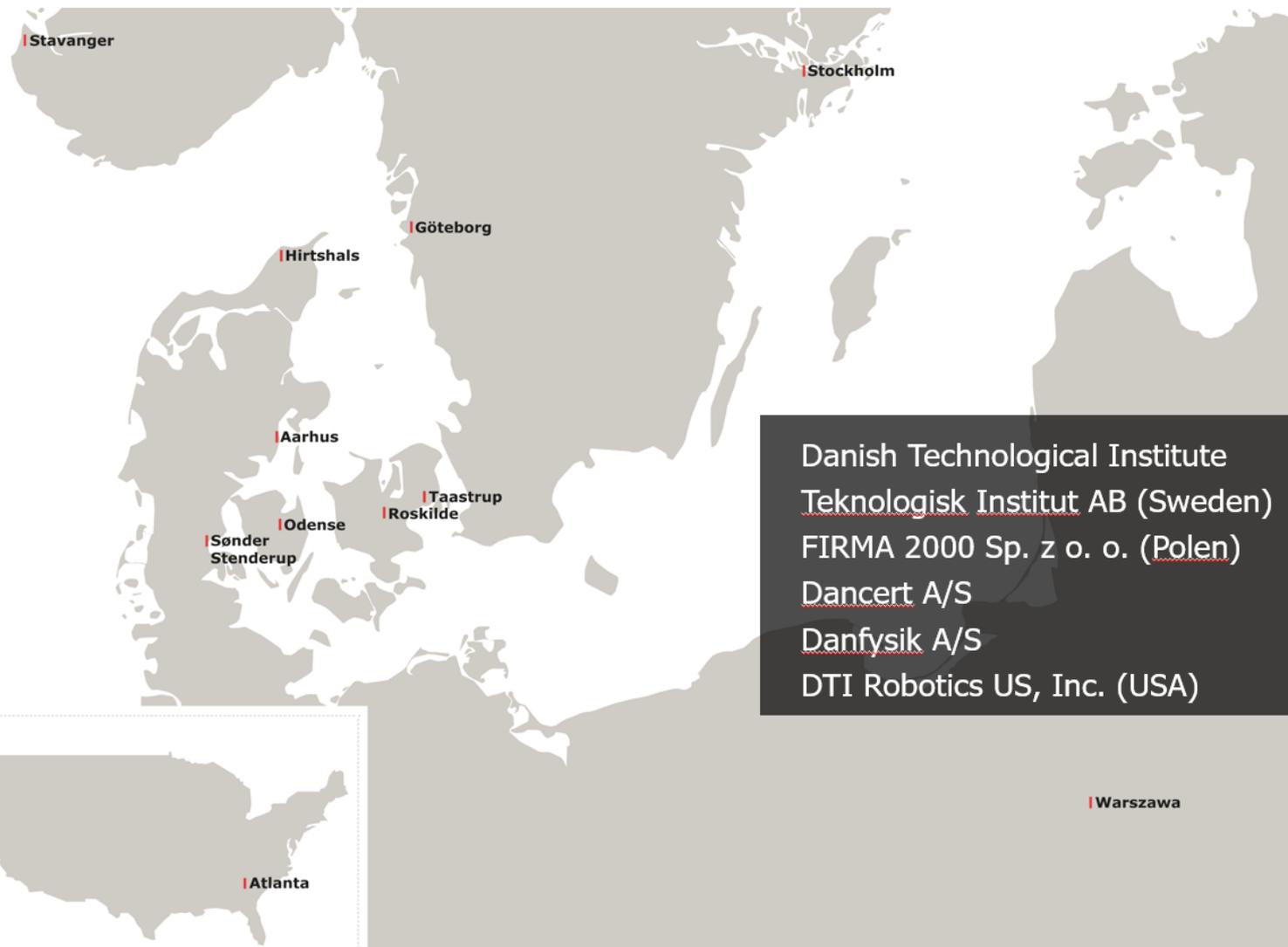




Climate friendly insulation. What, how and why?

