DIPLOMA PROGRAM:

aho, spring 2017
candidate
Cecilie Schjetlein Sundt

title:
Processing Facility for Seaweed

institute:
The Institute of Form, Theory and History

supervisor:
Erik Fenstad Langdalen
Seaweed is one of the most unexploited natural resources on the planet. Norway has a large and rich occurrence of this re-growing resource and it can be turned into an important source of income. In the ongoing development of this new type of industry the use of seaweed is investigated in a huge range of commercial items including food, cosmetics, fertilizers and biomass. Because this resource is naturally spread along the coast both large-scale ocean farming and the small to medium-scale industry can and should be developed simultaneously.

I wish to investigate the architectural potential in this new industry, more specifically the small to medium scale industrial building where high quality food products, from wild growing seaweed are produced. The scale of the project is purposely chosen to be medium because it is a scale that can thrive simultaneously in multiple communities along the coast. Many small communities suffer from depopulation and lack of employment because of the ongoing centralization of the fishing industry. The seaweed industry is an opportunity to revitalize and sustain some coastal communities that are in danger of disappearing.

In all industry there is a production line and a set of requirements, which defines the dimensions, the structure and the spatial qualities of the building. The aim with this diploma is to develop a typology and a set of spatial qualities for the small to medium-scale seaweed industry. To do that I also have to envisage the production process and define a set of rules as a base for the architectural work. The island Selvær in the Træna archipelago, 65km of the coast of Northern Norway, is the chosen location and the The Northern Company will serve as the business template for this typology and project.
THESES

With the diploma I wish to investigate how the conditions and the requirements of a production process can inform architectural space. What are the spatial qualities, the structure, the dimensions and the functional qualities in a commercial production building where handpicked naturally grown seaweed is processed? The aim is to develop a typology and an architectural identity for the small to medium scale seaweed industry.
This project is closely linked to real life. The conditions and requirements for a commercial production line are used to inform the architecture. How the architecture relates to nature (the seasons of the year, the climate, the tidal cycles, the ocean, the water, wind, sun etc) then becomes essential. The relationship between the exterior and interior environment and the buildings placement in the terrain is a key part of this project. Another key part of the project is the building process itself. Challenging weather conditions and limited access to tools and materials complicates the building. The seaweed industry will always be in coastal regions and building for it will face similar challenges regardless of location.
THE PRODUCTION LINE

1. Harvest
2. Lift and rinse
3. Bulk dripp
4. Cut and sort

5.a Dripping
5.b Weighing and packing

- Dried products
- Frozen products

8
1. Harvest
Harvesting can be done at low tide - 2 times a day from March-Jun.
The seaweed is collected from the reefs and small islands (many which only appears at low tide) that surrounds Selvær
Waders (a piece of clothing) and a knife is used in the process

2. Lift and rinse
The container with the seaweed, weighing 100 – 200 kilos, is hoisted from the boat into the processing facility using a suspension monorail crane
The seaweed is rinsed in a cold-water container

3. Bulk drip
The seaweed is lifted out of the cold-water container in bulks
The seaweed is left to drip for a little while to rid it of the excess water

4. Cut and sort
The seaweed is transported onto the processing table
The seaweed is sorted and cut in appropriate sizes

common production line for both frozen and dried products
5a. Dripping
The seaweed is hanged on racks or grates and left there to drip for 30min-1h until approx. 20 % of the water has evaporates

6a. Cold drying
The racks are moved into a room with cold circulating air and left there to dry for 6-8h until approx. 40 % of the water has evaporates

7a. Warm drying
The racks are moved into a room with warm circulating air (apprx. 40 ° C) and left there to dry for 2-4h until 25% of the water has evaporated

The finished product contain 10-15% of its original water content

8a. Weighing and packing
The dry seaweed is weighed and split into portions.
The portions are packed in foil bags.
The bags are packed in cardboard boxes
The boxes are placed on pallets for transportation

9a. Dry storage
The pallets are stored in a space where the temperature and humidity is controlled

11. Shipping
The product can be shipped in any dry container.
5b. Weighing and packing
The wet seaweed is weighed and split into portions of approx. 250 grams.
The portions are packed in foil bags and vacuum sealed.
The bags are packed in cardboard boxes each weighing approx. 3 kg.
The boxes are placed on pallets for transportation.

6b. Freezer
The pallets are transported with a pallet truck to the freezer -25 ° C to freeze.

7b. Freezer storage
When the seaweed is frozen it is moved to an -18° C storage freezer where it sits until shipping.

11. Shipping
The product can be shipped in any refrigerated container.

continued production line for frozen products
10. Production kitchen

In the facility’s kitchen the processed seaweed can be transformed to a wide range of different products. Each producer can have their own variations and own range of products. The possibilities are many - pesto, pasta, snacks, soups, spices to mention some.

