Transsolar
KlimaEngineering

Robust durch Lehmbau

Christian Frenzel
frenzel@transsolar.com

Quelle: Transsolar

EFFIZIENZ

DURCH GADGETS

Quelle: KI generiert

RAUM

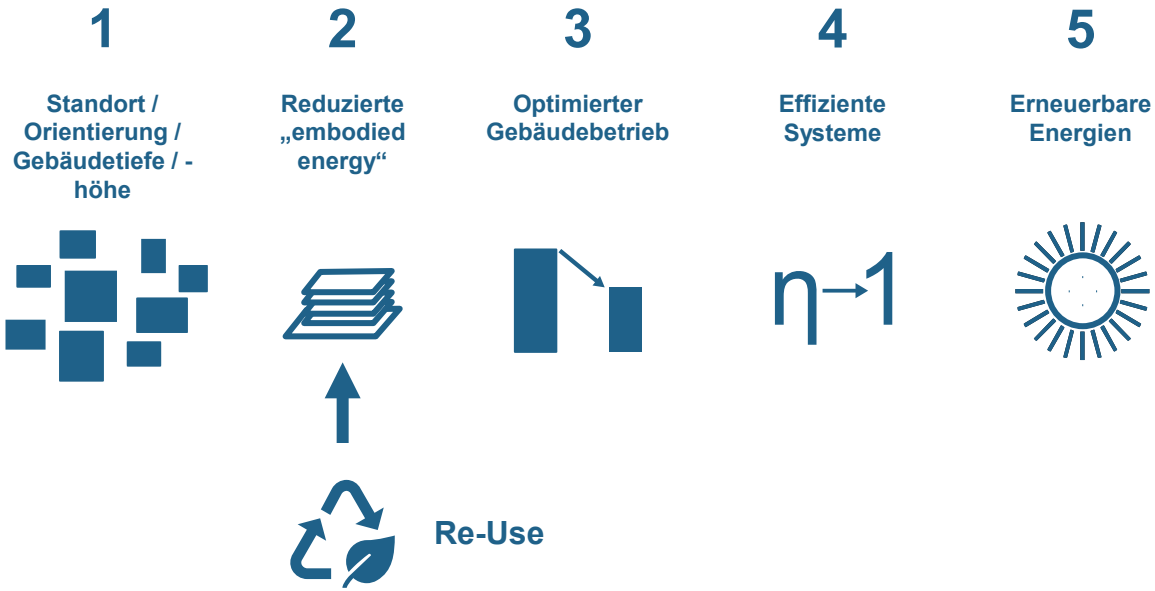
DURCH BEGEISTERUNG

Quelle: TRANSSOLAR

Quelle: TRANSSOLAR

Energie und Ressourceneffizienz

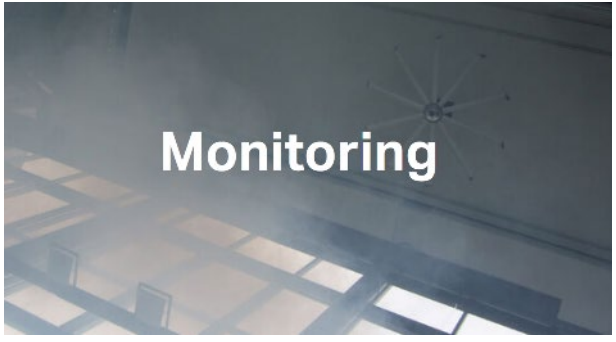
Stichworte



Quelle: TRANSSOLAR

Transsolar KlimaEngineering

