Carbon Exchange Market

Photosynthese = \( \text{CO}_2 \)-Fixation

\( 120 \text{ Gt C} \)

Respiration

\( 60 \text{ Gt C} \)

"Biomass" (NPP): 
\( 60 \text{ Gt C} \)

Soil - Corg 
\( \sim 1 + \% \text{ C} \)

\( \text{CO}_2 \)
Carbon Exchange Market

Photosynthesis = $\text{CO}_2$-Fixation

120 Gt C

Respiration

"Biomass" (NPP): 60 Gt C

Soil - Corg ~1 + % C

60 Gt C

$\text{CO}_2$

60 Gt C

60 Gt C
Carbon Exchange Market

Photosynthese = CO$_2$-Fixation

120 Gt C

Respiration

"Biomass" (NPP): 60 Gt C

CO$_2$

60 Gt C

Boden - Corg ~1 Gt C

Pyrolyse ~5 Gt C

human emissions

60 Gt C
Carbon Exchange Market

Photosynthesis = CO$_2$-Fixation

120 Gt C

Respiration

"Biomass" (NPP): 60 Gt C

CO$_2$

Reduction - 5 Gt C

60 Gt C

Boden-Corg ~1 + % C

Pyrolyse ~ 5 + Gt C

60 Gt C
Biomasse Waste in Germany

### Auszug der Anteile verschiedener Quellgruppen (ohne LUC) an den Treibhausgasemissionen (UBAa, 2012; EEA, 2011)

<table>
<thead>
<tr>
<th>Quellgruppe</th>
<th>Menge</th>
<th>Verwendung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biowaste</td>
<td>4,2 Mio. t</td>
<td>Composting</td>
</tr>
<tr>
<td>Green clippings</td>
<td>4,4 Mio. t</td>
<td>Composting</td>
</tr>
<tr>
<td>Food waste</td>
<td>1,8 Mio. t</td>
<td>Methanisation</td>
</tr>
<tr>
<td>Organic part of household waste</td>
<td>4,9 Mio. t</td>
<td>burning</td>
</tr>
<tr>
<td>Landscampe management</td>
<td>0,8 Mio. t</td>
<td>Keep on site burning</td>
</tr>
</tbody>
</table>

Deutschland (2010) [ca. 937 Mio. Mg]
# Carbon Emission vs Carbon Waste

Auszug der Anteile verschiedener Quellgruppen (ohne LUC) an den Treibhausgasemissionen (UBAa, 2012; EEA, 2011)

<table>
<thead>
<tr>
<th>Quellgruppe</th>
<th>Menge</th>
<th>Verwendung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biowaste</td>
<td>4,2 Mio. t</td>
<td>Composting</td>
</tr>
<tr>
<td>Green clippings</td>
<td>4,4 Mio. t</td>
<td>Composting</td>
</tr>
<tr>
<td>Food waste</td>
<td>1,8 Mio. t</td>
<td>Methanisation</td>
</tr>
<tr>
<td>Organic part of household</td>
<td>4,9 Mio. t</td>
<td>Burning</td>
</tr>
<tr>
<td>Landscampe management</td>
<td>0,8 Mio. t</td>
<td>Keep on site burning</td>
</tr>
</tbody>
</table>

250 Mio t C : 5.4 Mio t C

2%
Carbon Exchange Market

Photosynthesis = CO$_2$-Fixation

120 + x Gt C

Respiration

"Biomass" (NPP): 60 Gt C

Reduction - 5 Gt C

CO$_2$ Reduction - 5 Gt C

Pyrolyse ~ 5 + Gt C

Boden-Corg ~1 + % C
Doubling Photosynthesis

Allan Savory – Savory Institute, 2013, Simbabwe
Doubling Photosynthesis

Lessons from the Loess Plateau – John D. Liu, China

Hope in a Changing World –
http://www.youtube.com/watch?v=rQjKLYcu1PI&feature=youtu.be
Doubling Photosynthesis

