

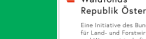


Kreislauffähiger 3D-Druck von Holzwänden: Vom Konzept zu ersten Prototypen

Benjamin Kromoser

23.10.2024

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Waldfonds
Republik Österreich

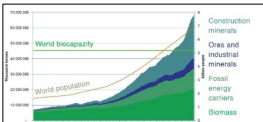
Eine Initiative des Bundesministeriums
für Land- und Forstwirtschaft, Regionen
und Wasserwirtschaft



1

Herausforderungen





The chart illustrates the projected resource demand for various materials from 2010 to 2050. The y-axis represents the 'Number of people' (0 to 70,000,000,000), and the x-axis represents the year (2010 to 2050). The chart compares 'World biocapacity' (green line) with 'World population' (yellow line). The stacked areas represent different resource categories: Biomass (dark green), Fossil energy carriers (blue), Industrial minerals (light blue), Ores and industrial minerals (dark blue), and Construction minerals (lightest blue). The chart shows that by 2050, the demand for construction minerals will exceed world biocapacity.

Quelle: (1) New materials. (sustainable 2015). European commission. (materialis.statista.com) (world's population)

Prof. Bergersen Krommeser 23.10.2024

2

2

Herausforderungen

Left Chart: Normalized Consumption

Category	Value
Jäger- und Sammler Ackerbaugesellschaft	20 GJ/pJ, 1 pJ/J
Energieverbrauch pro Person pro Jahr	70 GJ/pJ
Materialverbrauch pro Person pro Jahr	6 pJ/J
Industrielle Gesellschaft	400 GJ/pJ, 25 pJ/J

Right Chart: Cumulative Resource Extraction

The right chart displays cumulative extraction in Tausend Tonnen (left y-axis, 0 to 70,000) and Millionen Menschen (right y-axis, 0 to 8) from 1900 to 2050. The legend includes:

- Biomasse (green area)
- Erze und industrielle Minerale (grey area)
- Welt-Biokapazität (yellow line)
- Fossile Energieträger (dark green area)
- Baumaterialien (light green area)
- Weltverleinerung (red line)

The chart shows a significant increase in cumulative extraction of fossil fuels and minerals, with the world biocapacity line indicating a potential future resource shortage.

Quelle: (Bakel) T. Galsbol, D. Cooper, and S. Sateri: "Why we use more material," *Environmental Transactions of the Royal Society A Mathematical, Physical and Engineering Sciences*, vol. 371, no. 2055, p. 20180388, Jan. 2017, doi: 10.1098/rsta.2016.0385. (pewdie) New materials worldwide 2010. European commission. (material) statista.com. (world's population) worldpopulationreview.com.

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3

Circular economy

Graph showing World biocapacity (green line) and World population (orange line) from 1960 to 2050. The y-axis represents Biomass in Gt (0 to 70,000) and the x-axis represents Year (1960 to 2050). The graph illustrates the increasing demand for resources due to population growth and the corresponding depletion of biocapacity.

Diagram illustrating the Circular economy model, showing the flow of materials and energy between various sectors (Biomass, Renewable, Recycle, Reuse, Reduce, Repair, Refurbish, Repurpose) and the environment (Air, Water, Land). The model emphasizes the reuse and recycling of materials to minimize waste and resource consumption.

Quellen: (1) Flow materials worldwide 2016. European commission. jrc.ec.europa.eu/mixtra/population. (2) R. Kromm, S. Ruchman, R. Heilmann, B. Maza, and R. Witzmann. "Circular economy in wood construction – Analysis manufacturing of fully recyclable solid mass from renovation. Proof of concept and preliminary data." Construction and Building Materials, Vol. 264, S. 126216, Aug. 2022. doi: 10.1016/j.conbuildmat.2022.126216

Prof. Bärbel Kromm 23.10.2024

[illegible]

4

Weltweiter Bestand anthropogener Ressourcen

Materialbestand [Gt]

Legend:

- Beton
- Asphalt
- Ziegel
- Dauerplastik
- Stahl und Schrotter
- Polystyrol
- Papier
- Aluminium
- Eisen, Stahl
- Kupfer
- Andere Metalle
- Flaschenglas
- Flaschenglas
- Unschmettheit

Regions: Nord. Mittel- u. Ost. Europa, Süd. und Mittel- u. Ost. Europa, Asien (excl. China), China, Lateinamerika, Afrika, MEK, Lateinamerika, Süd. und Mittel- u. Ost. Europa

$\Sigma > 1000 \text{ Gt}$

Gesamtbestand Stadt Wien (2013) 380 Mio. Tonnen

Legend:

