

Utilization possibilities of waste products from fishing and hunting to biogas and biooil production in Uummannaq County

by Ph.D. student Ragnhildur Gunnarsdóttir (speaker) and
Ph.D. student Marianne Willemoes Jørgensen

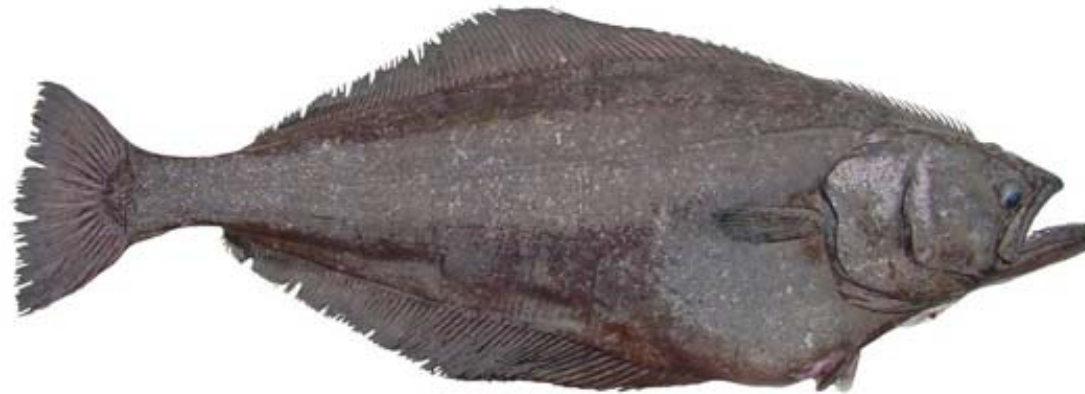
The Arctic Technology Centre
Department of Civil Engineering
Technical University of Denmark

Overview

- Introduction to the project *Utilization possibilities of waste products from fishing and hunting to biogas and biooil production in Uummannaq County*
- Project case: Uummannaq County
- Principles of biogas- and biooil production
- The experiments
- Results from the experiments
- Discussion

Introduction: The fishing industry

- Fish and shrimp industry is the primary industry in Greenland today
- 90% of all income originates from the fish and shrimp industry
- The fishing industry in Greenland today generates about 14.000 tons of waste products annually
- The prime fish industry is the Greenland Halibut production which generates the majority of the waste



Introduction: The fishing industry

- Today only 20% of the waste products from the fishing industry are utilized in Greenland.
 - About 3.000 tons of waste products from the Greenland Halibut production are utilized annually to produce fishmeal and fishoil in Royal Greenland's factory in Ilulissat, mainly to avoid discharging the waste into the harbour. The produced fishoil is used for internal energy production.
 - A small part of special waste products from the Greenland Halibut production is sold to Japan.
 - A small part of waste products is sold locally as dog food.

Introduction: Wastewater

- There is no tradition for treating wastewater in Greenland
 - This goes for both black wastewater, industrial wastewater and waste from the fish and shrimp industry.
 - In most cases it is led directly to the ocean since it is considered being the easiest and cheapest option.
- The wastewater outlet can have a negative impact on the marine environment:
 - For instance analysis of seawater and sediments from the ocean floor have shown that outlet of wastewater from Royal Greenland's shrimp factory in Sisimiut and outlet of wastewater from the Greenland Halibut factory in Ilulissat have negative impacts on the marine environment.

Introduction: The project

- The project was carried out in spring 2007 by Marianne Willemoes Jørgensen at The Centre for Arctic Technology
 - *Utilization possibilities of waste products from fishing and hunting generated in Uummannaq County*
- The aim of the project was to find some utilization possibilities of the waste products, taking the circumstances in Uummannaq County into consideration
- Numerous alternatives to utilize the waste products were identified in the project, such as:
 - Production of fishmeal and fishoil
 - Production of silage
 - Export of special waste products to produce for instance medicine and non-food articles (bags, shoes etc.)

Introduction: The project

- The Greenland Shark amounts for 50% of the total waste from the fishing industry in Uummannaq County
 - Due to the shark's poisonous meat it is not recommended to use as food
 - The shark's meat contains big amounts of trimethylamine oxide (TMAO)
 - Poisoning from TMAO has never been reported
 - Both humans and dogs carry a bacteria in the digestive tract that can reduce TMAO to the poisonous trimethylamine (TMA).
- The fact that the shark is such a big part of the total waste from the fishing industry in Uummannaq County, combined with the wish to find a financially reasonable solution was crucial for the choice of recommended use of the waste material in the project.