Lessons from the Loess Plateau – John D. Liu, China

Hope in a Changing World –
http://www.youtube.com/watch?v=rQjKLYcu1PI&feature=youtu.be
Climate Farming

photosynthesize

carbonize
55 Uses of Biochar

Soil amendment

Livestock farming

Biogas produktion
55 Uses of Biochar

Soil amendment

Livestock farming

Biogas produktion

Decontamination of soil and natural water
17. Soil additive for soil remediation, 18. highly adsorbing, plantable soil substrates 19. A barrier preventing pesticides getting into surface water 20. Treating pond and lake water

2.6 Waste water and sewage treatment

2.7 Treatment of drinking water
27. Micro-filters, 28. Macro-filters in developing countries

2.8 Exhaust filter
29. Controlling emissions, 30. Room air filters
55 Uses of Biochar

Building material

Textile industry
45. Fabric additive for functional underwear, 46. Thermal insulation for functional clothing, 47. Deodorant for shoe soles

Food industry
48. Conservation of food 49. Digesting helper
55 Uses of Biochar

Industry

Building material

Textile industry
45. Fabric additive for functional underwear, 46. Thermal insulation for functional clothing, 47. Deodorant for shoe soles

Food industry
48. Conservation of food, 49. Digesting helper

Wellness
48. Filling for mattresses, 49. filling for pillows

Radio protection
50. Shield against electromagnetic radiation (microwaves, TV, Netzgeräte, computer)

Further uses
Industrial materials (31. carbon fibres, 32. plastics)
Electronics (33. semiconductors, 34. batteries)
Metallurgy (35. metal reduction)
Cosmetics (36. soaps, 37. skin-cream, 38. therapeutic bath additives)
Paints and colouring (39. food colorants, 40. industrial paints)
Energy production (41. pellets, 42. substitute for lignite)
Medicines (43. detoxification, 44. carrier for active pharmaceutical ingredients)
55 Uses of Biochar

Building material

Textile industry
45. Fabric additive for functional underwear, 46. Thermal insulation for functional clothing, 47. Deodorant for shoe soles

Food industry
48. Conservation of food 49. Digesting helper

Wellness
48. Filling for mattresses, 49. filling for pillows

Radio protection
50. Shield against electromagnetic radiation (microwaves, TV, Netzgeräte, computer)

Further uses
Industrial materials (31. carbon fibres, 32. plastics)
Electronics (33. semiconductors, 34. batteries)
Metallurgy (35. metal reduction)
Cosmetics (36. soaps, 37. skin-cream, 38. therapeutic bath additives)
Paints and colouring (39. food colorants, 40. industrial paints)
Energy production (41. pellets, 42. substitute for lignite)
Medicines (43. detoxification, 44. carrier for active pharmaceutical ingredients)
Cascading use of biochar
Use it nine times – pay it only once

silage

feed additive

litter additive

liquid manure treatment

composting

urban soil substrate

soil amendment

humus increase

climate farming
1. Silage

Cascading use of biochar

1.

Charging biochar with malolactic bacteria and add

1 % BC to silage

reducing mycotoxins and butyric acid, adsorption of pesticides and herbicides
2. Feed additive

Cascading use of biochar

2.

1 % BC for feeding Carbon-Feed

increases energy efficiency of digestion, decreases milk cells, adsorption of gram positive bacteria (botulism), pesticides, herbicides, reducing odors, fixation of nutrients, improvement of barn climate
Ingredients: Wheat bran (40 %), biochar (15 %), sugar cane molasses, linseed, alpine herbs, corn flakes, wheat flakes, barley flakes, minerals

Water 43 %, raw proteins 7.5 %, raw ash 5.2 %, raw fibre 4.7 %, raw fat 1.7 %, sodium 0.03 %, calcium 0.08 %, phosphorus 0.5 %, magnesium 0.2 %, lysine 2.7 g/kg, methionine 1.0 g/kg

For cows, horses, chicken, pigs, sheep – dogs, cats ...
The red colobus monkeys, *Procolobus kirkii*, eat charcoal, (Zanzibar, Tanzania). These endangered animals have specially adapted stomachs which enable them to feed principally on leaves. They eat charcoal from burnt tree stumps and branches to detoxify poisons (mainly phenolics) obtained from their leafy diet and convert them into proteines.

