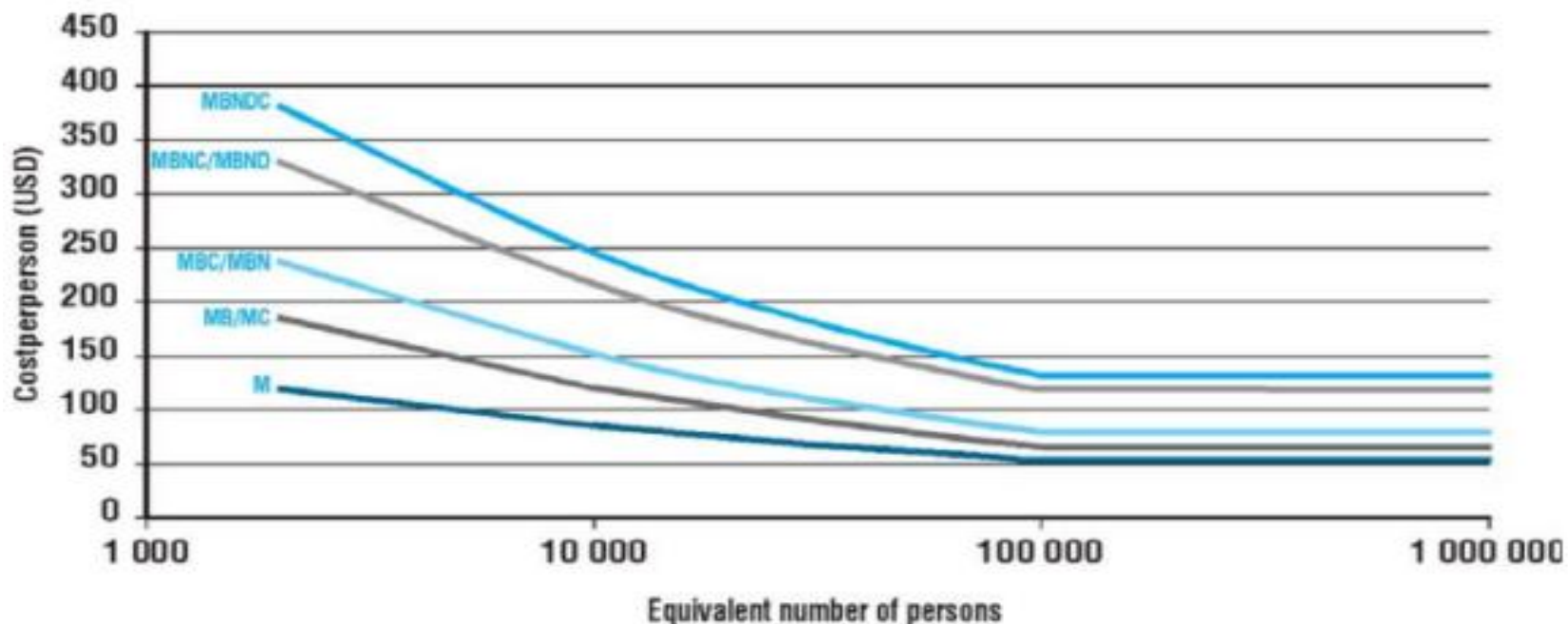
Examples of costly investment mistakes:

- construction of highly oversized water systems (or of insufficient capacity); or
- building a poorly designed system (e.g. its high vulnerability to floods and droughts)
- WSS cost structure: over 50% of costs are the costs related to water abstraction and transportation, wastewater transportation and treatment (even in the case of transportation by gravity, without much pumping)
- Much of fixed assets in the water sector are placed underground ==> difficult to monitor, lack of info about their real status, need for special (costly) control measures (the lack or asymmetry of information is the reason of some market failures)
- Overall, there are several **high risks and uncertainty impacting water sector development**, including:
 - demand & tariff risks
 - other regularoty & institutional risks (e.g. unfavorable changes in the Technical or ENV regulation); and
 - risk of natural hazards (those impacting water quantity or quality - floods & droughts, or safety& integrity of water infrastructure - e.g. earthquakes, ot tsunami - e.g. Fukusima)

Specificity of the water sector ... - 4

- key elements of water infrastructure systems (e.g. pipeline and pumping stations & treatment plants) has the feature of **natural monopoly** with a high economy of scale ==> the obstacle for developing competition on the market

Fig. 1. Unit capital cost function for main wastewater treatment technologies, in USD per person served (in 2000 West EU prices)