- Mörtel/Putz: 14%
- Ziegel: 34%
- Beton: 40%
- Andere Minerale: 8%
- Organische Materialien: 3%
- Metalle: 1%

[illegible]

5

Das Diagramm vergleicht zwei Wirtschaftssysteme:

- Kreislaufwirtschaft (oben):** Ein kreisförmiges Modell mit den Phasen **Verwertung** (mit einem grünen Pfeil von **Abriss** zu **Verwertung**), **Gewinnung**, **Herstellung**, **Einbau** und **Nutzung**. Ein grüner Pfeil führt von **Nutzung** zurück zu **Verwertung**.
- Lineare Wirtschaft (unten):** Ein gerader Prozessfluss durch die Phasen **Gewinnung**, **Herstellung**, **Einbau**, **Nutzung** und **Abriss**, verbunden durch grüne Pfeile.

6

Herausforderungen

1 m³ Beton ~ 1,25 Facharbeiterstunden

7

Herausforderungen

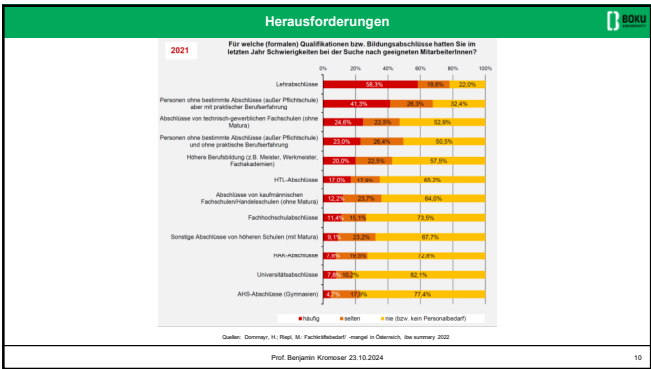
Sector	Percentage
Craft trades	55.4%
Technicians (excl. IT)	51.4%
Gastronomy/tourism	19.9%
Executives	18.3%
Sale/trade	15.5%
Auxiliary staff	15.0%
IT-Techniker	13.5%
Office/administration	12.5%
System-/ machine operation	12.2%
Personalized service	5.8%

8

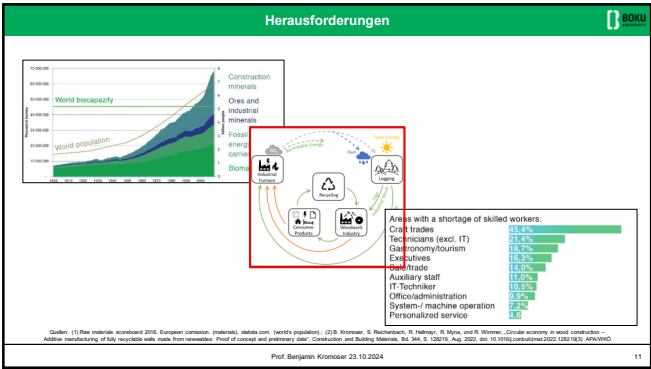
Herausforderungen

Sector	sehr stark	eher stark	eher schwach / wenig	gar nicht
Bau u. Baubehangewerbe	15.0%	35.0%	40.0%	10.0%
Herstellung von Holzwaren inkl. Möbellebau	18.0%	32.0%	40.0%	10.0%
Gastronomie, Hotellerie	10.0%	20.0%	50.0%	20.0%
Gesundheits- und Sozialwesen	10.0%	20.0%	50.0%	20.0%
Produktion Metall inkl. Maschinen- und Fahrzeugbau	10.0%	20.0%	50.0%	20.0%
Transport, Verkehr, Reinigung, Sicherheit	10.0%	20.0%	50.0%	20.0%
Herstellung von Nahrungsmitteln	10.0%	20.0%	50.0%	20.0%
Kfz-Handel und -Reparatur	10.0%	20.0%	50.0%	20.0%
EDV- u. IT-Dienstleister	10.0%	20.0%	50.0%	20.0%
Herstellung von elektrischen u. elektronischen Geräten inkl. Medizintechnik	10.0%	20.0%	50.0%	20.0%
Sonstige Herstellung u. Verarbeitung von Waren: Chemie, Kunststoff...	10.0%	20.0%	50.0%	20.0%
Personenbezogene Dienstleistungen: z.B. Masserie, Friseur, Kosmetiker	10.0%	20.0%	50.0%	20.0%
Sonstiges	10.0%	20.0%	50.0%	20.0%
Freizeit- und Vergnügungsbereich	10.0%	20.0%	50.0%	20.0%
Handel: Einzel- und Großhandel	10.0%	20.0%	50.0%	20.0%
Unternehmensberatung, Werbung, Aus- und Weiterbildung, Forschung u...	10.0%	20.0%	50.0%	20.0%
GESAMT	10.0%	20.0%	50.0%	20.0%