Introduction: The project

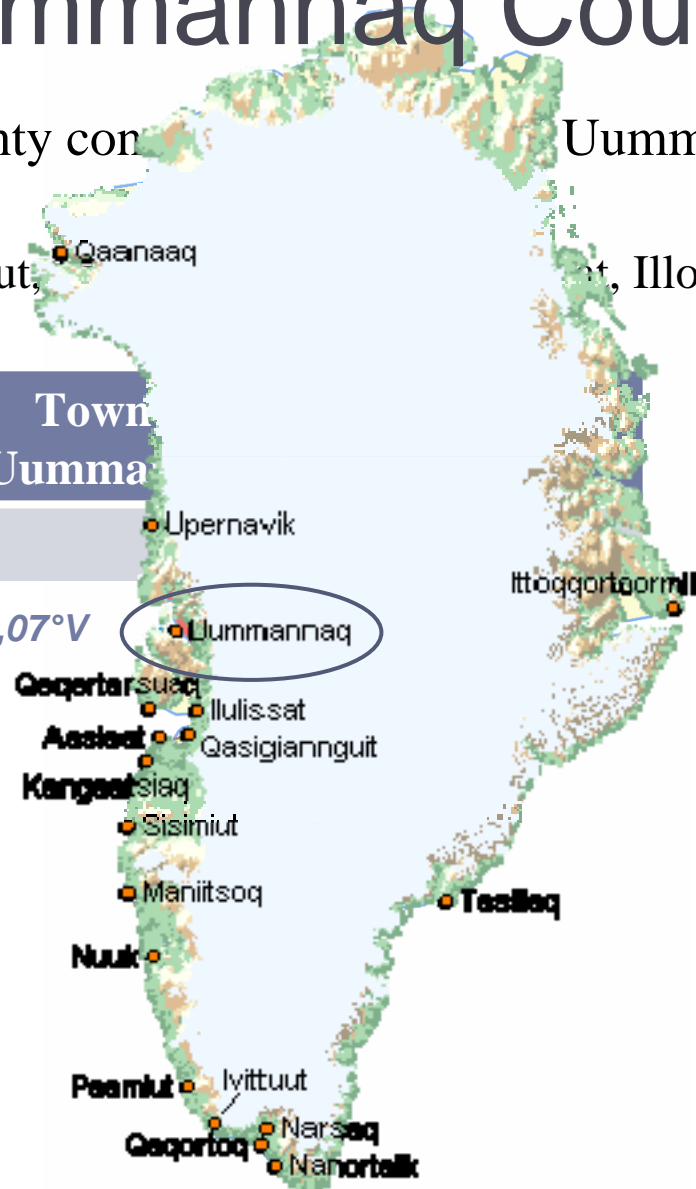
- The choice of recommended use fell on **biogas** and **biooil production**
- To determine the potential of biogas and biooil production:
 - The amount of waste products from fishing and hunting were estimated
 - Samples from the waste products were examined in the laboratory for relevant factors regarding the calculations on the potential biogas and biooil production.

Case: Uummannaq County

- Uummannaq County consists of Uummannaq and 7 smaller villages:
 - Niaqornat, Qaarsut, Upernavik, Illoqqortoormiit, Illorsuit and Nuugatsiaq

	Town Uumma
Inhabitants	

Location: 70,40°N and 52,07°V



Case: Uummannaq County

- Primary occupation of inhabitants is within the fishing industry
- The shark only has negative impact on the Halibut industry:
 - Main focus on the Greenland Halibut
 - It has no value within the fishing industry because of the poisonous meat
- There is a great number of the Greenland Shark in the ocean along Uummannaq County.
 - It eats the Greenland Halibut
 - It destroys the fishing lines
- Award is given by the county for each killed shark
 - The shark is therefore a contributing factor on the amount of waste in Uummannaq County



Case: Uummannaq County

- The annual amount of **fish processed** in Uummannaq County

	Town of Uummannaq	The 7 villages
Greenland Halibut [ton]*	2.006	2.884
Other species [ton]*	58	82