1% Biochar in Feed for Germany

- 13 Million cattle (650 000 t BC)
- 27 Million pigs (780 000 t BC)
- 2.4 Million sheep (43 000 t BC)
- 130 Million poultry (260 000 t BC)

1,7 Million tonnes biochar per year
5 Million tonnes CO2 per year
0.6% of annual CO2 emission in Germany

All statistics refer to Germany
Adsorption of anti-bacteria, anti-inflectica, anti-parasitica, hormones, analgetica, pathogenes, herbicides, pesticides

Cost of annual animal drugs: 19.2 Billion US-Dollar worldwide
Reduction of methane emission caused by rumination

Figure 4. Reduction in methane due to biochar and nitrate in local “Yellow” cattle fed cassava root and cassava foliage supplemented or not with biochar and with urea or potassium nitrate as NPN source.

http://www.lrrd.org/lrrd24/11/leng24199.htm for full details

BC – Biochar
KN – form of potassium nitrate
Black Burger Methane Reduction
3. Litter Amendment
Cascading use of biochar

5 - 10 % BC in litter

The carbonised biomass is mixed in the deep litter in the cubicles

reducing humidity and odors, fixation of nutrients, reducing NH3 and CH4 emissions, ameliorates hygiene, hoof infections
Biochar induced ammonia reduction in chicken farm
4. Liquid manure additive
Cascading use of biochar

4.
1-1,5 % BC
in liquid manure

Reducing NH3-losses, methane emissions, increases plant nutrient efficiency, decreases nutrient leaching and odors
Ammonia reduction through treating liquid manure with acidified biochar

Cumulative loss of NH$_3$, relative to the control:
- Slight increase for BC22
- 5-10% reduction for BC24
- Strong reduction for PSBC24 and PS (low pH of the slurry)

**Figure 2:** Cumulative ammonia loss during 8.5 h of measurement (21 days of storage) relative to Control.

BC - Biochar
PS – Phosphoric acid
Acidification & Charging with nutrients and MO lactic fermentation

Injecting
- vinasse (rich in sugar, proteins, N, P, K)
- rock powder (micro nutrients)
- lactic bacteria

Fill it into airtight big bags for anaerobic fermentation for 10 to 14 days

pH 4.5 to 5.5
Charged with lactic acids, pyruvat, inactivated cells
EBC – barn protocol

Stallprotokoll: 2 - Milchkühe / 20.01.2013 22:53

Futtermittel

[400] Bitte geben Sie die gewöhnlich verwendete Futterzusammensetzung in Prozent an:

- 60% Wiesenheu
- 30% Zuckerrohrknusprige Suppe
- 10% Maisilage

- Angaben in % Trockensubstanz
- Angaben in % Feuchtmasse
- Angaben in % Vol

[405] Welche Futterzusätze verwenden Sie (z.B. Steinmehle, Aktiv, Probiotika, Laktulose, Enterokokken, Algextrakt, Vitamine, Mineralstoffe etc.)?

Gesteinsmehl

[410] In welcher Form geben Sie die Pflanzenkohle zur Fütterung?

CarbonFutter

[415] Welche Menge Pflanzenkohle erhalten die Tiere pro Tag [in g pro kg Lebendgewicht]?

123 g pro kg Lebendgewicht
First results from 30 farms

**Biochar for bedding:**

84% less odors
**First results from 30 farms**

**Biochar for bedding:**
84% less odors

**Biochar as feed additive:**
77% less dysenterie
62% animals are calmer and balanced
77% less odor in barns
Observation: cells in milk decreased, less streptococcus, less rumen ulcer, better fitness
First results from 30 farms

**Biochar for bedding:**
84% less odors

**Biochar as feed additive:**
77% less dysenteries
62% animals are calmer and balanced
77% less odor in barns
Observation: cells in milk decreased, less streptococcus, less rumen ulcer, better fitness

**Biochar as liquid manure additive**
79% less odors
63% less cauterization of the liquid manure
More examples from livestock farms with CarbonFeed

Poultry farms
3 days after beginn of treatment with fermented biochar, vermifugation of round worms took place

Cow farm
one year after beginning administration, cows did not need any veterinary treatment during the first year of administration

Swine farms
pigs did not need any more antibiotic treatment during the first six months of administration

Chicks
the mortality rate decreased in a chicken farm, while at the same time a high and continual increase in weight of 90 - 100g per day was observed
5. Composting the manure

Cascading use of biochar

5.