Embodied Energy and Carbon Storage in Buildings October
9th, C40 WORLD MAYORS SUMMIT 2019, Copenhagen

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WHY alternative insulation – heat, sound and acoustic

- Strong in Sustainability
- Renewable – annual crops being part of the rotation
- Often byproducts is feedstock for insulation
- Climate impact - strong
- Indoor climate – breathable, low emissions to indoor climate
- Recyclable
- Very often excellent technical properties

BUT:

- Sometimes more expensive
- Availability vary
- Fire – Resistance is sometimes an issue
- Sufficient documentation lacking?
- Skepticism among builders

Cases: Sustainable Insulation

- Hemp Insulation – it started with hemp and flax insulation
- Eelgrass Insulation
- Hempcrete – the hemp house
- Paper and wood fiber Insulation



How?



ANW develops, builds and operates manufacturing lines for sustainable nonwoven products.

The company was established in 2006 and our team of specialists holds more than 20 years of industry experience.

ANW engages in joint ventures around the world, where we provide know-how, product development and full turnkey factory.



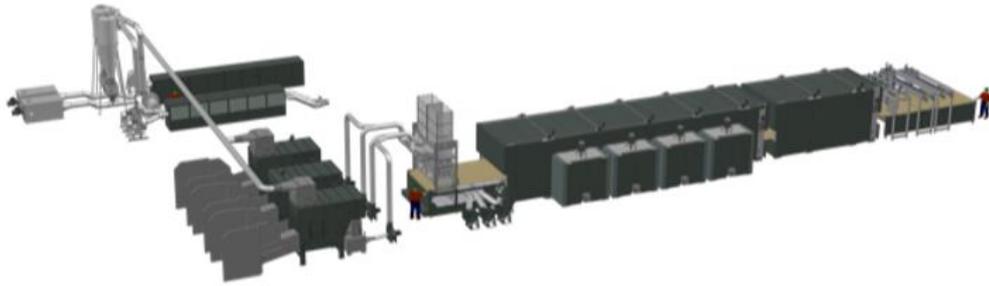
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Invented by Bodil E. Pallesen. Patents: METHOD FOR MANUFACTURING A FIBRE MAT, FIBRE MAT AND USE OF SUCH FIBRE MAT

Game changing patented CAFT-technology converting all sort of fibers into mats from Advance Nonwoven.dk, situated at Moellerup Estate, DK

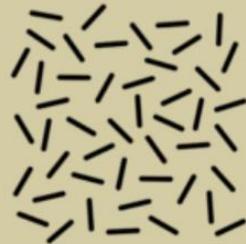
Full production line with CAFT-Technology from
Advance Nonwoven, established at Convert A/S
<https://convert.as/>





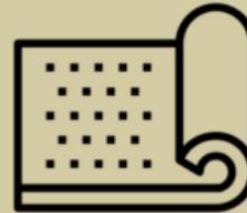
Shredding

From fraction to fibers



Mixing

From fibers to composite



Cafting

From composite to non-woven mat



Pressing

From mat to finished goods

The CONVERT proces

- Raw material is shredded down to a basic fiber or granulate
- Fiber or granulate is mixed to a composite
- Composite is made into a non-woven mat
- Mat is pressed into finished or semi-finished product
- Such as: growth media to insulation mat, mat for absorbing oil, solid board or furniture.

Hemp insulation

From the hemp stem processed into fibres or shives/hurds

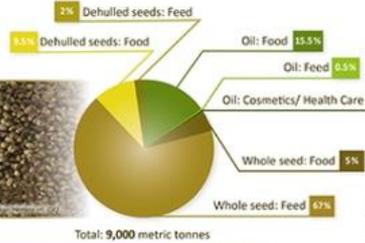


A natural biorefinery Hemp



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Seeds

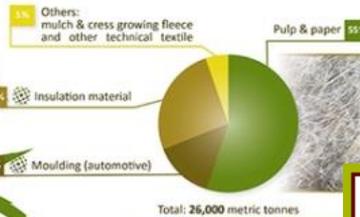


Flower

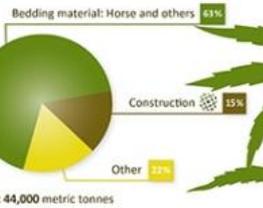
- Pharmaceutical: THC, CBD



Fibre



Shivs



Leaves

- Feed
- Pharmaceutical
- Tea & infusions



- Products currently being researched within **MultiHemp**
- Other products to be developed:
 - Phytosterols and waxes (from fibre processing dust).
 - Liquid biofuels (from hemp residual biomass).

