

Sustainable Wastewater Management in Lebanon: Decentralization is Key

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01. _____

Aim of this
Policy Paper

Lebanon is in the throes of a water crisis, one that is exacerbated by decades of mismanagement, conflicts and instability, and the impacts of climate change. In addition, the country has a severe lack of wastewater treatment plants. Many existing facilities are either non-operational or functioning below capacity due to poor maintenance and a lack of funding. A significant portion of wastewater is discharged directly into the environment without any treatment. This contributes to the pollution of rivers, coastal waters, and groundwater. The lack of proper wastewater management leads to widespread environmental contamination, which poses serious health risks, including waterborne diseases. Decentralized Wastewater Treatment Systems (DEWATS) offer reliable, low-cost, and low-maintenance solutions that align well with Lebanon's geographic and socio-economic context, presenting a promising approach in addressing the ongoing wastewater crisis sustainably.

This policy paper outlines a comprehensive roadmap for addressing Lebanon's wastewater treatment challenges, emphasizing short-, mid-, and long-term measures. The proposed policy measures aim to create a robust and sustainable wastewater management framework that leverages decentralized systems, fosters innovation, and ensures environmental and public health protection. By incorporating entrepreneurial solutions and promoting cohesive collaborative action among involved stakeholders, the paper provides a strategic plan to develop a resilient wastewater management system that addresses current issues, and anticipates future needs in Lebanon. The recommendations are based on research, interviews, local expertise, and consultations with stakeholders, ensuring their feasibility and relevance.

Lebanon's approach to wastewater treatment is failing

The wastewater situation in Lebanon

Lebanon produces more than 300M m³ of wastewater per year. According to reports dating back to 2019 before the financial and economic crisis, 20-30% of this volume was treated and only 8-12% received more than primary treatment. Due to electricity cuts and increased cost of fuel and lack of funding to purchase it, the percentage is currently likely to be much lower¹.

Literature indicates that 96 large- and small-scale Wastewater Treatment Plants (WWTPs) exist in Lebanon. Out of the larger-scale WWTPs, 9 are operational and 17 are not or only partially operational, whereas in the case of the small-scale WWTPs, 34 are operational and 46 are not or only partially operational. The below table demonstrates that while WWTPs should in principle be managed by the Regional Water Establishments (RWEs), in practices, most of the operational WWTPs are currently under the management of Municipalities

Table 1: Operational status and distribution of WWTPs according to water authorities.

Managing authority	Larger-scale WWTPs (above 2000 m ³ /day)		Small-scale WWTPs (up to 2000 m ³ /day)		Total		Grand total
	Not or partially operational	Operational	Not or partially operational	Operational	Not or partially operational	Operational	
CDR	10	4	1	2	11	6	17
BMLWE		1		9		10	10
SLWE	1	1		2	1	3	4
BWE	1	1	1		2	1	3
NLWE	None						
Municipalities	5	2	44	21	49	23	62
Total	17	9	46	34	63	43	96

Source: Eid-Sabbagh et al., 2022.

The reason that systems are not operational are varied and linked to occurrences at different stages of the development or operations of a WWTP. For larger-scale WWTPs, challenges are often related to the sewage network, house connections, and electricity for continued operation. Donors financing the capital investment for construction are often limited to the WWTP itself, whereas the responsibility for smooth operation of the sewage network lies with the Municipality², and house connections should be paid for by the households themselves. This, however, often is not coordinated to ensure the functioning of the system. Given the limited amount of government electricity available, WWTPs rely on operation by diesel generators, which significantly increases operational costs. With one or more of these factors unaccounted for and the responsibility for their financing and operation not clearly assigned, many WWTPs never initiate operations.

In addition to its population of 5.2 million inhabitants, Lebanon is currently hosting approximately 1.5 million Syrian refugees and 11,000 refugees of other nationalities (UNHCR). Many refugees live in Informal Tented Settlements (ITS) where basic services are provided by UN Agencies and NGOs. The Lebanese Government does not allow permanent infrastructure to be installed to service these settlements, leading to the international community spending approximately 35 million USD annually to deliver water trucking and desludging. In 2023, 400,000 m³ of wastewater was removed from 3,562 ITSs and safely disposed of. With declining funding for Water, Sanitation and Hygiene (WASH), at present, only 4 million USD are available, which will likely result in suspending a majority of the desludging services.³

The impact on the human and environmental health

The situation has devastating consequences for human and environmental health. Wastewater enters rivers, groundwater, and the Mediterranean Sea. The country faces increasing water shortages due to rising demands as well as climate change impacts, which has made informal water reuse become a common practice. Farmers who lack access to water or fuel to irrigate from wells, are forced to irrigate their crops with contaminated river water or raw sewage for lack of other options.⁴ Cases of Hepatitis appear on a regular basis and 23 people died after a Cholera outbreak in the North of the country in 2022.

¹ Eid-Sabbagh, K. 2023. Wastewater reuse in Lebanon: Shedding light on hydro-social politics at multiple scales. *Water Alternatives* 16(2): 606-631

² Municipalities retain ownership and are responsible for the management of existing sanitation networks (around 60% of Lebanese Households are connected), although they are operated by the Regional Water Establishments. This is enshrined in Municipal law 118 of 1977 and reiterated in subsequent laws 221/2000 and 377/2001.

