
THE FUTURE OF MATERIALS
AND ENERGY
COP23
CLEAN CARBON
TECHNOLOGY

THE FUTURE OF MATERIALS AND ENERGY

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Carbon fiber is already used in some applications.

Automotive / Mobility / Sports

Aviation

Construction ?

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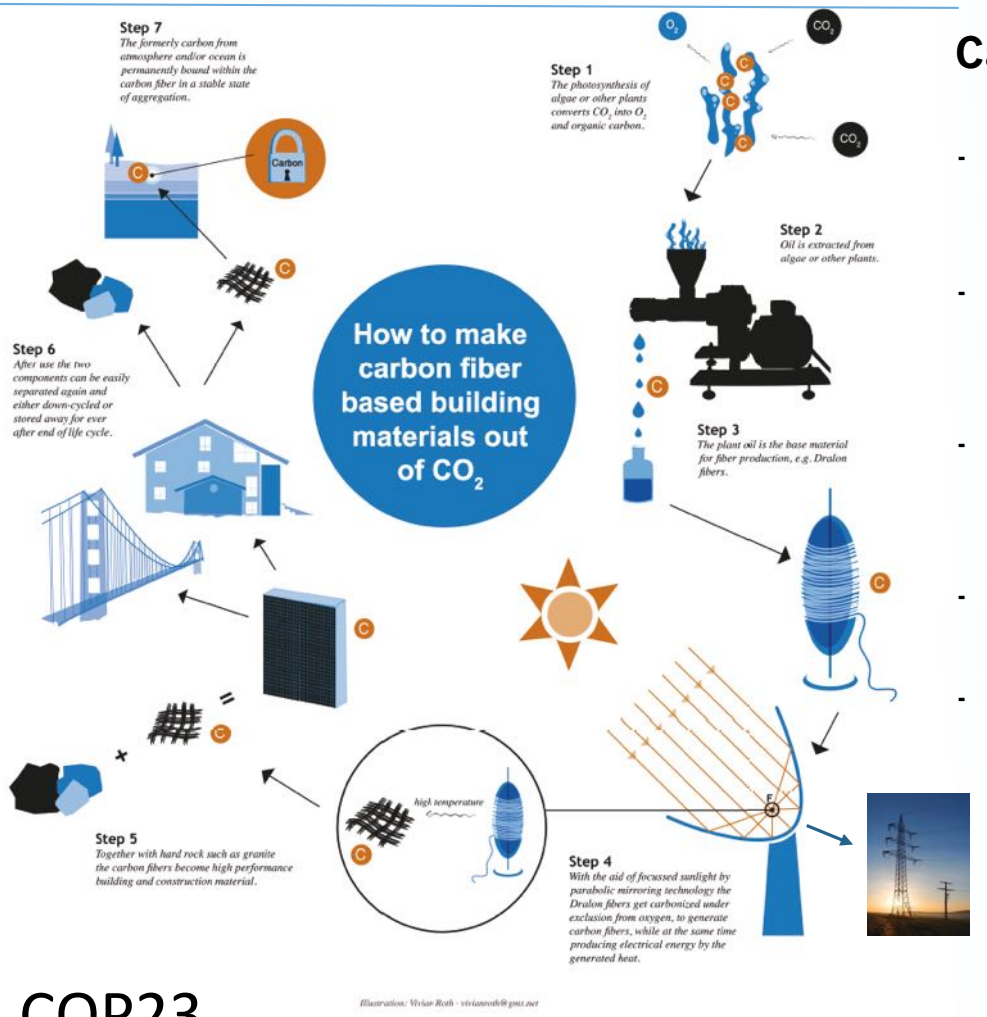

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Carbon negativity is being reached by:

- making of the precursor fiber from algal oil being fed with air bound CO_2
- using focused sunlight for simultaneous fiber + electricity production
- replacement of steel, aluminum and concrete by carbon fibers + minerals
- separation of carbon and minerals after use
- storage of solid state carbon underground

leading over time to **carbon negativity** since we make the material out of CO_2