Composting the carbon manure + the separated solids of the liquid manure

10 – 20% BC

Terra Preta
Composting with biochar

- 20% - 25% less C-lost
- 12% - 20% less N-lost
reduction of GHG during composting

Figure 2. Changes in N2O emission rate during pig manure composting.

Chen et al. 2010, Chemosphere 78: up to 65% reduced N loss (total Kjeldahl N) with up to 9% bamboo biochar addition (pig manure + sawdust +/- BC (pH 8.8)

Peat substrate vs BC-compost pumpkin

peat ED73  peat substitute  soil  compost  BC-compost
Peat substrate vs BC-compost pumpkin

Biomass – fresh weight

- Kompost
- BC-Kompost
- Kompost+BC
- ED 73
- TE
- PT
Nicotina benthamiana
Nicotina benthamiana

Biomass – fresh weight

[g]

Kompost  BC-Kompost  Kompost+BC  ED 73  TE  PT
Beet root
Beet root

Abb. 4.3: Biomasse von Blättern und Knollen bei roter Rübe (Beta vulgaris 'Cylindra'), Mittelwerte (+ Stabw. nur bei der Gesamtbiomasse).
Summary – biomass yield changes

ANOVA mean: p<0.001

% of "Compost" (=100%)

- Compost
- BC-Comp.
- Comp.+BC
- ED73
- Peat-subs.
- Palaterra

- mean all species
- % Nicotiana (leaves)
- % Calendula (total)
- % Lolium (total)
- % Beta vulgaris (roots)
- % Lycopersicum (fruits)
- % Cucurbita (total)
Total soluble nitrogen in biochar after composting

Prost, Borchard et al. (2012)

Total soluble nitrogen, gasification coke: from 0.0 to 11 705.5 mg kg⁻¹,
charcoal from 3.2 to 377.2 mg kg⁻¹
Nitrate extraction from composted biochar

\[ \sum \text{Nitrate N BC+} : 2078 \text{ mg N kg}^{-1} \]
Swiss Terra Preta

greenhouse substrates, urban farming, pot substrates, special cultures, tree nursery

Corresponding to 1000 t biochar / ha
Biochar-Compost Substrates

100% BC

70% BC

45% BC

0% BC

15% BC

30% BC
Biobeds for streetwater decontamination

Blanc, Boivin, Schmidt (2013)
Planting trees with terra preta

Highly concentrated hotspots close to the roots
under the roots: biochar substrates
7. Soil Amendment
Cascading use of biochar

7.
Soil amendment
Fixation of nutrients
Increase of SOM
free ranging animals
biocharen gesunden Boden
in combination with photosynthesizing green cover
10 kg biochar per sheep and year
8. Increase of humus (SOC)

Cascading use of biochar

Abiven S et al. – University Zurich

Data from a vineyard field trial in Valais

10 t BC / ha = ca. 0.5% total C in upper soil
8. Increase of humus (SOC)
Cascading use of biochar

Data from a vineyard field trial in Valais

Abiven S et al. – University Zurich

N=5
upper soil
30 cm

10 t BC / ha
= ca. 0.5%
total C in
upper soil

Vagabonde Control
Vagabonde biochar + compost
8. Increase of humus (SOC)
Cascading use of biochar

Data from a vineyard field trial in Valais

Abiven S et al. – University Zurich

10 t BC / ha = ca. 0.5% total C in upper soil

27 t CO2 / ha

N=5
upper soil 30 cm
9. Carbon sequestration: SOM, BC
Reducing NH3, CH4

CO2-certificate?
Cascading use of biochar

Use it nine times – pay it only once

- silage
- feed additive
- litter additive
- liquid manure treatment
- composting
- urban soil substrate
- soil amendment
- humus increase

climate farming
Slow release carbon fertilizer

Carbon and Nutrient Recycling

Slow release carbon fertilizers
wool – cont. 12% Amino-N
wool + 20% Biochar
wool + 20 % BC + 20 % vinasse (7% Norg)