Source: FEASIBLE model User guide

Specificity of the water sector ... - 5

The dark side of the (dis-)economy of scale can be seen in small human settlements (see Figure 2 below , with data fm Moldova)

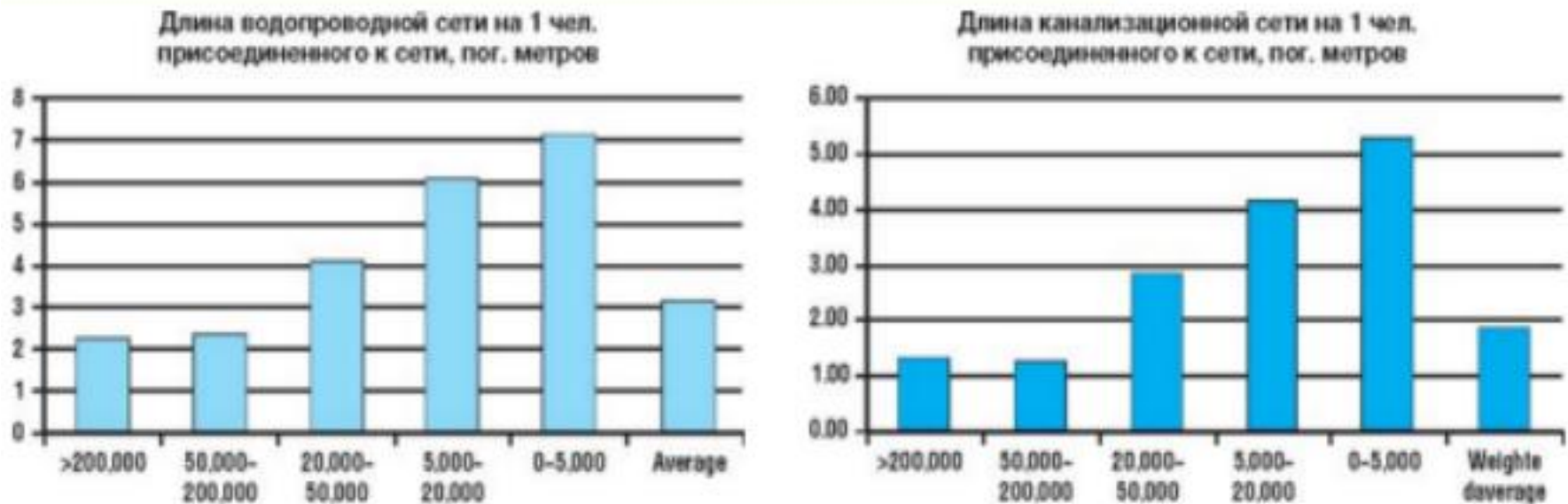


Рис. 2. Средняя длина уличной водопроводной и канализационной сети на 1 обслуживаемого жителя в населенных пунктах с разной численностью населения, погонных метров

Источник: OECD/EAP Task Force (2008).

Specificity of the water sector ... - 6

A huge variation of specific consumption of some main inputs, not least electricity:

unlike processing industries, where the difference in specific electricity consumption (per unit of output) between best & worst performing enterprises might be +/- 20%, in the water sector it could be up to 10-15 times! - see Fig 3 with data fm Moldova again

