# World Hemp Forum

Les rencontres du chanvre industriel

**19 & 20** November 2024

Troyes, France

Pôle européen du chanvre

Learn more pole-europeen-chanvre.eu

TROYES CH/MP/GNE

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Celsius Cerfrance Cerfranc



#### La valorisation de la chènevotte Shive Valorisation

Moderated by: **Guillaume Delannoy** FRD-CODEM / Construire en Chanvre (F)









**Steve Allin** (IE) International Hemp Building Association

Remi Loren (S) Ekolution **Cameron Mac Intosh** (USA) Americhanvre

Grand Est

TROYES

CHIMPLGN







# FRD-CODEM: a technological resource center dedicated to ecomaterials and biosourced materials

Multi-disciplinary skills across the entire value chain for ecomaterials and biobased materials



## FRD-CODEM: 15 years of support for the hemp sector

#### From the field to markets







### Construire en Chanvre Organisation (since 1998)

#### • Purpose :

- Regulatory framework development (Règles Professionnelles)
- o training for specifiers and craftsmen
- o granulat chanvre pour batiment" quality label
  o creation of reference works
- About **150 members covering the entire value chain** (hemp producers, binder producers, Architects/design offices, construction contractors, technical centers and laboratories, Real Estates, ...)













#### OVERVIEW OF HEMP IN BUILDINGS

#### **Process and products**



#### Hemp wool for insulation



- Panels with 100 % hemp or mix with coton and flax (+binder) or hemp in bulk
- Walls, roof, attic, floor



#### Hemp wool for insulation



- Light insulation panels
- Compétitive thermal conductivity, heat comfort, acoustical performances
- Carbon storage

| Performances | Density              | Thermal conductivity | Phase<br>displacement<br>(300 mm<br>thickness) | Acoustical<br>performances<br>(Rw - C,Ctr) | Fire resistance classification | Biogenic<br>carbon storage<br>(for 300mm<br>panels)                    |
|--------------|----------------------|----------------------|--|--|--------------------------------|--|
| Hemp wool    | 40 kg/m <sup>3</sup> | 0,04 W/m.K           | 8,6 h  | 56<br>(-2,-7)                              | E                              | 9,6 kgCO <sub>2</sub> /m <sup>2</sup><br>with 6,6 kg of<br>hemp fibers |



#### Hemp concrete for insulation



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#### Hemp wool for insulation



- Hygrothermal performances and comfort
- The best summer comfort performance
- Excellent fire resistance



| Performances     | Density               | Thermal<br>conductivity | Phase<br>displacement<br>(300 mm<br>thickness) | Acoustical<br>performances<br>(Rw - C,Ctr) | Fire resistance classification | Biogenic<br>carbon storage<br>(for 300mm<br>hempcrete)               |
|------------------|-----------------------|-------------------------|--|--|--------------------------------|--|
| Hemp<br>concrete | 350 kg/m <sup>3</sup> | 0,07 W/m.K              | 20 h   | 46<br>(-2,-4)                              | В                              | 50 kgCO <sub>2</sub> /m <sup>2</sup><br>with 13,5 kg of<br>hemp shiv |





#### HEMP IN THE BUILDING SECTOR IN FRANCE

#### France experience

Construire en Chanvre as key player for the development of hemp concrete



 $\bigcirc$  $\bigcirc$  $\bigcirc$ 1998 : 2007: 2012 : 1986 : 2024 : Creation of Hemp shiv First First building New validation of Construire en reconized label for Rules of Construction Chanvre Rules of building Construction TRUIRE ENCI CHANVRE

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World Forun

#### France experience

#### Some buildings



Architecte Pascal Bas

Architectes CAN AI

1<sup>e</sup>R+6 Structure bois et béton de chanvre préfabriqué (Nantes)





LA MAISON DU HAND - CRETEIL (94

frd

CODEM

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# Hemp Building Expertise

Consultancy and the International Hemp Building Association STEVE ALLIN



First use of hemp building materials as hemp plaster 1997

Building with Hemp published 2005



35 Hemp Building Courses in 10 countries





1st Symposium attracted 75 delegates from around the world to my home town of Kenmare

