

# Biodas – From Waste to Energy

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## INTRODUCTION

Waterless toilets have gradually been replaced by the water closets in developed countries throughout the 20th century. This has led to challenges regarding the wastewater treatment and comprehensive sewerage system construction. The few places left in Denmark without sewers are found in the old allotment gardens. This project is concerned with the investigation and development of an alternative toilet to the water closet that will fit into the conditions of allotment gardens. This implies a solution, which will be attractive for the users as well as an improvement for the environment. The project was carried out in the course *Holistic Design*, DTU E11, in collaboration with Jurgis Ratkevicius and Thomas Den Heeten.

## THEORY

The thesis behind this project is that the use of water for flushing toilets is a waste of clean drinking water as well as a degradation of the value in human waste. The idea with the waterless toilet is to protect the environment through reduced water consumption and pollution but also a possibility for reusing the energy in the waste more optimal. A long term perspective for the project is to develop popular waterless toilets, which are feasible in a country of high sanitation level.

## METHODS

The project was carried out with starting point in reports about toilet conditions in allotment gardens and field work where personas and criteria were specified leading to the project requirement specification. A combination of systematic and creative concept development led to 7 concepts, which was narrowed down to the final concept Biodas through use of criteria weighting and Pugh's matrix. Concept specification using CAD modeling and a physical model complemented with a business plan and system overview.

## RESULTS

The final concept Biodas consists of two main parts: 1) The toilet collects the human waste and other organic household waste in a container. This is done through a "drawer" function and a bowl cover to move the waste from the seat to a container underneath, which should also minimize the smell and cleaning. The container must be emptied by the owner every 10 days for 2 persons. 2) The system, which the toilet is a part of, revolves around the waste transportation, treatment and energy yield. The waste is treated in a biogas plant, which converts the energy in the waste into biogas and possibly electricity. The energy production efficiency depends very much on the plant size, which would make it more profitable for several allotment unions, the entire municipality or region to share it.

## CONCLUSION

The project ended with a mock-up of the Biodas toilet, a business plan for the Biodas Company and a short report to convince the municipality to subsidize the Biodas. To get the Biodas on the market, we want to first concentrate on the toilet itself, getting funding to make a proper prototype and testing it with allotment garden users. Second, the biogas system should be further developed in collaboration with biogas experts.