³ WASH Sector Lebanon, Alert as of April 30, 2024

⁴ IWMI, 2022. Setting the Ground to Water Reuse Policies and Projects in Lebanon, <https://rewater-mena.iwmi.org/stories/setting-the-ground-to-water-reuse-policies-and-projects-in-lebanon/>

A lack of operational capacity and an insufficient regulatory framework

Most of the RWEs responsible for Water and Wastewater Management (see Annex 1 for a detailed overview of the legal and institutional structure), particularly in the Bekaa and the North, are unable to manage WWTPs, both in terms of personnel capacity for operation, or monitoring of contractors, covering the high energy costs, and the absence of a wastewater component as part of the water tariff. This situation, while not new, has been heavily amplified since 2019, as tariffs continue to be collected in Lebanese Lira, the worth of which plummeted due to the currency devaluation⁵, while simultaneously fuel prices kept increasing. The financial crisis also resulted in a reduction of water tariff collection due to widespread poverty.⁶ As a result, three out of four RWEs never managed to recover operational costs.⁷

The Ministry of Energy and Water (MoEW) is currently reviewing the National Water Sector Strategy and complementing it with several policy objectives that are sound in principle, but unrealistic in their scope, at the current pace of developments. A change from the current flat to a volumetric water tariff has been suggested but not yet passed, and previous projects working on improving subscription and collection rates have demonstrated that putting in place updated subscription data and decision-making on subscription changes and debt adjustment, requires unified action from the MoEW and Water Establishments.

To offer sustainable solutions to the wastewater crisis and enable better cost recovery, it is also important to consider the outputs of the wastewater treatment process. The Government of Lebanon and the Lebanese Standards Institution are currently working on legislation and standards for the reuse of wastewater and sludge. The first related guidelines were developed in 2010 under a Food and Agricultural Organization (FAO) project, and while they were not officially ratified, until now, they represented a practical reference in the planning of water reuse projects. If implemented, the sale of treated wastewater and sludge (processed with co-composting, pyrolysis or other) for reuse in agriculture presents an attractive circular business model, allowing increased cost recovery.

⁵ Between October 2019 and now, the Lebanese Lira dropped from 1500 LL to at times nearly 150.000 LL to a dollar, later stabilizing around 90.000 LL for 1 USD.

⁶ Chemonics, 2024. Rehabilitating and Sustaining Lebanon's Wastewater Treatment Plants, <https://chemonics.com/impact-story/rehabilitating-and-sustaining-lebanons-wastewater-treatment-plants/>

⁷ Eid-Sabbagh, K. 2023. Wastewater reuse in Lebanon: Shedding light on hydro-social politics at multiple scales. *Water Alternatives* 16(2): 606-631



Source: Cewas. Reed-bed Filter in Harim, Bcharre, 2024

03.

The case for
supporting and investing
in **Wastewater
Entrepreneurship**

Decentralized wastewater treatment systems need to be part of the solution

Over the past three decades, approximately 1 billion USD were invested by the international community and public institutions in the Lebanese wastewater sector. The impact of these investments remains insufficient⁸. The current approach to Wastewater Management in Lebanon is failing. Only 35% of the larger WWTPs are performing actual treatment and the small-scale plants, which are mostly mechanical, have also not yielded the necessary results.

So, what are the alternatives to address the growing need for solutions to the wastewater problem? For one, Decentralized Wastewater Treatment Systems (DEWATS) could be one viable solution that corresponds directly to many of the difficulties that the current wastewater treatment system is facing. They provide reliable and efficient treatment and processing of domestic wastewater, only require short planning and implementation phases, have moderate investment costs, and limited requirements for operation and maintenance.

Decentralized and sustainable sanitation systems are based on a set of design and layout principles, which include reliability, longevity, tolerance towards inflow fluctuation, cost efficiency and, most importantly, low control and maintenance requirements⁹. They also provide a degree of flexibility and adaptability that makes them suitable for a wide range of contexts, rather than just providing a static hardware solution. Apart from technical and engineering aspects, the specific local economic and social situation is taken into consideration and all aspects of the value chain are addressed. The systems can be applied in a modular systems approach and provide treatment ranging from 1 m³ to 1,000 m³ per day per unit, and can treat wastewater from domestic and/or industrial sources depending on their design. Treatment systems range from primary treatment (sedimentation ponds, settlers, septic tanks or bio-digesters), secondary treatment (anaerobic baffled reactors, anaerobic filters or anaerobic and facultative pond systems), complementary secondary aerobic or facultative treatment (for instance through gravel filters), and finally post-treatment through aerobic polishing ponds.

⁸ Lebanon Daoura/Bourj Hammoud Wastewater Treatment Plant, <https://rb.gy/8fg6v9>

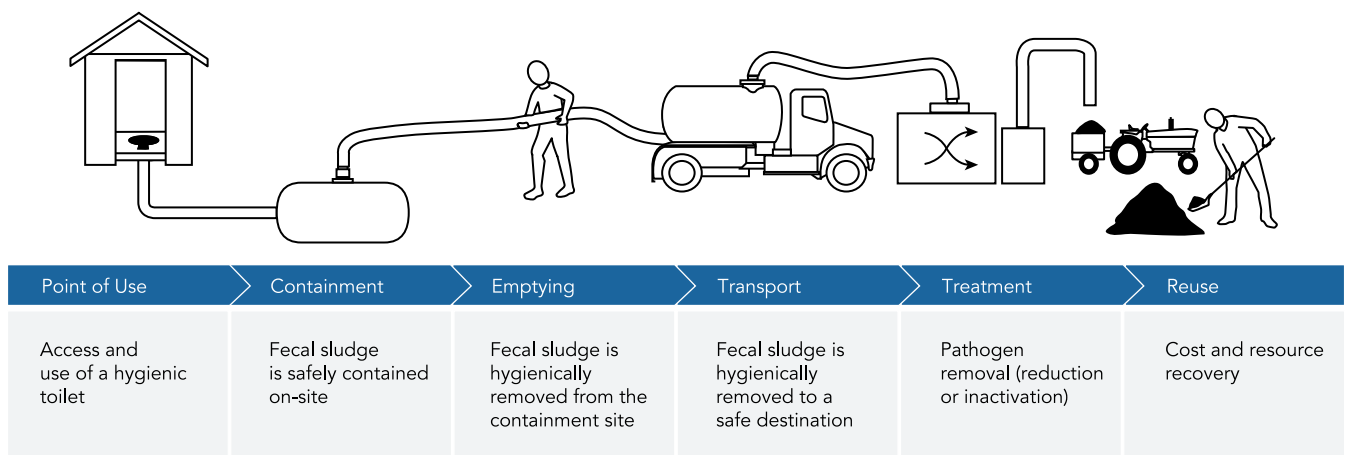
⁹ https://sswm.info/sites/default/files/reference_attachments/DEWATS_Guidebook_small.pdf