Norg – Nitrogen bound in organic molecules or cells
Vinasse - cheap organic fertiliser a waste from sugar made from cane sugar
BC - Biochar
wool + 20 % BC + 20 % vinasse + 30% pyrolyse ash
(7% Norg / 6.5% P$_2$O$_5$ / 6% K$_2$O)
Slow release Carbon Fertilizer (8% Norg)

pyrolyse the carbon rich biomass

and

charge it with nutrient rich biomass
Biochar will play its most important agronomic role as additive where organic matter decomposes or labile organic matter tends to get lost.
Decontamination of waste water
Adsorption of contaminants by activated biochar

DF = Diclofenac (Entzündungshemmer)
BT = Benzotriazole (Rostschutzmittel)
Magnetic charging of biochar

Biochar

Ferrous sulfate
Integrated Activation of Biochar

- **Feedstock blending**
- **High temperature activation > 600°C:** KOH or K2CO3
- **Middle temperature activation (< 600°C):** H3PO4 or lacto ferments
- **Low temperature charging with Nutrients**
- **Outgasing & condensation**
- **Low temperature inoculation with MO**

Diagram:
- Gas flow and pressure
- Rektor
- Brennkammer
- KOH or K2CO3
- H3PO4 or lacto ferments
- Feedstock blending
- Low temperature charging with Nutrients
- Outgasing & condensation
- Low temperature inoculation with MO
<table>
<thead>
<tr>
<th>Betriebsbeurteilung Pflanzenkohle - Biochar</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>bio.inspecta-Nummer</td>
<td></td>
</tr>
<tr>
<td>Betrieb</td>
<td></td>
</tr>
<tr>
<td>Name, Vorname</td>
<td></td>
</tr>
<tr>
<td>Adresse</td>
<td>Tel.</td>
</tr>
<tr>
<td>PLZ, Ort</td>
<td>E-mail</td>
</tr>
</tbody>
</table>

**Allgemeine Anmerkungen des Inspektors**

---

**Antrag des Inspektors**

- Anerkennung als basic, premium oder bio: [ ]
- Der Betrieb kann nicht anerkannt werden: [ ]
- Fehlende Unterlagen nachteilen (Frist: 6 Wochen): [ ]

Datum, Stempel, Unterschrift Inspektor/Inspektörin:

Datum, Stempel, Unterschrift Betriebsleiter/Betriebsleiterin:

Durch die Unterzeichnete hat die Unterlagen eingesehen und bestätigt die Vollständigkeit und Richtigkeit der bei der Kontrolle gemachten Angaben. Er/ Sie hat die Auflagen und Fristen zur Kenntnis genommen. Soweit nicht anders vermerkt, müssen die Auflagen inkl. Fristen gemäß Inspektort/inspektörin eingehalten werden.

**Anmerkung der Zertifizierungsstelle**

---

**Entscheid der Zertifizierungsstelle (q.inspecta)**

- Anerkennung gemäß Antrag des Inspektors: [ ]
- Anerkennung als basic, premium oder bio: [ ]
- Der Betrieb wird nicht anerkannt: [ ]

Datum, Stempel, Unterschrift Zertifizierter Zertifiziererin:

---

*European BioChar Certificate*
# EBC-Certificate

www.european-biochar.org

analyses from accredited labs

<table>
<thead>
<tr>
<th>ID</th>
<th>Massnahme</th>
<th>Analysewert</th>
<th>Anlage</th>
<th>Methode</th>
<th>Bemerkungen, Grenzwerte</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eingesetzte Biomasse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td><strong>Es wurden ausschließlich naturbelassene, unbehandelte, lösungsmittelfreie organisiche Biomassen verwendet?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td><strong>Es wurden ausschliesslich Biomassen verwendet, die auf der Positivliste geführt sind?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>130</td>
<td><strong>Wurden landwirtschaftliche Primärprodukte (Navaro) verwendet?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>140</td>
<td><strong>Landwirtschaftliche Primärprodukte (Navaro) stammen ausschließlich aus biologischem Anbau. Ein aktuelles Zertifikat liegt vor.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>340</td>
<td>Blei-Konzentration der Pflanzenkohle in gt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>350</td>
<td>Cadmium-Konzentration der Pflanzenkohle in gt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>Kupfer-Konzentration der Pflanzenkohle in gt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Control of sustainable production (feedstock positive list)