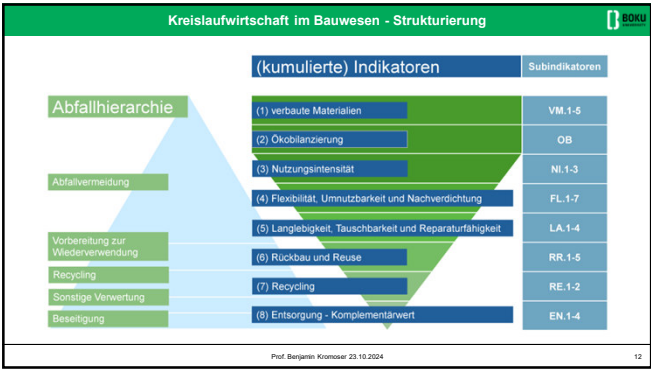
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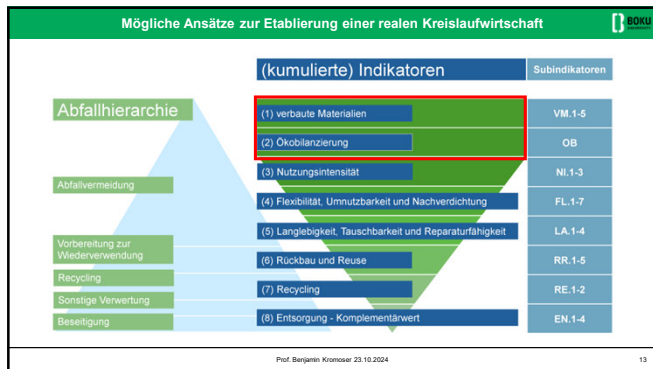
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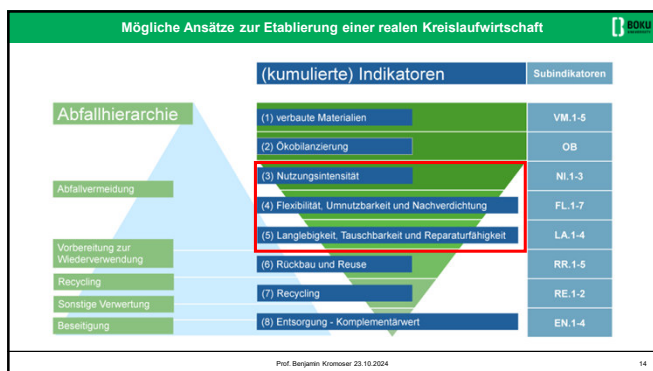
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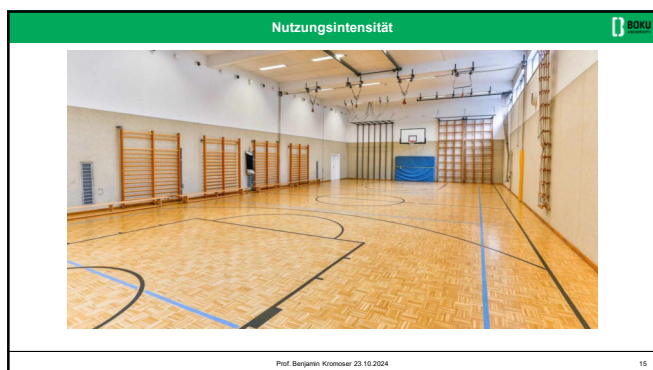
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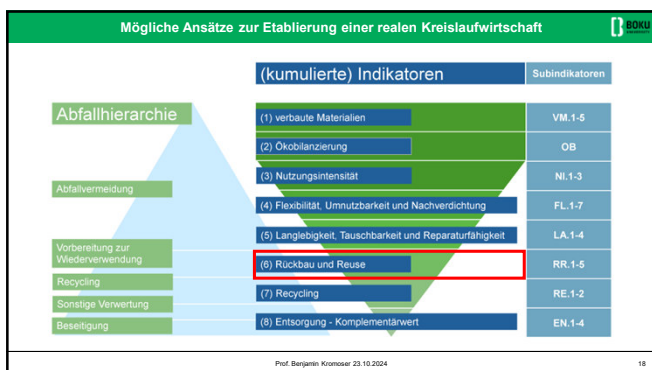
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16