Sustainable and decentralized sanitation systems have proven successful for decades in many contexts and relevant information, trainings and further capacity building are widely available. A comprehensive resource is the Compendium of Sanitation Systems and Technologies developed by the International Water Association (IWA) and the Swiss Institute for Aquatic Research EAWAG.

<https://www.eawag.ch/en/departement/sandec/publications/compendium/>

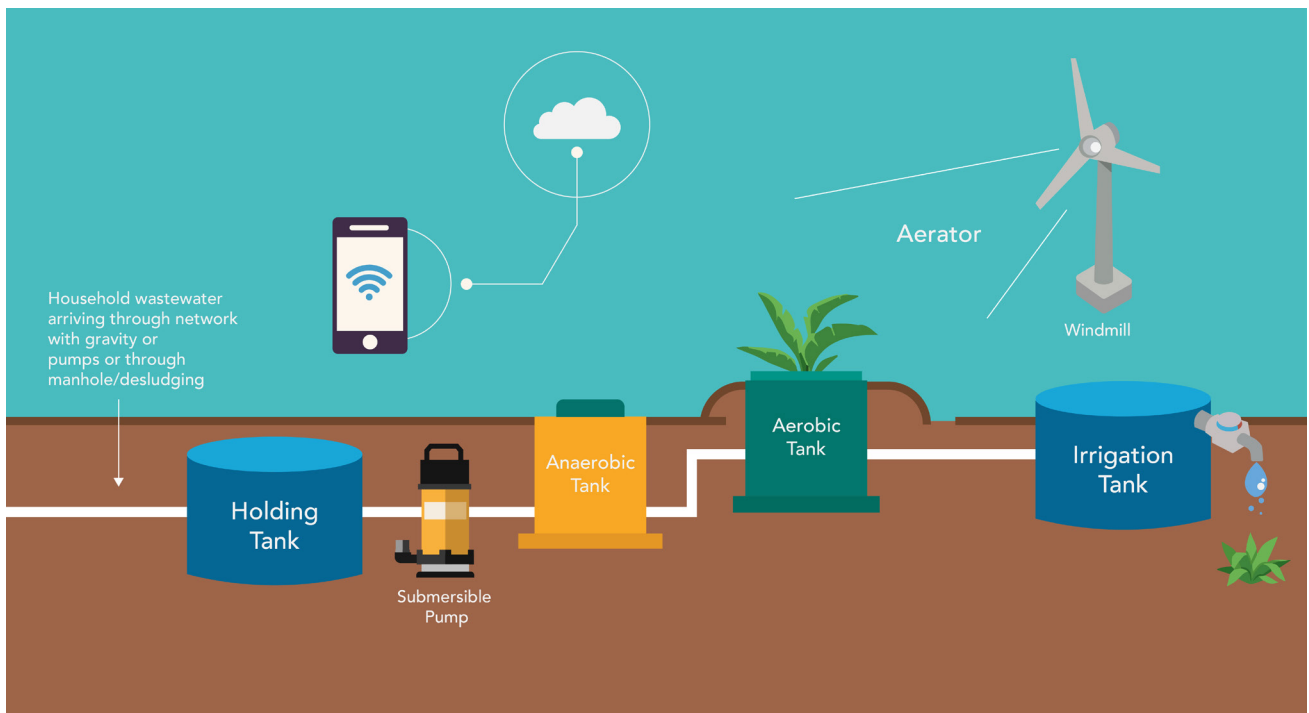
Additional practical knowledge, including opportunities for current courses and exchange, is available in the Sustainable Sanitation and Water Management Toolbox: (sswm.info) and the Sanitation Learning Hub (sanitationlearninghub.org).

The circular sanitation value chain is composed of various stages, as defined by the above-mentioned sources. Starting with the toilet as a point of use, through containment, emptying, transport, treatment and reuse. Not all sanitation systems have to go through all stages.



Source: Sanitation Value Chain, adapted from Tilley, E., Ulrich, L., Lüthi, C., Raymond, P. Zurbrügg, C. and Schertenleib R. (2014b) Compendium of Sanitation Systems and Technologies – 2nd revised edition, Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dübendorf, Switzerland.

DEWATS that are locally connected through a network pre-empt the need for emptying and transport, thus further reducing the cost of emptying and transport. The reuse component is important, since it demonstrates that safely treated wastewater can be turned into a resource and the revenue can contribute to covering the costs of the process.



Source Adapted from Mrüna's Biompod system

Decentralized wastewater treatment systems bring a range of advantages, as they are:

- **technically & operationally appropriate** in the long term due to the fact that low or no electricity is required, and fewer chemical and technological processes are involved;
- **financially & economically viable**, since the water can be directly reused, and sludge can be turned into nutrients through additional processes;
- **socially acceptable**, as the 'Not In My Back Yard' (NIMBY) effect is lower compared to larger plants, thus facing less resistance from local communities where the wastewater treatment plant is supposed to be implemented, due to concerns over the negative visual impact, noise or smell.
- **institutionally appropriate**, given that they are easy to maintain, and their operation requires a low level of technological skill.

