

SUSTAINABLE WATER MANAGEMENT IN A *Changing Climate*

13th BALKANS JOINT CONFERENCE
AND EXHIBITION



11-12-13 NOVEMBER 2025
DURRËS, ALBANIA

National sustainable sewage sludge management and reuse strategy, the case of Georgia.

Monica Jimenez B.
Idrostudi Srl

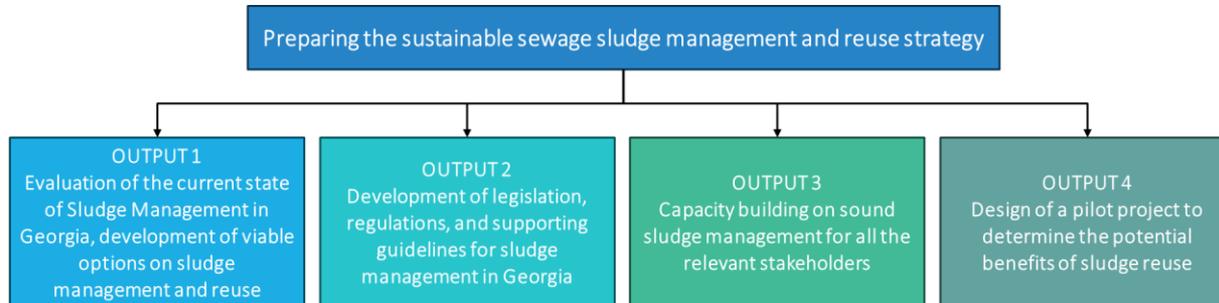
Durrës - Albania, November 2025

Outline

- Introduction: National sustainable sewage sludge management and reuse strategy, the case of Georgia.
- Objectives of the Work
- Main Debates & Issues: Technical, Legislative, and Administrative Challenges
- Alternatives for Solving Problems and International Best Practices
- Results and Recommendations
- Future Perspectives and Professional Considerations

Objectives

- To evaluate and improve sewage sludge management and reuse strategies in Georgia.
- To develop legislation, regulations, and guidelines that support sustainable sludge management.
- To strengthen capacity building for relevant stakeholders and design pilot projects to determine sludge reuse benefits.



Main debates & issues

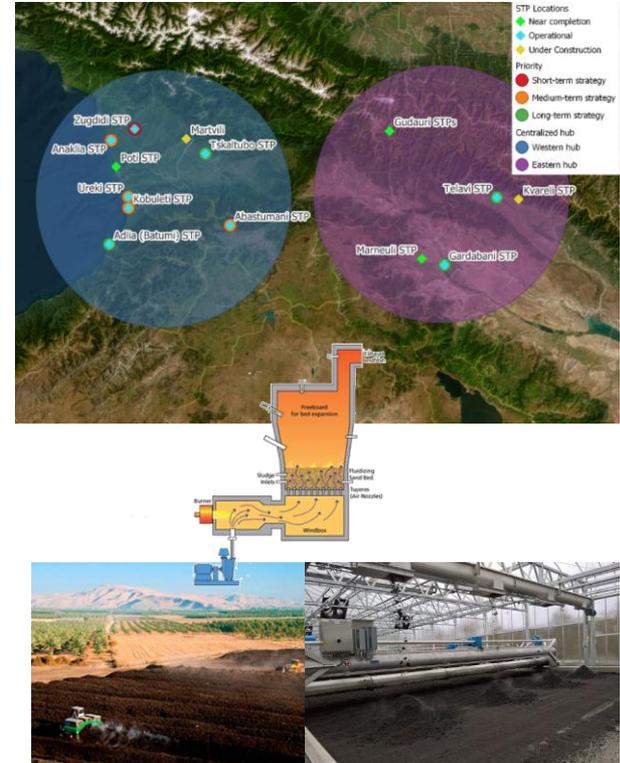
- Rapidly increasing sludge volumes due to expansion of sewage treatment plants (STPs):
 - Lack of proper sludge management = unsustainable practices,
 - inadequate storage,
 - regulatory non-compliance.
- Data availability and accuracy are major barriers.
- Technical, administrative, and legislative gaps:
 - Insufficient regulatory frameworks,
 - lack of accredited Laboratories for sludge analysis (national level),
 - partial engagement from local stakeholders or unclear responsibility division.
- ACCEPTANCE.