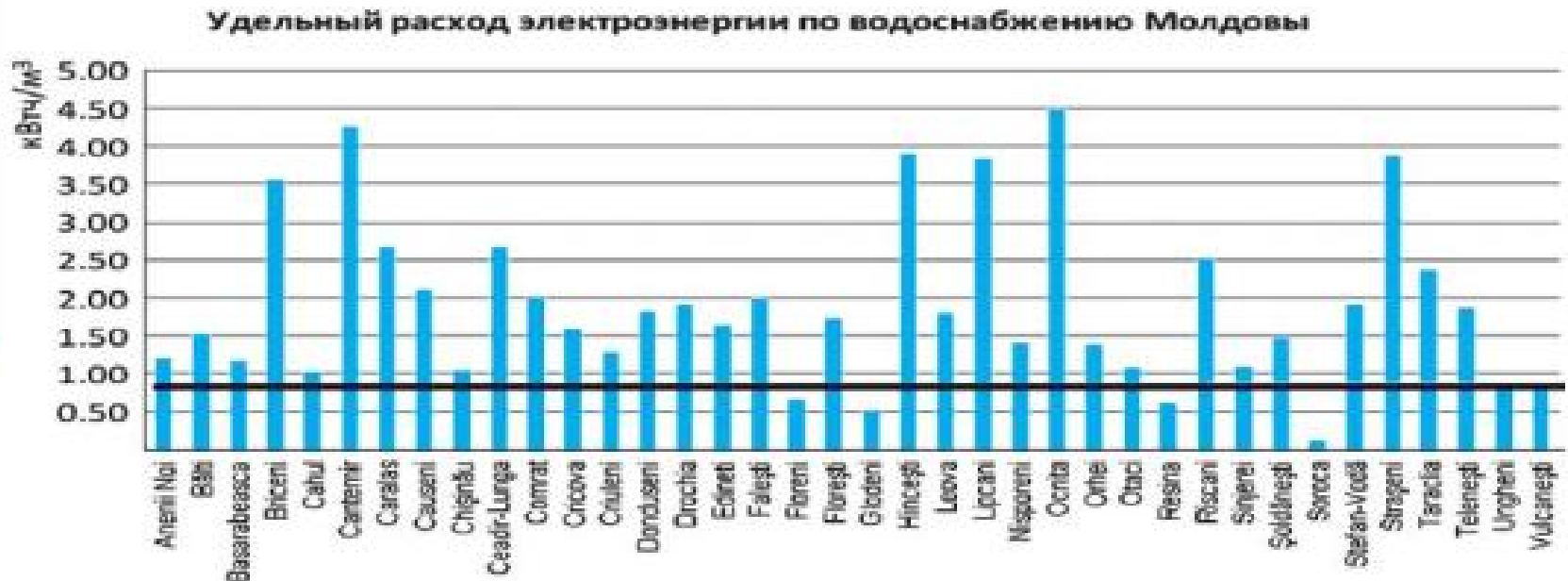


Рис. 3. Удельный расход электроэнергии по водоснабжению в населенных пунктах Молдовы, кВтч на 1 м³

Specificity of the water sector ... - 7

High **non-renew water (NRW)**: up to 70-85% of water pumped into the transportation (water main) and distribution network.

Example fm Yerevan: in early 2000ies, over 80%

Many positive and negative externalities, including:

- **positive impact on the quality of life and labour productivity;**
- **negative health impact**, if tap water does not meet drinking water standards, and ENV impact if wastewater is not treated to the standard, or sludge is not properly treated.

Specificity of competition in the sector:

- no competition **on** the market; but
 - the possibility to compete **for** the market (for the right to serve the whole market in certain settlement(s) or area, during an agreed period of time),
- if to properly address challenges associated with PSP/PPP: from selecting concessionaire through properly organised tender to preparing a balanced contract with the winner.

Complexity to attract bank loans due to:

- transaction specific assets;
- the issue of proper collateral.

Water sector is often very fragile for corruption (increasing costs by up to 30%)

Specificity of the water sector ... - 8

!! Affordability issue, especially in depressed, low income regions & settlements

==> the need for social support measures well targeted to the vulnerable consumers (poor households etc)

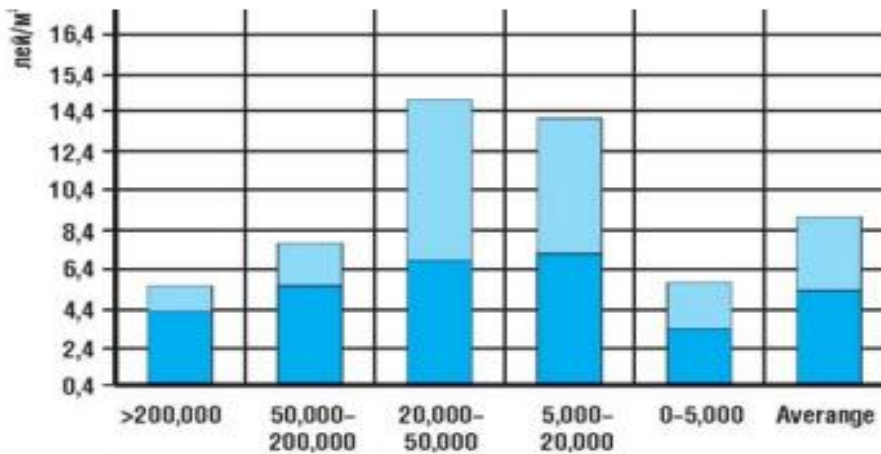


Рис. 6. Величина тарифов по ВСиВО для населения в зависимости от размера поселения (числа жителей), в котором они проживают, Молдова, 2006 г.