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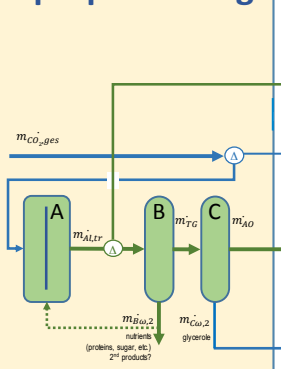
Interconnected R&D domains

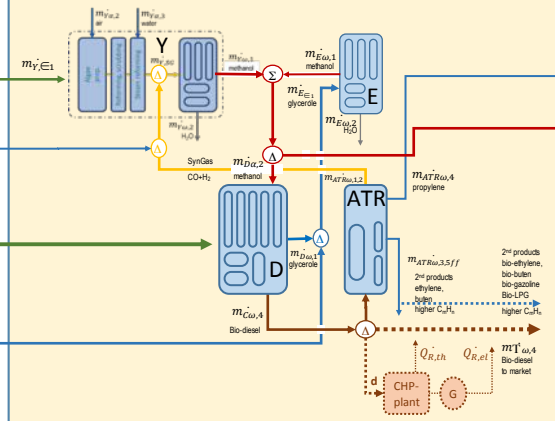
- towards proof of concept by prototypes

algae farming + preprocessing



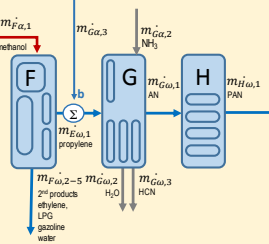
New! based on TUM-Know-How

algae biomass2chem refinery → alcohols & olefins



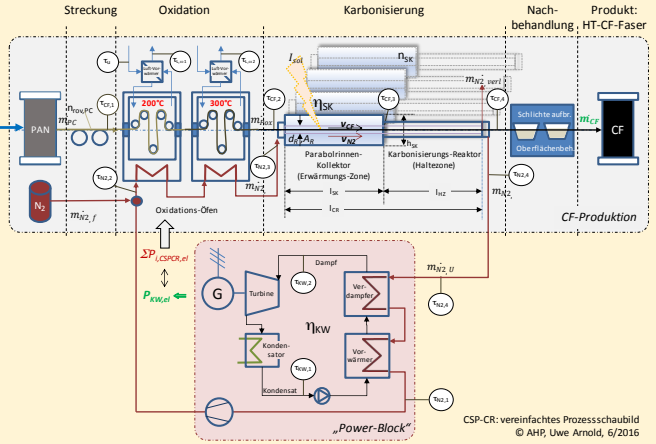
in process-combi based upon known partial processes + CCT-Know-How

existing chem. industry facilities



Existing plants in D, US, CN

CSP-CR



New!