Data from 2013, on 2010 harvest in Europe (EHA). Available at: <http://eha.org/medya/2014/10/13/06-EuropeanHempIndex>

MultiHemp

The MultiHemp project aims at developing hemp genotypes with enhanced traits suitable for diverse cultivation environments and to provide improved feedstock for a wide array of innovative and products generated within an integrated biorefinery. For more information, see <http://www.multihemp.eu>.

The MultiHemp project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No 311849.



Roots

Rejuvenate soil with nutrients.
Provide aeration of soils.

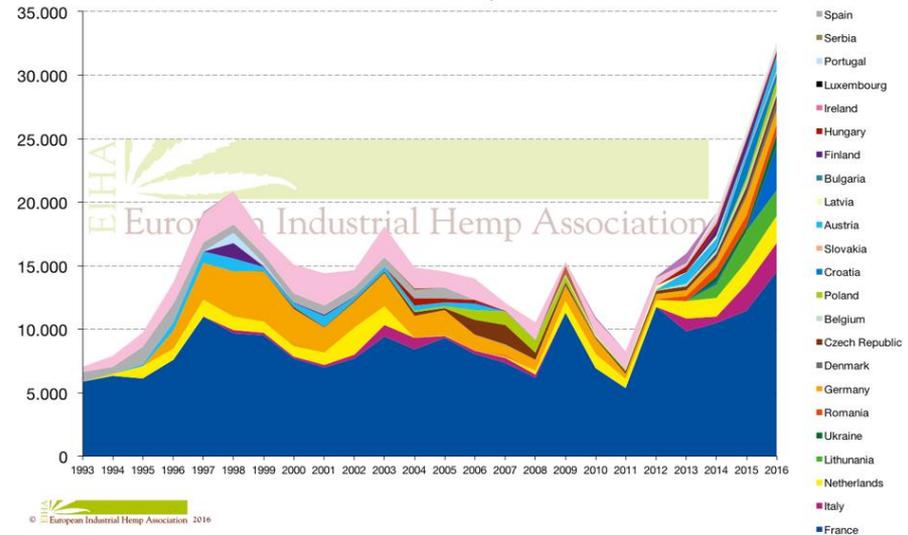


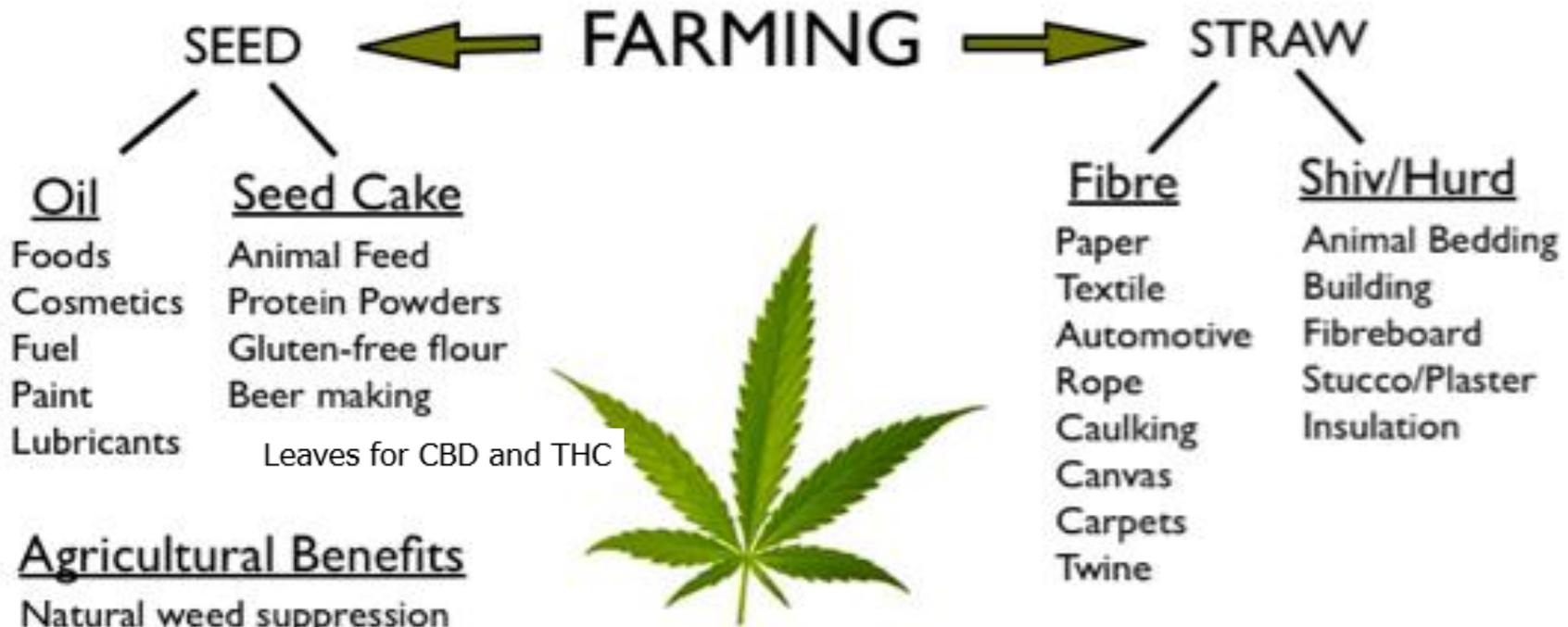
FIBRA

The main target of the FIBRA project is to the research activities carried out in both European Union and China on natural crops, to provide a long term vision on common research activities on fibre crops and improve researchers' training opportunities; more information, see <http://www.fibrafpj>.

The FIBRA project has received funding from European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No. 311965.

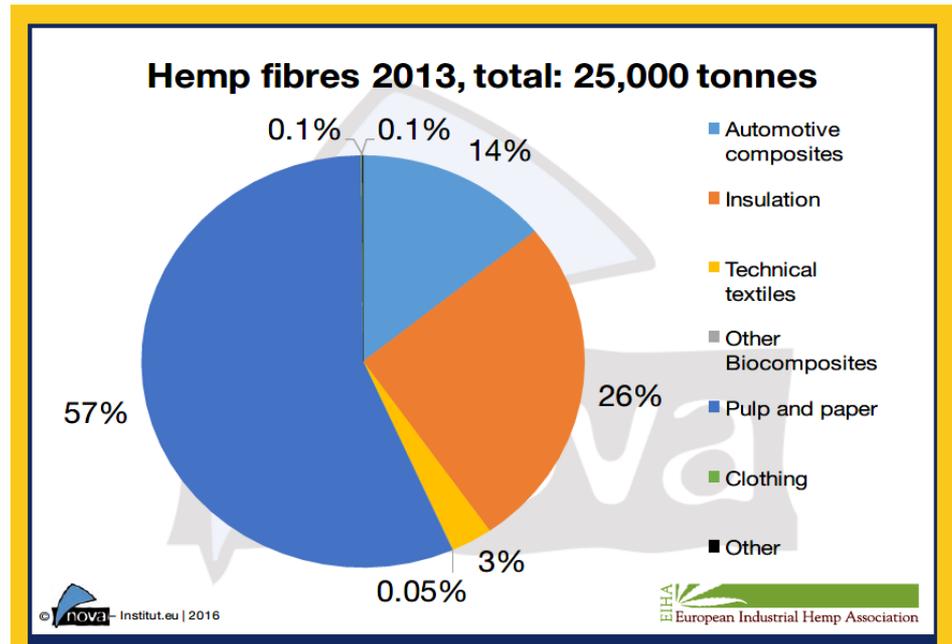
Hemp Cultivation Area in the EU (ha) 2016: ca. 32,500 ha