International Hemp Building Association formed 2009





TANA

#### Hemp Building 50 International Case Studies 2021





## 50 different projects with a wide variety of details that have been successfully installed.







**IHBA** Membership provides access to over 150 presentations from our database. plus our Best Practice Guide

**Hemp Building Materials** 

**IHBA Best Practice Guide** updated to include recent developments in a fast changing environment.





INTERNATIONAL HEMP BUILDING ASSOCIATION

# IHBA

#### Represents many companies and approaches to materials and construction fro high tech to low tech <u>www.internationalhempbuilding.org</u>



## Regulated materials and Systems



#### Certifications for reality not engineered synthetic conditions



To build structures containing materials that behave as Lambda tests record, we would have to build here.

#### Atacama Desert



# Thank you

Steve Allin

# EKOLUTION

Leading the green materials revolution



HEMP FIBRE INSULATION

## **GREENHOUSE GAS EMISSIONS**

# **222 0** of **Sweden's** annual greenhouse gas

emissions (Boverket 2023).

EKOLUTION

12% of

Europe's total annual greenhouse gas emissions (MCKinsey & CO 2021)

## **ENERGY LOSSES**

## Buildings use 38 of all energy in

11,4°C

Sweden (Energy Agency 2017).

## **ENERGY LOSSES**

# 80% of emissions are caused by the heating of the existing building stock

(McKinsey & CO 2021).

## HARMFUL EMISSIONS – "SICK BUILDNG SYNDROME"

# **90%** of our lives are spent indoors, making the indoor climate crucial for our health and well-being

(Boverket 2022).

### **INDUSTRIAL HEMP**



## from seed to product



## per ha

### THE HEMP PLANT



## **GROWN IN SKÅNE**

# 54 growers

# 640 ha



Grant: Klimatklivet - 94 mSEK

Series A – 61.5 mSEK

Production start 2024 Q4

Production capacity: 230 000 m<sup>3</sup>/year

# FACTORY STP1 -2024



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#### **HEMP PLANT – POTENTIAL**

## THE HEMP PLANT HAS OVER 50,000 END-USE APPLICATIONS, MAKING IT A UNIQUE CROP TO GROW AND REFINE


## **CO2-BINDING PRODUCTS**

## -70 000 tons

CO<sub>2</sub> eq per factory/year

-0,5% of the building sector's emissions in Sweden

## **3 000 000** m<sup>2</sup> insulation / 6

000 tons fiber



EKOLUTION

## **FACTORY SWEDEN**

Production consists of:

Hemp processing & Non-woven production

- Hemp fiber insulation
- Textile fibre

- Façade insulation
- Acoustic panels
- Hemp lime insulation
- Hemp lime acoustic panel
- Door insulation

• Biomass for biogas

• Hemp shives

- Furniture
- Automotive
- Formpress



## FACTORY STAFFANSTORP, SWEDEN





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## **EKOLUTION HEMP FIBRE INSULATION**

<del>له</del>  $CO_2$ **Ekolution's Ekolution's insulation** Ekolution has a lower Ekolution's price of hemp **Ekolution's products** fiber insulation is **reduced** offers better thermal climate impact compared products are create a healthy to its competitors by performance recyclable and indoor climate in compared to circular. buildings conventional -85 kg insulation. -70% by up to **10%** 100% ╋╋┥ ...CO2 per m3 is saved compared to mineral ...Positive impact ...can be wool due to carbon ...Lower energy ... compared to today's on the **health**, recycled after dioxide sequestration and price of the insulation consumption for work completed low emissions buildings using environment, and projects. Ekolution hemp fiber air quality. insulation

EKOLUTION

## **EKOLUTION HEMP FIBRE INSULATION**

#### Description:

EKOLUTION

Thermal insulation for the building envelope consisting of hemp fiber, fire retardants (food-grade mineral salts), and binder (recycled textile fibers from postconsumer waste).