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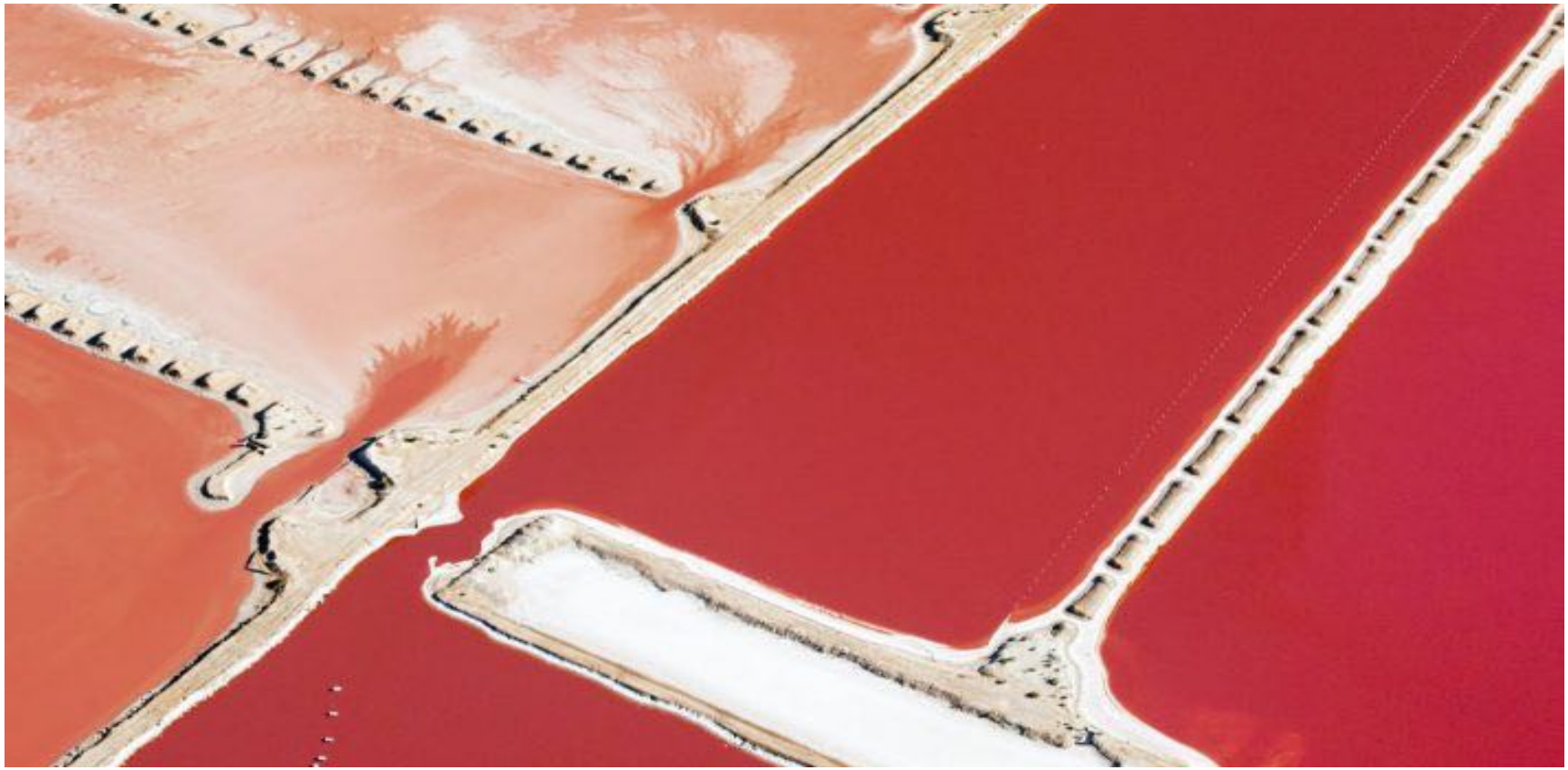
Existing Algae farming Hutt Lagoon, Autralia - winning of Beta Carotin



