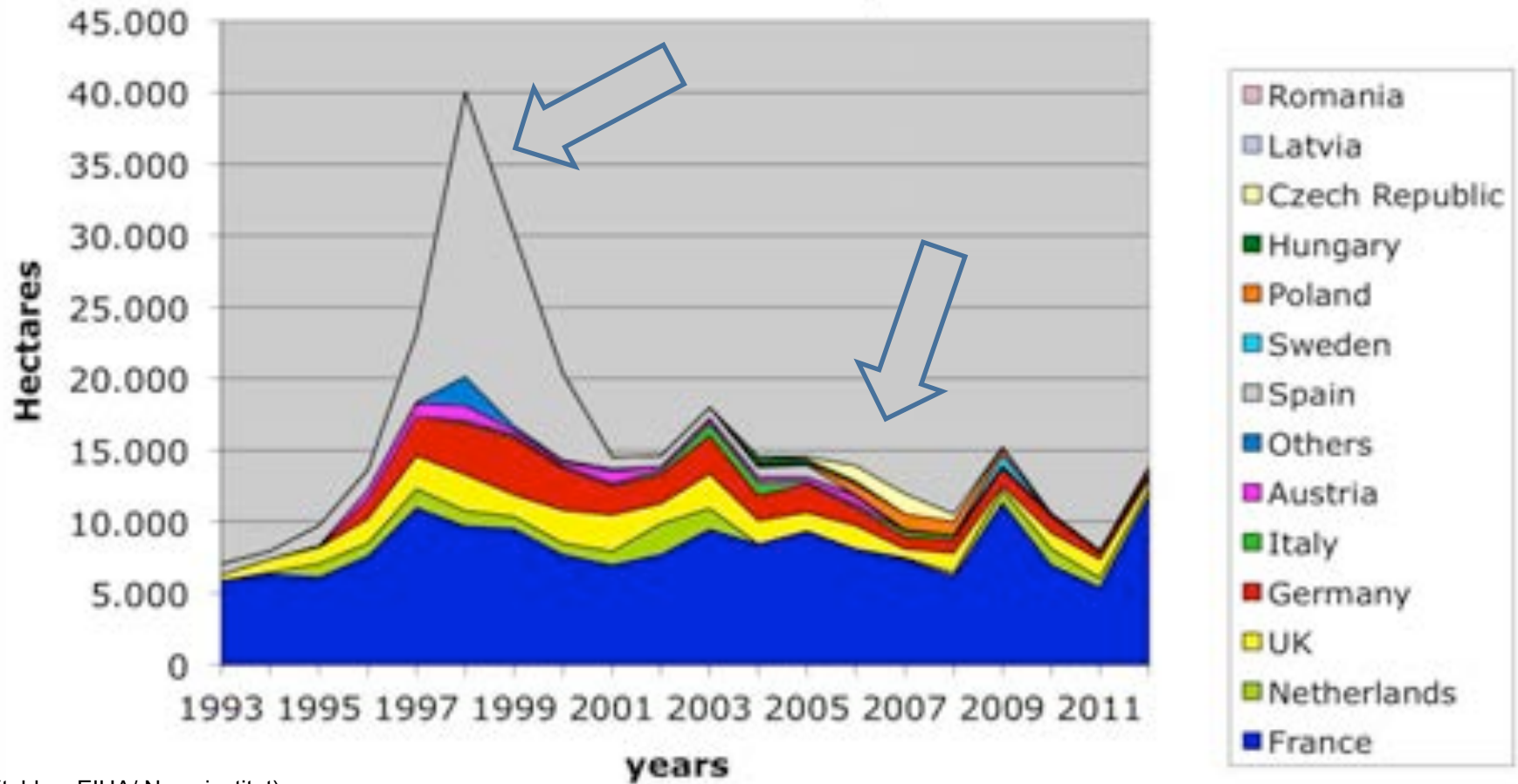




10. EIHA CONFERENCES, Wesseling, Germany, 2013
Loadbearing HEMP-BUILDING in South European climate
Monika Brümmer, Cannabric, Spain

Hemp Cultivation Area in the EU (ha)

2012: 14,000 ha



(tables: EIHA/ Nova institut)

	1998	1999	2000	2001	2002	2003	2004	2005	2006
	in ha	in ha	in ha	in ha	in ha	in ha	in ha	in ha	in ha
Spanien	19.860	13.473	6.103	850	691	744	678	853	3