Agricultural Benefits

- Natural weed suppression
- Grown without pesticides or herbicides
- Pollen isolation
- Soil improvement in crop rotation
- Deep roots are natural soil aerator



Hemp insulation – Danish mats



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* Danish hemp mats were developed by Bodil Pallesen, under the auspices of the Center for Agriculture in the years 1997-2007, and the development of new markets from 2007 – now. Photo: Bodil Pallesen

Hemp Insulation

Cooperation with ANW since the start of the company, and ANW has started their business based on the development work carried out by Bodil Pallesen

Properties:

- Hemp is a unique material for building materials, that can breathe
- The Insulation mats hold specific heat capacity: 1,6 kJ/kg K.
- Thermal Conductivity: 0,037 - 0,040 W/mK
- Excellent acoustic properties
- Nice to handle and touch
- ANW has developed systems to impregnate single fibers with flame retardants – typically phosphorus compounds
- Production of hemp fiber mats started in 2010, small scale – and is now available produced from Convert A/S, since 2019

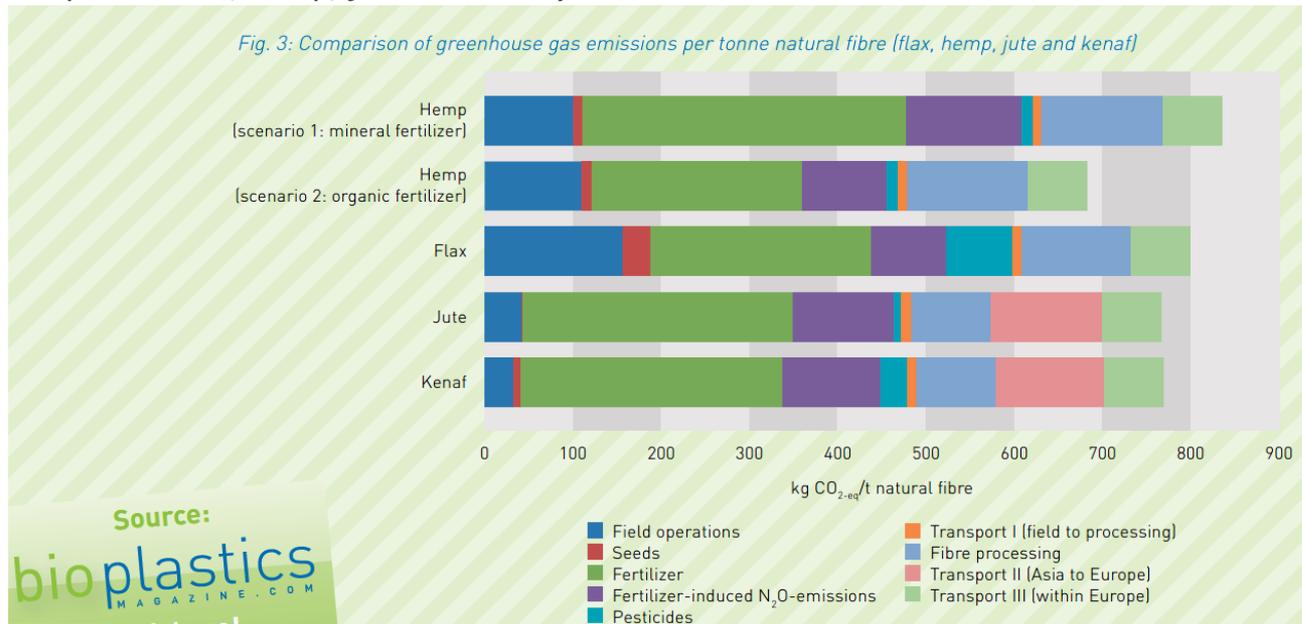
Sound insulation



Foto: Bodil Pallesen

CO₂-emissions

- Production of 1 tonne of continuous filament glass fibre products (CFGF) extracted and manufactured from raw materials for factory export has an average impact of 1.7 tonnes CO₂-eq. Based on data from Ecoinvent 3, glass fibre production has an impact of 2.2 tonnes CO₂-eq per tonne glass fibre.
- Compared with natural fibres, which have greenhouse gas emissions between 0.5–0.7 tonnes of CO₂-eq per tonne of natural fibre (from cultivation to fibre factory exit gate) (Source NovaInstitute: Carbon footprint of flax, hemp, jute and kenaf)





Insulation from eelgrass



Developed through 2015 – 2017, with support from MUDP, by DTI, Advance Nonwoven and Storhaven, Læsø

- Sea-weed – eelgrass – for insulation and roof ridges
- Today production takes place at Convert A/S and since 2019 marketed by ZosterA Aps, among others.