In addition, they correspond well with Lebanon's geographical properties – the country's rural and mountain areas are dotted by many villages, smaller cities and urban neighborhoods that are ideally suited for decentralized sanitation systems, due to their size, concentration, available space, proximity to the agricultural sector with need for re-use of the outputs, and gravity, which can replace the need for pumping. Furthermore, the systems are versatile in their application and can be adapted according to local needs and circumstances, in terms of modular composition as well as treatment quality.

It is thus evident why DEWATS should be part of a comprehensive wastewater strategy in Lebanon, complementing other decentralized and centralized wastewater treatment solutions.

Reed-bed Filter in Harim, Bcharre

Since 2013, a reed-bed wastewater treatment plant has been operating in Bcharre, serving the needs of 40 households, equivalent to 300 inhabitants of the locality Harim. The pilot system was part of a decentralized cooperation project between the North Lebanon Water Establishment (NLWE), the Union of Municipalities in Bcharre, the Rhone-Alpes Region, and the Water Agency Rhone Mediterranean Corsica (AERMC), and financed with 550,000 Euros funding from Agence Francaise de Développement and 100,000 Euros from the Municipality for the acquisition of the land. Implemented by the French company Corail Development, it consists of 1,720m of collection and transfer networks, 40 house connections, a pumping station, and the reed-bed filter treatment plant. Gravity is used for most of the network flow, avoiding electricity costs. Operation of the system mainly consists of cutting the reeds, which are carried out by a local farmer. Apart from this, no major operational or maintenance costs have been necessary to date. According to the Master Plan for Sanitation of Bcharre Caza, 14 reed-bed filter treatment plants and 10 activated sludge stations were planned. To date, only one pilot reed-bed has been made operational.^{10 11}

¹⁰ SSWM Case Study (2021) Reed Bed Filter Treatment Plant in Harim, Bcharre, <https://www.youtube.com/watch?v=3kY5Tfwowk4>











¹¹ PSeau (2017) Pilot of Reed Bed Filter Treatment Plant, <https://rb.gy/p2044e>

Decentralized wastewater business models

While at times a fight against windmills, a handful of daring Lebanese wastewater enterprises recognized an opportunity to find less energy-intensive and more sustainable methods to manage wastewater. These entrepreneurs have developed, sold, and even exported proven technologies for decentralized wastewater treatment, and beyond merely selling treatment units, they have also built an understanding of operation and maintenance requirements, and analyzed options for reuse of treated wastewater and other sanitation end-products.

These experiences and insights form the basis for developing solutions that are cheaper and/or more effective than the current practices, and establishing revenue streams that allow cost-covering business models. In a country with staggeringly dysfunctional to non-existing wastewater management, it is not only the (social) business success that matters in these efforts. Wastewater entrepreneurs form one of the biggest assets Lebanon has at hand in solving its environmental crisis. But just like water resources are affected, the lack of incentives, financing and cooperation of communities, local and national government, RWEs and Donors, all threaten to push the country's wastewater entrepreneurs out of business and/or out of the country.

Depending on the business model of wastewater enterprises, different performance indicators determine success:

Sales of DEWATS	Wastewater service operator	Sales of recovered resources ¹²
 Length/duration of sales cycle [in months]	 Revenue generation from operation and maintenance contracts	 Revenue generation from sales of treated wastewater, fertilizer, etc.
 Revenue generation from equipment sales and installation fees	 Revenue generation from fees ¹³	 Cost of production and distribution
 Production costs	 Operational costs ¹⁴	 Number of customers and revenue per customer
	 Density of systems under operation	

¹² or sanitation end-products

¹³ including households and dumping fees

¹⁴ including among others energy consumption, labor, fuel & fleet maintenance and spare parts

Let us have a look at examples of Lebanese enterprises that have specialized in developing and implementing solutions for wastewater management, along the lines of these business models.

[Mrüna](https://www.mruna.com/) (<https://www.mruna.com/>) integrates two primary models: sales of DEWATS (Decentralized Wastewater Treatment Systems) and wastewater service operations. The company's innovative DEWATS system, BiomWeb, is nature-based and produced for clients including municipalities, real estate developers abroad, and international Donors for application in refugee settings. The company manufactures systems in Lebanon and installs them both locally and in the United Arab Emirates.

Product and Innovation

The BiomPod system is inspired by the principle that there is no waste in nature. It aims to emulate natural aquatic systems to minimize maintenance and operational costs, and avoid the use of chemicals. The system utilizes bacteria, microbes, fungi, insects, and plants found in wetlands to treat wastewater and immobilize toxic heavy metals.

Its key features include:

- o Compact Design, as BiomPod combines anaerobic and aerobic tanks with microbiology and a reed-bed system in a reduced space.
- o Advanced Monitoring, since each system is equipped with IoT sensors for remote monitoring, requiring minimal operational maintenance.
- o Scalability due to its modular design, which allows additional tanks to be added in series for increased treatment capacity or in parallel for additional throughput.

Achievements and Impact

- o Pilot Project in Malaaqa: In 2021, Mrüna implemented its decentralized, remotely operated, nature-based wastewater treatment system in the informal settlement of Malaaqa in collaboration with UNICEF.
- o Miziara Implementation: With support from Cewas, Mrüna further developed its business model towards becoming a service provider by implementing a BiomWeb system in Miziara, a municipality in Northern Lebanon. The system treats 12,000 liters of wastewater daily for 80 people in a remote neighborhood, preventing untreated discharge into a nature reserve.