Spain 2013:
+/- 150 ha for
fiber export

advantages of using hemp in construction



ENVIRONMENTAL FRIENDLY

- fast growing hemp can replace construction materials based on non renewable resources
- grows in different soils and climates (contrary to even faster growing bamboo)
- this allows to spread hempbuilding techniques all over the world
- building with hemp makes possible a carbon sequestration during the life time of the building

USER FRIENDLY

- hemp as part of our second and third skin (clothing and housing), is an envelop with positive influence on our life quality (regarding hygrothermal issues, moisture buffering and breathability)
- no pesticides and herbicides need to be applied in hemp farming, which makes hemp apt for green building and people with multiple chemical sensitiveness
- shield against some kind of radiations
- not harmful for the builders in its application

hemp stalk - aptitude for construction

(free of hallucinogenic substances, free of albumin: NO CHEMICAL TREATMENT NEEDED FOR USE IN CONSTRUCTION)



fiber materials

Loose fiber (to avoid thermal bridges)



**Hemp felt in stripes,
acoustic absorption, thermal insulation**

hemp materials for application in DRY CONSTRUCTION



felt for under or on top of floor slabs



Insulating panes, walls or roofs



**textile,
rope
and
twine**



TEXTILE CONSTRUCTION MATERIALS based on hemp





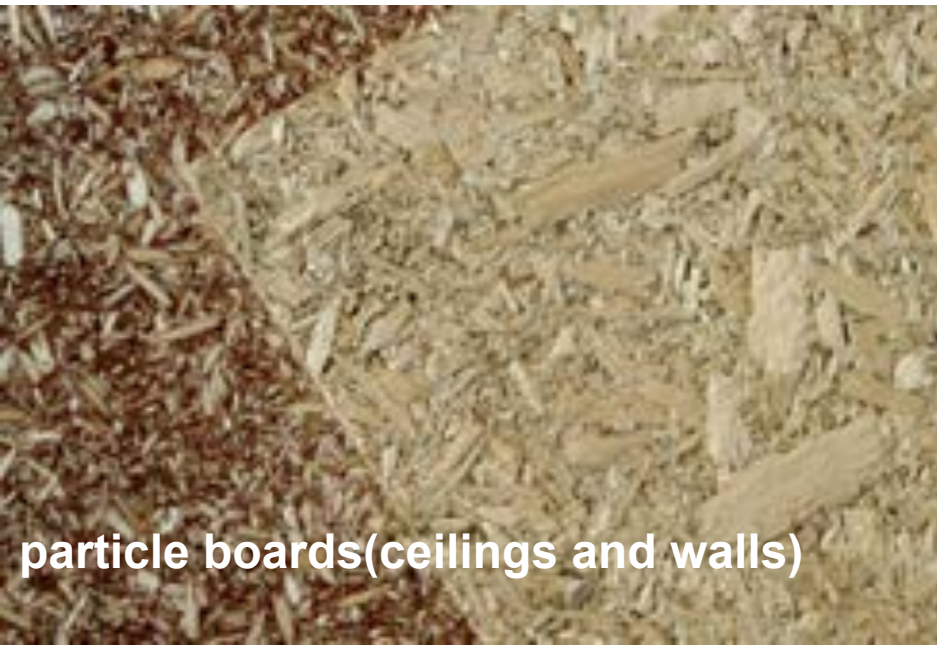


bricks and pre-made pieces



hempstraw (loose filling and mortars)

hemphurds and binders, mainly for wet construction



particle boards(ceilings and walls)



hemphurds

Insulating mortars, all applications



Examples of **NORD EUROPEAN HEMPBUILDING**, originated in France in the years 90. Systems with very light and insulating hemp-lime-mortars without load bearing functions, adapted on the constructive and thermal needs northern Europe.



