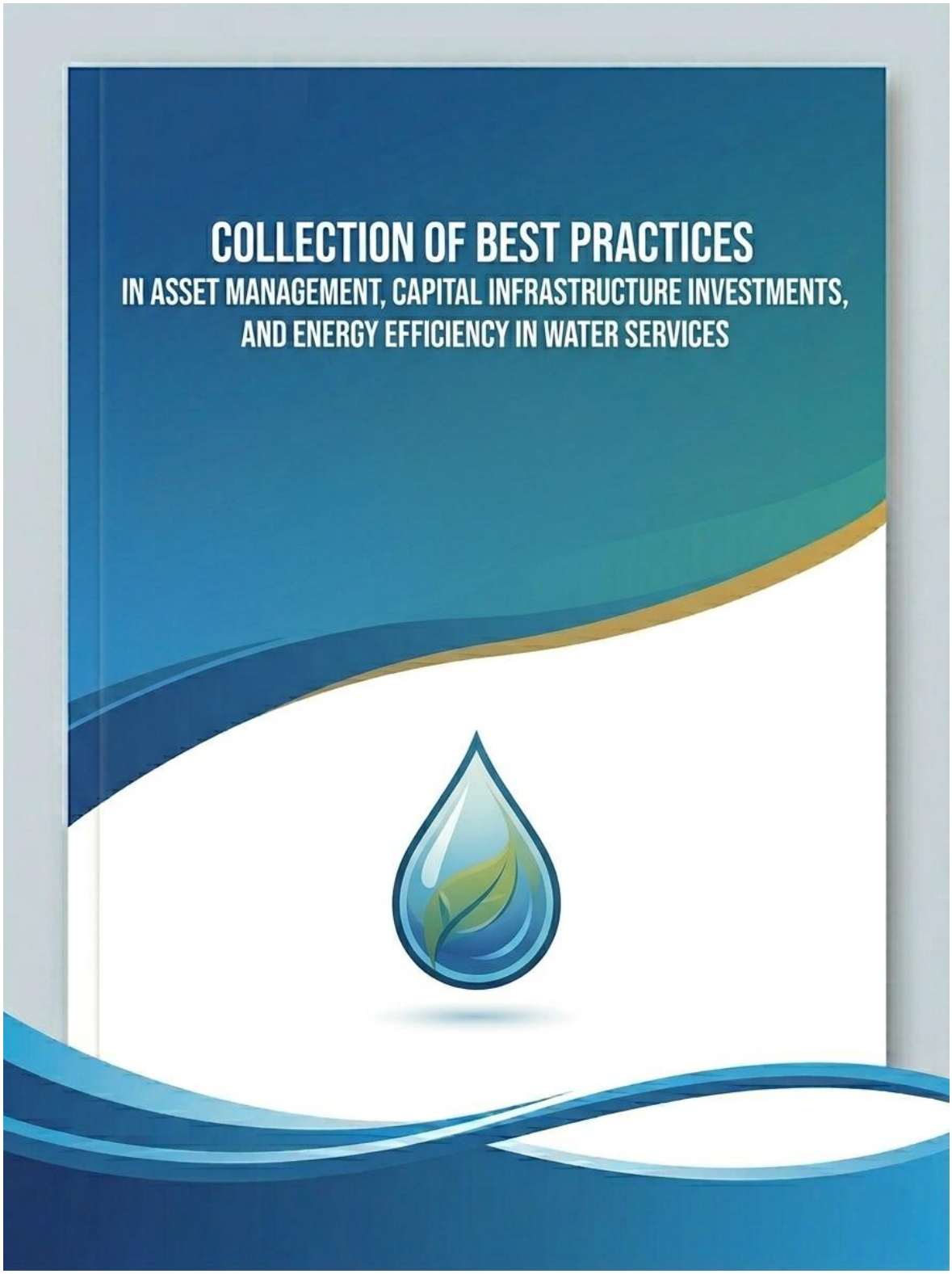

NALAS Working group on Water Management

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Contents

Acronyms

NALAS – Network of Associations of Local Authorities of South-east Europe

EU- European Union

SEE – South East Europe

TF – Task Force

WGWM – Working group on water management

RCDN – Regional Capacity Development Network

KfW - German state-owned investment and development bank

SECO – Swiss State Secretariat for Economic Affairs

LGU – Local Government Unit

LGA – Local Government Association

PUC – Public Utility Company

APUC – Association of Public Utility Companies

NRW – Non-revenue water

GIS - Geographic Information System

WWTP – Waste water treatment plant

Chapter 1: Introduction

The water and sanitation services (WSS) sector in South East Europe (SEE) currently stands at a crossroads. Faced with the dual pressure of aging infrastructure and increasingly limited financial resources, local governments and utilities can no longer rely on reactive management. To ensure the long-term sustainability of water services, it is essential that they strategically and proactively plan and implement relevant and innovative measures. In doing so, regional experiences could help, inspire, and motivate.

The NALAS Task Force on Solid Waste and Water Management, particularly the Working Group on Water Management is a regional expert body that contributes to implementation of NALAS' strategic objectives, as well as relevant projects, such as the Regional Capacity Development Network for Water and Sanitations Services (RCDN).

One of the main activities foreseen in the Working Groups' Action Plan 2024-2025 is identifying best practices in provision of WSS in South-East Europe with aim to increase the capacities of both local authorities and public utility companies in planning, financing, decision-making, regulation, and monitoring.

What are Best Practices?

RCDN definition of Best Practice builds on the commonly agreed definition of the Food and Agriculture Organisation of the United Nations: *"A Good Practice is not only a practice that is good, but one that has been proven to work well and produce good results and is therefore recommended as a model. It is a successful experience which has been tested, validated, repeated in practice, and deserves to be shared so that more people can adopt it."*

In the context of the SEE WSS sector, **best practices** are documented successes and established methodologies that have proven effective in the field. These practices include specific technical and managerial solutions that serve as a practical guide for modernising infrastructure and improving service.

