



GLOMMEN  
TECHNOLOGY AS



- *Formålet er å øke verdiskapningen fra skogsprodukter*
- *gjennom utvikling av metoder for foredling av trevirke*
- *som bidrar til å styrke betalingsevnen for tømmer*

*- Skogsmelasse – Wood Sugars as ingredient in feed for ruminants -*



Wood sugars are extracted in the form of a syrup, "wood molasses", - *skogsmelasse*



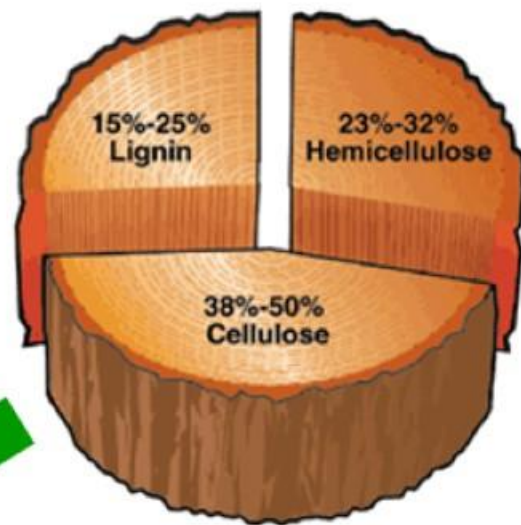
*The wood sugar are used as ingredient in feed for ruminants, substituting molasses from cane and beet sugar*



*Remaining wood pulp made to renewable fuel pellets, substituting coal as fuel for electricity generation*



*Wood pulp after extraction can be used as high quality and renewable growing media, substituting peat, or as animal bedding*





## RAW MATERIALS

- Sawdust, low value sawmill by-product
- Cellulose chips, higher value sawmill by-product
- Chips made from roundwood, energy wood and pulpwood



## GLOMMEN BIO REFINERY

- Auto-hydrolysis enables hemicellulose to be extracted as wood sugars, up to 25% of the wood
- No chemicals added for the process, which is a variant of “steam explosion”
- Potentially glucose can be extracted from cellulose by enzymatic treatment, we are doing that, - yet. That could potentially add 40% of the wood as sugars





## **PRODUCTS AT PRESENT**



**Wood sugars -  
skogsmelasse**



**Fibrous material  
peat substitute**



**Fuel pellets**

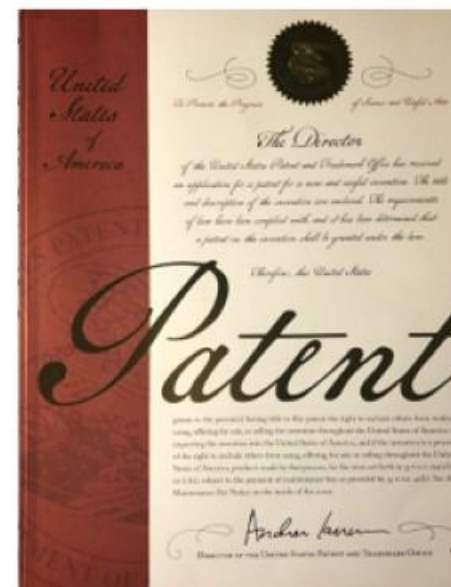
## *Business Idea*

- We are developing and selling knowhow, making technology available
- Patent granted in USA and Russia, patent pending in Europe
- Further processes and products in the pipeline, based on core process

### *Commercializing knowhow by:*

- 1) *Licensing of right to use process*
- 2) *Design, engineering and support for building production plants*

- We already have international and Norwegian licensees
- We are now engineering the first industrial scale plant, to be located in Norway.
- Roll-out in scale after first plant is successfully in operation



## *Protein from wood for fish feed?*

- About 2/3 of the wood can be made to sugars
- Sugars can be converted to protein, by various methods

*transforming wood to animal and fish feed is  
high on a ranking list of sustainable solutions*

- So far so good, but:

*Economic viability is another matter*

- There is no abundance of “waste”, or “unused” wood raw materials easily available
- Wood sugars will not be sold any cheaper than other sugars, whatever the cost of raw materials
- We have looked into this, and concluded: “For us, not yet”

## *Potential - quantities*

*Norway alone as geographical perspective is not enough*

- The forest resources in Norway are big enough for initializing such development
- But too small for meeting demand for fish food
- Norwegian quantities could theoretically reach 1 million tons of protein rich fish feed. But that is pure fantasy for decades, - 100 000 tons would be quite an achievement
- Developing wood technology for Norway alone is either not viable, too small quantities

*The wood basket is around the Baltic and North Sea*

- The wood market in Northern Europe is linked together, with supplies from:
  - Sweden
  - Finland
  - Baltic states
  - Russia, north western part
  - Germany, northern part
  - Norway

*With the right technologies and economics, these areas could supply raw materials for millions of tons of fish feed*



## ***We welcome partners***

*Without serious partners in Blue sector, we will probably forget about it*

- Our technology ***might*** be one of the pillars for making products for aquaculture
- We welcome serious partners in that industry who want to look a closer into it, and participate in R&D
- Aside from protein for fish feed at scale, some smaller spinoffs could also be considered

### Prebiotics for fish?

Our wood sugar contains galactoglucomannan, which has prebiotic properties. In the US such a product has been sold as prebiotic for fish, with about 1% added to the fish feed. Tests have shown strengthening immune system for fish, as well as animals.

Any interest?

### Fish sludge as fertilizer?

Recently someone made a test:

- 1) Mixing our substrate (growing media) with fish sludge, and
- 2) Growing tomatoes in it

Anecdotal evidence of result:

**The biggest tomatoes ever grown in Vestlandet!**



## *Possible site for first plant*

### *Kirkenær – forest industry cluster*

- *Bergene Holm, sawmill*
- *Solør AgroTre, pole mill*
- *Solør Bioenergi, CHP*





*Possible site for first plant*





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*Thank you for your attention!*