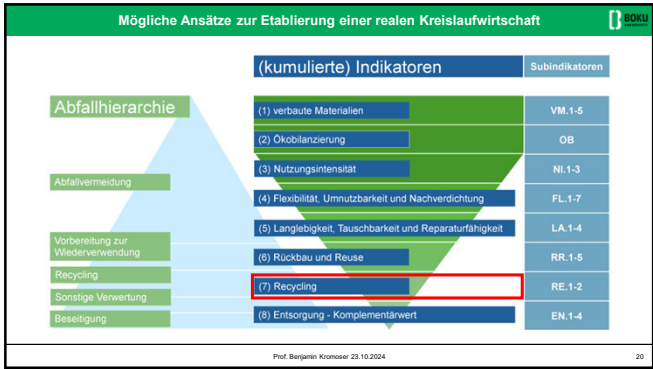
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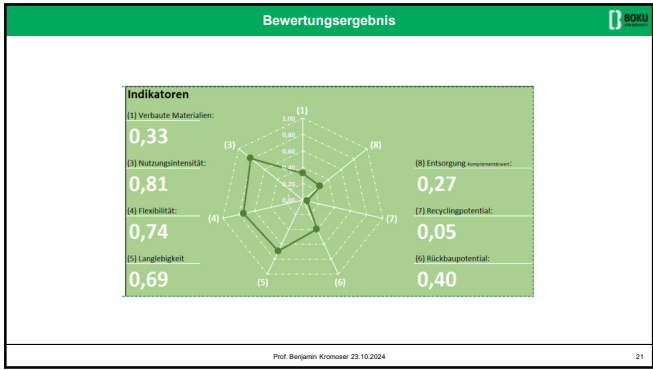
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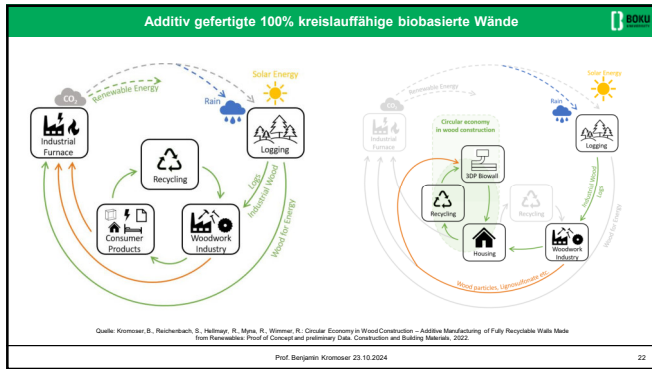
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20



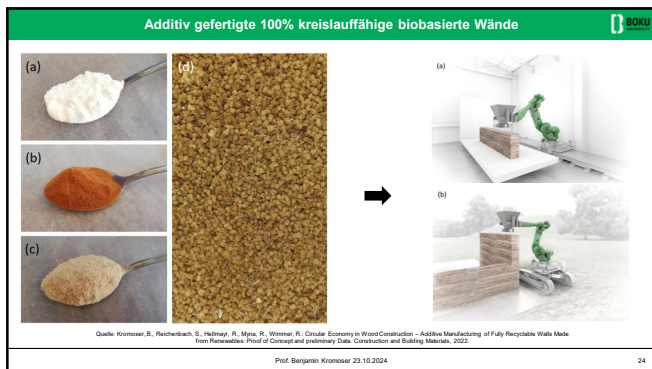
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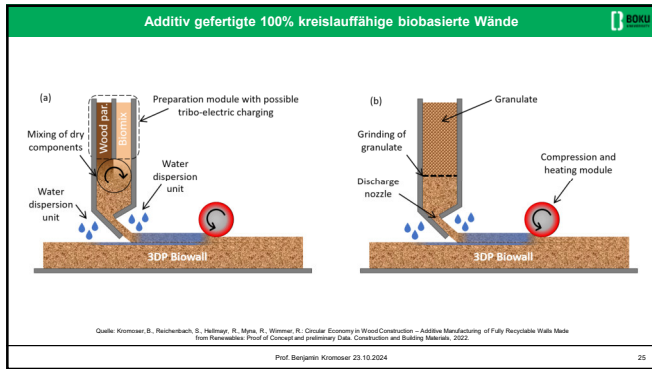
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23