Why Best Practices?

The systematic collection and sharing of such practices are vital to stimulate regional improvement. By utilising experience-based decisions, local governments and their utilities can avoid "reinventing the wheel" and prevent the repetition of costly mistakes. Best practices provide a mechanism for proactive risk management, improved service quality, financial sustainability, and knowledge transfer.

Local governments and their utilities are the frontline providers of essential services. It is at the local level where the impact of aging systems and climate change—such as droughts or extreme weather events—is most acutely felt. Implementing best practices locally is necessary because reliable and secure WSS is a prerequisite for local economic development and the well-being of citizens, adopting efficiency practices leads to immediate operational cost reductions, and strategic frameworks empower local authorities to manage large-scale capital projects effectively, ensuring long-term system resilience and compliance with EU and national climate goals.

Ultimately, these best practices serve as more than just a resource; they are a foundation for strengthening the capacity of local stakeholders to achieve a water-secure and resilient future for the entire region.

Chapter 2: Key thematic areas

In preparing this collection, three thematic areas were selected as the focus of good practices: Asset Management, Capital Investment Projects, and Energy Efficiency & Climate Impact Management. These themes were identified by the NALAS Working Group on Water Management as the most critical levers for improving service quality and financial sustainability in the SEE water and sanitation services sector. They directly reflect the key challenges described in the introduction: aging and often undocumented infrastructure (addressed through Asset Management), need for large-scale modernisation and system expansion (addressed through Capital Investment Projects), and rising operating costs and climate vulnerability (addressed through Energy Efficiency and Climate Impact Management). The chosen areas also scored highest in terms of regional relevance, potential for replication across different utility sizes, and alignment with EU and national policy priorities.

1. Asset Management

Asset Management is the cornerstone of sustainable WSS services in the SEE region. It provides a structured approach to managing infrastructure that is often decades old, ensuring that limited budgets are allocated where they are needed most.

Effective asset management acts as a mechanism for long-term financial and environmental sustainability. It directly impacts the quality, reliability, and security of the WSS services, which is essential for both the well-being of citizens and the stability of local economies.

Sharing regional examples allows utilities to move away from "run-to-failure" mentalities toward systematic risk management and maintenance schedules that extend the life of critical infrastructure.

2. Capital Investment Projects (CIP)

Large-scale capital projects represent the primary tool for modernising the region’s water and sanitation systems. These investments are more than just construction projects; they are opportunities to fundamentally reshape system resilience.

CIP planning is essential for addressing non-revenue water (NRW), improving water quality, and extending service capacity to underserved areas. When executed correctly, these projects ensure the maximum return on public funding and stimulate sustainable economic growth.

By adopting proven planning frameworks and project management methodologies used successfully elsewhere in the region, Local Government Units (LGUs) can strengthen the financial viability of their investment proposals and ensure projects are completed on time and within budget.

3. Energy Efficiency and Climate Impact Management

Energy consumption is typically one of the largest operational expenditures for WSS utilities. Simultaneously, the SEE region is increasingly vulnerable to climate-driven threats, including prolonged droughts and extreme weather events that damage critical assets.

Improving energy efficiency offers an immediate path to operational cost savings. Transitioning to low-carbon operations—such as integrating solar power or optimising pump efficiency—not only reduces costs but also aligns local operations with EU and national climate goals.

Disseminating successful regional strategies for climate risk integration helps utilities plan for the future. Whether it is adapting to water scarcity or protecting infrastructure from floods, sharing these experiences is vital for building a resilient, low-carbon water and sanitation services sector.

Chapter 3: Best Practices from South-East Europe

Best practices in Asset Management

1. Investments in distribution system to tackle water losses

"Waterworks" LLC PLJEVLJA ("Vodovod" DOO Pljevlja), Municipality of Pljevlja, Montenegro

"Waterworks" LLC Pljevlja, serving the urban and suburban areas, faced chronic, systemic issues from high water losses caused primarily by an aged network and illegal connections. The consequence of these losses was severe and long-standing: third of the city of Pljevlja faced daily restrictions in water supply, leading to an extremely deteriorated level of service over the past 20 years. Furthermore, high losses required excessive water capture, processing, and transportation, resulting in significantly increased electricity consumption at pumping stations and greater wear and tear on infrastructure. The problem also led to infrastructure damage (roads/facilities), air penetration in pipes (incorrect metering), and increased health risks due to low pressures.

The Good Practice was an initiative to transition from passive acceptance of losses to an active, controlled water loss management policy. The primary goal was to achieve a regular water supply regime for all consumers without restrictions by reducing network losses to an economically profitable level.

Key Actions

1. Cooperation Established: The Waterworks Company initiated the project and secured crucial support from its founder, the Municipality of Pljevlja.
2. Contracting: A specialized contractor was engaged for the detection phase.
3. Active Detection and Repair: The process involved a rapid, intensive 5-day detection activity in a pilot area, utilising expert teams, followed by immediate sanitation and repair measures.
4. Scaling Up: Following the outstanding results from the pilot phase in the Guke/Bogiševac area, the Municipality committed to and financed the continuation of the program, successfully completing seven stages of detection and repair to date.

Results and Impact

The project delivered immediate and quantifiable benefits, reversing decades of poor performance:

Performance Indicator	Before Intervention	After Intervention (Pilot Area)
Service Level	20 years of daily restrictions	Restrictive regime terminated.
NRW Reduction (Pilot)	High, unsustainable losses	Reduced losses by 12–14 litres per second (l/s).
Energy Savings	High electricity bills	Significant reduction in pumping costs.

