A Challenging Opportunity:

Greywater Use in the Middle East and North Africa (MENA)

The Middle East and North Africa is one of the most water scarce regions of the world – 5% of the world's population makes due with 1% of the planet's freshwater resources (World Bank, 2003). By 2025, most countries in MENA will face an "absolute" water scarcity (Abu Zeid, 2006).

The high cost of supply driven approaches to water resource development and the inadequacy of conventional, centralised water borne sanitation is well documented (WHO, 2000). The result: a paradigm shift is rippling through the field of water management. Water demand management is a way to get the most from limited supplies by using water efficiently and promoting conservation as a response to scarcity instead of seeking new sources of supply from already overtaxed water resources. Among the avenues being pursued is the use of wastewater to offset the demand for fresh supplies.

Reusing wastewater brings with it risks largely associated with the high levels of nutrients and the presence of pathogens. These risks can be mitigated by separating waste water into its black water and greywater components. Research supported by IDRC since 1999 has shown the latter to be of particular benefit to poor communities, both rural and urban.

What is greywater?

Greywater comes from bathtubs and sinks and is distinct from black water which comes from toilets. It:
- makes up 55%–65% of household water effluent (Morel and Diener, 2006),
- contains 90% less nitrogen, a problematic nutrient present in large quantities in black water (INWRDAM, 2007),
- presents fewer health and environmental risks,
- can boost agricultural productivity when used wisely and appropriately.

Separating, containing, and using greywater is a simple water demand management strategy that has benefits at the household level as an alternative water resource. Because it is less of a health risk than combined wastewater, greywater is suitable for decentralized technologies and methods for reuse, an important consideration for rural and poor urban communities with limited access to water and sanitation services.

Greywater use in MENA

Little information has existed on local greywater recovery and use practices in the MENA (CSBE, 2003). The limited scientific data on greywater is partly the result of a general limitation of resources for knowledge generation in MENA (Oman, 2007). But as Morel and Diener (2006) point out there are other reasons: "…greywater has traditionally been given lowest priority in environmental sanitation systems."

IDRC's contribution to greywater research

A 1999 meeting convened by IDRC in Gaza of environmental organisations and researchers identified greywater recovery as a priority on which action and research were needed. Five subsequent projects have been implemented in Lebanon, Jordan, and the Palestinian Territories. The implementing partners have been the:
- Palestinian Agricultural Relief Committee (PARC),
- Islamic Network on Water Resources Development and Management (INWRDAM, Jordan),
- Middle East Centre for the Transfer of Appropriate Technology (MECTAT, Lebanon),
- Royal Scientific Society (RSS, Jordan).

Most IDRC projects involved the installation of a household wastewater treatment system. The systems are upflow-anaerobic treatment systems attached to existing household plumbing. Though systems differ across projects, results from earlier trials led to improvements over time. Systems cost $300-400 to install depending on the topography near the home and the soil type. This was by far the most expensive cost associated with the system.

Results of Analysis

Social and Economic Data

In Jordan, a comprehensive survey (n=60) of the users one year after the installation of 110 household systems found the following:
- A large number of the households expressed an interest in keeping the systems (91%).
- 90% of those surveyed claimed that they found the systems "good", "very good", or "excellent", while 5% found the system unacceptable. Most of the latter group were unhappy with the odour problem.
- 95% responded that workload was reduced by the systems. Greywater delivered via drip irrigation systems reduced or eliminated irrigation by hand.
- One quarter of those surveyed suggested that the system increased tension with their neighbours. (Problem cited included irritation with odours.)

For treated greywater use to be viable, it is evident that households should have an economic incentive for its use.

In Jordan, research showed:
- the benefit/cost ratio of using treated greywater was 1.83 over a period of 5 years and with a discount rate of 3% (INWRDAM, 2007). This includes the capital costs (i.e. installment costs of the system are taken into consideration),
- the average of operation and maintenance costs was approximately 40 US$/family/year,
- financial benefits (an average of 188 US$/family/year) flow largely from lower water bills, savings in septic tank discharges, and increases in olive production due to better irrigation of trees,
- the average net present value (discounted benefits-discounted costs) over a 5 year period, with a discount rate of 3%, amounts to 271 US$, representing only about 50% of the average *monthly* family income.

Thus, over five years, the result does not suggest the existence of a strong economic incentive for households to install greywater treatment systems.