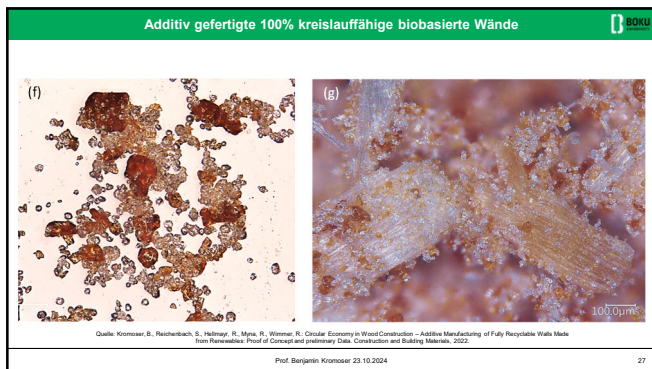
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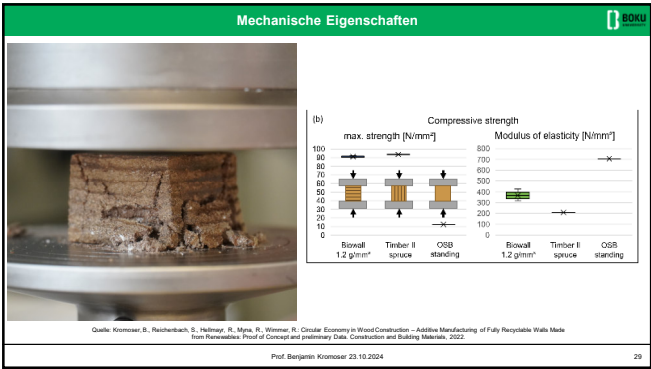
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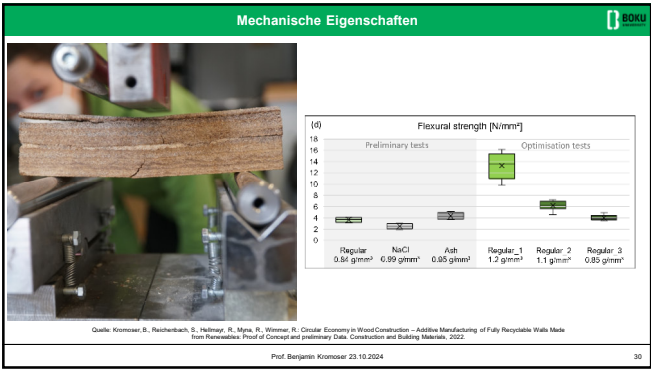
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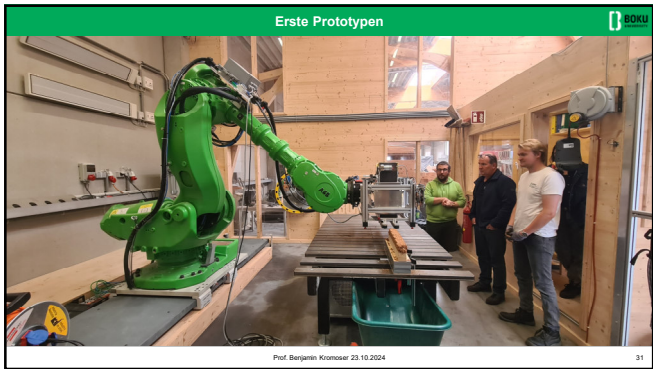
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29



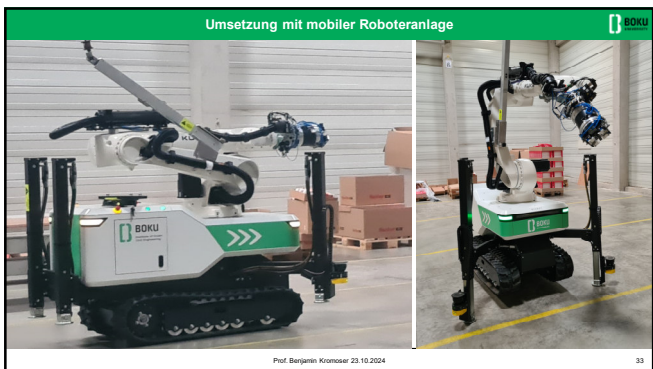
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31



32



33

Kurzvorstellung Prefab.Facade

- Kooperative Systementwicklung
- Digitale Prozesskette (Aufnahme, Segmentierung, Produktionsdaten)
- Automatisierte Herstellung

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34

Lehre an der BOKU

Neues Masterstudium **Green Building Engineering** seit Herbst 2023!

Doctoral School Build like Nature: Resilient Buildings, Materials and Society (**BUILD.NATURE**)

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35

Team

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36













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