Financial Savings (Example: 3-Month Comparison, April–June)

Pumping Station	3-Month Cost (Before)	3-Month Cost (After)	Savings
PODBOGIŠEVAC	€4,351.86	€648.00	**€3,703.86**
PODLIJEŠ	€15,801.54	€10,610.15	**€5,191.39**
Total Savings	€20,153.40	€11,258.15	**€8,895.25**

Success Factors

This practice is considered a "success story" because it ended a 20-year service crisis. While not unique in methodology, its success highlights critical factors for SEE local governments and their utilities:

- Political will and financial support: The most critical factor was the Municipality's recognition and sustained financing of the project, demonstrating a best practice in cooperation between the municipal founder and the water operator.
- Prioritisation: The utility committed to tackling a problem often ignored by others due to perceived water abundance, proving the significant financial and service benefits.
- Reliance on Expertise: Utilising the long-term experience of internal technical staff was key to the implementation success.

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2. Digital Transformation of Asset Management System

Korça Regional Water Supply and Sewerage Utility (UKKO), Albania

UKKO serves approximately 90,000 residents in the Korça region. While the utility achieved nearly universal water coverage (98%), it faced a critical operational crisis: managing a 260 km network that was largely undocumented. With Non-Revenue Water at 50% and maintenance being entirely reactive, the utility required a structural shift toward digital asset management to ensure long-term financial and operational survival.

The core of this practice was moving from paper-based records to a centralized, GIS-integrated Asset Management System. This transition was not merely a software installation but a complete redesign of field operations. Supported by the Municipality of Korça, KfW, and SECO, UKKO mapped its entire water and sewer infrastructure into a live digital database.

A key innovation was the introduction of mobile field integration. Instead of reporting back to the office, field teams now use tablets to log failures, asset conditions, and repairs directly from the site. This real-time data flow ensures that the digital map is always accurate and reflects the current state of the physical network.

Key Actions:

- Full Network Mapping: Comprehensive digital mapping of all water and sewer infrastructure.
- Digital Asset Database: Establishing a live database linked directly to daily operational routines.
- Mobile Field Integration: Equipping field teams with tablets for real-time reporting of failures and repairs.
- Capacity Building: Specialised training for staff on asset condition assessment and preventive maintenance.
- Strategic Budgeting: Integrating asset performance data into annual financial and investment planning.

Results and Impact

The transition has yielded measurable improvements for both the utility and the community:

- Operational Efficiency: Faster detection and pinpointing of leaks, leading to significantly shorter service interruptions.
- Strategic Planning: Accurate data allows for targeted asset replacement, optimising the use of limited financial resources.
- Financial Sustainability: A steady reduction in technical water losses and overall lower operational costs.
- Enhanced Accountability: Greater transparency in management and a stronger evidence base when applying for national or international (KfW/SECO) funding.

Lessons for Sustainability

UKKO’s experience highlights that the technology is only as good as the institutional commitment behind it. By implementing the system in phases, the utility was able to demonstrate immediate "quick wins" in critical areas, which helped overcome initial staff hesitation. Today, asset management is a core organisational function with dedicated roles, ensuring that the GIS platform remains the "single source of truth" for both daily repairs and multi-year strategic budgeting. This foundation now secures a more reliable service for citizens and a more stable economic environment for local businesses.

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3. Corporate Asset Management System (KUVARS)

Istanbul Water and Sewerage Administration İSKİ, Istanbul, Türkiye

Istanbul Water and Sewerage Administration İSKİ, is managing a vast network that includes over 23,000 km of water lines and 114 treatment plants, serving over 15.7 million people in Istanbul. The organisation faced significant pressure from rapid urbanisation, aging infrastructure, and the need for digital transformation.

The primary goal of the **Corporate Asset Management System KUVARS** was to transition from reactive maintenance to a systematic, integrated approach to asset management. By tracking the entire lifecycle of an asset—from planning to maintenance and decommissioning—İSKİ aimed to increase equipment uptime, reduce operational costs through predictable budgeting, and improve the overall efficiency of its large workforce.

Key Actions

- Asset Tree Hierarchy: Integrated underground and above-ground assets into a standardised Enterprise Asset Management (EAM) system, recording age, financial value, and technical characteristics.
- Workflow Automation: Automated the entire lifecycle of work orders—from creation for preventive or corrective maintenance to final approval and completion.
- Mobile Deployment: Launched a mobile application allowing field teams to work offline in areas with low connectivity, ensuring real-time data entry and better response times.
- Systems Integration: * GIS: Linked facility information to map screens for spatial visualisation.
    - PDKS: Integrated personnel tracking to manage workforce allocation automatically.
    - Warehouse: Connected corporate inventory to ensure parts availability for maintenance.
- Occupational Safety Integration: Embedded health and safety protocols directly into the work order process to protect employees during field interventions.
- Proactive Maintenance: Utilised system data to shift toward predictive maintenance, minimising the impact of unplanned asset downtime.

Results and Impact

- Extensive Digital Inventory: Successfully registered and currently managing approximately 100,000 assets within the centralised system.
- Operational Efficiency: Achieved a steady output of approximately 88 work orders per day in 2024, totalling over 2,600 specialised orders within the system's first major phase.
- Massive Scalability: The system is designed to eventually manage several million assets, including individual sewage lines and millions of water and electricity meters.

- Data-Driven Decision Making: Provided management with clear visibility into asset age and performance, allowing for more accurate long-term financial planning and investment.
- Improved Service Reliability: Optimised infrastructure management resulted in more consistent service for the citizens of Istanbul by reducing the frequency and duration of service interruptions.

In summary, İSKİ's **KUVARS** project is a transformative model for megacity asset management. By integrating GIS, personnel, and warehouse data into a single mobile-accessible platform, İSKİ has successfully moved beyond simple inventory tracking into dynamic infrastructure stewardship. This proactive approach not only lowers long-term operational costs but ensures that Istanbul's critical water and wastewater services can remain resilient in the face of continuous urban growth.