Harvest of eelgrass - *Zostera marina* - at Boqø 2017, Denmark





Cradle to cradle certification of seaweed batts at Gold-level



- <https://www.teknologisk.dk/gennemtestede-tangprodukter-opnaar-flot-certifikat/38153?cms.query=tang+>

Advantages of the eelgrass insulation mats



- Renewable and sustainable
- Not flammable - does not fire
- Thermal conductivity: minimum at the same level as mineral wool
- Long durability
- The mats are easily manageable and touch-sensitive
- No toxic additives needed
- Has a naturally high salt content, which protects against rotting and microbial degradation
- Can be composted
- The product can be recycled – perfect bio-circular product
- Remove nitrogen from the aquatic environment when harvested/removed from the coast

U-value – same as mineral wool

- Eelgrass insulation mats have a measured U value $0.425 \text{ W / m}^2 \text{ K}$, at a density approx. 70 kg / m^3 , mean temperature 10.1 g Celsius , $\Delta T = 15.0 \text{ g Celsius}$, and the lambda value is calculated at 0.037 W / mK , which is fully at the height of mineral wool.





- A credited fire test has been carried out by the Danish Institute of Fire Technology, and shows the seaweed mats achieve a fire class E, without the addition of fire retardance.
- EN13823 standard
- Billede 1: below 2 min.
- Billede 2: 7,39 min.
- Billede 3: 8,45 min

Sound insulation



Materialer til test: Hård (15 mm) og bløde (40 mm) hampmåtter og de mørke tang-måtter (80 mm) – her vist med den kompakte side øverst, og helt til med den bløde side øverst. Tang-måtten er målt både med den bløde og den kompakte side eksponeret.