Gardabani,
Zugdidi,
Abastumani,
Kobuleti,
Batumi,
Anaklia,
Tskaltubo,
Telavi,
Ureki.



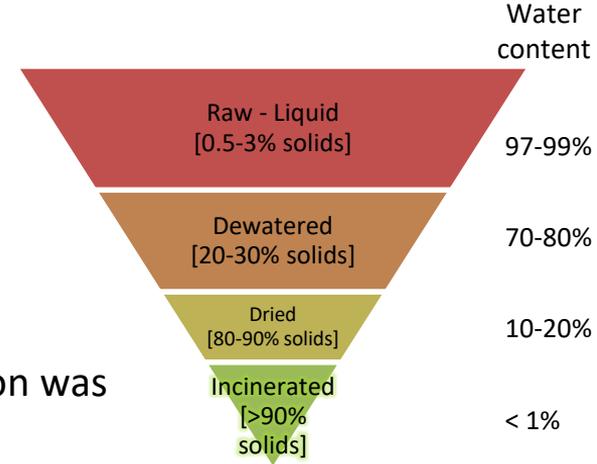
Alternatives for solving the problem/problems

- Technical:
 - Assessment and adaptation of international best practices and emerging technologies, to go from WASTE to OPPORTUNITY (R&E recovery).
 - Creation of centralized hubs
- Legislation:
 - Drafting and adopting new technical legislation and operational regulations for sludge management, including certified laboratories and monitoring protocols.
- Institutional:
 - Capacity development, multi-agency institutional coordination, stakeholder engagement, and public sensitization campaigns.



Results

- Technical:
 - Specific technological improvements can be done to the STPs.
 - Analyzed sludge can be reused for any alternative due to its characteristics (EU Directive .
 - Implementation of dewatering sections alone reduced sludge production by 90%; with thermal drying, a further 7.7% reduction was achieved at pilot sites.
- Legislation:
 - Clear, comprehensive sludge reuse legislation was drafted.
 - Certified laboratories are required for reliable sludge analysis and secure reuse practices.
- Administrative:
 - Public awareness campaigns and educational initiatives should be launched to improve acceptance of new sludge management practices.



Recommendations

- Integrated Sludge Management Plan (Specific solutions to specific STPs)
- Divide the actions into term perspectives →
- Establish and apply clear, comprehensive and technical regulations.
- Prioritize resolving the laboratory certification gap, enabling full sludge characterization and testing.
- Clarify and strengthen the roles and responsibilities of ministries and agencies.
- Sensitization campaigns: public awareness, acceptance, and ownership.