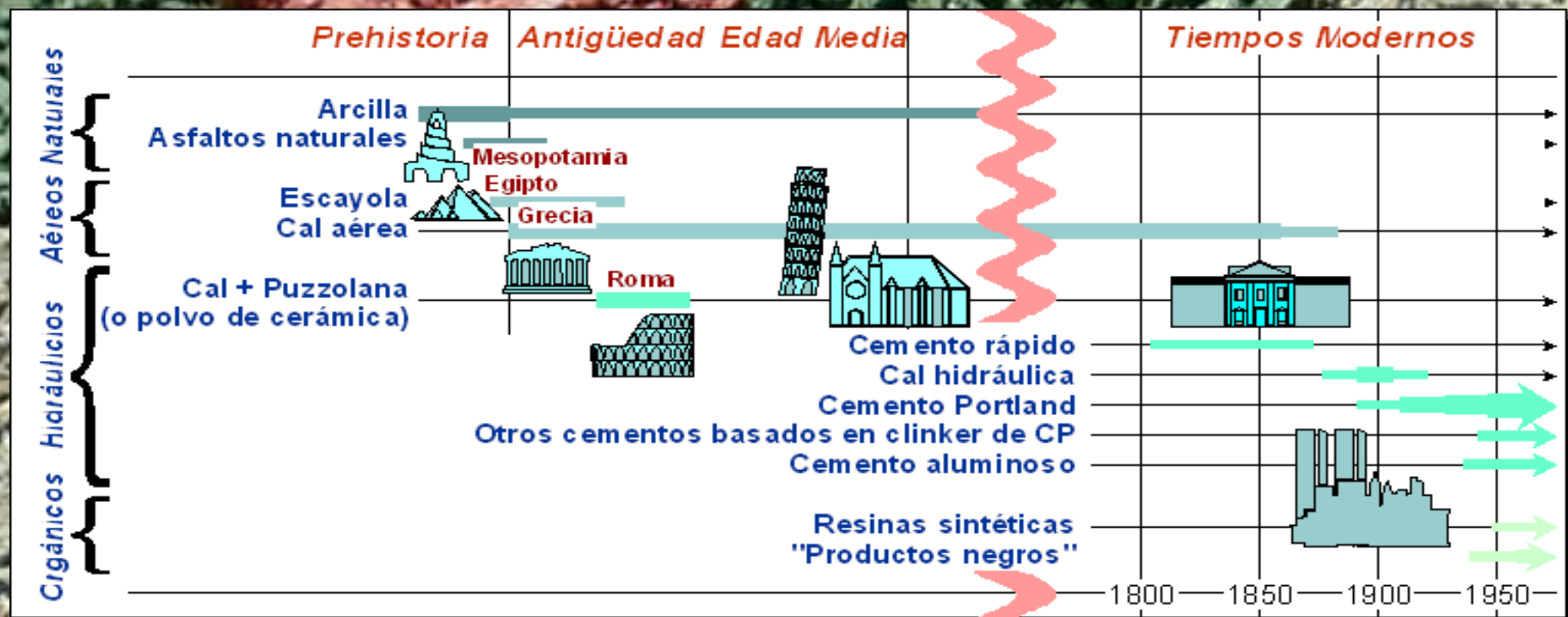


**compacted hemp walls house in construction
(loadbearing), architect: Monika Brümmer (Spain)**



LOADBEARING WALLS (Cannabric/ Spain), thermally and mechanically adapted to South European aereas, poor in wood and with better drying conditions





HEMP BUILDING = LOW ENERGY BUILDING

Renewable materials: products based on hemp, wood, straw, cork, bamboo and others.

Low impact materials: binders like lime, unfired clay, natural gypsum and others.



habitable planete, comfortable housing

There is a global need to reduce the greenhouse gas emissions:

Since the industrial revolution, the concentration of CO2 in the atmosphere has increased by 30% and most comes from industrial processes (construction materials of non renewable sources).

Due to insufficient thermal performance, Spanish buildings are responsible for 40% of national energy consumption, of which heating / cooling represents between 40 and 55%.

The "envelope" must be the first measure of shock to get the conditions of comfort, with the lowest possible embodied energy.

CO2 emissions in a one family house:

With conventional material:

(cement, beton bricks, cerámic bricks...)

up to 50 tons

With hemp+lime walls (hempcrete):

0 tons (carbon neutral building)



hemp-lime construction in France

With Cannabric (clay based):

