

**DABAS RESURSU IZMANTOŠANAS ZINĀTNISKIE,
EKONOMISKIE UN SOCIĀLIE ASPEKTI
PAŠREIZĒJĀ VIDES UN ĢEOPOLITISKAJĀ KONTEKSTĀ**

2024. GADA 5. DECEMBRIS

LATVIJAS BIOZINĀTŅU UN TEHNOĻIJU UNIVERSITĀTE,
MEŽA UN VIDES ZINĀTŅU FAKULTĀTE

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FROM WASTEWATER TO RENEWABLE ENERGY: A CIRCULAR ECONOMY MODEL FOR REDUCING URBAN POLLUTION

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Introduction

European Green Deal and circular economy action plan has been developed and the main focus of this plan is to reduce waste volume and promote the introduction of circular patterns in reactive nitrogen management. Particular attention shall be paid to reducing the amount of nitrogen waste through separate collection and labelling. In addition, a bioeconomy strategy covering all sectors and systems based on nitrogen rich biological resources should be mentioned. It covers and links all terrestrial and marine ecosystems and their diverse services. The bioeconomy strategy is based on the principles of sustainability and the circular economy of nitrogen and other resources. The assessment of current objectives and the need for the most sustainable use of available resources prompts the search for alternatives in already established technologies. Biological purification plants consume a large amount of energy that is mostly obtained from fossil resources and do not recirculate nitrogen. By implementing an alternative household wastewater purification method - phytoremediation by the use of willow in underground stream wetland allows for a sustainable use of nitrogen resources and saves energy as household wastewater purification is performed by natural means. More-over, wood chips are obtained from willow which is used in energy generation. **The aim of the research is to develop a circular economy model for willow used in wastewater phytoremediation.**

Materials and Methods

The hypothesis of the research is the following: The household wastewater purification method which uses willow for phytoremediation in underground stream wetland complies with the circular economy model. Calculations are made in the research in regards to the pilot territory for Nakotne village in Latvia. The following parameters were calculated in the paper: the necessary area for creating the underground wetland, the cost of it and also the benefits obtained from the wetland (the amount of energy generated, CO² accumulated, oxygen created), and the ability of willow to accumulate polluting elements (nitrogen and phosphorus) present in household wastewater was researched. After assessing the information obtained in the calculations it has been implemented in the proposed circular economy model.

Results

Based on the fact that Nākotne village of Jelgava county was determined as the pilot territory, all values were calculated according to the number of people in Nākotne village, 738 inhabitants, and the area of underground wetlands required for this number of people is 0.5166 m². All values reflected in Figure 1 are given for the 24-year willow growth period, except for precipitation and evaporation volumes. Within 24 years, 969,732.00 m³ of domestic wastewater will flow into the underground wetland from Nākotne village, which will contain 48.96 tons of nitrogen and 12.96 tons of phosphorus.

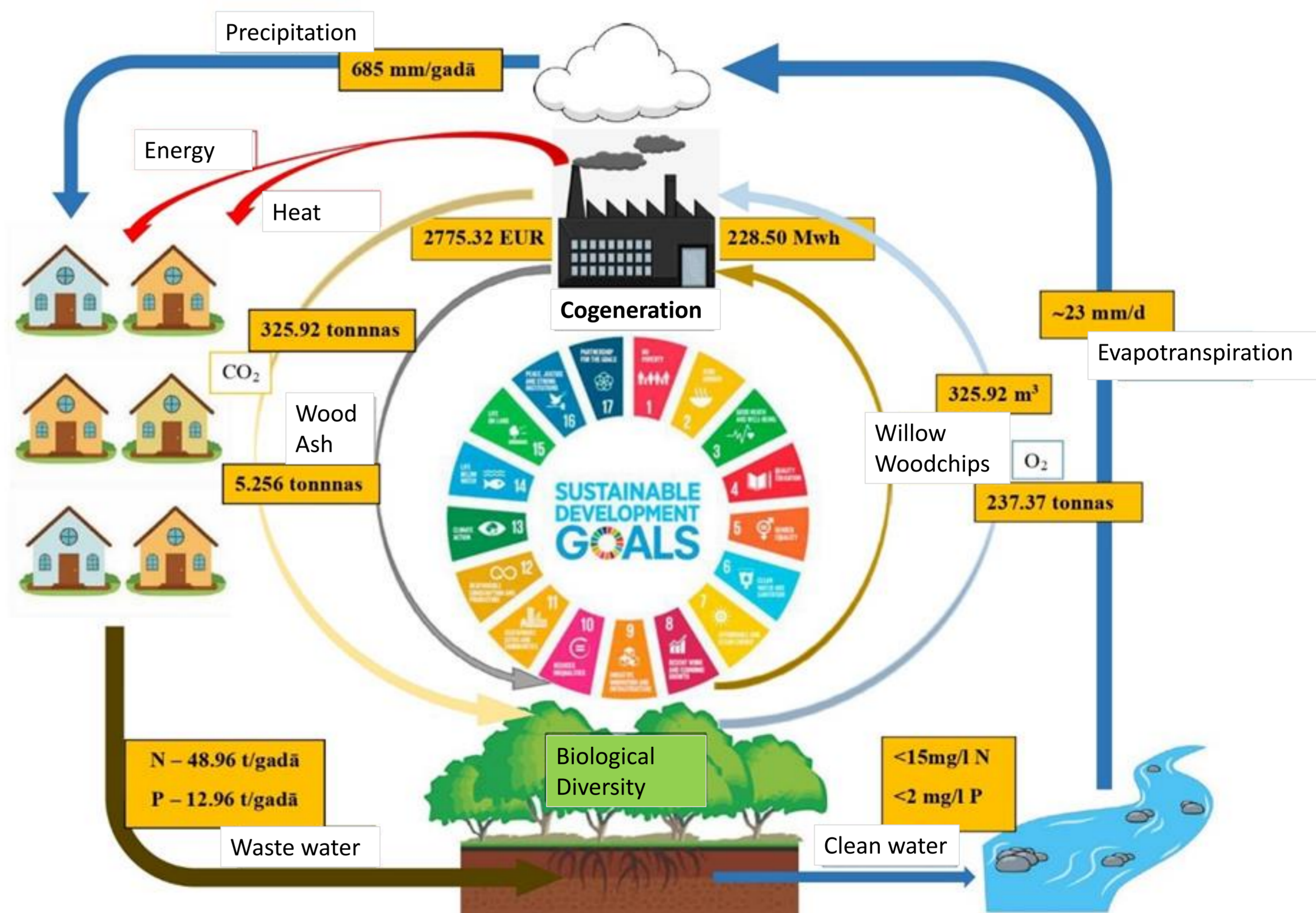


Figure 1. Circular economy model with reflected results for Nakotne village

Conclusion

It is concluded in the research that willow has potential in household wastewater purification and that the proposed model of willow planting in underground stream wetland complies with the principals of circular economy model.