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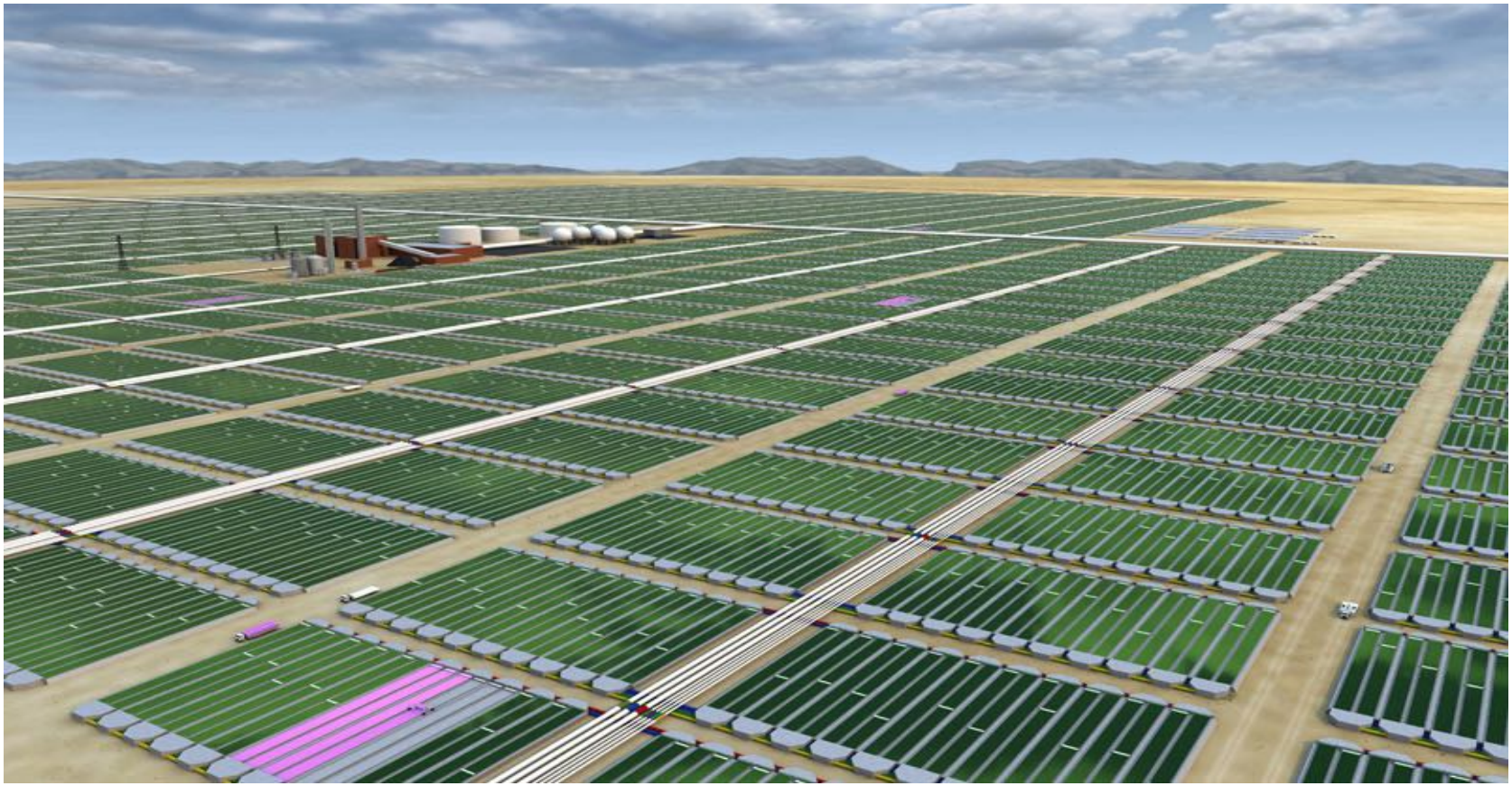
animated future projection, Algeria, Iran, Mexico, China, India and Australia