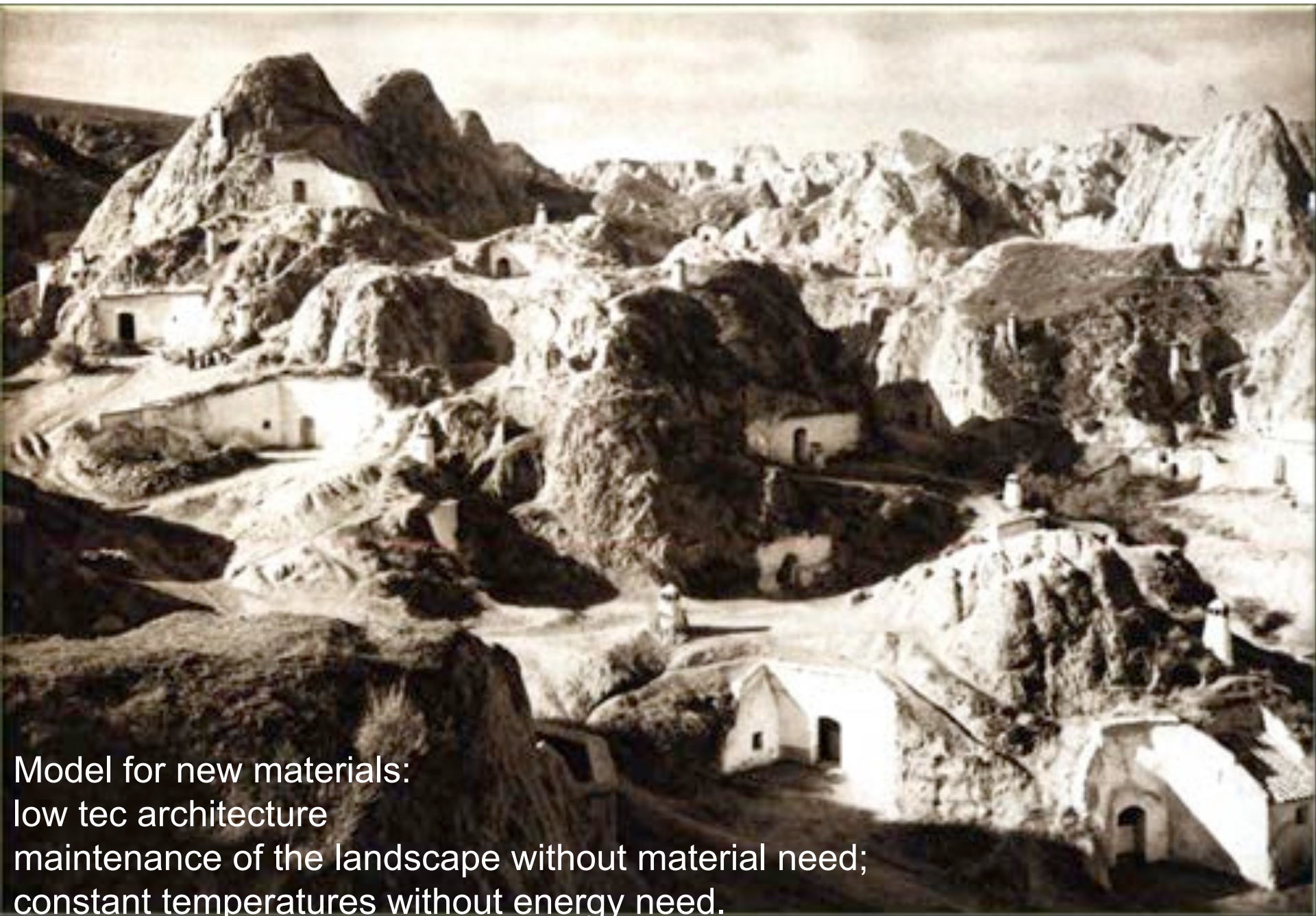
up to - 8 tons

(carbon sequestration)