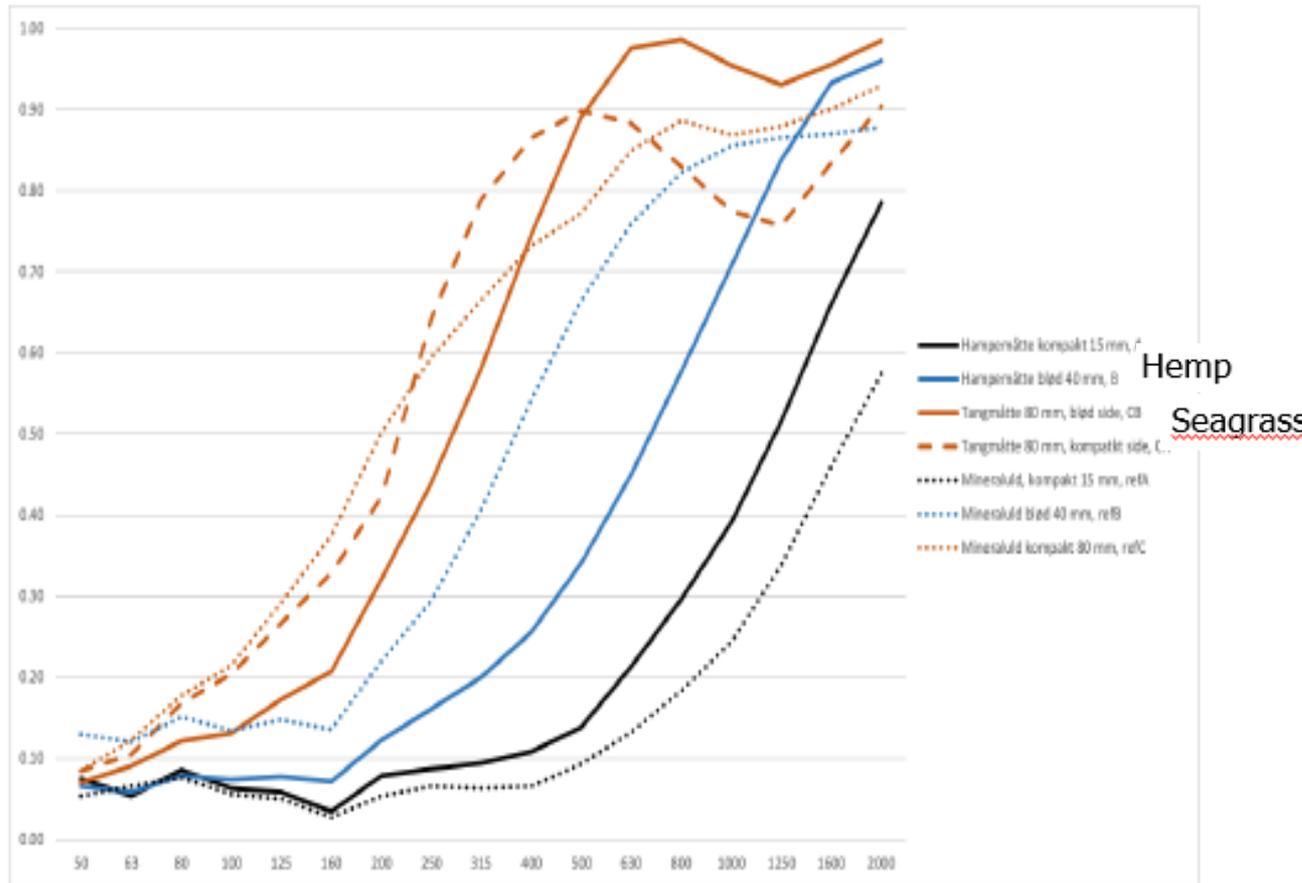
De tre referencematerialer. Fra venstre mod højre: 15 mm kompakt mineraluld, 40 mm blødt isoleringsmateriale, 80 mm kompakt mineraluld.

Type	Tykkelse	Betegnelse
Hampmåtte (kompakt)	15 mm	A
Hampmåtte (blød)	40 mm	B
Tangmåtte (blød side)	80 mm	CB
Tangmåtte (kompakt side)	80 mm	CH

Tabel over de forskellige materialevarianter, der er målt.



The seaweed insulation mat is a porous material and behaves like mineral wool, and at the highest frequencies it is the 80 mm seaweed mat that performs slightly better than the 80 mm mineral wool mat. The seagrass/eelgrass mat with the compact upper surface absorbs better than the soft ones at the lower sound frequencies and very similar to the mat from mineral wool. At frequencies above 500 Hz, it decreases slightly, and here the seaweed mat with the soft side manages better.



