

## Technology Assessment of the Collection of Cast Seaweed and Use as Feedstock for Biogas Production- The Case of Solrød, Denmark

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**Abstract :** The Baltic Sea is suffering from nitrogen and phosphorus pollution, which causes eutrophication of the maritime environment and hence threatens the biodiversity of the Baltic Sea area. The intensified quantity of nutrients in the water has created challenges with the growth of seaweed being discarded on beaches around the sea. The cast seaweed has led to odor problems hampering the use of beach areas around the Bay of Køge in Denmark. This is the case in, e.g., Solrød Municipality, where recreational activities have been disrupted when cast seaweed pile up on the beach. Initiatives have, however, been introduced within the municipality to remove the cast seaweed from the beach and utilize it for renewable energy production at the nearby Solrød Biogas Plant, thus being co-digested with animal manure for power and heat production. This paper investigates which type of technology application's have been applied in the effort to optimize the collection of cast seaweed, and will further reveal, how the seaweed has been pre-treated at the biogas plant to be utilized for energy production the most efficient, hereunder the challenges connected with the content of sand. Heavy metal contents in the seaweed and how it is managed will also be addressed, which is vital as the digestate is utilized as soil fertilizer on nearby farms. Finally, the paper will outline the energy production scheme connected to the use of seaweed as feedstock for biogas production, as well as the amount of nitrogen-rich fertilizer produced. The theoretical approach adopted in the paper relies on the thinking of Circular Bio-Economy, where biological materials are cascaded and re-circulated etc., to increase and extend their value and usability. The data for this research is collected as part of the EU Interreg project "Cluster On Anaerobic digestion, environmental Services, and nuTrients removaL" (COASTAL Biogas), 2014-2020. Data gathering consists of, e.g., interviews with relevant stakeholders connected to seaweed collection and operation of the biogas plant in Solrød Municipality. It further entails studies of progress and evaluation reports from the municipality, analysis of seaweed digestion results from scholars connected to the research, as well as studies of scientific literature to supplement the above. Besides this, observations and photo documentation have been applied in the field. This paper concludes, among others, that the seaweed harvester technology currently adopted is functional in the maritime environment close to the beachfront but inadequate in collecting seaweed directly on the beach. New technology hence needs to be developed to increase the efficiency of seaweed collection. It is further concluded that the amount of sand transported to Solrød Biogas Plant with the seaweed continues to pose challenges. The seaweed is pre-treated for sand in a receiving tank with a strong stirrer, washing off the sand, which ends at the bottom of the tank where collected. The seaweed is then chopped by a macerator and mixed with the other feedstock. The wear down of the receiving tank stirrer and the chopper are, however, significant, and new methods should be adopted.

**Keywords :** biogas, circular bio-economy, Denmark, maritime technology, cast seaweed, solrød municipality

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