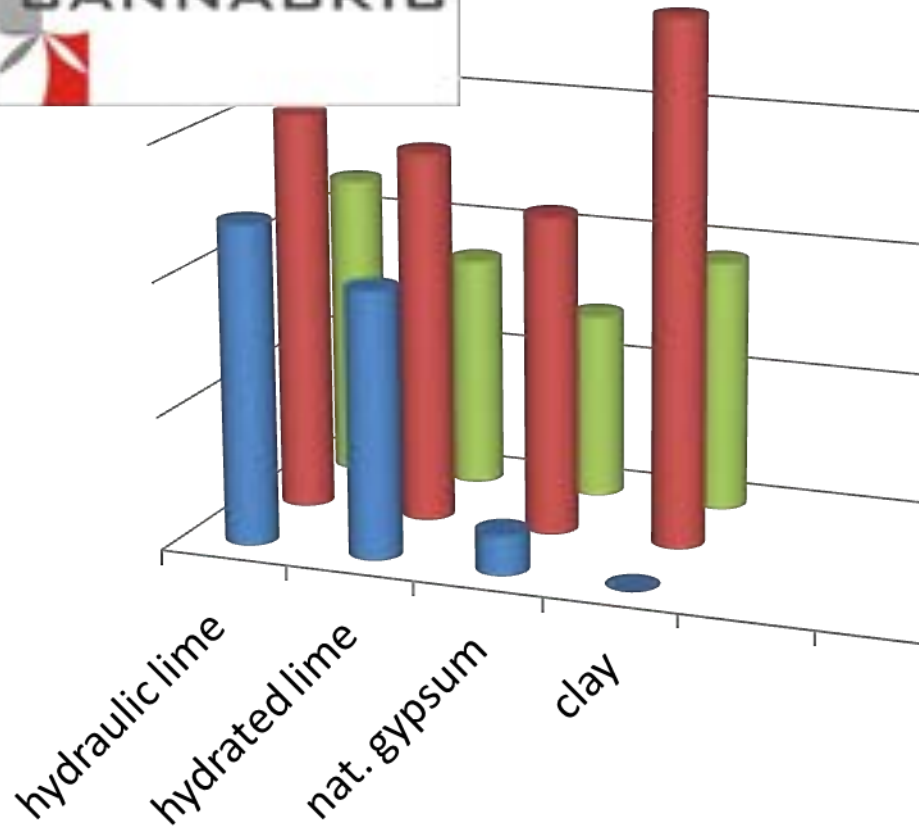




Guadix is situated in a *depresión* formed by erosion of sedimentary material of Sierra Nevada (Granada/ Andalusia) and is example for semidesertic climate of high temperature variations day-night. For these climate, we can't work with too low thermal conductivities, but need **dynamic insulation materials capable of regulating temperature** by thermal inertia and osmosis. The European guidelines of 0 energy consumption in short term, are adapted on Nord European conditions, where low thermal conductivities make much more sense, but the building codes still don't consider all thermal qualities of materials some of which are useful for the Southern parts of Europe. In all cases it makes no sense to achieve energy savings, if heating or cooling, with highly-impactful materials or systems and this way the combination of hemp and natural binders plays an important role.



Model for new materials:
low tec architecture
maintenance of the landscape without material need;
constant temperatures without energy need.



■ embodied energy

■ thermal inertia

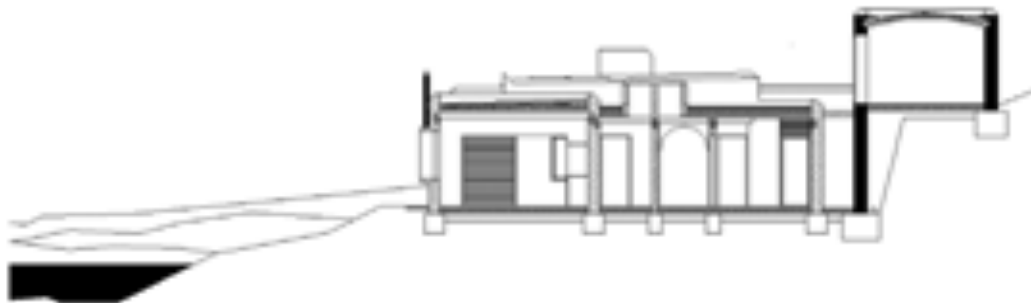
■ thermal conductivity



Clay binder has the best qualities but is not contemplated by the building codes.
Most existing standards regarding earthbuilding are out of date, besides the spanish UNE41410 (2008).
Each material found is different and has to be tested for aptitude.



hemp completes thermal performances of clay to walls of minimum thickness, at the same time both complete themselves mechanically, acoustically and regarding fire-resistance.



troglodyte architecture and hempbuilding qualities



similtudes:

conservation of natural
resources

free of toxic emissions

protect against radiation

bioclimatic qualities

energy saving
surrounding

completing each other:

compression strenght
very long persistance, no reciclation needed
landscape conservation = material gain
thermal comfort by high thermal inercia
fire resistant, no toxic emissions
acoustic absorption (mass)
mineral

fiber strenght (traction)
renewable, easy reciclable
up to negative global warming potencial
thermal comfort by low thermal conductivity
combustive
acoustic damping (fibers)
decomposable