11. Storage and shipping

Storage and shipping will depend on the type of product. The facility provides 3 different types of storage; dry, frozen and a cooling storage; which covers all parts of the production. Depending on the product it can be shipped in a freezer container, dry container or a cooling truck.

further processing of the dried and frozen products
PROGRAM

A lifting and rinsing space
A space to cut and sort the seaweed (a general production space)
A place to pack theseaweed to be frozen
Freezer storage
Dripping room
Cold drying room
Warm drying room
Packing room
Dry storage
Storage for equipment and packaging for the products
Wardrobe with a toilet, shower and a drying cabinet
Production kitchen with a cold storage
Office space and break room
Workshop and tool shed
Hallway
The chosen site for this project is the small island Selvær in the Træna archipelago 65 km off the Norwegian coast. A deciding factor for the choice of site, in addition to the access to the large supply of natural growing seaweed, is the shortage of viable industries and livelihoods for the populations on the island. The seaweed industry is an opportunity to create jobs and sustain small communities on the Norwegian coastline.
Træna municipality

Selvær
harvest areas
1. Tidal heights

- 3950: High water with 1000 year return
- 3060: Highest Astronomical Tide (HAT)
- 2300: Mean high water (coastal outline)
- 1510: Mean sea level
- 0: Cart Datum
- -320: Low water with 20 year return
SEASONS

harvest

January
February
March
April
May
June
July
August
September
October
November
December
SUBMITTED MATERIAL

drawings
Site plans 1: 50 000/ 1:4 000/1:200
Sections 1:100/1:50
Plans 1:100/50
Elevations 1:100/1:50
Details 1:20-1:10

spatial illustrations
Exterior and interior

models
Site models 1:100/1:200
Section model 1:25
Sketch models 1:200-1:50

diagrams
The production line
Seasons

process
Diploma program
Process
Research
## SCHEDULE

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<th>week</th>
<th>plan</th>
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<tbody>
<tr>
<td>Week 02</td>
<td>Continue with the rapport</td>
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<tr>
<td>Week 03</td>
<td>Site visit to Træna + meetings</td>
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<tr>
<td>Week 04</td>
<td>Sketch, structure models, spatial investigations</td>
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<td>Week 05</td>
<td>Sketch, structure models, spatial investigations</td>
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<td>Week 06</td>
<td>Concept</td>
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<td>Week 07</td>
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<td>Week 08</td>
<td>Concept</td>
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<td>Week 09</td>
<td>Plan. sections, model</td>
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<td>Week 10</td>
<td>Plan. sections, model</td>
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<td>Week 11</td>
<td>Plan. sections, model</td>
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<tr>
<td>Week 12</td>
<td>Plan. sections, model</td>
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<td>Week 13</td>
<td>Site visit and observation of the production on Træna</td>
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<td>Week 14</td>
<td>Presentation dummy - Layout and final decisions</td>
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<td>Week 15</td>
<td>Completion of plans and solutions</td>
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<td>Week 16</td>
<td>Production: Model, visualization, diagrams, text</td>
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<td>Week 17</td>
<td>Production: Model, visualization, diagrams, text</td>
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<td>Week 18</td>
<td>Production: Finalizing, test plotting</td>
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<td>Week 19</td>
<td>Production: Last finish and printing</td>
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<td>Week 20</td>
<td>Deadline 15th of May</td>
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REFERENCES

literature
Christensen, Arne Lie: Den norske byggeskikk, Oslo, 1995
Ellefsen, Karlo Otto og Lundevall, Tarald: Fisekvær, Myre på Yttersida, Pax Forlag A/S, Oslo 2017
Printz, Henrik: Vi sanker tang og tare: kort oversikt over de viktigste arter og deres innsamling, Oslo, 1953

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http://www.northerncompany.no
http://www.tenktraena.no
http://www.seaweedenergysolutions.com
http://www.seaweedenergysolutions.com/assets/files/2014.06.11%20Tare-reportasjen.pdf
**conversation**

Zoe Christiansen:  
The founder of *The Northern Company* and *Træna Food labs*

Moa Bjørnson:  
Project leader for the development of *Træna* (*Think Træna*)

Lars Skimten:  
The founder of *Kimten Seaweed Harvest* which harvest for *The Northern Company*

Oda:  
Harvest manager for *The Northern Company*

Franz Christiansen:  
Works for *The Northern Company*

Merete Lillegård:  
Owning partner of *The Northern Seaweed Company* and inhabitant on *Selvær*

Turid Myhre:  
An inhabitant on *Selvær* who has lived on the island her whole life

Kåre Myhre:  
An inhabitant on *Selvær*