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Best practices in Capital Investment Projects (CIP)

4. Budva WWTP Bypass

"Waste water" LLC Budva ("Otpadne vode" d.o.o.), Montenegro

Budva Waste Water Treatment Plant (capacity 100,000 PE) is critical for protecting the highly sensitive Adriatic coast. The main challenge emerged from hydraulic overload during peak tourist season and frequent heavy rainfalls that cause stormwater to mix with the sewage system.

The consequences were sudden increases in inflow causing a hydraulic shock to the biological treatment stage, which increased the risk of sludge loss. This instability directly threatened the ability to maintain effluent quality within legal parameters, thus endangering the Adriatic Sea ecosystem and local tourism.

The Good Practice involved the design and installation of an Automatic Bypass-Emergency Discharge mechanism to provide controlled relief during periods of extreme hydraulic stress. The primary objective was to ensure the stability and sustainability of the biological treatment process by automatically and safely managing sudden, massive inflows, thereby preventing the loss of activated sludge and maintaining quality standards for the protection of the Adriatic Sea.

Key Actions

1. Problem Analysis: Plant operators identified the critical points in the biological treatment and clarifiers where sludge was lost during rainfall-induced overflows.
2. Bypass Design: The technical design, developed by "Exploring" LLC, created a pipeline to redirect water from the masthead to the final measuring chamber.
3. Automatic Activation: The system is data-driven and automated:

- Water passes through rough grates, grease, and sand traps.
- Online TOC/HPK sensors measure the organic load.
- If the sensors indicate the organic load is low (i.e., mostly stormwater infiltration), the bypass is automatically activated.

4. Controlled Discharge: Redirected water bypasses the biological stage but is still passing through fine mechanical treatment (rotary screens, 0.75 mm) before discharge, maintaining compliance standards.

Results and Impact

The project is currently in the testing phase (commissioned 15.112024), but the conceptual impact is clear and significant.

- Reduced Hydraulic Load: Significantly reduces physical stress on the bioreactor and final clarifiers during storm events.
- Process Stability: Prevents the washing out of activated sludge, ensuring continuous, stable plant operation.
- Environmental Protection: Guarantees maintenance of effluent quality in accordance with regulations, protecting the Adriatic Sea, which is vital for the local tourism economy.

Innovation and Success Factors

The innovation lies in the automatic, real-time control of the emergency discharge. Instead of relying on manual intervention or simple flow volume, the system uses TOC/HPK parameters to confirm the low organic load (stormwater) before activating the bypass. This approach allows for controlled emergency discharge without jeopardising the effluent quality. The intervention is the first step in the utility's long-term plan to improve the entire wastewater treatment process, securing reliable service for residents, tourists, and the regional economy. The practice is easily transferable and replicable in other WWTPs across the SEE region that face high hydraulic variability and have existing automatic flow control systems.

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5. Reconstruction of the reservoir dam in the town of Rîșcani

Rîșcani, Moldova

Rîșcani City Hall, serving approximately 8,700 residents in northern Moldova, faced a critical infrastructure crisis. The city's lake dam was deteriorating, posing a significant flood risk to nearby homes, while the connecting river was choked with sediment and waste. The primary goal was to ensure long-term hydrotechnical safety while transforming these degraded areas into a resilient, ecological, and attractive recreational "promenade" for the community, aligned with the 2023–2027 Urban Revitalisation Plan.

Key Actions

To achieve these objectives, the City Hall implemented a multi-faceted approach involving technical experts, international partners, and the local community:

- Strategic Resource Planning: Identified and secured preliminary agreements with hydro-engineering specialists before submitting funding applications to ensure technical feasibility.
- Infrastructure Reinforcement: Executed capital repairs on the dam body, including waterproofing and the removal of invasive vegetation that threatened structural integrity.
- Modernising Discharge Systems: Reconstructed the lock and weir systems to allow for controlled and safe water discharge during flood periods.
- Ecological Cleaning: Contracted specialised services to remove silt and waste from the riverbed, restoring the water flow and local biodiversity.
- Participatory Greening: Organised volunteer actions to plant chestnut trees, which serve both to stabilise the riverbanks and improve the landscape's aesthetics.
- Educational Integration: Partnered with the local Vocational School, where students manufactured the urban furniture (benches) as part of their practical training.
- Transparency & Socialisation: Held a City Fishing Competition upon project completion to inform the public about the results and celebrate the new space.

Results and Impact

The integrated approach led to significant improvements in safety, community spirit, and institutional knowledge:

- Eliminated Flood Risks: The reinforcement of the dam and repair of water discharge systems have secured the safety of life and property for residents in adjacent areas.
- Urban Regeneration: Transformed a degraded site into a functional, aesthetic leisure area that directly supports public health and well-being.
- Consolidated Civic Responsibility: By involving students and volunteers, the community has taken "ownership" of the space, acting as long-term guardians of the infrastructure.
- Institutional Resilience (Lesson Learnt): A key success factor was the proactive hiring of accredited specialists during the planning phase, proving that technical expertise must be secured *prior* to implementation.
- Long-term Sustainability: Continuity is ensured through local budget allocations and self-financing micro-projects, complemented by ongoing community-led maintenance and monitoring.

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6. Bijeljina Sewerage System and the Wastewater Treatment Plant

Vodovod i kanalizacija Bijeljina, Republic of Srpska, Bosnia and Herzegovina

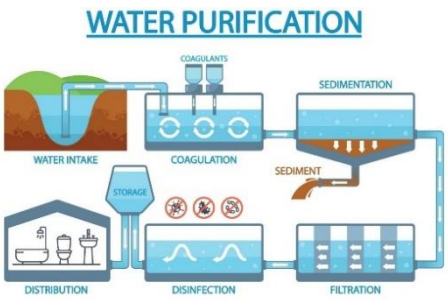
A.D. „Vodovod i kanalizacija“ Bijeljina, a public utility in Republic of Srpska, Bosnia and Herzegovina, is responsible for water supply and wastewater management. The city faced a critical risk to its only source of drinking water due to the prevalence of septic tanks. The primary goal was to implement a functional and sustainable project cycle for a new sewerage system and waste water treatment plant (WWTP). This aimed to improve the standard of living and hygiene for residents, protect the vital water source, and establish a model for successful infrastructure projects through effective local cooperation and international donor engagement.