A DYNAMIC INSULATOR (BRICKS IN COMPARISON):

material	specific thermal coefficient	density	heat accumulating capacity (thermal inertia)	thermal conductivity	heat transition coefficient with 30 cm wall thickness
	J/ g·K	kg/m ³	kJ/ m ³ ·K	W/ m·K	W/ m ² ·K
dry earth (loam stone)	0,89	1800	1602	0,91	2,0
massif fired brick	0,83	1700	1411	0,96	2,08
Cannabric *	1,113	1171	1303	0,19	0,57
light loam stone with straw	1	1200	1200	0,47	1,23
light ceramic brick	0,79	910	719	0,29	0,83
cement bloc	0,84	750	630	1,15	2,33
straw ball	1,4	250	350	0,1	0,32
hemp hurds *	2,109	110	232	0,048	
air	1,01	1,2	1,21	0,13	







cave as a model of adaptation to warm climate



































Cannabric houses in construction
Architect: Monika Brümmer

**muro de carga monocapa: sin necesidad de aislamiento,
Resistente a fuego, elevado confort térmico-acust.-biocl.**





Cannabric houses in construction
Architect: Monika Brümmer

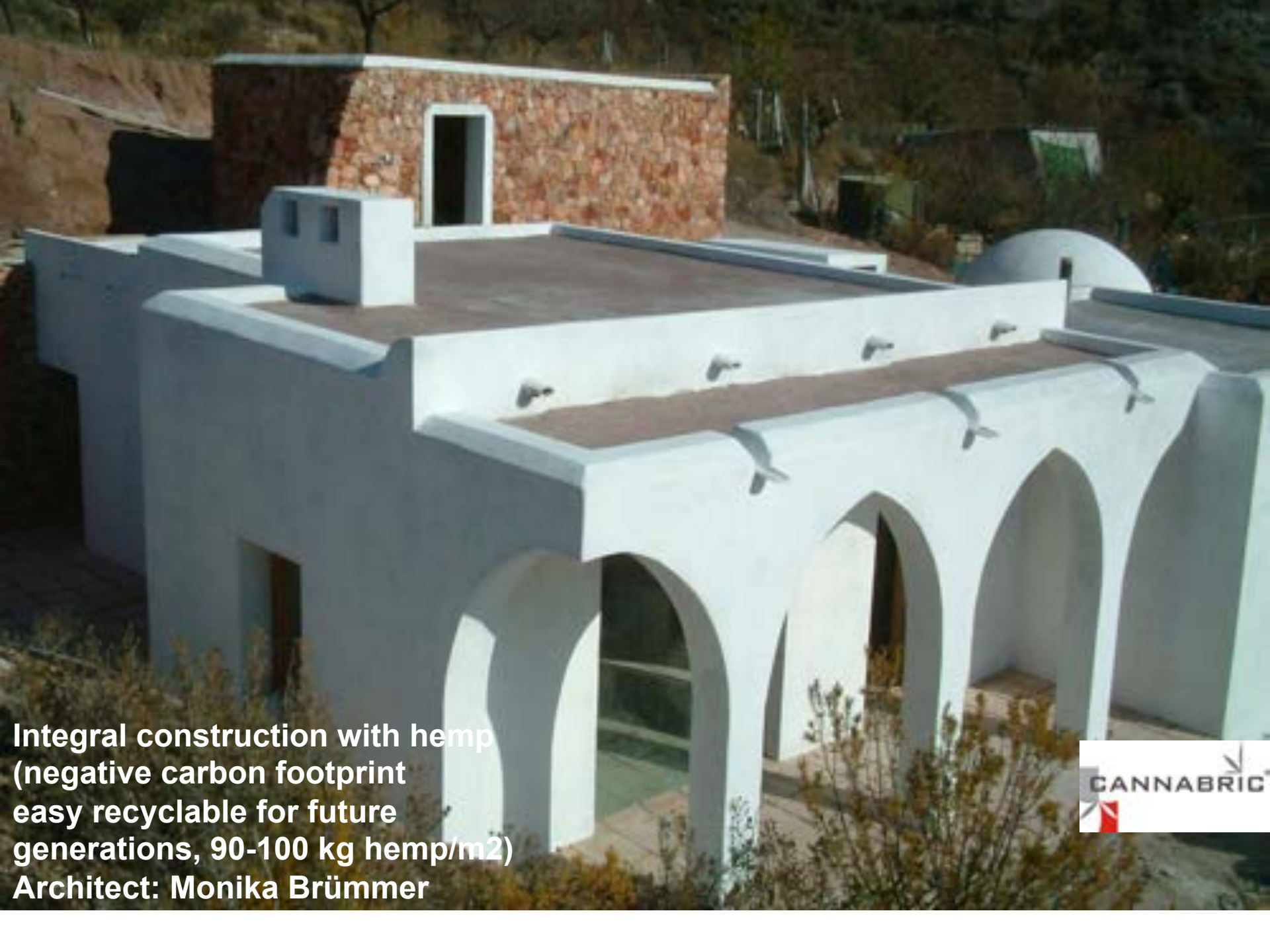
Cannabric houses in construction
Architect: Monika Brümmer