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Seaweed Insulation

ADVANCE NONWOVEN A/S



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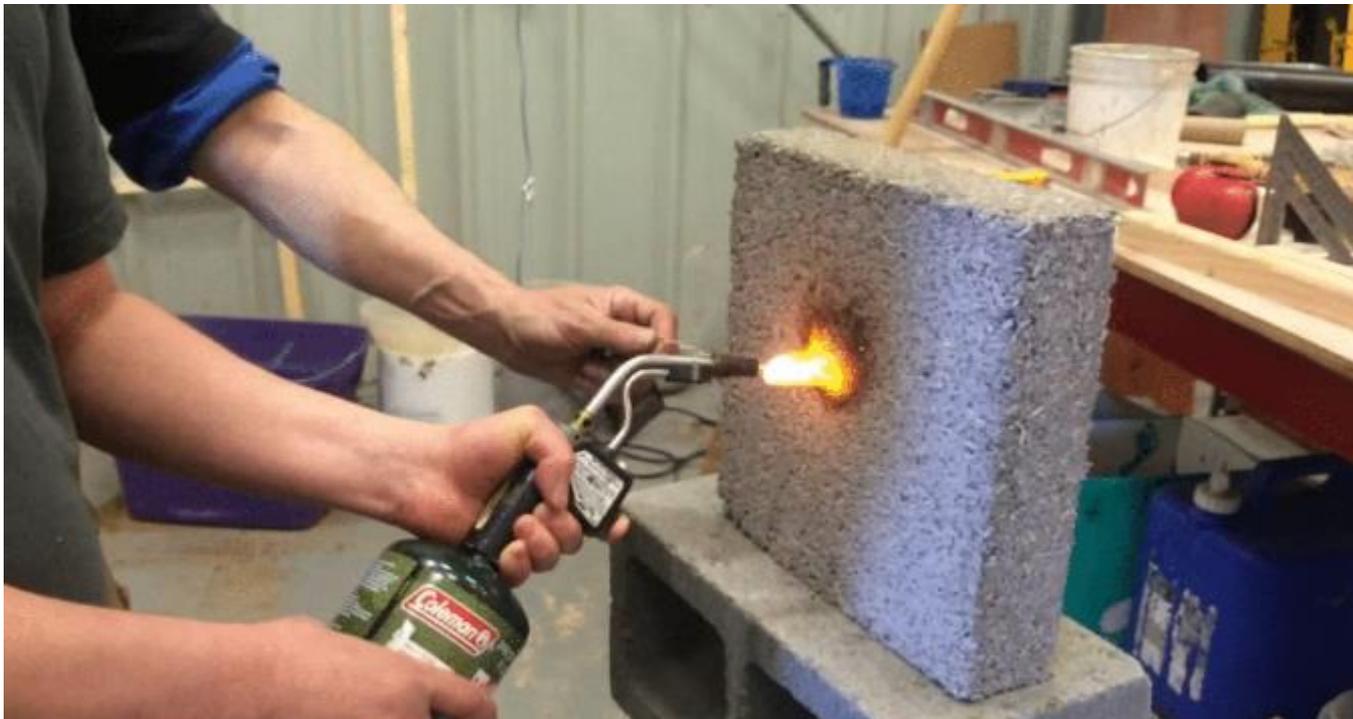
- <http://www.c2ccertified.org/products/scorecard/seaweed-insulation>

The Hemp House from hemp shives – DunAgro, “HempCal”



Fire-resistance – HempCal House

- Wall thickness of 300 → WBDBO of 73 min.
- This more than meets the requirements of the Building Decree since we assume a wall thickness of 400 to 500 mm with another plate on the inside that is also fire resistant for at least 60 minutes.



CO₂-storage – HempCal House from shives and lime

- Fiber hemp absorbs a lot of CO₂ during the growth cycle: 13,500 tons per hectare.
- A house of Hemp-house with a capacity of 120 m³ stores around 14 tons of CO₂
- A traditionally built house with a capacity of 120 m³ releases around 25 tons of CO₂.
- HempCal is therefore a CO₂ "negative" material, it removes more CO₂ from the atmosphere than it enters.
- App. 10 – 14 tonnes shives for a house equivalent to 1,5 – 2 hectare hemp

Source: DunAgro

Recycled paper and wood for insulation



Thanks to



- MUDP – Danish Environmental Protection Agency (Danish EPA) (Miljøstyrelsen)

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Biomaterialer - Produktudvikling ud fra plantefibre og restmaterialer



Foto: Martin Håkan / Coverganda.dk

Udslip af drivhusgasser, mangel på råvarer samt affalds- og forureningsproblematikker udgør en stigende trussel for vores klima. Forbrugere og virksomheder efterspørger derfor også innovative biomaterialer som aldrig før, og der er stor fokus på cirkulær økonomi, bioøkonomi og bæredygtighed.

Biobaserede produkter er bionedbrydelige og mindre forurenende, fordi de giver mindre affald, kan recirkuleres og udleder mindre CO₂ ved fremstilling. Foruden miljømæssige fordele kan produkterne endda have bedre tekniske egenskaber med hensyn til styrke, lethed og isoleringsevne. Plantefibre fx er velegnede til brug i



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Send

- <http://www.teknologisk.dk/ydelser/biomaterialer/produktudvikling-ud-fra-plantefibre-og-restmaterialer/37309>