| ENERGY   | CLIMATE  |          |  |  |
|--|--|----------|--|--|
| $\lambda = 0,039 \text{ W}/(\text{m}^2 \text{ K})$ | $GWP_{bio} = -2,25 \text{ kg CO}_2 \text{ eq }/\text{ kg}$ | C-s1, d0 |  |  |
| c = 2300 kJ/(m <sup>2</sup> K)                     | GWP <sub>fossil</sub> = 0,29 kg CO <sub>2</sub> eq / kg    |          |  |  |

FIRE Work and indoor environment VOC emissions – M1 standard 100% recyaböe och no waste

Certified under European harmonized standard EAD 040005-00-1201 with CE marking. Additional certifications include EPD, VOC emissions, fire, and moisture standards.

| ETA – CE   | EPD   | EMISSIONS   | FIRE MOISTL   | JRE   |
|--|---|---|---|---|
| <image/> <image/> <text><text><text><text><text><text><text><text></text></text></text></text></text></text></text></text>   |   | <text></text>   |   | RAPPORT    Image: State |
| New Yorkson Nacional Americana<br>The Tarawane Technical Americana<br>The Tarawane Technical Americana<br>State Strawane Technical Americana<br>State State Strawane Technical Americana<br>State State State State State<br>State State State State State State<br>State State State State State<br>State State State State State State State<br>State State State State State State State State State<br>State State State State State State State State State State<br>State State State State State State State State State<br>State State S | A series of the | <text><text><text><text><text><text><text></text></text></text></text></text></text></text> | CaLO<br>The normalize square and the samehases square with the same if the same is the same is the same if the same is the same | Densitie      The state                   |

CE

## Kv Badskon

Total CO2 savings 32 000 kg CO<sub>2</sub> eq

SAvings fossile carbon-dioxide per boa  $12 \text{ kg CO}_2 \text{ eq} / \text{m}^2$ 

DEVELOPER MKB, Malmö Fastighets AB

EKOLUTION

CONTRACTOR PEAB

N I I II

Bålsta

CHLOGICENTERS

Logisticscenter, new production

Total CO2 savings 193\_000 kg CO<sub>2</sub> eq

SAvings fossile carbon-dioxide per area  $10 \text{ kg CO}_2 \text{ eq} / \text{m}^2$ 

887

DEVELOPER

EKOLUTION

CONTRACTOR Shared INTERNATIONAL SCALING

#### COMMERCIALISATION & NEXT STEPS

#### **SCALING APPROACH**





# EKOLUTION

Leading the green materials revolution





Hempcrete Installation • Hempcrete Materials • Hempcrete Training



AMERICHANVRE

WWW.AMERICHANVRE.COM

IGH PERFORMANCE HEMPCRETE

PAHIC IN NATIONAL HEMP

Presented by





## **Ereasy Spray Applied**

## Hempcrete

- Designed, manufactured and distributed globally by Damien and Celine Baumer of the Baumer Ereasy Company
- Materials are mixed on site and introduced to the wall pneumatically with additional equipment
- Dramatic reduction in installation labor and overall costs compared to cast in-situ
- Only one side of the wall is formed other side is sprayed and then "screeded" flat
- Increased consistency in placement density versus hand-placed methods
- Surface tension with framing members when sprayed
- Monolithic building insulation envelope for highperformance construction





## EREASY Spray Applied Hempcrete System

- Cuts labor by 60% or more in comparison with cast in-situ methodology, overall 20-30% reduction in hempcrete cost
- EREASY binder cures in 4-6 weeks as opposed to 10-12 or more with other binders
- Lighter hurd to binder ratio means higher R value and greater cost efficiency
- Driven by 375cfm air compressor
- Americhanvre is the exclusive licensee for the Baumer Ereasy Hempcrete System designed in France
- Ereasy hardware now domestically produced by Americhanvre in the United States
- Covered by full use United States Patent





## EREASY

#### TRAINING

JOIN US

#### APRIL 27-30, 2024

FOR OUR NEXT EREASY SPRAY APPLICATION TECHNICIAN TRAINING

HOSTED BY:



