CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

LED BY IWMI International Water Management Institute

RE$OURCE RECOVERY AND REU$E

REPORT SERIES

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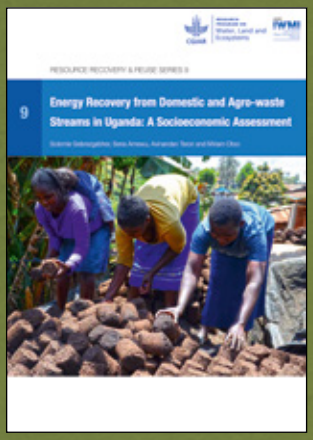
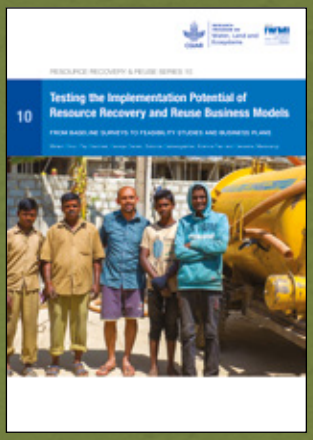
The RRR Report Series of documents present summaries and reviews of the sub-program's research and resulting application guidelines, targeting development experts and others in the research for development continuum.





ON-FARM TREATMENT OPTIONS FOR WASTEWATER, GREYWATER AND FECAL SLUDGE WITH SPECIAL REFERENCE TO WEST AFRICA

Resource Recovery and Reuse Series 1

Where conventional wastewater treatment is lacking, and water in streams and rivers used for crop irrigation is heavily polluted, alternative or additional options for health risk reduction are needed. Although it can hardly replace conventional treatment, on-farm treatment can contribute to risk reduction, especially if combined with other measures such as safe irrigation practices and post-harvest crop washing. Based on experiences in West Africa, this report presents an overview of low-cost wastewater treatment technologies for pathogen removal, which can be adapted for use in urban and peri-urban areas in low-income countries.

TECHNOLOGICAL OPTIONS FOR SAFE RESOURCE RECOVERY FROM FECAL SLUDGE

Resource Recovery and Reuse Series 2

Fecal sludge contains important quantities of organic matter and nutrients that are valuable for agricultural production. This report describes technical solutions for the recycling of fecal sludge to benefit agriculture; this is particularly important for developing countries where there is an urgent need to enhance, at low cost, soil fertility for agricultural purposes.

CO-COMPOSTING OF SOLID WASTE AND FECAL SLUDGE FOR NUTRIENT AND ORGANIC MATTER RECOVERY

Resource Recovery and Reuse Series 3

Composting, as a low-cost technology, remains a valid and relevant option to enhance waste management in developing countries, where the bulk of the solid waste collected is organic in nature but recycling rates are still low. This report provides practical guidance and the latest knowledge related to co-composting of organic waste from municipal waste streams, including human excreta, in order to support planners, researchers, development experts and practitioners in their work.

GLOBAL EXPERIENCES IN WATER REUSE

Resource Recovery and Reuse Series 4

This report reviews a range of drivers, barriers, benefits and incentives for water reuse and wastewater use outside of the United States; outlines the state of, and geographic variation in, water reuse and wastewater use; and reviews paths for expanding the scale of safe and sustainable water reuse and wastewater use in different contexts as also discussed in the frame of the Sustainable Development Goals (SDGs).

POTENTIAL BUSINESS OPPORTUNITIES FROM SALINE WATER AND SALT-AFFECTED LAND RESOURCES

Resource Recovery and Reuse Series 5

Saline water and salt-affected lands suffer from low agricultural productivity and significant environmental

constraints. This report presents four case studies on saline water recycling and reuse from developed and developing countries. These examples suggest that strategic investments in salt-affected, irrigated zones can make a significant contribution to poverty reduction, generate additional economic benefits, and ensure equitable social development for smallholders and marginalized groups, among other advantages.

BUSINESS MODELS FECAL SLUDGE MANAGEMENT

Resource Recovery and Reuse Series 6

With more attention being given to fecal sludge management (FSM) from on-site sanitation systems under the new Sustainable Development Goals (SDGs), this report presents an analysis of FSM cases from Asia, Africa and Latin America, their institutional setup and business model for service delivery beyond access to toilets, i.e., collection, treatment and disposal of fecal sludge. In total 18 FSM business models were developed based on review of 37 successful business cases. The business models extracted also cover in-situ energy recovery as well as different options for capturing the crop nutrient value of the fecal sludge.