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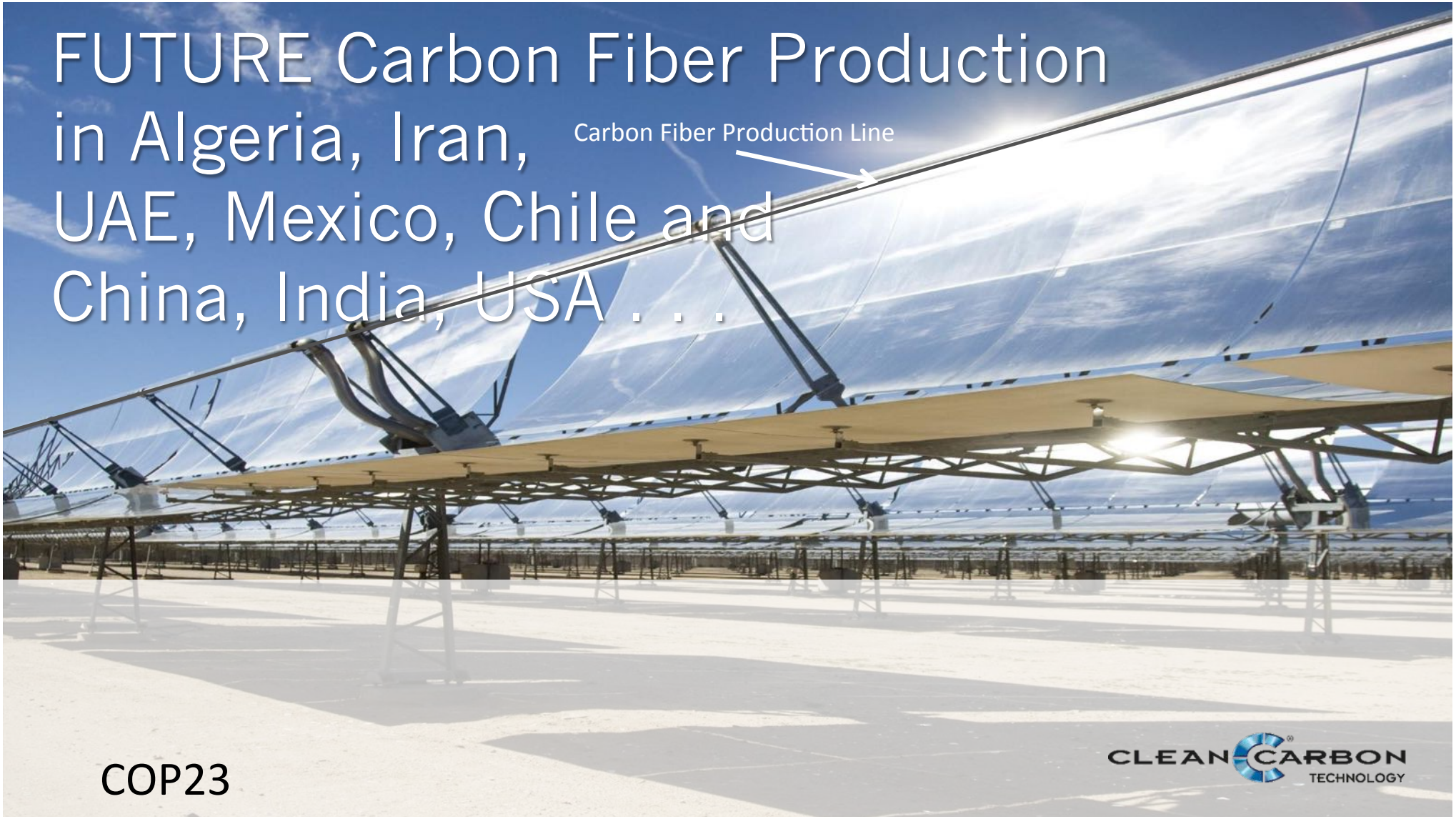
FUTURE Carbon Fiber Production
in Algeria, Iran,
UAE, Mexico, Chile and
China, India, USA . . .
Carbon Fiber Production Line
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Stone

Africa – Nero Assoluto Granite

- **Hard stone has unlimited availability, contrary to lime stone (cement)**

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anywhere else: Germany, France, China, India, New Zealand, Norway, Ireland and Switzerland

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Carbon + Stone is a new hybrid material replacing steel, aluminum and concrete

CFM® CarbonFiberMinerals

- **Granite has about the same specific weight as Aluminum → 2,6 – 2,9 g/cm^3**
- **Granite has about the same e-Modulus as Aluminum → 40 – 80 GPa**
- **pressure strength → up to 300 N/mm^2 → 4 x better than concrete**