Recommendation Theme	Short-Term (0-3 years)	Medium-Term (3-10 years)	Long-Term (>10 years)
Public Awareness & Integrated Sludge Management Plan (ISMP)	<ul style="list-style-type: none"> • Develop and launch public sensitization and ownership campaigns. • Development of a ISMP for sludge management and reuse. 	<ul style="list-style-type: none"> • Evaluate social acceptance and adapt strategies accordingly. • Fully implement the ISMP and integrate awareness campaigns 	Maintain established, socially embedded awareness programs ensuring ongoing public ownership and acceptance.
Legislation & Regulatory Framework	<ul style="list-style-type: none"> • Draft and adopt clear, comprehensive legislation and technical regulations, including explicit sludge terminology, classifications, and permissible limits. • Include emergency protocols and enforcement & monitoring mechanisms. • Establish reasonable compliance timelines for existing and new STPs. 	<ul style="list-style-type: none"> • Review and update legislation based on operational experience and international developments. • Refine thresholds and standards as monitoring data accumulates. 	Continuous legislation reviews and update based on operational experience and aligned with EU/international developments.
Institutional Coordination & Stakeholder Engagement	<ul style="list-style-type: none"> • Establish and activate multi-agency coordination structures. • Continuous structured stakeholder engagement and consultation. 	<ul style="list-style-type: none"> • Strengthen coordination & stakeholder participation expansion. • Conduct ongoing public engagement and knowledge dissemination efforts. 	Embed sludge management within holistic national environmental and agricultural policies with settled institutional collaboration.
Capacity Building & Education	<ul style="list-style-type: none"> • Develop and deliver targeted training programs for regulators, operators, and final users. • Produce educational materials. • Begin incorporating sludge management topics into education curricula. 	<ul style="list-style-type: none"> • Deliver advanced and continuous training to all relevant stakeholders. • Expand formal education integration (universities, institutes, polytechnics). 	Sustain professional education and research centres specializing in sludge management.
Operational & Technical Management	<ul style="list-style-type: none"> • Standardize sampling and documentation procedures in operations. • Implement initial technology deployments suitable for existing infrastructure considering clusters and hubs. • Begin developing certification protocols for 	<ul style="list-style-type: none"> • Expand and optimize technology deployments as well as assessment of feasibility of centralized facilities. • Enhance pollutants and emission controls. • Implement laboratory development plans including established fully 	Deploy state-of-the-art technologies at local scale and within clustered hubs optimized for resource recovery. Sustain and evolve a robust national laboratory network with international

The future of the matter

- Consider monitoring of emerging contaminants and the need for flexible management systems responsive to new regulatory limits and technical standards – Certified laboratories.
- It is crucial to continuously review and update legislation based on operational experience and international best practices, particularly as EU directives and global trends evolve.
- Investment in professional education, research centers, and certified national laboratory networks is needed for sustainable sludge management and analysis.
- Future planning should encourage:
 - strategic economic assessments & business opportunities.
 - incentivize technology innovation.
 - embed sludge management in national policy frameworks alongside environmental and agricultural objectives.
 - Acceptance & awareness.



References [1]

- Zyazic, M. A. (2013). Effects of sewage sludge on the yield of plants in the rotation system of wheat, white head cabbage, tomato. *Eurasian Journal of Soil Science*, 2(1), 35-44. Black Sea Agricultural Research Institute, Samsun, Turkey.
- Warman, P. R., & Termeer, W. C. (2005). Evaluation of sewage sludge, septic waste, and sludge compost applications to corn and forage yields and N, P and K content of crops and soils. *Bioresource Technology*, 96(8), 955-961. Coastal BioAgresearch Ltd. & Nova Scotia Agricultural College, Canada.
- Junior, A., & Guo, M. (2023). Efficacy of sewage sludge derived biochar on enhancing soil health and crop productivity in strongly acidic soil. *Frontiers in Soil Science*, 3, Article 1066547. <https://doi.org/10.3389/fsoil.2023.1066547>. Department of Agriculture and Natural Resources, Delaware State University, United States.
- Abou Jaoude, L., Mohtar, R. H., Kamaledine, F., Dbaibo, R., Bou Said, R., Keniar, I., & Yanni, S. F. (2025). Impact of treated wastewater sludge on soil and wheat growth characteristics in a semi-arid climate. *Science of the Total Environment*, 974, Article 179166. <https://doi.org/10.1016/j.scitotenv.2025.179166>. American University of Beirut, Lebanon; Agriculture and Agri-Food Canada, Ottawa, Canada; Texas A&M University, USA.
- Melo, W., Delarica, D., Guedes, A., Lavezzo, L., Donha, R., de Arajo, A., de Melo, G., & Macedo, F. (2018). Ten years of application of sewage sludge on tropical soil: A balance sheet on agricultural crops and environmental quality. *Science of the Total Environment*, 643, 1493-1501. <https://doi.org/10.1016/j.scitotenv.2018.06.254>. São Paulo State University (UNESP), Federal University of Piauí, University of Brazil.
- Zarina, R., & Mezule, L. (2023). Opportunities for resource recovery from Latvian municipal sewage sludge. *Heliyon*, 9(e20435), 1-13. <https://doi.org/10.1016/j.heliyon.2023.e20435>. Water Research and Environmental Biotechnology Laboratory, Riga Technical University, Latvia.