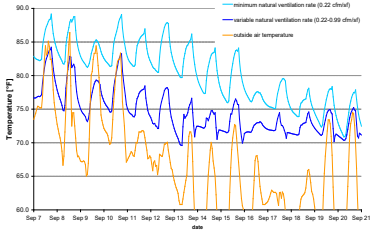
Tätigkeitsfelder

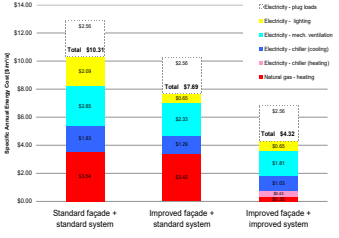


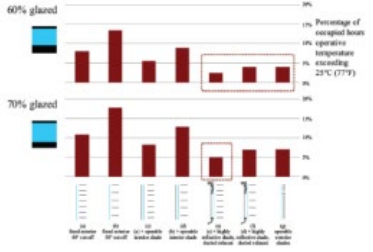
Quelle: TRANSSOLAR

SIMULATIONTOOLS

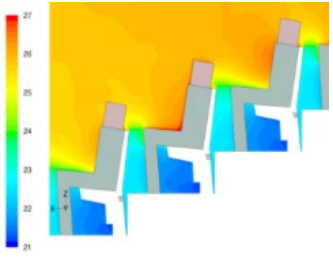
HYGRO-THERMISCH

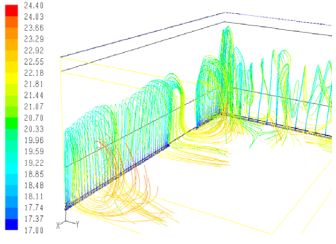




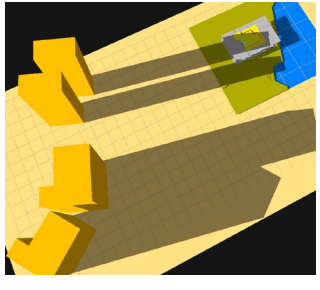


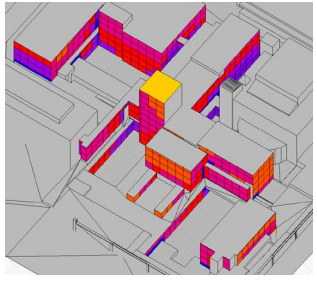
STRÖMUNG

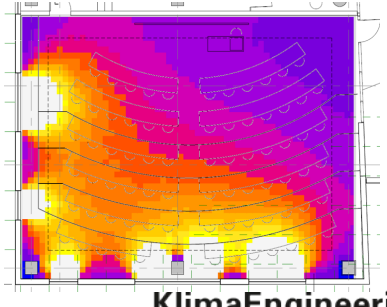




