

Making the Water Energy Nexus Real

Stockholm explores the feasibility of energy extraction from food waste in their water system.

A 2016 CNCA Innovation Fund grant to the City of Stockholm is allowing them to explore the feasibility of source separating wastewater flows in dense urban areas. See what they are working on now.

Stockholm's Wastewater System Project Summary

Although the wastewater system in Stockholm is quite advanced in terms of treating water at a moderate cost with high resource efficiency, improvements can still be made. Wastewater contains resources that are not optimally reused in Swedish wastewater systems. By source-separating wastewater flows at the household level, waste streams can be managed in such a way that energy can be captured and resources utilized. This project is focused on: (1) creating a feasibility study that describes potential scenarios for source separating wastewater flows in dense urban areas, and (2) building a business model for the implementation of such systems.

Energy Capture Opportunities

There is wasted energy in sewage. Even though many modern wastewater treatment plants have heat recovery from treated wastewater, most of the energy used to heat water in homes is wasted in transport between the residential property and the water treatment plant. There is also wasted biogas potential. The waste disposers that are currently being introduced in Stockholm are connected to the sewer system. The food waste is currently transported to the wastewater treatment plant. The treatment plants are designed to treat water, not to optimize energy recovery, so up to 60 percent of the biogas potential is lost. Finally, there are wasted nutrients from food waste and the toilet water. Non-wanted compounds in the wastewater currently contaminate valuable nutrients, making farmers reluctant to use conventional wastewater sludge.

Problem Description

The management of Stockholm's wastewater is very efficient, in terms of effluent and cost efficiency. However, changes in the conventional system are still difficult to implement. The wastewater business has traditionally focused on water, developing knowledge on how to best treat wastewater. Adjusting focus to include retrieving resources from the water will take time. According to a pre-feasibility study created by the City of Stockholm, source separation appears to be a viable option to explore. The assumption is that by separating flows at the household level, waste streams within water flows can be utilized and optimized. The diagram below describes the anticipated use of each flow.

Making the Water Energy Nexus Real



Image Source: Grantee Proposal

Proposed Solution

Stockholm's Royal Seaport (SRS) is located inside city limits, and is the currently undeveloped pilot area for this project. Around 3,000 new apartments will be constructed in SRS over the next 5 years. SRS is currently serviced by traditional sewer systems. However, in the requirements attached to the land allocation agreements, developers of the area must plan for three wastewater pipes emerging from each building: one from kitchen waste disposers, one from toilets, and one for the rest of the wastewater. These source-separated wastewater systems will then be tested and observed for resource recovery optimization.

The implementation of the project requires a highly-integrated approach due to the number of stakeholders involved. With a source-separated wastewater system, stakeholder roles will shift and business models will change. Some of the anticipated changes are:

- Residents will need to accept a slightly different wastewater system as part of their energy conservation efforts.
- Water utilities will lose nutrients, organic influx, and heat. This could potentially affect the treatment processes both negatively and positively.
- Energy utilities will lose a market share if energy is recovered on a property level.
- Farmers will need to be willing to accept use of residual waste products in farming operations.

The expected long-term impact is not only on the 3,000 new apartments within the SRS, but also on the 100,000 new apartments that will be built in Stockholm in the next 15-20 years. The proposed project may influence the City's future planning methodology. At this point, the city is focusing only on new developments, but over time this method could also be applicable in retrofits to existing development.