Cannabrig houses in construction
Architect: Monika Brümmer



**Integral construction with hemp
(negative carbon footprint
easy recyclable for future
generations, 90-100 kg hemp/m²)
Architect: Monika Brümmer**







Cannabric houses in construction
arquitect: Antonio Garcia Morales (Spain)



exteriorsCannabric houses
arquitect: Antonio Garcia Morales (Spain)



exteriors Cannabric houses
arquitect: Ricardo Higuera (Spain)



interiors Cannabric houses
arquitect: Ricardo Higuera (Spain)



Cannabric houses exteriors
holiday apartments, Ibiza (Spain)



Cannabris houses in construction
holiday apartments, Ibiza (Spain)



Cannabric houses exteriors
holiday apartments, Ibiza (Spain)



exteriors Cannabriga houses
arquitect: Petra Jebens-Zirkel (Spain)



Cannabric houses in construction
arquitect: Petra Jebens-Zirkel (Spain)



exteriors Cannabric houses
arquitect: Petra Jebens-Zirkel (Spain)



Cannabric houses in construction
arquitect: Petra Jebens-Zirkel (Spain)



interiors Cannabric houses
arquitect: Petra Jebens-Zirkel (Spain)



Cannabric houses in construction
arquitect: Almudena Mateo-Sagasta (Spain)