**EREASY**®

WWW.AMERICHANVRE.COM/TRAINING/



## Ereasy System Commercial Success under Americhanvre

- First hempcrete spray application system to be used in the United States successfully – projects in Idaho, Washington, British Columbia, Minnesota, Montana, Michigan, Missouri, West Virginia, Pennsylvania, Virginia, New York, Massachusetts, Vermont
- Twelve unique, Americhanvre trained Ereasy owner-operators around the USA and well over one hundred trained Ereasy Technicians including first nations and workforce development programs
- Forty plus Ereasy Hempcrete insulated projects installed by Americhanvre – retrofit, new construction, affordable housing
- Single most utilized hempcrete installation system in the United States hemp building industry



## Americhanvre Research/Documentation

 ASTM C-518 Thermal Resistance Testing – R2.2/in for Ereasy Spray Applied Hempcrete – Performed by Americhanvre <u>https://americhanvre.com/wp-</u>

content/uploads/2023/03/Americhanvre-C518-Testing-Report-HBI-32223.pdf

- Pennsylvania Housing Research Center (PHRC) "Thermal, Energy, and Indoor Environmental Quality Performance of the PA Hemp House" <u>https://www.phrc.psu.edu/assets/docs/Publications/P</u> <u>HRC-Research-Report\_Thermal-Energy.pdf</u>
- ASTM E-119 One Hour Fire Resistance Rating Achieved July 2024
- Americhanvre owner Cameron McIntosh cowriter/proponent for Appendix AY-Hemp Lime <u>https://ushba.org/wp-</u> <u>content/uploads/proposal\_8646-Final.pdf</u>

Thermal, Energy, and Indoor Environmental Quality Performance of the PA Hemp House

Submitted to DON Services, Inc.

By Ali Memari, Corey Griffin, Hojae Yi, Sarah Klinetob Lowe, Nadia Mirzai, and Mahsa Hashemi

September 2022



Pennsylvania Housing Research Center (PHRC) Penn State, University Park, Pennsylvania





PENNSYLVANIA HOUSING RESEARCH CENTER



### Americhanvre Grants/Awards

- 2021 PA Dept. of Ag. DON Services, New Castle, PA – "Project PA Hemp Home" – consortium under DON including Americhanvre, PA Housing Research Center (Penn State Univ.), Parson's New School Healthy Materials Lab
- 2022 PA Dept. of Ag. PA Hemp Industry Council – "Invest in PA Hemp"
- 2022 PA Dept. of Ag. All Together Now PA "Invest in PA Hemp"
- 2023 National Science Foundation PA Industrial Hemp Engine
- 2023 U.S. Army SBIR/STTR Direct to Phase II award, Sustainable Building Materials and Technologies – Spray Applied Hempcrete





Americhanvre – Army SBIR Research Focus

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| CO2  |  |   |   | inatural<br>line<br>NHL35                           |
|--|--|---|---|---|
| LIFE CYCLE<br>ASSESSMENT and<br>EPD  | FIRE<br>RESISTANCE<br>TESTING  | IN-FIELD<br>PERFORMANCE<br>MONITORING   | CONSOLIDATED<br>EREASY<br>EQUIPMENT   | DOMESTIC<br>BINDER<br>DEVELOPMENT                   |
| Assess the carbon<br>storage capacity of<br>each cubic foot of<br>EREASY spray applied<br>hempcrete. | ASTM E-119 fire<br>resistance testing of<br>four common<br>hempcrete wall<br>assembly details for<br>one hour fire<br>resistance rating. | Objectively measured,<br>scientific monitoring<br>and analysis of<br>thermal, energy and<br>interior air quality<br>performance data in<br>completed EREASY<br>homes. | A fully automated,<br>self-contained, mobile<br>spray application<br>machine for ease of<br>deployment. | Formulation of<br>domestic EREASY<br>system binder. |