CUBEX SAL www.cubexmena.com is a specialized waste management consultancy firm with a focus on resource-oriented biowaste management practices anchored in environmental responsibility, practicality, and economic viability. With expertise in fecal sludge management, CUBEX aims to prevent septic sludge from ending up in waterways through reducing its accumulation and recovering it in a solid state as a source of revenues feeding operational expenses.

Product and Innovation

CUBEX started out with Household level decentralized sanitation systems, however due to the lack of incentives for households to purchase such systems, it focused its research and development on Decantra, a mobile servicing technology that aimed to reduce transportation costs from septic systems by processing the wastewater on-site and recovering the solids for integration into a composting operation. CUBEX also executed several projects revolving around faecal sludge characterisation and dewatering, mainly with Eawag, and gained extensive experience in non-collective sanitation and sludge management.

Achievements and Impact

The business supported the operation of the emergency omni-processor system in Iaat-Lebanon, implemented by Unicef to alleviate the load of wastewater from informal settlement into centralised WWTPs and validate the recovery of safe bio-solids for reuse. Currently, the company focuses on consulting for donor agencies, NGOs and municipalities in the waste and wastewater sector and is implementing a project to provide a comprehensive understanding to community members on wastewater treatment to strengthen the local municipal and private sector's capacity to manage non-collective sanitation systems and ensure proper maintenance and sustainable operations. community members on wastewater treatment, to strengthen the local municipal and private sector's capacity to manage household wastewater treatment systems and ensure proper maintenance.

Understanding the needs, opportunities, and threats for entrepreneurs

Enterprises operate within an ecosystem that can strongly influence whether they succeed or fail, despite a robust business model. Policies are a highly relevant aspect of the ecosystem, that define revenue opportunities for enterprises. The fact that Lebanon does not currently have clear regulations and standards regarding the re-use of wastewater and sludge, for instance, strongly limits potential revenues from sales of systems and recovered resources. The ecosystem architecture also defines whether infrastructure such as sewer lines exist or must be included in the capital expenses of DEWATS. The availability, timing, and continuity of finances available through Donors, investors or banking systems will decide whether a business in the wastewater system can develop its capital expense-heavy research and development, as well as pilot first systems. The ecosystem also comprises knowledge, including whether technical and managerial expertise, as well as qualified staff are available in the country and whether specialized business support can be provided throughout the enterprise development trajectory.

To thrive and generate impact, enterprises pursuing these models need various types of support at different stages of their entrepreneurial journey. Multiple support factors along the pipeline are needed for wastewater entrepreneurs to thrive. While these performance indicators are key to making the financial models of wastewater enterprises work, several requirements, success factors, financing, and support services need to be in place to enable entrepreneurs to succeed in this field.



Source: Mrüna, Biomweb system

04. _____

Roadmap for supporting **Decentralized Wastewater**

The following roadmap outlines actions that various actors including the Government, at the national and local level, Donors, impact investors, International Agencies, NGOs and entrepreneurs can do, to leverage resources and maximize sustainable wastewater treatment solutions.

As part of the methodology to create this roadmap, and with support from the Spark 'From Innovation to Creation' programme, we reviewed relevant literature, consulted with sector experts, financiers and entrepreneurs, compiling key data, insights, experiences and lessons learned for the development of decentralized wastewater treatment business models. Throughout the analysis of these insights, we drew on Cewas' expertise in supporting water entrepreneurs since 2009, to draw conclusions, structures, and map directional information.

The short-term measures are thought to be actions that can be implemented immediately and in approximately the next year, led by implementation stakeholders and involving additional stakeholders, ensuring a participatory and transparent approach. Mid-term and long-term measures should also be applied starting now, but it is expected that their implementation will take longer, because their enactment is more complex, or they build on previous short- and mid-term measures.

Short-term Measures

Category	Measure	Implementation stakeholders
Regulatory	1. Analyse options to reduce barriers linked to permits for decentralized wastewater systems	MoE and MoI
Value Chain	2. Ensure tenders are accessible to large contractors and emerging wastewater enterprises, fostering competition 3. Create partnerships with universities: develop innovative solutions and business models & provide access to labs 4. Assess decentralized WWT potential and cost savings with identification of suitable communities	Donors, NGOs Universities, NGOs, enterprises NGOs, WASH Sector
Financing	5. Foster better services through results-based finance and performance contracts in development projects, including provisions for handover to Water Establishments	Donors, in collaboration with MoEW, RWE, NGOS, enterprises
Awareness	6. Awareness raising campaigns on the benefits of decentralized WWT to support demand creation	NGOs, CSOs Ongoing

Regulatory Measures

1. Analyze Options to Reduce Barriers Linked to Permits for Decentralized Wastewater Systems:

The current permitting process for DEWATS can be complex and time-consuming, often discouraging investment and implementation. In addition, in the Lebanese context specifically, changing governments, political vacuums and corruption led to increased difficulties in receiving permits for entrepreneurial activities. By analyzing and streamlining these processes, the government, specifically the Ministry of Environment and the Ministry of Industry can remove unnecessary obstacles and expedite project approvals. Simplifying the regulatory framework will encourage more private and public entities to adopt DEWATS, and has the potential to accelerate project approvals, fostering innovation and expanding the reach of sustainable wastewater management solutions.