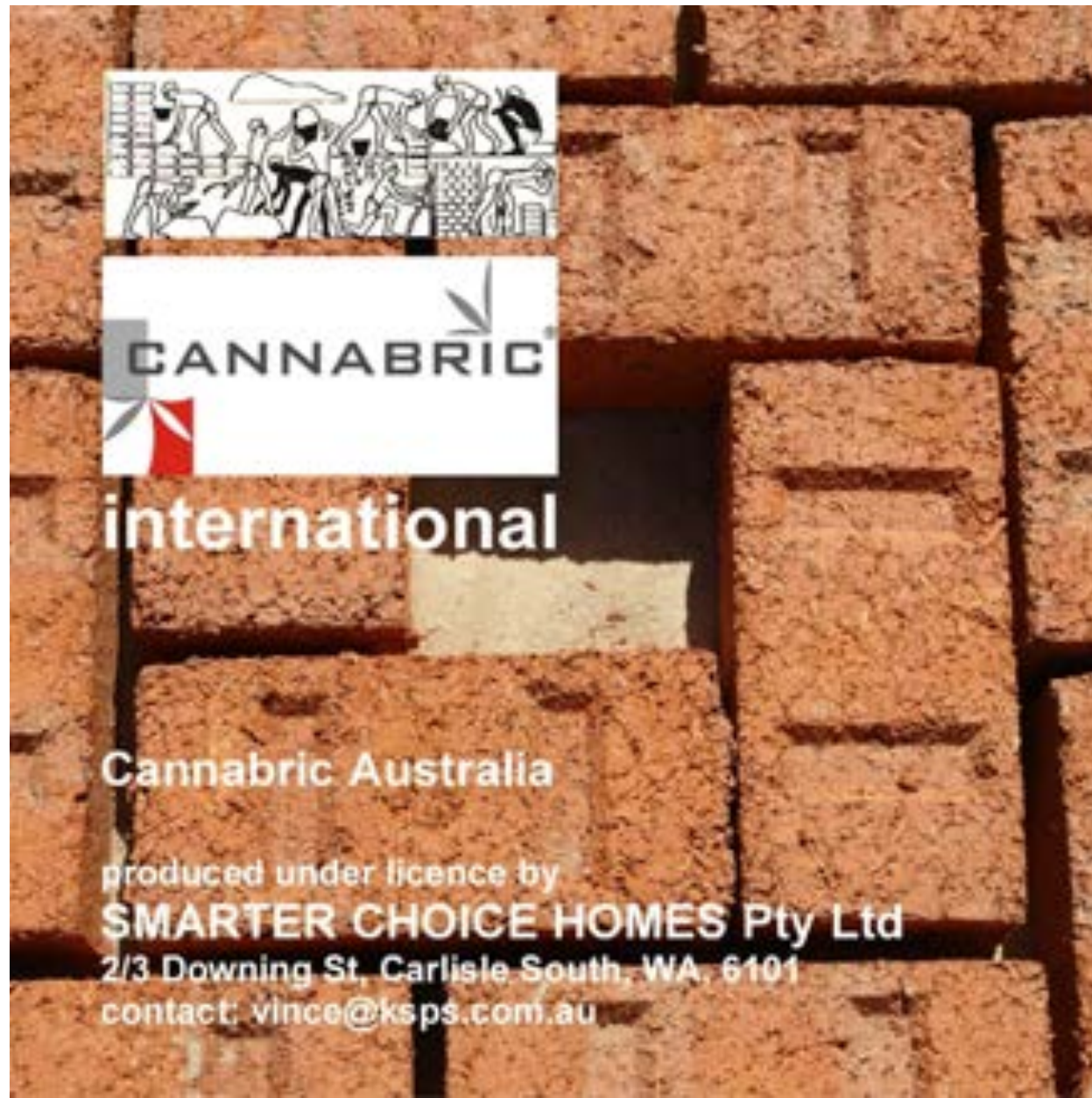


Cannabris houses exteriors
architect: Almudena Mateo-Sagasta (Spain)



Cannabric houses exteriors
arquitect: Almudena Mateo-Sagasta (Spain)

1. SPREADING KNOW HOW, saves time:
New partnerships, are creating opportunities all over the world.







international

Cannabric Australia

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contact: vince@ksps.com.au



2. RESEARCH

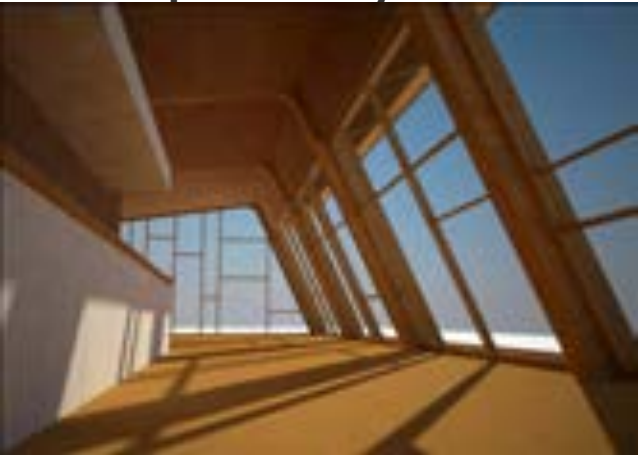
(GRANADA UNIVERSITY, OXFORD UNIVERSITY)

- investigation on pathologies and climate adapted use of different binders and compositions in hemp-mortars**
- into the thermal performance and durability of such materials in different circumstances**

3. GREENBUILDING - PRODUCT -

DEVELOPMENT

of premade elements for modular housing, for progress in the field of construction in adaption to the economic needs and the responsibility for the



An advertisement for cannabpanel industrial hempbuilding. The background is a large, reddish-brown textured wall with several rectangular openings. Text is overlaid on the image. At the top, there are small, faint labels for different parts of the structure: 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre', 'Canal de la poutre'. The main text reads: 'cannabpanel® industrial hempbuilding', 'energy saving surrounding on a large scale'. At the bottom, there is a logo for 'I + D CANNABRIC' and the website 'www.cannabric.com'. A small inset image shows a person standing next to a large panel.

Divulagation and exchange for increasing use of low impact materials in construction



**II International
hempbuilding congress
of IHBA (Granada/ Spain
2011)**



thank you.

danke.

gracias.

merci.

bedankt.

شُكْرًا.

[www. cannabric.com](http://www.cannabric.com)
www.internationalhempbuilding.org