**Estimation based on information given by the three fishing companies Royal Greenland, Uummannaq Seafood A/S and Nussuaq Fish*

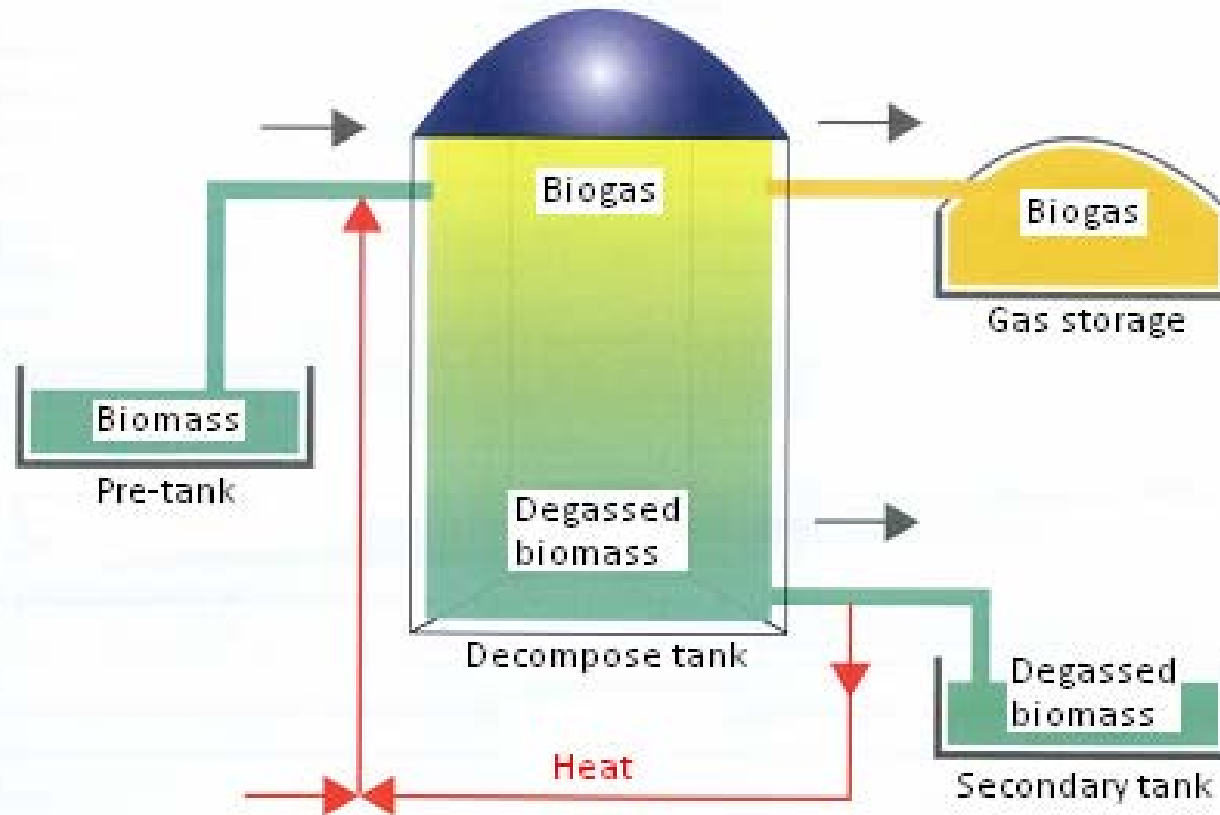
Case: Uummannaq County

- Estimated annual amounts of **waste products from fishing and hunting** in Uummannaq County

	Town of Uummannaq	The 7 villages
Greenland Halibut [ton]	301	433
Other species [ton]	20	26
Greenland Shark [ton]	47	938
Seal blubber [ton]	7	0*

**It is assumed that all parts of the seal are used in the villages*

The principle in the design of a biogas plant



The efficiency of the produced biogas

- Theoretical biogas potential of different fractions of the waste was calculated in the project.
- During biogas production, a loss of energy occurs that corresponds to about 40% of the theoretical biogas potential.
 - 25% is used to warm up the biogas plant
 - 15% is because of engine loss
 - A bigger energy loss can be expected under arctic circumstances
- The efficiency (60%) is best utilized if both heat and electricity is produced
 - Percentage distribution is estimated to be 25% heat and 35% electricity
- It has been estimated by The Danish Environmental Protection Agency (Miljøstyrelsen) that only 85% of the theoretical biogas potential can be utilized in practice.