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. . . railway sleeper, 3,3 mio load reversal test 50 . . . 128kN

DB requirements for concrete sleeper 176kN (Schienenauflager)

Prof. Dr.-Ing. Ö. Bucak

Hochschule München
Labor für Stahl- und Leichtmetallbau
Karlstrasse 6
80333 München
Tel.: ++49 (0)89/1265-2611
Fax: ++49 (0)89-1265-2699
Mobil: ++49 (0)179-2058861
Email: bucak@laborsl.de

Das Labor is a DIBt bauaufsichtlich acjknowleged
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. . . railway sleeper, 10 mio load reversal test 50 . . . 176kN

DB requirements for B70 concrete sleeper 176kN (Schienenauflager)

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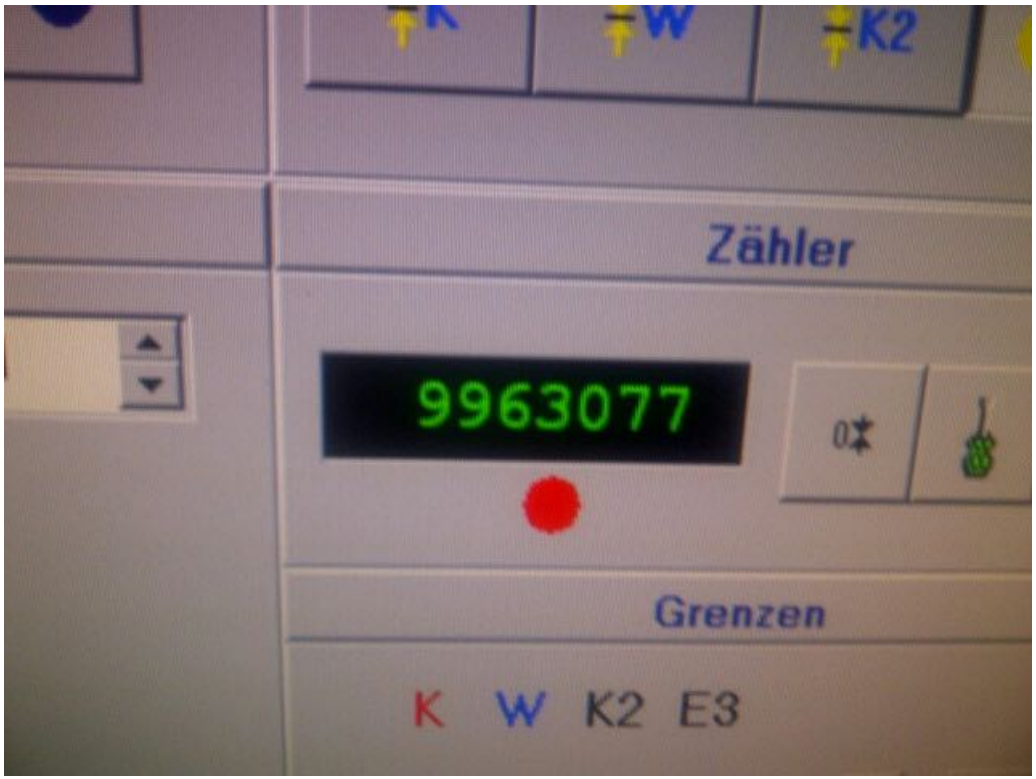
. . . railway sleeper, 10 mio load reversal test 50 . . . 176kN

DB requirements for B70 concrete sleeper 176kN (Schienenauflager)



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. . . railway sleeper, 10 mio load reversal test 50 . . . 176kN

DB requirements for B70 concrete sleeper 176kN (Schienenauflager)