■ – ВС; ■ – ВО

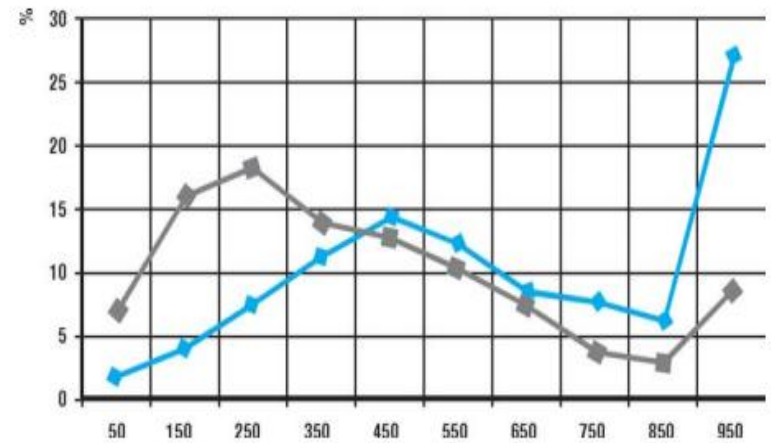


Рис. 7. Распределение сельского и городского населения Молдовы по уровню среднего душевого дохода, лей в месяц, 2006 г.

◆ – города; ■ – села.

Источник: OECD/EAP Task Force (2008).

Specificity of WSS in EECCA (ex-Soviet Republics)

High coverage by centralised WSS systems in urban settlement, BUT often:

- oversized, inefficient systems (deteriorated pipes, high leakages, outdated pumps)
- low service quality (intermittent supply, low pressure, tap water does not meet drinking water requirements/standards etc.)
- unrealistic wastewater treatment norms (not achievable without significant upfront investment), and (in Russia) high fines for violating the norms (sometimes, comparable with the annual revenue of the utility)
- high tariffs, not affordable for a significant proportion of population ==> the need for (i) operational subsidies to water utilities (*vodokanals*) & (ii) social support measures

Low coverage by centralised (piped) service in rural areas, even by drinking water supply: the coverage has dropped significantly after the collapse of the *kolkhoz-sovkhoz* system

Investment into sanitation should go back-to-back with investment in piped water supply, to avoid ENV impacts and human-made hazards (e.g. land slides)

in 90ies: Poor financial health of most water utilities - accounts receivable could be at 300-500% of annual income of water utility)

Specificity of MPWI, irrigation & flood protection systems

General: High (& growing, due to climate) variability of seasonal precipitation and annual run-off ==> high risks and uncertainty for water users

Multi-Purpose Water Infrastructure (MPWI): the need to manage trade-offs impacting major water uses, incl. (i) saving water for irrigation during vegetation period (late spring - summer) *versus* using water for electricity generation at winter times; or (i) water for environment *versus* (ii) water for irrigation & electricity

Costly mistakes of wrong forecasting of floods (spring/autumn and flash floods) - examples

Irrigation: in many regions (e.g. arid areas in Central Asia, *Volgodrad oblast & Kalmykiya*) the value of land spots very much depends on the access to irrigation water

- **large upfront investment**, ideally building irrigation canals jointly with collector-drainage system, to increase yields and prevent the land salinity problem), but **relatively low O&M** costs (e.g. in Kyrgyzstan, at some 40 USD per hectar) compared to additional agri-food produce on irrigated land vs non-irrigated land (e.g. USD 5000 versus USD 2000 per hectar)

- **significant water losses** (evaporation-the case of AUS, infiltration, non-accounted for water)

- challenge of **ensuring equity** in access to irrigation water (upstream vs downstream users)

- **the need for co-operative management of large systems** (sometimes 100s km) ==> the challenge related to selecting a sustainable business model (BM): e.g. state irrigation system + water-users associations + individual agri-food producers

Flood & mud-flow protection systems: often generate no revenues ==> should be funded from the public budget; the benefits = prevented losses of life & economic assets.

Conclusions from the above considerations

Multiple market failures, externalities and specific risks and uncertainty in the water sector determines the need for a careful sector regulation, to prevent, or compensate for, market failures, and control the risks at acceptable level.