Key Actions

- Strategic Partnership: Signed a formal Agreement on Cooperation between the local self-government and the water utility to ensure unified strategic and technical action.
- Diverse Financing: Secured a total budget of over €41 million through a combination of City of Bijeljina funds (€11.7M), EBRD loans (€12M), and various international grants (IPA, SIDA, ORIO).
- Infrastructure Construction: Built approximately 120 km of new sewerage network and a main collector transporting waste 6.7 km to the WWTP in Velika Obarska.
- Proactive Personnel Management: Involved key technical staff in all phases of the project cycle and appointed a dedicated Project Implementation Unit (PIU) to monitor progress.
- Operational Training: Conducted comprehensive theoretical and practical training for operators during the trial operation phase to ensure long-term maintenance capacity.
- Regulatory Enforcement: Implemented city-level decisions mandating that all fecal waste from septic tanks must be properly disposed of at the WWTP.

Results and Impact

- Water Source Preservation: Successfully protected the city’s sole drinking water source by eliminating the threat posed by failing septic tanks.
- Operational Excellence: Established a fully functional WWTP with high efficiency and a highly trained crew capable of maintaining the system with internal resources.
- International Standards: Implemented an Environmental Management System in accordance with international best practices.
- Long-term Sustainability: Secured political and financial support for economic sustainability, including necessary budget planning and service price adjustments.



- Critical Technical Lessons: Identified that a 12-month trial period is optimal (to cover all four seasons) compared to the initial 3-month period, ensuring systems can withstand extreme weather.

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7. Strategic capital infrastructure planning

Mariborski Vodovod, Slovenia

Mariborski Vodovod manages an extensive and aging regional water supply system consisting of over 1,723 km of network and 139 pumping stations. The utility faced challenges from deteriorating infrastructure, varying levels of network development across different municipalities, and the increasing pressure of climate-related water fluctuations.

The primary goal was to implement the **Drinking Water Supply Program 2026–2029**, a strategic framework designed to ensure a stable, safe, and long-term reliable water supply. The program aimed to systematically prioritise the renewal of critical pipelines, improve hydraulic performance, and safeguard groundwater sources to create a resilient, future-proof system.

Key Actions

- Comprehensive Infrastructure Assessment: Conducted a data-driven analysis of the entire network, evaluating the physical condition of pipelines, facilities, and the hydraulic performance of supply zones.
- Risk-Based Prioritisation: Identified critical network sections and prioritised investments based on technical urgency, security of supply, water-loss levels, and regulatory compliance.
- Technical Integration: Utilised a combination of operational data, hydraulic modeling, and direct field insights from maintenance teams to ensure realistic infrastructure gap evaluation.
- Coordinated Investment Planning: Developed a unified investment plan defining specific renewal projects and system upgrades across multiple municipalities.
- Multi-Departmental Collaboration: Fostered internal cooperation between planning, engineering, and operational departments to ensure all proposed actions were technically feasible and financially justified.
- Institutional Alignment: Worked closely with municipal owners to secure the necessary institutional and financial frameworks for long-term investment approval.

Results and Impact

- Structured Investment Framework: Established a clear, transparent roadmap for capital projects, moving away from reactive repairs to proactive, planned infrastructure renewal.
- Enhanced Supply Security: Reduced risks associated with aging infrastructure, leading to more stable water pressure and fewer service interruptions for residents and businesses.
- Improved Planning Certainty: Provided municipalities with a predictable investment cycle and a strengthened basis for long-term regional development.
- Operational Efficiency: Enabled internal teams to reduce emergency interventions through better network performance and more predictable maintenance schedules.
- Sustainable Governance: Secured multi-year financial planning and organizational responsibility, ensuring that infrastructure maintenance is a continuous process.
- Transferable Methodology: Created a scalable, data-driven planning model that can be replicated by other regional utilities facing similar aging infrastructure challenges.

Summary

In conclusion, Mariborski Vodovod has successfully transformed its investment approach by adopting the Drinking Water Supply Program 2026–2029. By integrating hydraulic modelling with field data and securing municipal cooperation, the utility moved from fragmented maintenance to a regionally coordinated capital investment strategy. This proactive framework ensures that financial resources are directed where they provide the highest benefit, securing a resilient and safe water supply for the entire Maribor region for years to come.

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8. Intermunicipal protection of the water

City of Kruševac and the municipalities of Brus and Blace, Serbia

The Rasina River basin in central Serbia faced severe environmental risks because municipal wastewater from Kruševac, Brus, and Blace was discharged untreated into the Rasina and Blatišnica rivers. This pollution directly threatened Lake Ćelije, the primary drinking water reservoir for the entire region. Smaller municipalities like Brus and Blace lacked the financial and technical capacity to operate modern treatment plants independently.

The goal was to establish a modern, financially sustainable wastewater treatment system under a single regional concept. This involved building three separate Wastewater Treatment Plants (WWTPs) but managing them through a unified regional operating model where the larger utility, PUC "Vodovod–Kruševac," operates all facilities to protect the common water source.

