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Deutsches Institut für Entwicklungspolitik

German Development Institute

NEXUS BRIEF No. 2/2016

Sewage Systems and Energy: Focus on Urban India

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The nexus issue

Sewage treatment plants use vast amounts of energy; in many places, they account for the lion's share of municipal energy consumption. This in itself shows the degree of interconnection between water and energy in sewage systems. Energy efficiency measures offer significant cost saving potential to cities, municipalities and wastewater treatment companies. These measures may include the replacement of sub-components or whole plants, the replacement of solar-powered sludge drying systems, and in-plant energy/electricity production. The latter can be achieved by means of biogas or combined heat and power production in the treatment plant. A large sewage treatment plant can cover up to 80 percent of its own energy requirements.

These kinds of energy-saving technologies are not as widespread in the sewage systems of developing countries. In India, just ten percent of the total sewage produced is treated and only around one third of urban households is connected to the sewage system. At the same time, we are seeing explosive growth in the number of new residential areas, planned and unplanned, as urbanisation proceeds apace. This means that there are an increasing number of households to be connected to the system. Available and affordable land, especially for sewage treatment plants and large piping systems, is in particularly short supply in major cities. There is an increasing political focus in India on the treatment and recycling of water, a scarce resource in the country. As such, urban administrations and supply companies are under immense pressure to organise water and sewage systems in a resource and cost efficient manner in order to satisfy future growth in demand for water and energy.

Research goals

The goal of this sub-project was to analyse the conditions and instruments needed for promoting resource-efficient strategies within India's urban sewage systems. This gave rise to the following focused questions:

- What are the drivers and obstacles with regard to the diffusion of energy-efficient technologies in the Indian sewage sector?
- What can be done to promote investment in sustainable and resource-efficient solutions?

In order to answer these questions, three cities were analysed, each facing different challenges. Delhi is a mega city confronted with marked population growth and a dilapidated and an incomplete sewage system. Nashik in the state of Maharahstra is constructing an innovative waste and sewage-based biogas plant in order to meet stricter energy efficiency requirements. Kochi is the commercial centre of Kerala. Conventional large scale wastewater treatment plants requiring deeply sunken sewers are barely feasible in the coastal city with its high water table.

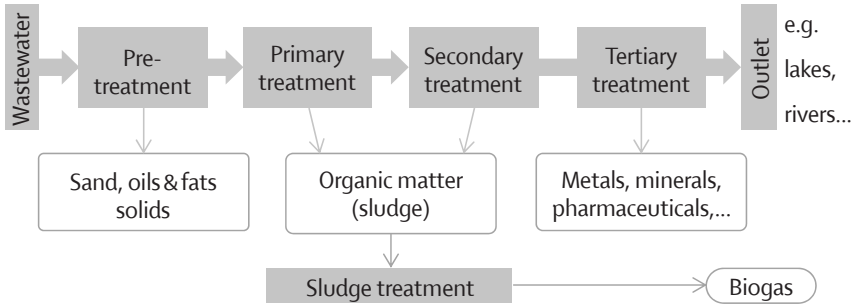
Results

There are no explicit forms of nexus governance in any of the three cities studied. However, the first innovative initiatives are working to promote resource-efficient, life cycle-oriented solutions. Water prices and subsidies, binding discharge standards and regulations on energy savings are key instruments when it comes to the diffusion of energy-efficient technologies. Standards and regulations are especially effective when they are introduced gradually and monitored locally.

Feed-in tariffs for biogas do not provide any incentive at present. Regulatory loopholes exist (1) in the taxation of sewage when new buildings

Investment in energy efficiency and electricity production can also prove worthwhile with sewage treatment plants in developing countries. Resource and cost efficiency vary depending on the plant.

Fig. 1: Schematic diagram of sewage treatment process and resulting substances



Source: German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE)

are constructed, (2) in the systematic pricing of sewage and (3) in the introduction of standards for the recycling of treated sewage and for sludge.

Reasons for a lack of investment in energy and resource-efficient sewage systems which can be optimally adapted to local conditions are:

1) high volume losses in piping systems and and low drinking water pricing (no cost recovery),
2) a strong interest on the part of a range of actors in maintaining the status quo,
3) a prevailing paradigm which favours the use of large conventional treatment plants,
4) a range of procedural difficulties with tenders, management and controls throughout the sewage system.

Recommendations

There is as yet no systematic, intersectoral consideration of water, energy and available land in the policy-making and investment planning processes. Where this does occur, it tends to be limited to specific individual cases. The following recommendations can be derived for the nexus strategy from this case study:

- Use terms less abstract than "nexus": adopting the language of local actors (e.g. lifecycle approach) boosts interest in and identification with the topic.
- Do not complete step 5 before step 1: depending on the local situation, ensure that a given sector is functioning properly before introducing a further level of complexity.
- Encourage a pragmatic change of mindset and the use of cost arguments: this can increase investment in energy-efficient technologies.
- Leverage the potential of green procurement: a lifecycle-oriented mindset should be encouraged in order to design tenders and agreements appropriately.
- Enable the use of climate funds for investment financing of resource-efficient solutions to take account of the large volume of greenhouse gases emitted by sewage and sludge.

India's sewage system is largely still stuck in a lock-in situation.

A strong interest in maintaining the status quo and existing price structures mean change can only be gradual.

Water and land shortages promote change.

The project "Implementing the water-energy-food nexus: incentive structures and policy instruments" is being funded by the German Federal Ministry for Economic Cooperation and Development (BMZ). www.die-gdi.de/en/nexus/

Further publications

Never, B. (2016). *Wastewater and energy saving in urban India* (Discussion Paper 12/2016). Bonn: German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE).

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