GUIDELINES AND REGULATIONS FOR FECAL SLUDGE MANAGEMENT FROM ON-SITE SANITATION FACILITIES

Resource Recovery and Reuse Series 7

Fecal Sludge Management (FSM) services are often provided by the informal sector without adequate technology and safety precautions. The need for official recognition, support and regulatory guidance for safe and sustainable FSM is evident, and it is the objective of this report to provide the reader with empirical examples of FSM from across the globe. This report reviews relevant regulatory aspects of FSM, and introduces a framework for a generic guideline for FSM that builds on experiences and technical standards from various countries.

RECYCLING AND REUSE OF TREATED WASTEWATER IN URBAN INDIA: A PROPOSED ADVISORY AND GUIDANCE DOCUMENT

Resource Recovery and Reuse Series 8

Urban India faces significant challenges in terms of the availability of adequate water supply and sanitation infrastructure. This 'note' on wastewater recycling and reuse in urban India identifies the economic benefits of wastewater recycling from the perspective of public spending. It also provides supporting information on the evolution and current practices of wastewater recycling internationally, and the national and international regulatory and policy frameworks that guide wastewater recycling.

ENERGY RECOVERY FROM DOMESTIC AND AGRO-WASTE STREAMS IN UGANDA: A SOCIOECONOMIC ASSESSMENT

Resource Recovery and Reuse Series 9

Africa is in the midst of an urbanization boom which creates a range of opportunities and challenges. Dealing with domestic and agricultural waste is one of the most pressing issues. As most cities in Africa grapple with the challenge of energy security, recovering energy from waste offers benefits for improving waste management while providing reliable energy to an emerging urbanizing Africa. This report presents a socioeconomic assessment of three energy business models based on feasibility studies carried out in Kampala, Uganda: Dry fuel manufacturing model, Energy Service Company (ESCO) model and On-site energy generation model.

TESTING THE IMPLEMENTATION POTENTIAL OF RESOURCE RECOVERY AND REUSE BUSINESS MODELS: FROM BASELINE SURVEYS TO FEASIBILITY STUDIES AND BUSINESS PLANS

Resource Recovery and Reuse Series 10

In many developing countries, the sanitation sector is highly subsidized by public sector agencies, which has resulted in the inadequate and inequitable provision of waste management services. A paradigm shift towards cost recovery is increasingly being supported by many donors. This development advocates for a shift from waste 'treatment for disposal' to 'treatment for reuse'. This guideline presents a detailed methodological framework that can be used for the feasibility assessment of RRR business models in the context of developing countries. Its purpose is to support public and private sectors as well as investors in determining the potential viability of RRR in a particular location and context.

RESOURCE RECOVERY: INNOVATIONS AND PROMISING PRACTICES FOR TURNING WASTE INTO FEED, FERTILIZER, ENERGY AND RAW MATERIALS

Resource Recovery and Reuse Series 11

There are many examples of innovative thinking and technologies generated by the resource recovery and reuse (RRR) sector. Many of these practices appear to be self-sustainable and could be performed without or via limited subsidies; however, they still require more testing or proof of concept under different geographical settings or a favorable political economy to ensure adoption. This report presents on overview of more than 40 emerging models, and promising ideas, pilots and innovations by young researchers and entrepreneurs.

ABOUT RESOURCE RECOVERY AND REUSE

Resource Recovery and Reuse (RRR) is a subprogram of the CGIAR Research Program on Water, Land and Ecosystems (WLE) dedicated to applied research on the safe recovery of water, nutrients and energy from domestic and agro-industrial waste streams. This subprogram aims to create impact through different lines of action research, including (i) developing and testing scalable RRR business models, (ii) assessing and mitigating risks from RRR for public health and the environment, (iii) supporting public and private entities with innovative approaches for the safe reuse of wastewater and organic waste, and (iv) improving rural-urban linkages and resource allocations while minimizing the negative urban footprint on the peri-urban environment. This sub-program works closely with the RUAF Foundation, World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), United Nations Environment Programme (UNEP), United Nations University (UNU), and many national and international partners across the globe.

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