References [2]

- Cucina, M., De Nisi, P., Sordi, S., & Adani, F. (2021). Sewage sludge as N-fertilizers for crop production enabling the circular bioeconomy in agriculture: A challenge for the new EU regulation 1009/2019. *Sustainability*, 13(23), 13165. <https://doi.org/10.3390/su132313165>. Gruppo Ricicla Lab., DiSAA, Università degli Studi di Milano, Milan, Italy; ACS Dobfar SpA, Tribiano, Italy.
- Hoang, S. A., Bolan, N., Madhubashani, A. M. P., Vithanage, M., Perera, V., Wijesekara, H., Wang, H., Srivastava, P., Kirkham, M. B., Mickan, B. S., Rinklebe, J., & Siddique, K. H. M. (2022). Treatment processes to eliminate potential environmental hazards and restore agronomic value of sewage sludge: A review. *Environmental Pollution*, 293, 118564. <https://doi.org/10.1016/j.envpol.2021.118564>. University of Newcastle, Australia; University of Western Australia, Australia; University of Sri Jayewardenepura, Sri Lanka; Sabaragamuwa University, Sri Lanka; Foshan University, China; CSIRO, Australia; Kansas State University, USA; University of Wuppertal, Germany; Sejong University, Republic of Korea.
- Frank-Kamenetsky, D. (2021). Sewage sludge handling in the Baltic Sea region in 2018. *HELCOM – Baltic Marine Environment Protection Commission*. Helsinki Commission (HELCOM), Finland.
- Usman, K., Khan, S., Ghulam, S., Khan, M. U., Khan, N., Anwar Khan, M., & Khalil, S. K. (2012). Sewage sludge: An important biological resource for sustainable agriculture and its environmental implications. *American Journal of Plant Sciences*, 3(12), 1708–1721. <https://doi.org/10.4236/ajps.2012.312209>. Gomal University & Agricultural University Peshawar, Pakistan.
- Samara, E., Matsi, T., & Balidakis, A. (2017). Soil application of sewage sludge stabilized with steelmaking slag and its effect on soil properties and wheat growth. *Waste Management*, 61, 545–554. <https://doi.org/10.1016/j.wasman.2017.06.016>. Soil Science Laboratory, Faculty of Agriculture, Aristotle University of Thessaloniki, Greece.

References [3]

- Praspaliauskas, M., & Pėdjius, N. (2017). A review of sludge characteristics in Lithuania's wastewater treatment plants and perspectives of its usage in thermal processes. *Renewable and Sustainable Energy Reviews*, 67, 899–907. <https://doi.org/10.1016/j.rser.2016.09.041>. Lithuanian Energy Institute, Lithuania.
- Balkrishna A., Banejee S., Gosh S., Chauhan D., Kaushik I., Arya V., Singh S. K., 2024, “Reuse of Sewage sludge as Organic Agricultural Products: An efficient Technology-Based Initiative”, *Applied and Environmental Soil Science*, Volume 2024, Issue 1.
- Di Fabio S., Giuliano A., Langone M., Petta L., 2023, “La gestione dei fanghi di depurazione in ottica di economia circolare”, *Laboratorio Tecnologie per l'uso e gestione efficiente di acqua e reflui*, ENEA.
- Mabrouk O., Hamdi H., Sayadi S., Al-Ghouti M. A., Abu-Dieyeh M. H., Zouari N., 2023, “Reuse of sludge as Organic soil Amendment: Insights into the current situation and potential Challenges”, *MDPI, Sustainability* 2023, Vol. 15, Issue 8.
- Rosato M. A., 2023, “Il recupero di fertilizzanti da fanghi fognari”, *Agronotizie*.
- Valchev, D., Ribarova, I., Borisov, B. et al., 2024, “Valuable elements in sludge from eight municipal wastewater treatment plants in relation to their recovery potential.”, *Environ Sci Eur* 36, 11.



Faleminderit

Questions?

idrostudi