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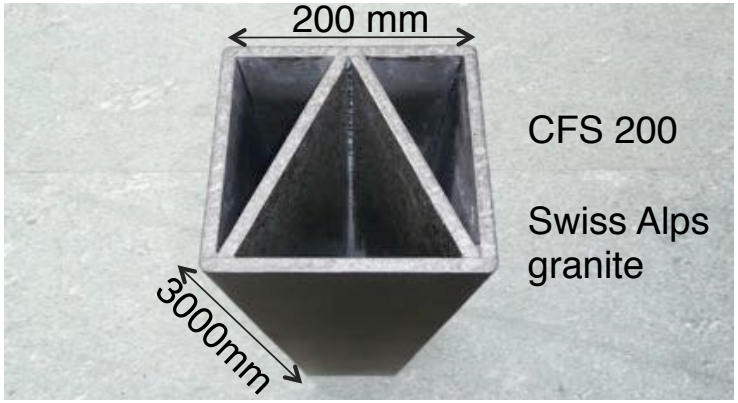
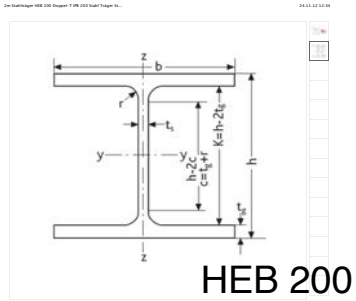
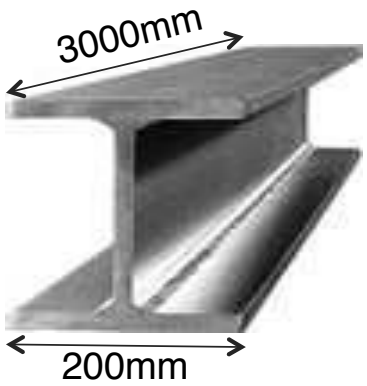
pillar from CFM® in contrary to steel at same dimensions







vertical load before breakage 1470 kN

(150 t = 100 x VW Golf 6)

- 2 x lighter
  - Stahl 195 kg (3 m)
  - CFM® 105 kg (3 m)

- 50% + less production energy

According to german Energy-Mix in 2010:

- Steel : ***301 kg*** **of CO_2**

versus

- CFM®: ***140 kg*** **of CO_2**

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MineralCarbonCompositeTechnology MCT®

- natural mineral resource hard stone
  - unlimited availability
  - durable and non-rusting
  - better insulation properties than metals and concrete
  - non flammable
  - recyclable
  - same spec. weight like aluminum
  - much less thermal expansion
  - very good damping properties
  - all material properties of stone fit perfectly with those of carbon fibers
  - can be perfectly combinded with glass

3,0 mm MCC® Platte

House wall from 20 mm thin MCC® plates with insulation layer from PUR foam between the plates

4 x lighter than concrete wall

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photovoltaic glass-glass module with frame from MCC®