The principle in the production of biooil

- When producing biooil the raw material (the fishing waste) is divided into three fractions:
 - Oil
 - Dry material (protein/ash)
 - Water
- The process goes like this:
 1. The raw material is warmed up, whereby the fat cells explode and the oil is released.
 2. The raw material is sieved mechanically and pressed whereby the raw material is divided into a solid phase and a liquid phase.
 3. Remaining dissolved dry material in the liquid phase is removed in a decant centrifuge.
 4. The oil is separated from the liquid phase in an oil separator.

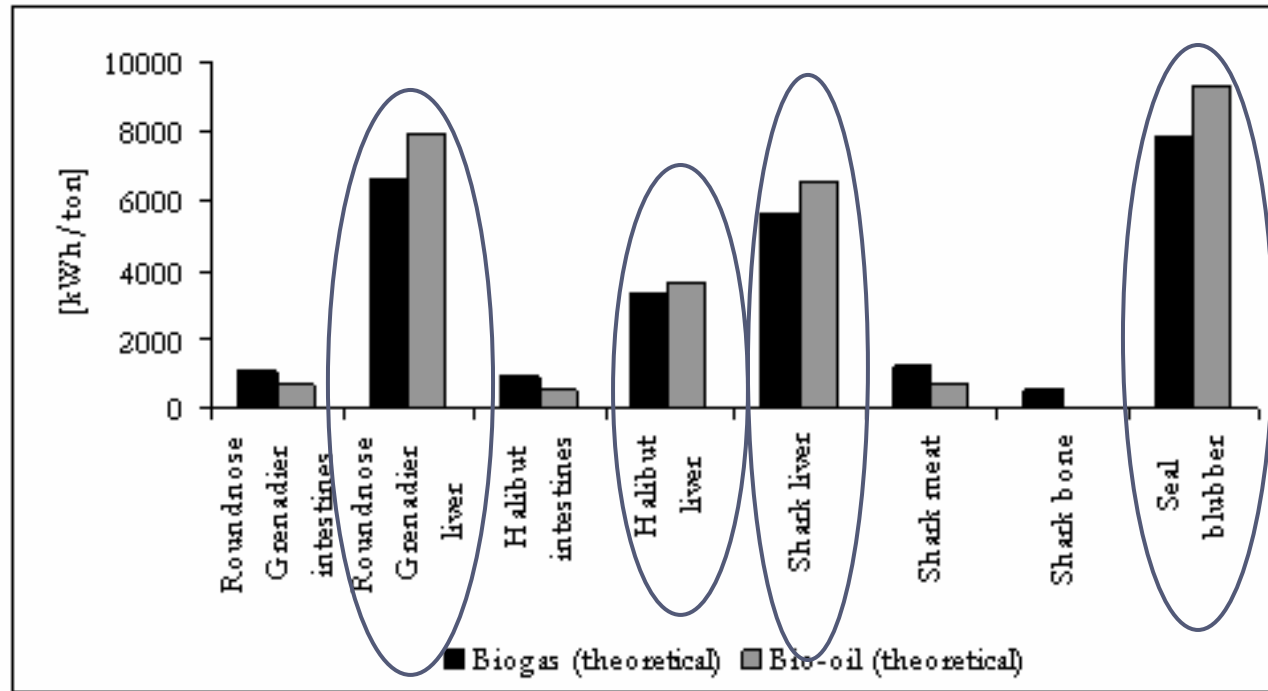
The experiments: Sampling

- Samples included:
 - The Greenland Shark (*Havkal*)
 - Roundnose Grenadier (*Skolæst*) → Representing "other species"
 - Greenland Halibut (*Hellefisk*)
 - Seal blubber (*Grønlandsk sæl*)
- Each specimen was divided into different fractions to be able to analyze the utilization possibilities of each fragment:
 - Skin
 - Bone
 - Meat
 - Intestines → The liver was kept separated
- Experiments were conducted on all fragments, but only the fragments ending up as waste are included in this presentation

The experiments: Analytical methods

- To determine the potential of biogas and biooil production the samples were examined in regard to the content of:
 - Protein
 - Carbohydrates
 - Lipid (fat)
- In relation to production of biogas and the possibility to utilize the degassed biomass as fertilizer, further experiments were conducted:
 - Nutrients
 - Heavy metals
 - Sulphur

Results: Theoretical biogas and biooil potential



The theoretical amount of energy that can be retrieved when using either biogas or biooil production. Theoretical biogas has been reduced with 15% according to standard guidelines.