In particular, the water sector requires regulating the following :

Technical regulation, to ensure:

- (i) safety and resilience (examples of accidents in Volgograd, Borovichi, Petropavlovsk KAZ, Moldova); and
- (ii) cost-effectiveness of capital expenditure, OM and ultimately more affordable tariffs at cost-recovery levels ;

Sanitary, Hygiene and ENV regulation, to ensure little health risks (fm water for drinking & bathing) and ENV risks; and

Economic (incl. anti-monopoly and tariff) **regulation** to prevent service providers from mis-using their market power (local monopoly) and ensure the affordability of water bills for end-users, not least households, or small farmers

Various types of water sector regulation are briefly discussed below, one by one, starting from general objectives of the regulation.

Key objectives of water sector regulation

Specific objectives depend on the sub-sector, while the General objectives include :

- Safe & reliable (timely) supply with water in required amounts, and provision of quality water services at affordable price / tariff, while ensuring non-discriminatory access to water and water services for all.
- **Establishing right incentives** for: the quality of water services, and increasing coverage by the service; water use efficiency; improving environmental performance indicators; cost-effective public investment, and attracting required investment to the sector from other sources.
- **Resilience of water systems** to various hazard, incl. climate and water related ones
- **Prevention of the appearance and (or) private appropriation of any rent** (monopoly rent, environmental rent / free riding; natural resource rent: water-land or water-energy rent, corruption rent etc.), and where **such a rent exists, it should be appropriated to the extent possible into the public budget, to the benefit of the whole society.**

Importantly, on the negative side: the regulation significantly impacts the costs of water services, and hence the affordability thereof.

Technical regulation

Objectives:

- safety & resilience
- ensuring required quality of water service
- cost-effectiveness of investment as well as O&M (incl. energy savings)

Some LRAs on technical regulation:

Legacy fm the former USSR:

- SNiPs (строительные нормы и правила) - construction norms and rules
- GOSTs & OSTs - state standards and sectoral (отраслевые) standards

More recent:

- National standards: e.g. in Russia: GOST R
- Technical *Reglements* (Технические регламенты);
- Codes of Practice (Коды практик)

Examples:

СНиП 2.04.02-84 ВОДОСНАБЖЕНИЕ. НАРУЖНЫЕ СЕТИ И СООРУЖЕНИЯ
(and a similar SNiP for Sanitation / ВОДООТВЕДЕНИЕ, all adopted back to 1984-1986)

Technical regulation - some issues & available policy responses

Some SNiPs are largely outdated, do not take into account changes: in demand; new technologies, materials (e.g. plastic pipes) or equipment emerged since their adoption:

Example: the СНиП 2.04.02-84, **implemented in rural areas**, requires construction of:

- highly over-sized centralised/piped system, with water consumption at 120-160+ litres per capita per day (**lcd**), while the factual metered consumption is at 50-70 lcd;
- two lines of pipe from respective water source, and
- plenty of costly fire-fighting hydrants, while **in a village** establishing a clear water reservoir could offer a cheaper solution in case of accident on the pipeline from water source as well as the required amount of water for fire-fighting.

Negative consequences: wastage of capital / investment from the public budget

In some large cities, on the contrary, the SNiP requirement to have a reserve water & electricity supply sources is often violated ==> lack of resilience to hazards

Policy responses:

- revising outdated SNiPs (or parts of SNiPs) - example: Kyrgyzstan
- adopting: respective Code of Practice while making ineffective respective parts of SNiPs - example - Moldova; or new Technical Regulations replacing outdated SNiPs- example: Russia
- compliance enforcement

Sanitary & Hygiene and Environmental Regulation

Objectives:

- ensuring required quality of water & service quality
- reducing health & ENV risks
- safety & resilience of water services

Some LRAs on Sanitary-Epidemiological, Hygiene and ENV regulation:

Legacy fm the former USSR:

- GOSTs (e.g. for drinking water)
- SanPiNs (санитарные правила и нормы) for drinking water supply systems, for tap water quality, and for regular monitoring of fresh water and tap water quality
- ENV norms for ambient fresh water quality, and for discharges into water bodies

More recent:

- National standards: e.g. in Russia: **GOST R**
- National Sanitary, Hygiene (**ГН**) and ENV norms and rules

Examples:

ГОСТ Р 51232-98. Группа Н08. ГОСУДАРСТВЕННЫЙ СТАНДАРТ РОССИЙСКОЙ ФЕДЕРАЦИИ
ВОДА ПИТЬЕВАЯ Общие требования к организации и методам контроля

ГН 2.1.5.689-98 Предельно допустимые концентрации (ПДК) химических веществ в воде водных объектов хоз/-питьевого и культурно-бытового водопользования

Sanitary & Hygiene and Environmental Regulation -2

Examples of SanPiNs (to list just a few):