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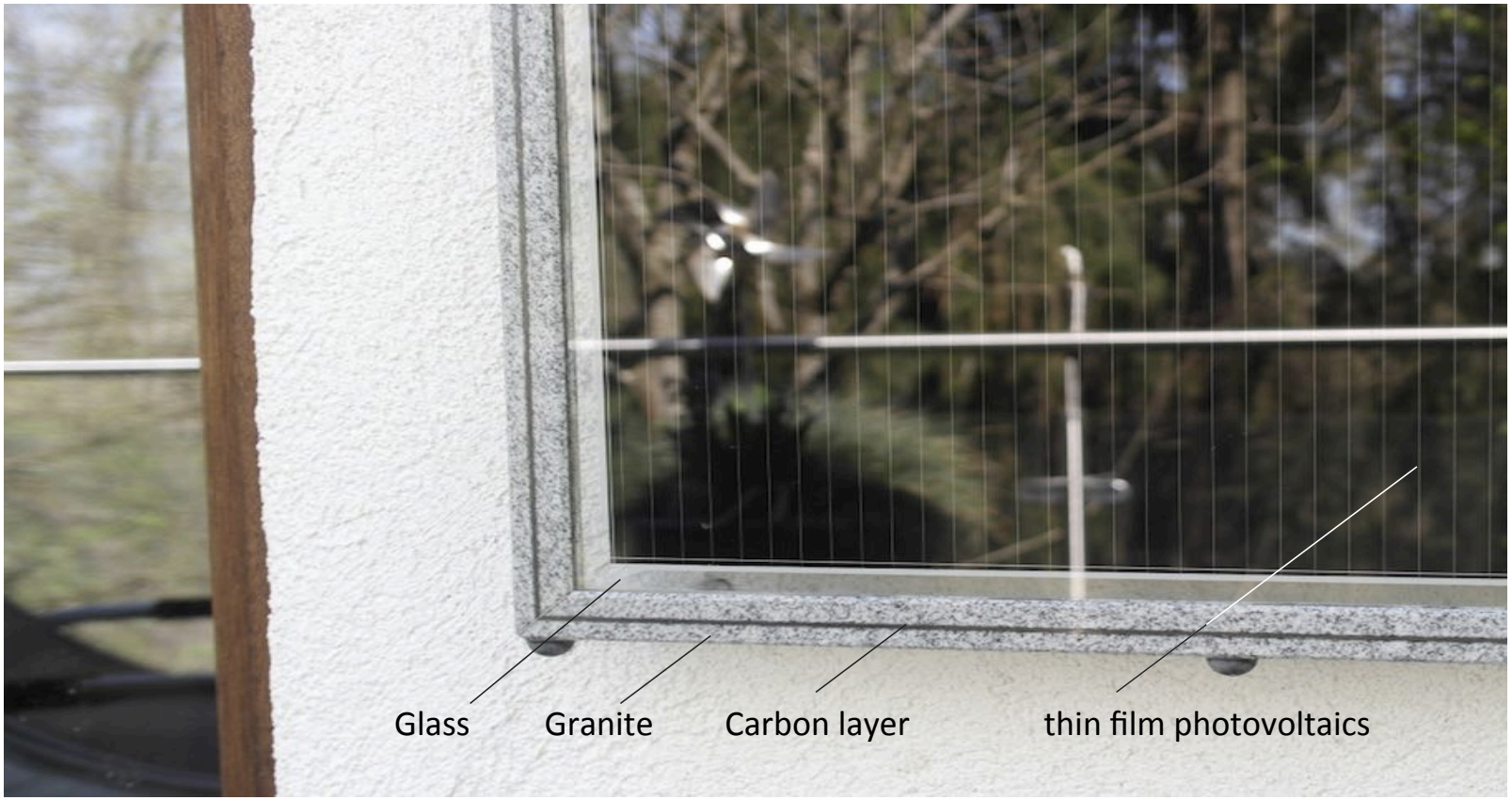
frame from MCC® is fixed to the glass by hard bonding



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responding to climate change by help of carbon fibers made from algal oil

over time emission-negativity

20% of all CO_2- emissions come from steel & cement production

- **in order to replace 1,6 Gt of Steel needed per year → we need 1,1 Gt of Carbon Fiber**
- **in case the Carbon Fiber will be produced from algal oil about → 4 Gt/a CO_2 will be hold back and later on withdrawn from atmosphere (in case we are using air bound CO_2)**

4Gt CO_2 / a means withdrawal of 1532 Gt CO_2 in 2400

representing all emissions of the past 200 years

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Frame profile for automotive industry from
Carbon fibers and African granite

- Granite
- Salt water
- Carbondioxide
- Deserts
- and Sunlight

are all limitless resources !

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Emanuel Macron asks the question of all questions: „ . . . is this made of CO_2?“

- Granite
- Salt water
- Carbondioxide
- Deserts
- and Sunlight

are all limitless resources !

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Thank you for Your attention

- **Granite**
- **Salt water**
- **Carbondioxide**
- **Deserts**
- **and Sunlight**

are all limitless resources !

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