#### Quality control of biochar

#### Characterization of biochar

#### Classification of biochar

<table>
<thead>
<tr>
<th>Measure</th>
<th>Source</th>
<th>Approves</th>
<th>Source</th>
<th>Remarks, Defects, File</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allgemeines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>001 Die Pflanzenkohle-Biochar Richtlinien liegen den Berichte vor und sind ihm bekannt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>002 Auflegen aus dem Vorjahr erfolgt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dokumente</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>010 Eingangsbelege Rohstoffe vollständig vorhanden</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>011 Produktionsprotokole vollständig vorhanden</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warenverpackung</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>020 Auf Lieferscheinen und/oder Rechnungen ist die Qualität der</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **250** Sauerstoffs-Konzentration im Abgas der Synthesegasverbrennung (bez. auf 11 vol% O2) wird eingehalten
- **260** NOx-Konzentration im Abgas der Synthesegasverbrennung (bez. auf 11 vol% O2) wird eingehalten
- **270** Gesamt-C-Konzentration im Abgas der Synthesegasverbrennung (bez. auf 11 vol% O2) wird eingehalten
55 Uses of Biochar

Building material

Textile industry
45. Fabric additive for functional underwear, 46. Thermal insulation for functional clothing, 47. Deodorant for shoe soles

Food industry
48. Conservation of food 49. Digesting helper

Wellness
48. Filling for mattresses, 49. filling for pillows

Radio protection
50. Shield against electromagnetic radiation (microwaves, TV, Netzgeräte, computer)

Further uses
Industrial materials (31. carbon fibres, 32. plastics)
Electronics (33. semiconductors, 34. batteries)
Metallurgy (35. metal reduction)
Cosmetics (36. soaps, 37. skin-cream, 38. therapeutic bath additives)
Paints and colouring (39. food colorants, 40. industrial paints)
Energy production (41. pellets, 42. substitute for lignite)
Medicines (43. detoxification, 44. carrier for active pharmaceutical ingredients)
Biochar in Textile Industry

45. Fabric additive for functional underwear,
46. Thermal insulation for functional clothing,
47. Deodorant for shoe soles

30% bambou-char
Conservation of Food

Regulation of humidity, anti-bacteriologic, adsorption of ethylen
Cosmetics

36. soaps, 37. skin-cream, 38. therapeutic bath additives)
Graphen

33. semiconductors, 34. batteries, 35 nanotubes

TEM of Activated carbon from DDGS biochar (KOH 0.075 1050 °C). TEM at 20 nm,
Graphen
Biochar-Clay-Plaster for optimal indoor climate

humidity control, thermal insulation, toxin fixation, electro-magnetic shielding
Jet application of biochar + argile + sand
Biochar for habitats
Effects of Biochar-Plaster

- Regulation / buffering of humidity
- Insulation
- Noise protection
- Toxin binding (solute, VOC)
- Blocking of high frequency radiation
- Low electrostatic charging of air
- Conservation of wood
- Reduction of dust (Milben!)
Effects of Biochar-Plaster

- Deodorising
- aesthetic
- Anti-bacteriological, fungicide (repellent)
- Air cleaning
- Increase of redox potential
- Emission of far-infrared radiation
Ithaka Institute’s conferencing room
Ithaka Institute’s conferencing room
Painted with Claycolour
Biochar Bricks

Cement
Lime
Clay
Light Weight Biochar Bricks can swim.
Water Uptake of Biochar Bricks

biochar-cement – bricks
water up-take after 12 hours

- 3:1
- 5:1
- 4:1:1
Fridge House in Kenya
Biochar Housing as Carbon Sink

1 t biochar (DM) stocks some 3 t CO2equ
Biochar Housing as Carbon Sink

To be recycled after 1000 years as organic litter soil amendment
Biochar Pillows
sleep on you char
carbon recycling is the key for the sustainable development of the human civilisation

At least 4 Gt C would have to be fixated by biomass recycling while reducing the human emissions by at least 5 Gt C.
Where do we get the Carbon from?
Where do we get the Carbon from?

Double the terrestrial biomass production
Carbon Exchange Market