This study, however, did not take into account improvement to the environment, larger scale notions of water conservation, nor the impact of changed attitudes towards water use in water scarce regions. Furthermore, it is clear from the social survey that despite the weak economic argument, there are social factors at play that led beneficiaries to express contentment with the system and its contribution to improving the environment.

All projects supported by IDRC found that engaging communities in monitoring strengthened interest and ownership ultimately leading to increased success.

Health

No excessive levels of microbiological risk in the treated effluent were noted in any IDRC-supported project. While effluent was not acceptable for unrestricted irrigation, parameters fell within the 1989 WHO guidelines for restricted irrigation (i.e. crops that should not be eaten raw). As a result, one of the main recommendations was limiting the use of greywater to high value tree crops, like olives. In more recent work, IDRC supported researchers are exploring the use of trickling sand filters (e.g. RSS in Jordan) to further treat greywater. Preliminary results on the efficiency of the trickling sand filter was found to be very effective. For example, the sand filter removed 99% of E.coli (Assayed, 2007).

Challenges and problems

While the effluent quality does meet the 1989 WHO Guidelines for restricted irrigation, some problems remain. These include:
- the relatively high capital costs for systems,
- odour from treatment,
- system performance which was found to be closely related to the attitude and approach of the individual farmers (Bino, 2007).

Policy Considerations

An increasing number of jurisdictions are developing policies related to greywater and wastewater use. Arizona, Jordan, Australia, and the UK, for example, all have a supportive policy environment for greywater use.

The recent publication of the new WHO Guidelines for the *Safe Use of Wastewater, Excreta and Greywater* (2006) will be very influential in the development of a greywater policy. The guidelines are premised on the *Stockholm Framework* – an approach that considers context before the development of health based targets (WHO, 2006). WHO also advocates a framework to reduce risk through targeted planning and management. This allows space for countries that cannot afford expensive centralized treatment to look at interim solutions that improve public health.

Simple solutions such as avoiding contact, sub surface treatment, and drip irrigation are useful ways to approach greywater (WHO, 2006). Along with the promotion of simple treatment systems, the IDRC projects all advocated for ways in which greywater could be safely reused in the absence of treatment.

To bolster greywater use across MENA, participants at a 2007 meeting is Aqaba, Jordan agreed to define greywater use as a water scarcity issue and not a poverty alleviation strategy. This perspective, amongst others, was captured in the Aqaba Declaration *(see sidebar)*.

Conclusions

- At the national level, treated greywater use can make a significant contribution to efficiently managing the demand for water scare resources.
- At the household level, treated greywater use can have a positive economic impact on livelihoods in marginalised rural communities.
- Greywater, as a sub-type of wastewater, should be managed differently and accounted for differently in national water planning including in water budgets.
- With a modest investment in risk reduction, greywater is widely considered to be relatively free of risk and safe to use on certain crops.
- The new reference for policy and action associated with greywater is the recently published 2006 *Guidelines for Safe Use of Wastewater, Excreta and Greywater* published by the WHO.

Aqaba Declaration

In February 2007 at a meeting in Aqaba (Jordan), IDRC and the Centre for the Study of the Built Environment (CSBE) assessed the results of work done on greywater use from 1999 to 2007 and outlined an agenda for future work. One outcome was the Aqaba declaration designed to promote greywater use across the region. Researchers and policymakers working on the subject debated the issue and while there was certainly room to be more ambitious, the declaration will serve as a baseline upon which to build more comprehensive water use strategies.

The declaration reads:

We, 30 experts, researchers and practitioners from eight different countries and representing 18 institutions, agree that greywater provides an important potential to alleviate water scarcity in dry countries and that it should be seen as a water source as opposed to a waste product. We also agree that reclaimed greywater use can be environmentally, socially and economically beneficial, and culturally acceptable.

We consider that greywater use must be promoted in a way that minimizes health and environmental risks while generating economic benefits.

Based on what is known to date, we also agree that:

- *Greywater use is considered to have potential as a water demand management option for the MENA region and that we should respond to existing demand for non-conventional sources of water by promoting the widespread adoption of greywater use.*
- *It is useful to see greywater both as a strategy to address water scarcity, as well as a poverty alleviation strategy.*
- *In order to raise the profile of greywater and promote its widespread use, we need to work closely with all relevant stakeholders and should focus on clear and straightforward messages.*
- *We agree that more information is required, for example on:*
  – Impacts of greywater use on health,
  – Impacts of greywater use on soil and plants,
  – Social and economic impacts,
  – Greywater characterization,
  – Appropriate technologies.
- *We agree that any technological intervention should be cost effective while meeting accepted standards.*

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