Key Actions

- Regional Strategic Planning: Secured a combination of KfW development credits (for Kruševac) and EU IPA grants (for Brus and Blace) to finance three WWTPs under one cohesive environmental concept.
- Inter-Municipal Cooperation Agreement: Signed a landmark agreement on 3 March 2021, where Brus and Blace formally delegated the operation and maintenance of their plants to the more experienced Kruševac utility.
- Harmonised Standards: Designed and constructed the three WWTPs using compatible treatment standards to allow for integrated regional management.
- Shared Cost Methodology: Developed a transparent system to allocate operational costs (energy, chemicals, and staffing) and adjusted tariffs so that the combined customer base of all three municipalities jointly covers the costs. Centralised Capacity Development: Trained a specialised regional team within PUC "Vodovod–Kruševac" to manage the complex biological and technical processes across all sites.
- Environmental Monitoring: Established routine effluent and river quality monitoring to track the specific impact of the plants on the recovery of Lake Ćelije.

Results and Impact

- Water Source Protection: Successfully reduced organic and nutrient pollution loads in the rivers, directly securing the long-term quality of the Lake Ćelije drinking water reservoir.
- Professionalised Operations: Enabled smaller municipalities to benefit from high-level professional management that they could not have sustained on their own.
- Financial Resilience: Created a broader customer base and economies of scale, significantly reducing the financial risk of plant failure or under-funding in smaller towns.
- Institutional Innovation: The project serves as a national model for "Inter-Municipal Cooperation," showing how asset ownership can remain local while operations are centralised for efficiency.
- National/EU Compliance: Advanced the Republic of Serbia's progress toward meeting stringent national and EU environmental and water quality standards.

The Kruševac-Brus-Blace case is example of regional solidarity in the WSS sector. By identifying a shared environmental threat—the contamination of a common drinking water source—the municipalities moved past political boundaries to centralise expertise and approaches. This "Regional Operator" model demonstrates that cooperation is a technical and financial necessity for smaller municipalities aiming to achieve modern, sustainable sanitation services.

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9. Cogeneration for Energy Efficiency

Vodovod i Kanalizacija d.o.o. Split, Croatia

The project covers the Split agglomeration (400,000 PE) and involves the construction of three separate WWTPs (Stupe, Divulje, and Čiovo), managed by Vodovod i Kanalizacija d.o.o. Split.

The main challenge for the utility is the high consumption of electricity, which represents a significant long-term operating cost, despite EU funds covering most of the initial construction.

The consequences of high operating costs are: direct cost pressure on the water service provider and indirectly keeps the water service price higher for end-users (citizens).

The Good Practice involved selecting and implementing Cogeneration (Combined Heat and Power - CHP) technology. The primary objective was to reduce operating costs to the maximum extent by generating on-site energy from waste sludge, thereby rationalising service costs and ensuring compliance with EU climate and efficiency goals.

Key Actions

- Project Feasibility: Demonstrated affordability and persistence in securing EU co-financing (approx. 75% of the investment) against initial resistance, overcoming the major obstacle of CHP's high construction cost.
- Energy Analysis: Conducted detailed analysis to choose the most favourable energy efficiency measure, which identified CHP as the best alternative for maximising energy self-sufficiency.
- CHP Implementation: An internal combustion engine is installed, powered by biogas (obtained from the anaerobic digestion of WWTP waste sludge).
- Dual Energy Output: The engine drives a generator to produce electricity for the plant, and the resultant thermal energy (heat) is simultaneously utilised in the process of further drying the sludge.

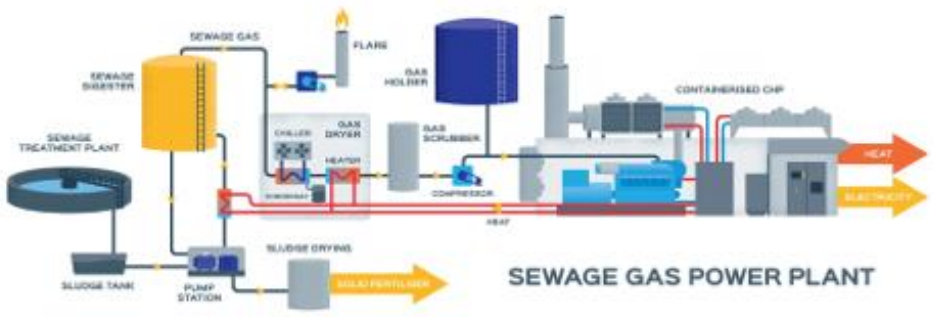
Results and Impact

The project is currently under construction, but the projected impact is clear and significant.

- Cost Reduction: Projected annual saving of WWTP operating costs in the amount of €876,150.
- Community Benefit: The direct benefit is a lower price of water service for the final users—the citizens of Split and its surroundings.
- Environmental Impact: Utilises biogas, an environmentally friendly energy source, and maximises efficiency by reusing the thermal by-product.

Innovation and Success Factors

While CHP technology is not new, its successful implementation in the Republic of Croatia, often facing resistance for co-financing, makes it a significant success story. The essence is the reduction of operating costs using an environmentally sound, self-sufficient system and it is operated automatically with low maintenance needs (only 3 employees planned), ensuring long-term self-funding through the vast cost savings.



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10. Energy Efficiency through Smart Pumping Systems

Shkodër Regional Water Supply and Sewerage Utility, Albania

The Shkodër Regional Water Supply Utility serves over 135,000 residents in northern Albania. Due to the region's geography, the utility relies heavily on pumping stations to maintain adequate water pressure, making electricity one of its highest operational expenses. Before this intervention, the system was burdened by aging, oversized pumps that operated at a constant speed regardless of actual demand. This inefficiency led to exorbitant energy bills, frequent equipment breakdowns, and inconsistent water pressure for consumers. The primary goal was to modernise the pumping infrastructure and introduce intelligent control mechanisms to drastically reduce energy consumption, lower operational costs, and stabilise the water supply.

Key Actions

- Comprehensive Energy Audit: Conducted a detailed assessment of existing pumping stations to pinpoint the most inefficient units and prioritise investments where they would yield the highest ROI.
- Strategic Equipment Upgrading: Replaced old, inefficient pumps with modern, high-efficiency models specifically sized to meet the actual demand of the network.