Results: Nutrients and heavy metals

- Nutrient composition and the level of heavy metals and sulphur upheld the standards for agricultural use.

Discussion

- Potential energy outcome using either biogas or biooil production with an efficiency level of 60 percent (aside from the 15% deduction in case of biogas production):

	Town of Uummannaq	The 7 villages
Biogas [kWh]	218.558	1.411.561
Biooil [kWh]	224.439	1.324.612

- Total amount of energy used in Uummannaq County in 2005:

	Town of Uummannaq	The 7 villages
Energy [kWh]	5.700.000	3.660.000

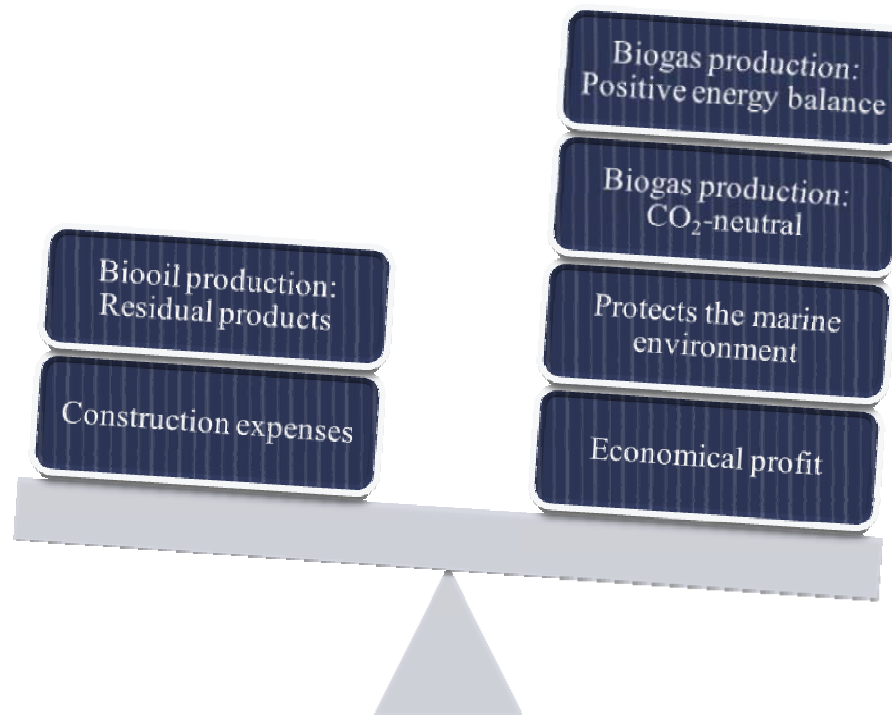
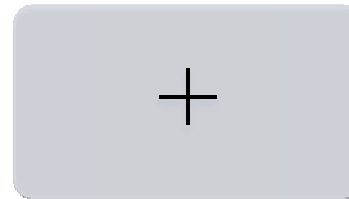
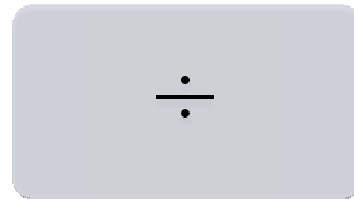
- Savings with the price of energy in Uummannaq County in 2006 of 3,7 DKR/kWh:

	Biogas	Biooil
Percent	Approx. 17%	Approx. 16%
Economical (DKR)	Approx. 6 mill.	Approx. 5,7 mill.

Discussion

- The waste products from biogas production could be utilized in agriculture.
- The waste products from biooil production have no direct use.
→ With this in mind the **biogas production** would probably be the most beneficial solution in regard to energy production and a solution to the waste problem.

Advantages and disadvantages



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