Value Chain Measures

A robust value chain for decentralized wastewater treatment in Lebanon is crucial, as it ensures the efficient and sustainable management of wastewater at a local level. This approach reduces the burden on centralized systems, mitigates environmental pollution, and enhances water security by enabling the reuse of treated wastewater. It fosters innovation and competition, encouraging the development of cost-effective and adaptable treatment technologies. Moreover, a strong value chain supports local economies by creating jobs and engaging communities in sustainable practices. To enable the value chain for decentralized sustainable wastewater treatment in Lebanon, several strategic measures can be implemented.

In the short term, these include:

2. Ensure Tenders are Accessible to Both Large Contractors and Emerging Wastewater Enterprises, Fostering Competition:

Donors and NGOs can encourage healthy competition by opening tenders to a wider range of participants, including both established large contractors and smaller, emerging enterprises. This can lead to more innovative and cost-effective solutions, as smaller enterprises often bring new technologies and approaches to the table. Fostering competition can also drive down costs and improve service quality, making wastewater treatment more accessible and efficient. Currently, Lebanon is facing a brain-drain of the smartest and most innovative members of its workforce. The positive effect of this measure can contribute to curbing the rate of brain-drain through offering smaller enterprises more opportunities.

3. Create Partnerships with Universities: Collaborating with universities can spur the development of cutting-edge technologies and innovative business models for wastewater treatment. Academic institutions can provide valuable research capabilities, technical expertise, and access to laboratory facilities. The latter should be accessible to all researchers, even if they are outside of the student and alumni body. Partnerships between Universities with the private and public sector, as well as NGOs, can lead to breakthroughs in sustainable treatment methods and improve system designs. A win-win measure, the Universities benefit from applied and practical training opportunities for their students and contacts for potential career options, thus helping to train the next generation of professionals in the sector and strengthening the overall capacity for wastewater management in Lebanon.

4. Assess Decentralized Wastewater Treatment Potential and Cost Savings with Identification of Suitable Communities: NGOs, Municipalities and knowledgeable businesses in the WASH Sector, could evaluate the potential for DEWATS across various communities by conducting a thorough assessment of their potential for cost savings. This will help identify where these systems can be most effectively implemented, providing opportunities for awareness raising with communities, while proposing an interesting value proposition for them by quantifying the effects. By focusing on areas with the greatest need and the highest potential for cost savings, resources can be allocated more efficiently. This measure ensures that opportunities are identified, and investments are targeted strategically, leading to better outcomes in terms of both environmental impact and financial viability. Ideally, the assessment should be conducted with the support, or in coordination with, the Ministry of Energy and Water, in order to facilitate the uptake of the assessment results into future revisions and additions of the Water Sector Strategy.

Financing Measures

5. Foster Better Services through Results-based Finance and Performance Contracts in Development Projects, Including Provisions for Handover to Water Establishments: To enhance the effectiveness and sustainability of development projects, it is essential to adopt results-based finance and performance-based contracts, particularly in the operations of wastewater facilities. Development initiatives often fall short by focusing solely on infrastructure, neglecting operational sustainability. By linking financial incentives to measurable outcomes and operational performance, these contracts ensure that wastewater facilities are not only built, but also maintained and operated efficiently. This approach will generate a greater impact from development programs and create opportunities for wastewater entrepreneurs to provide operational services or succeed with decentralized wastewater treatment solutions that are economically competitive, when considering the overall life-cycle cost.

By law, wastewater infrastructure and operation should be handed over to Water Establishments. In order to prevent a break-down of operation after the handover due to their limited capacity, Water Establishments, the MoEW, Donors, NGOs and local enterprises should create an operational plan managed by Lebanese enterprises. This plan would set out how to provide capacity building to Water Establishments with supervision from NGOs, and regular reporting to the MoEW and Donors for a period of several years past the completion of the project, with adequate financial project support.

Awareness Raising Measures

6. Awareness Raising Campaigns on the Benefits of Decentralized WWT to Support Demand Creation:

With the current situation of continuous crises in Lebanon, wastewater treatment does not seem like an immediate priority for the general public, and it is only a pain point to a few that are directly affected (living in the vicinity of untreated wastewater). However, the cost of inaction is very high, due to increasing scarcity and the effect on our health in terms of water and food quality. NGOs and CSOs should make advocating for the urgency of sustainable solutions a main objective, especially given that local solutions and successfully implemented pilots exist. Campaigns, awareness sessions, as well as field visits to pilot projects can be organized.

*In 2022 a site-visit to the reed-bed filter system in Harim, Bcharre was organized by the Environment Academy, gathering citizens from Al Bouaida to learn about solutions for wastewater problems in their Municipality.*¹⁵

¹⁵ Lessons from Bcharre for Bouaida's Reed Bed Wastewater System, 2022. <https://rb.gy/v17vtl>

Mid-term Measures

Category	Measure	Implementation stakeholders
Regulatory	7. Pass regulation and standards for the reuse of treated wastewater	Government, MoEW, LIBNOR
Value Chain	8. Map available inventory and provide inventory finance support	Municipalities, NGOs, RWEs
	9. Create a network of national and international advisors that support R&D in the wastewater sector	Universities, WASH Sector, NGOs
Financing	10. Leverage cost reductions (desludging, fuel and water pumping) from reusing treated wastewater for willingness to pay	Enterprises, Municipalities

Regulatory Measures

7. Pass Regulation for the Reuse of Treated Wastewater: Establishing comprehensive regulations for the reuse of treated wastewater is crucial for promoting sustainable water management practices in Lebanon. The Ministry of Energy and Water is responsible for developing the regulation, whereas the Government is responsible for passing it. The application of the regulation requires further practical details for implementation, such as standards, which are developed by LIBNOR.