- Installation of Variable Speed Drives (VSDs): Integrated VSD technology to allow pumps to automatically adjust their speed based on real-time flow and pressure needs, eliminating energy waste during low-demand periods.
- Digital Monitoring Implementation: Introduced real-time digital monitoring tools that provide live data on energy use, pump performance, and system pressure.
- Technical Capacity Building: Provided hands-on training for technical staff on operating the new high-tech equipment and using data analytics for preventive maintenance.
- Multi-Level Support: Facilitated coordination between the Municipality of Shkodër, national institutions, and international partners to secure the necessary technical expertise and financial backing.

Results and Impact

- Significant Energy Savings: Achieved up to a 30% reduction in energy consumption, immediately improving the utility's financial health and freeing up capital for further infrastructure projects.
- Operational Reliability: Drastically reduced the frequency of pump failures and emergency repairs, leading to a more resilient and predictable maintenance schedule.
- Improved Service Quality: Citizens now experience much more stable water pressure, particularly during peak usage hours, ensuring a consistent supply across both urban and suburban areas.
- Environmental Benefit: Lowered the utility's carbon footprint through reduced electricity demand, contributing to more sustainable municipal operations.
- Institutional Sustainability: Established a dedicated monitoring routine where trained staff use real-time data to ensure the system continues to operate at peak efficiency, preventing future cost spikes.

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11. Enhance the sustainability of the regional water sector

Municipal Enterprise "Apa-Canal" Anenii Noi, Moldova

The Municipal Enterprise "Apa-Canal" Anenii Noi provides water capture, treatment, and sewage services for the city of Anenii Noi. The organisation faced significant economic instability due to the constantly increasing and unstable costs of electricity, which directly impacted water tariffs for end consumers. The primary goal of this good practice was to install photovoltaic panels at the drinking water pumping station to reduce electricity expenses, decrease energy vulnerability, and maintain stable water prices for the community.

Key Actions

- Conducted a thorough economic analysis of the energy situation and drafted a detailed technical project for the installation.
- Installed a photovoltaic system with a maximum capacity of 120 kW/hour at the drinking water pumping station to cover a demand of 76 kW/hour.
- Secured partial financing from the Local Government to address the high initial costs of the installation.
- Managed bureaucratic obstacles and high project costs through close partnership with local government entities.
- Assigned a dedicated energy specialist and four station operators to oversee the system's proper functioning and daily maintenance.
- Integrated the project into a long-term strategy, ensuring the installation is covered by a 3-year warranty and supported by internal funds for future maintenance.

Results and Impact

- Significantly reduced the enterprise's dependence on purchased electricity, strengthening its economic stability.
- Enabled the utility to maintain drinking water tariffs at the same price for end consumers despite market fluctuations.
- Reduced the energy and economic vulnerability of the enterprise, ensuring more resilient water supply services.
- Demonstrated a successful model unique to the district that can be replicated across other municipal objects managed by the enterprise.
- Ensured long-term sustainability through secured staff roles and dedicated funding for the system's durability beyond the warranty period.
- Established a path toward full recovery of the invested costs through projected energy savings over the coming years

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12. Energy efficiency and climate mitigation efforts by systematic optimisation of network pressure

Mariborski Vodovod, Slovenia

Mariborski Vodovod manages a complex water supply system with 139 pumping stations operating across varied terrain. Energy for pumping represents a significant operational expense, exacerbated by aging infrastructure and climate-driven fluctuations in water availability. High or unstable network pressure not only wastes energy but also increases the frequency of pipe bursts and water losses.

The primary goal was to reduce energy intensity and improve climate resilience by optimisng pumping station performance. The utility aimed to establish a stable, efficient pressure regime that would lower operational costs, extend the lifespan of infrastructure, and ensure a sustainable water supply capable of meeting national and EU climate objectives.

Key Actions

- Pressure Zone Analysis: Conducted a systematic analysis of supply zones using SCADA data and field measurements to identify areas with unnecessarily high pressure.
- Hydraulic Fine-Tuning: Adjusted pumping schedules and optimised pump operating points to align more closely with actual demand.
- Valve Optimisation: Calibrated pressure-reducing valves (PRVs) to stabilise network pressure, preventing hydraulic shocks and reducing stress on pipes.
- Continuous SCADA Monitoring: Utilised real-time monitoring to observe pressure behaviour and make gradual, data-driven adjustments.
- Inter-Departmental Coordination: Fostered close cooperation between hydraulic specialists, SCADA teams, and field maintenance staff to ensure adjustments did not disrupt service.
- Phased Implementation: Employed a step-by-step reduction strategy to mitigate risks associated with older infrastructure and inconsistent equipment response.

Results and Impact

- Energy Savings: Achieved a measurable reduction in electricity consumption by eliminating the energy wasted on maintaining excessive pressure.
- Infrastructure Longevity: Stabilised pressures led to significantly fewer pipe bursts and emergency interventions, reducing maintenance costs and material waste.
- Consistent Service Quality: Customers experienced more stable pressure levels and fewer service interruptions caused by network failures.
- Operational Stability: Internal teams gained a more predictable hydraulic environment, allowing for better long-term maintenance planning.
- Financial Reinvestment: The savings generated from lower energy bills provided the utility with funds to reinvest in further system upgrades and monitoring technology.

- Climate Resilience: Improved the utility's ability to operate reliably during extreme weather or periods of fluctuating demand, strengthening overall system resilience.

In summary, Mariborski Vodovod successfully turned pressure management into a powerful tool for climate mitigation. By moving from a reactive operational model to a data-driven, systematic optimisation of its pumping regimes, the utility demonstrated that significant energy savings and infrastructure protection can be achieved without major capital expenditures. This practice provides a sustainable, permanent framework for energy efficiency that benefits the environment, the utility's budget, and the local community.