**COMMERCIALIZATION MILESTONES & EXTERNAL INVESTMENT** 

**US ARMY INTEGRATION** 

#### Americhanvre Overview Fire Resistance Testing



#### ASTM e119 – 1 Hour Fire Test – Passed as of 9 JUL 24



Exterior Wall Maintained Average Ambient temp of 85.7 Degrees for 1 Hour – exposure face subjected to 1700 Degrees

#### Americhanvre Overview In-Field Performance Monitoring







Interior/Exterior Temperature, Humidity and Interior Air Quality Sensors Installed and Monitored by the Pennsylvania Housing Research Center at Penn State University

### Americhanvre Team



Cameron McIntosh – Americhanvre President and Principal Owner

- BFA Barton College
- Founder Americhanvre Cast Hemp
- US Hemp Building Association Director at Large
- All Together Now PA Sustainable Building Materials Lead
- PA Hemp Industry Council BOD Treasurer
- Co-writer/proponent IRC Appendix AY Hemp Lime
- Writer/recipient/principal investigator U.S. Army SBIR Sustainable Building Materials Direct to Phase II

 $\begin{array}{l} \mbox{Melissa} \ \mbox{McIntosh} - \mbox{Americhanvre CFO} \ \mbox{and Principal} \\ \mbox{Owner} \end{array}$ 

- BS Accounting, Barton College
- MBA DeSales University Accounting
- Founder Americhanvre Cast Hemp
- Twelve years corporate bookkeeping experience, specialty in state sales/use tax



Charlotte Tarr - Project Manager

- BA Political Science/Environmental Studies
- 17 years experience cost/software/data collection and analysis for Office of Secretary of Defense (OSD)
- Cost Assessment and Program Evaluation
  (CAPE)
- Program Manager Cost Assessment Data Enterprise (CADE)
- Project Management Professional (PMP)
- Identity and Access Management (IAM) Security + certification
- Top Secret Clearance

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Managed \$68m+ in DoD contracts



Dr. Dick Thurston - Advisor

- Attorney with RLT Global Consulting LLC
- MA/PhD University of Virginia
- Former VP of Corporate Staff/General Counsel for Texas Instruments
- Expertise in IP rights, technology licensing, corporate law, business planning, small-medium sized business development
- 40+ years of experience in assisting companies to create their IP value proposition
- Further expertise in semiconductors, carbon nanotubes, 3D printing, electronic sensors



#### Richard Steffens – Advisor

- Senior Advisor with TTSE Tech LLC
- Former US Dept. of Commerce Deputy Secretary for Asia
- Former Assistant Director for Venture Development for NJ Commission on Science and Technology
- Connected nearly \$50m in financing for early-stage firms to establish manufacturing and distribution operations



## Americhanvre Case Study –

## The Raft at Lower Sioux

- Emergency housing duplex built by Ereasy Owner/Operator Lower Sioux Tribe in Minnesota on Lower Sioux Reservation
- Insulated with Ereasy Spray Applied hempcrete system in only three days
- First hempcrete home in Minnesota and first hempcrete emergency housing duplex in the United States
- Entire 1600 sqft structure completed for <\$200,000.00
- "The Raft" will be owned and operated by Lower Sioux as emergency affordable housing for up to two families in crisis at a time
- Eight Lower Sioux Tribe members trained as Ereasy Spray Application Technicians – also engaged Lower Sioux Youth Program for project support/workforce development























### Hillside Center for Sustainable Living – Newburyport, MA



- Fully sustainable low-rise multi-family community development by Ereasy system owner/operator Hall and Moskow in Newburyport, MA
- Solar, passive house, grey water system, permeable paving, native edible landscaping
- Existing units constructed from concrete and EPS foam
- Southrise building is 12 units and Ereasy spray applied hempcrete system to replace concrete and EPS foam detail
- First of its kind commercial hempcrete construction for the United States
- Full-section tilt-up panel design by Hall and Moskow adapted to include Ereasy spray applied hempcrete with support from Americhanvre

AMERIC



























# HILLSIDE SUSTAINABLE LIVING





REAL ESTATE OWNERS, MANAGERS, DEVELOPERS