Standards for water quality and permissible uses are important, since they define the reuse of water for irrigation and industrial processes, ensuring the safe and effective recycling of water. By doing so, they will reduce the pressure on freshwater resources and support a circular economy. Additionally, the application of regulations and standards will encourage investment in advanced treatment technologies and innovative reuse projects, fostering a more resilient and resource-efficient water management strategy. Ensuring compliance with health and environmental guidelines will further contribute to public health and sustainability.

This measure is considered a mid-term measure, since the MoEW and LIBNOR have been working on and are currently finalizing the setting of the standards, based on international standards. Voices of practitioners highlighted the importance of setting realistic standards and adopting a step-by-step approach for fulfillment. Setting the bar too high and making regulations very stringent from the start, could discourage the development of solutions. Reaching a practical level of treatment and discharge quality is better than not making any improvement due to regulatory barriers.

Value Chain Measures

8. Map Available Inventory and Provide Inventory Finance Support:

Wastewater Treatment needs equipment (sensors, machinery), which while not high-tech, is often not readily available in the country. Conducting a thorough inventory of existing wastewater treatment related material and infrastructure that is currently in the country in warehouses of Water Establishments, Municipalities, engineering companies and NGOs will create a comprehensive understanding of what is available and what is needed. Donors can then provide informed financial support for inventory management, ensuring that resources are utilized efficiently and projects are not delayed due to lack of materials. This measure will help streamline operations, reduce costs, and enable quicker implementation of wastewater treatment projects.

9. Create a Network of National and International Advisors to Support R&D in the Wastewater Sector:

Even simple solutions such as DEWATS require a certain level of know-how and expertise to discuss how best to adapt them to local conditions. Therefore, a network of National and International Advisors could be developed by NGOs, potentially hosted by the WASH Sector or a local University. The Network should ensure a balance of practitioners from the private sector, NGOs, Municipalities, and representatives of Academia with practical knowledge of Lebanon as well as internationally. In fact, an international platform for Sustainable Sanitation in emergencies including a Helpdesk function already exists and is being expanded. The Sani-Hub is a joint sector effort of the Global WASH Cluster, bringing together all knowledge on planning and implementing sanitation and fecal sludge management on one single platform. While focused on emergencies, it has useful information for non-emergency contexts and a help desk of international experts that can be contacted. Advisors in this network can provide valuable insights, share best practices, and offer guidance on cutting-edge technologies and innovative approaches.

The Sani-Hub (sanihub.info/) is a joint sector effort of the Global WASH Cluster, bringing together all knowledge on planning and implementing sanitation and fecal sludge management on one single platform. While focused on emergencies, it has useful information for non-emergency contexts and a help desk of international experts that can be contacted.

Financing Measures

10. Leverage Cost Reductions (Desludging, Fuel for Water Pumping) from Reusing Treated Wastewater for Willingness to Pay:

DEWATS lead to cost reductions compared to the status quo. Presently, households regularly pay for desludging trucks for their septic systems, whereas farmers bear increasing costs for pumping water from wells or far away water sources. With DEWATS these costs can be fully or partially avoided, and the cost savings can be leveraged to encourage the payment of contributions for wastewater treatment services, such as operation and maintenance. Such contributions are voluntary, since the collection of fees and tariffs is reserved to the Regional Water Establishments, which do not have the necessary collection mechanisms in place. However, with sufficient awareness raising and engagement, as well as a contribution that is slightly lower than what customers would normally pay, the incentive to switch from conventional ways of paying for wastewater or fuel for water pumping, to DEWATS is attractive. Selected case studies have shown, that where the local community trusts the Municipality and inhabitants care about clean water and their surroundings, they are willing to pay a small contribution. Here, the enterprises lead the way, in collaboration with the Municipalities.

Long-term Measures

Category	Measure	Implementation stakeholders
Regulatory	11. Advocate for and initiate policy dialogue on regulation of sanitation end-products as well as products from organic waste recycling	MoEW, MoA, NGOs, CSOs, enterprises
	12. Prepare for implementation of wastewater fees (in water tariffs) with ability for private operators to access these fees	MoEW, RWE, Donors, enterprises
Value Chain	13. Facilitate the identification and provision of space for DEWATS	Municipalities
Financing	14. Provide preferential loans for essential service providers (with de-risking by donors)	Financial institutions, Donors

Regulatory Measures

11. Initiate Policy Dialogue on Regulation of Sanitation End-Products and Products from Organic Waste Recycling Engaging in policy dialogue to regulate sanitation end-products (such as treated sludge) and products from organic waste recycling (like compost) is crucial, both for safety and to enable business models with the potential to recover costs of wastewater treatment processes more effectively. Clear regulations will ensure these products are handled and utilized, minimizing health risks and environmental impacts, while allowing for the safely processed sludge to be sold on the market as compost, soil amendment, fertilizer or energy. This dialogue should involve stakeholders from government agencies, the private sector, civil society, and international organizations to develop comprehensive, enforceable standards.

12. Prepare for Implementation of Wastewater Fees (in Water Tariffs) with the Ability for Private Operators to Access These Fees:

In the long term, wastewater fees need to be set as an integral part of the water tariff. As it stands, collection and revenue is centralized by Regional Water Establishments and revenue is intended solely to support their operation. However, the collection rate of the Water Establishments is low, due, amongst other reasons, to lack of resources for follow-up of payment. For the polluter pays principle to work effectively, Water Establishments could collaborate with local enterprises, subcontracted as private operators to collect and access these fees, ensuring a self-generating revenue to cover part of the wastewater treatment services. This measure involves setting appropriate fee structures, ensuring transparency, and building mechanisms for fee collection and distribution. Enabling private operators have access to these fees will attract private investment, improve service delivery, and enhance operational efficiency. It also creates an incentive for private entities such as aspiring entrepreneurs to enter the market, fostering competition and innovation. To implement the measure, a long-term engagement between the MoEW, RWEs, Donors and enterprises is expected.