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13. Reducing the energy footprint of wastewater treatment

Istanbul Water and Sewerage Administration İSKİ, Istanbul, Türkiye

As a megacity utility serving over 15.7 million people, İSKİ faces significant energy expenditures for its 90 wastewater treatment plants. Traditional treatment methods are energy-intensive and require large land areas, which is a major constraint in Istanbul's dense urban environment.

The primary goal of this initiative was to reduce the energy footprint of wastewater treatment while simultaneously recovering organic matter and nutrients. By testing cutting-edge technologies like High-Load Activated Sludge (HLAS) and Anaerobic Membrane Bioreactors (AnMBR), İSKİ aimed to transform its facilities into energy-generating "resource recovery centres" that align with EU and national climate goals.

Key Actions

- Pilot HLAS Implementation: Established a pilot-scale High-Load Activated Sludge (Process A) system at the Baltalimanı facility to test rapid carbon capture without the need for large primary sedimentation tanks.
- AnMBR Research: Partnered with Istanbul Technical University to install and operate an Anaerobic Membrane Bioreactor (AnMBR) system, focusing on biogas production and nutrient recovery.
- Space-Saving Design: Utilised high-rate biological processes to treat wastewater in significantly less time and space, addressing the city's land constraints.

- Micropollutant Removal: Integrated an ozone-based treatment system to study the removal of emerging contaminants and improve effluent quality.
- Sludge Digestion Innovation: Pioneered the first use of egg-shaped sludge digester tanks in Turkey to optimise mixing and maximise biogas yield.
- Dynamic Modelling: Conducted extensive mathematical modelling and simulation studies to determine the optimal operating parameters for future full-scale deployment.

Results and Impact

- Efficiency Breakthroughs: Pilot studies successfully reduced hydraulic retention time to just 75 minutes, achieving an 80% removal of suspended solids (SS) and 65% removal of Chemical Oxygen Demand (COD).
- Facility Transformation: The Baltalimanı plant, which served only as a preliminary treatment site since 1997, was successfully upgraded to a full biological treatment plant in 2023.
- Energy Potential: Demonstrated the viability of generating biogas through AnMBR, moving İSKİ closer to its goal of energy-neutral wastewater operations.
- Scientific Leadership: Contributed significantly to the global water sector by publishing four international articles and presenting at three major conferences based on these pilot findings.
- Operational Savings: The high-rate systems offered an alternative solution for space-constrained areas, providing significant energy and construction cost savings compared to traditional plants.
- Environmental Stewardship: Improved the quality of discharge into Istanbul's surrounding water bodies, providing better environmental protection for the region's residents.

In summary, İSKİ is leading a paradigm shift in regional wastewater management by replacing traditional, land-heavy treatment with compact, energy-efficient biological systems. The success of the HLAS and AnMBR pilot programs demonstrates that high-density urban areas can achieve superior treatment results while producing renewable energy. This research-driven approach provides a clear roadmap for water utilities across South East Europe to modernise their aging infrastructure in a climate-resilient and sustainable manner.

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14.Mini hydro-plant on the water supply system

Municipality of Andrijevica/Water and Sanitation LLC ("Vodovod i kanalizacija" d.o.o.), Montenegro

The **Municipality of Andrijevica** is a small, relatively young local self-government unit in the north-east of Montenegro, characterised by exceptionally rich and pure water resources, primarily from the Lim River basin.

Energy is one of the largest operational expenditures for the water utility. As a consequence, the existing water resources were being utilised only for supply, missing a significant opportunity for operational cost savings and revenue generation necessary for stable water utility functioning and compliance with low-carbon, resilient goals.

This practice involved the design, construction, and operation of the **Mini Hydro-Plant (MHP) "Krkori"** directly integrated into the city's water supply system. The primary objective was to harness the natural kinetic energy of the water drop to generate electricity for sale, ensuring the long-term financial stability of the water utility while preserving the integrity and quality of the drinking water supply.

Key Actions

1. Funding**:** The Municipality of Andrijevica secured credit funds for electro-mechanical equipment, supported by the Government of Montenegro (via the Public Works Administration) for part of the construction financing.
2. Infrastructure Construction: A new water intake structure and a sedimentation tank were built at the source. Steel pipes were laid over 3.4 km towards the machine house and the 100,000 m3 city water reservoir, utilising the significant 15% gross drop.
3. Plant Integration: The machine house was constructed over the reservoir, ensuring no possibility of contact between the generating plant and the drinking water. Electro-mechanical equipment, including the turbine generator and pre-turbine shutter, was installed. The building integrates the chlorine station, guardhouse, plant, and tank as a single, compliant unit.
4. Energy Connection: A 35/10 kV switchyard was built next to the facility to distribute the generated electricity via the transmission line system.
5. Quality Control (Lesson Learnt): External supervision was implemented to address and resolve multiple shortcomings found in the technical documentation and execution that had originated under the previous government, ensuring the facility met all standards.

Results and Impact

The MHP "Krkori" was put into operation in April 2021 with an installed power of 398 kilowatts.

- Financial Strength: The project successfully energy-valorised the hydro potential, leading to annual revenues from electricity ales of approximately €208,000.00 (data from 2024), significantly strengthening the water company's economic status.

- Process Stability: Ensured stable, continuous income for the water utility, allowing for better planning and maintenance.

Sustainability and Innovation

- Environmental Protection/Innovation: This is one of the rare MHPs built directly on a city's water supply system where biodiversity is preserved to the maximum because it uses the same amount of water already intended for city supply.
- Sustainability: The project is fully sustainable, generating recurring, substantial revenue. It is highly transferable and replicable for all water companies in the SEE region that have similar hydro potential (significant elevation drops) within their distribution networks.

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