СанПиН 3.02.003.04. Санитарно-эпидемиологические требования по охране поверхностных вод от загрязнения

СанПиН 2.1.5.980-00. Гигиенические требования к охране поверхностных вод

СанПиН 2.1.4.027-95. **Зоны санитарной охраны источников водоснабжения и водопроводов хозяйственно-питьевого назначения**

СанПиН 3907-85. Санитарные правила проектирования, строительства и эксплуатации водохранилищ (and similar rules for WSS systems)

Some issues with the implementation and compliance enforcement:

- the rules for sanitary protection zones (SPZs) are often violated (private cottages, or grazing /live stock withing the SPZs)
- some ENV norms based on the *zero risk* concept are unrealistic, without significant upfront investment: e.g. discharge norms for water bodies assigned for fishery

Policy responses include:

- setting more realistic ENV noms, based on the *accepatable level of risks* approach
- compliance enforcement

Economic regulation, incl. anti-monopoly & tariff regulation

Objectives:

- preventing service providers from eventually mis-using their monopoly power (local monopoly)
- appropriation of the water rent into the public budget
- ensuring affordability of water services for end-users (not least for households)
- establishing state support measures targeted at vulnerable groups of water consumers

Some LRAs (to list just a few):

Water Code, Administrative Code, Criminal Code

Tax Code (water related taxes, fees and charges)

Anti-monopoly law and sub-law regulation: requires awarding contracts to private operators of water systems through competitive bidding

Law on water, Law on drinking water, Law on WSS (in Russia)

Federal Law on Concession Agreements (in Russia)

Tariff setting methodologies and rules (procedure) adopted at the national or province level

Rules and methodologies for providing subsidies to vulnerable households; etc.

Examples of Tariff methodologies:

- Губернатор Тюменской области НА, Постановление от 02.08.99 г. N 163, О методике расчета тарифов на услуги водоснабжения и водоотведения
- НАРЭ РМ, Постановление № 489/2019 от 20 декабря 2019 г. МЕТОДОЛОГИЯ определения, утверждения и применения тарифов на публичную услугу водоснабжения

Economic regulation - some issues & available policy responses

Some issues with the implementation and compliance enforcement:

- competitive bidding is not always properly organised (if at all), or inadequate selection criteria are used (in WSS the best criterion - the lowest level of long term tariff profile for the required coverage and service quality)
- water-energy rent is appropriated by powerful private Corp.s - example: *Russian Aluminium*
- too many of small operators which need to be regulated - over and above the Regulator's capacity to regulate (the case of ANRE in Moldova)
- weak tariff setting methodology, rules and procedures
- violations of established rules, procedures, methodologies

Policy responses include:

- regularly revisiting and improving the regulation (incl. prohibiting by law improper practices, rules, criteria etc.);
- applying a fully fledged regulation to a few number of larger operators, and establishing simplified rules and procedures to small operators, complemented by delegating the right to regulate them to public administrations of lower levels (province, municipality)
- compliance enforcement

Additional Literature

Гальперин В.М., Игнатъев С.М., Моргунов В.И., Микроэкономика (тома 1-2, раздел 10.9 Естественная монополия) - СПб: Экономическая школа ГУ ВШЭ, 2008

Мартусевич А.П., Мартусевич Р.А., *«Особенности ВКХ, определяющие сложности регулирования и создания рынка в отрасли»*, Вестник РАВВ. № 6'2010, Москва

Козельцев М.Л., Мартусевич А.П., Мартусевич Р. А., *О необходимости учета особенностей секторов экономики при переходе на технологическое нормирование и регулирование в области охраны окружающей среды*, Вестник Московского Университета, Серия 6 Экономика, №2 2011

Региональный проект USAID по водным ресурсам и окружающей среде (в Центральной Азии), Турсуналиева Д.М., Мартусевич А.П., Сиваев С.Б., *Учебный модуль 2: «Особенности рынка воды и регулирования водохозяйственных услуг»* (проект от 17.08.2022)

National regulations (in each country, several dozens of legal regulatory acts):

- Water & Tax Codes, Water Law, Concession Law and anti-monopoly regulation;
- on Tariff setting methodology and procedure; and on subsidies to vulnerable consumer groups regarding payments for housing and utility services (incl. water & electricity bills)
- Environmental, Sanitary & Hygiene regulations on fresh water bodies and water systems
- Technical regulations for water systems.



Thanks for your attention!

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Water Cycle on Earth