Value Chain Measures

13. Facilitate the Identification and Provision of Space for Decentralized Wastewater Treatment Systems:

This is a practical step that will contribute to facilitating the implementation of DEWATS. Identifying suitable locations and providing the necessary space for such systems is crucial for their successful enactment. This measure would need to be led by Municipalities and local authorities, including recurring engagement with community stakeholders to secure sites that are strategically located and meet the technical requirements for DEWATS, while being socially accepted and clarifying any legal property issues. Ensuring that space is available and accessible will accelerate the deployment of these systems, leading to improved wastewater management and environmental protection.

Financing Measures

14. Provide Preferential Loans for Essential Service Providers (with De-risking by Donors): The wastewater treatment market, often managed by public authorities in a centralized manner, features few clients, large contracts, and high capital expenses. Private clients and investors rarely have sufficient understanding of the market to invest confidently.

Donors have provided grants for testing, pilot implementations, and otherwise focused funding on large-scale conventional wastewater treatment plants with the hope to create larger impact – often in vain. With the ongoing crises in Lebanon, we are witnessing a reduction in investor interest, and a diversion of donor funding from development to humanitarian priorities, or to other crisis contexts altogether. Traditional commercial financing solutions usually provided by banks are essential for many wastewater entrepreneurs to be able to grow, and for interested clients to purchase the systems and solutions. Since the 2019 financial crisis however, trust in financial institutions is at a low point. In addition, banks continue applying restrictions and extremely high fees for any financial activities or transactions, while offers of loans and other financial services are close to non-existent. Overcoming the lack of trust and restrictive conditions could be achieved through the banking sector deploying smaller tickets, with a guarantee and quality backing from donors.

The USAID-funded Water Sanitation Conservation Project recently entered an agreement with the housing bank Banque de l'Habitat, offering loans for private and collective households to invest in sustainable sanitation solutions. This partnership will be tested in the case of the Antoura project. Combined with savings from regular desludging, it can offer an attractive solution to encourage investments in Decentralized Wastewater Treatment Systems.

05. _____

Recommendations and Next Steps

Alternative solutions for the current failing approach to wastewater management are in dire need. This roadmap for supporting decentralized wastewater treatment in Lebanon outlines a strategy involving various stakeholders, including government agencies, Donors, impact investors, international agencies, NGOs, and entrepreneurs. It emphasizes short-, mid-, and long-term measures to establish sustainable wastewater management systems, starting with addressing mainly value chain and awareness raising measures in the short-term, while preparing increasingly for the implementation of regulatory and financial measures in the longer term.

Throughout all these steps, close collaboration between actors, and a participatory and transparent approach between the leading institutions, other stakeholders, and the population in general are crucial. We will continue to raise awareness and hope that these recommendations will inspire action on the part of the actors involved.

Disclaimer: this paper is limited in scope and does not address all the facets of wastewater and related investments in Lebanon. Furthermore, the assessment of the interventions highlighted in the paper is based only on expert and practitioner opinions with only limited data collection. The listed strategies should be used as a guiding compass, and comments and suggestions for additional measures will be taken on board for future discussions with Cewas and stakeholders.

06.

Annexes

Basics of the legal structure of the water and wastewater sector:

According to Law 221 of 2000, the primary legal structure governing Lebanon's water and wastewater sector, the Ministry of Energy and Water is in charge of policy making, planning, regulation (however without mention of tariff setting or approvals), implementation and monitoring of the water sector and citizen engagement/information. The four Regional Water Establishments are responsible for operating and maintaining water supply and wastewater services for communities, and have a responsibility to propose water tariffs that reflect the community's socio-economic conditions. While they are a public entity, they were supposed to be managed financially independently based on tariff and fee collection, to ensure operation of the systems. The Water Code of 2020 aimed to address a few gaps in the policy, for instance, it suggested to establish a National Water Council for policy and planning and facilitate private sector involvement, promoting user and polluter pay principles and ensuring that tariffs are consumption based through installing water meters, and that tariffs should ensure the financial sustainability of the RWEs. However, it does not explain the process for tariff setting.¹⁶ In 2024, the Water Sector Strategy, first issued in 2012, updated in 2020, continues to be under review. The RWEs never gained autonomy for tariff setting, dealing with debt and non-payers, hiring and firing of staff, leaving them dependent on funding from donors and development agencies as well as the Ministry of Energy and Water. The Council for Reconstruction and Development, an entity that was established post-civil-war to rebuild the country with lower bureaucratic approvals for tenders and decisions, exists until today and continues to be involved in the construction of WWTP, often with minimal coordination with RWEs and the population.

¹⁶ Oxfam (2021) Introduction of consumption-based water and wastewater tariffs in Lebanon, https://www.pseau.org/outils/ouvrages/oxfam_introduction_of_consumption_based_water_wastewater_tariffs_in_lebanon_2021.pdf

Future vision and legal developments

The vision of the Government, as expressed in the 2024-2035 National Water Sector Strategy designed by the Ministry of Energy and Water aims to provide safe, equitable and affordable water and wastewater services to the population, while protecting the quality of all water resources and aquatic bodies, as well as ensuring financially sustainable management of the sector. Specifically, it sets the goal to properly collect and treat 60% of the population's wastewater and recover all water and wastewater operating costs by 2028 through adjustment of tariffs, increased collection (80%) and subscription rates (75%), while reducing the cost of energy by 20% through the adoption of energy efficient techniques and practices.

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