TAGESLICHT







Quelle: TRANSSOLAR

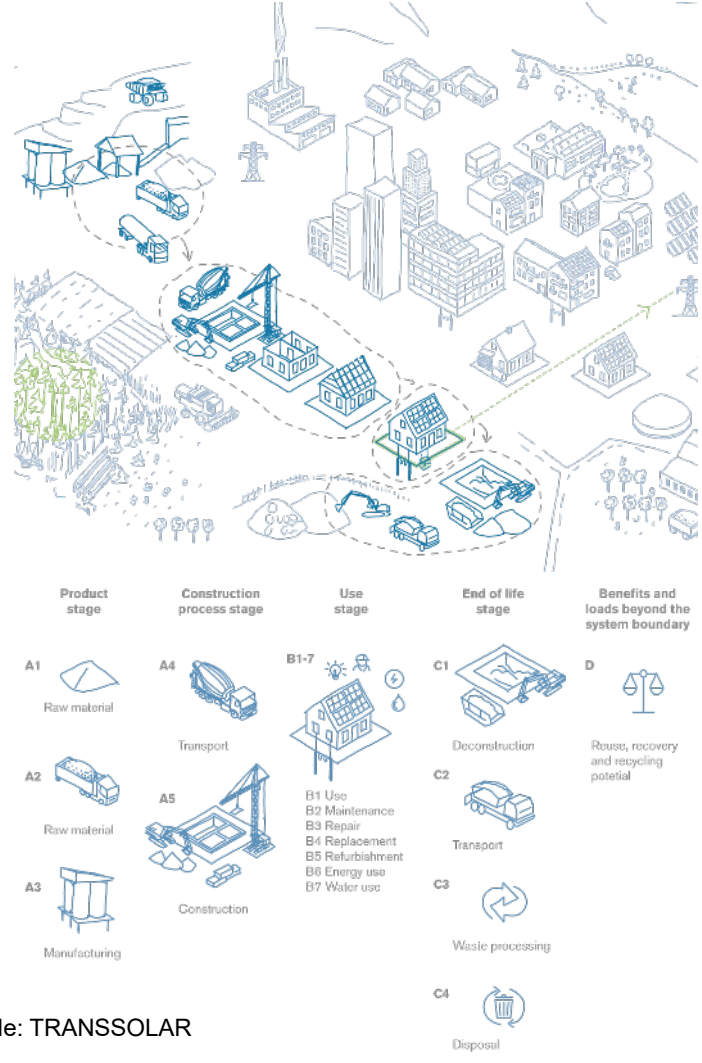
KlimaEngineering

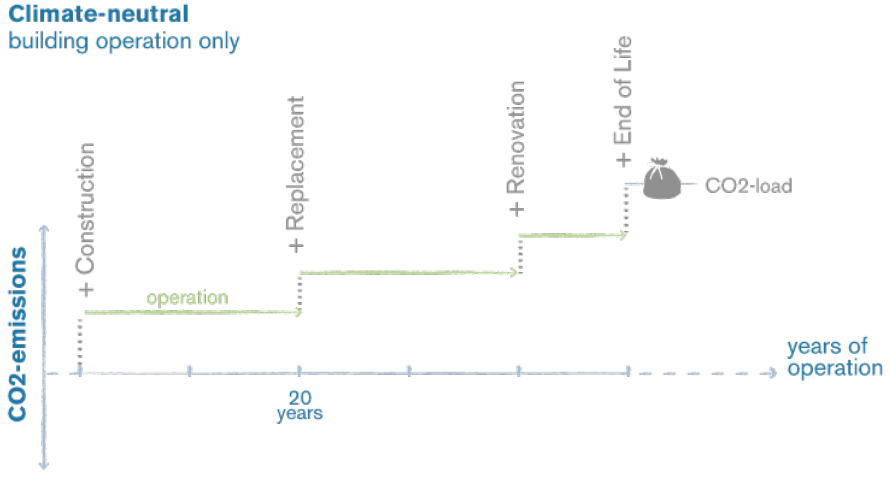
High comfort

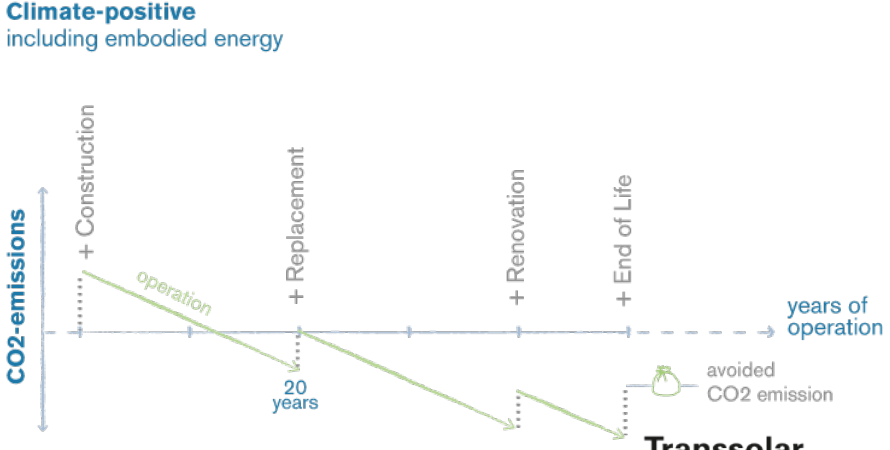
Quelle: TRANSSOLAR

Transsolar
KlimaEngineering

Low impact







Transsolar KlimaEngineering

Quelle: TRANSSOLAR

Die Art wie wir Komfort betrachten …

Quelle: TRANSSOLAR

… hat enormen Einfluss

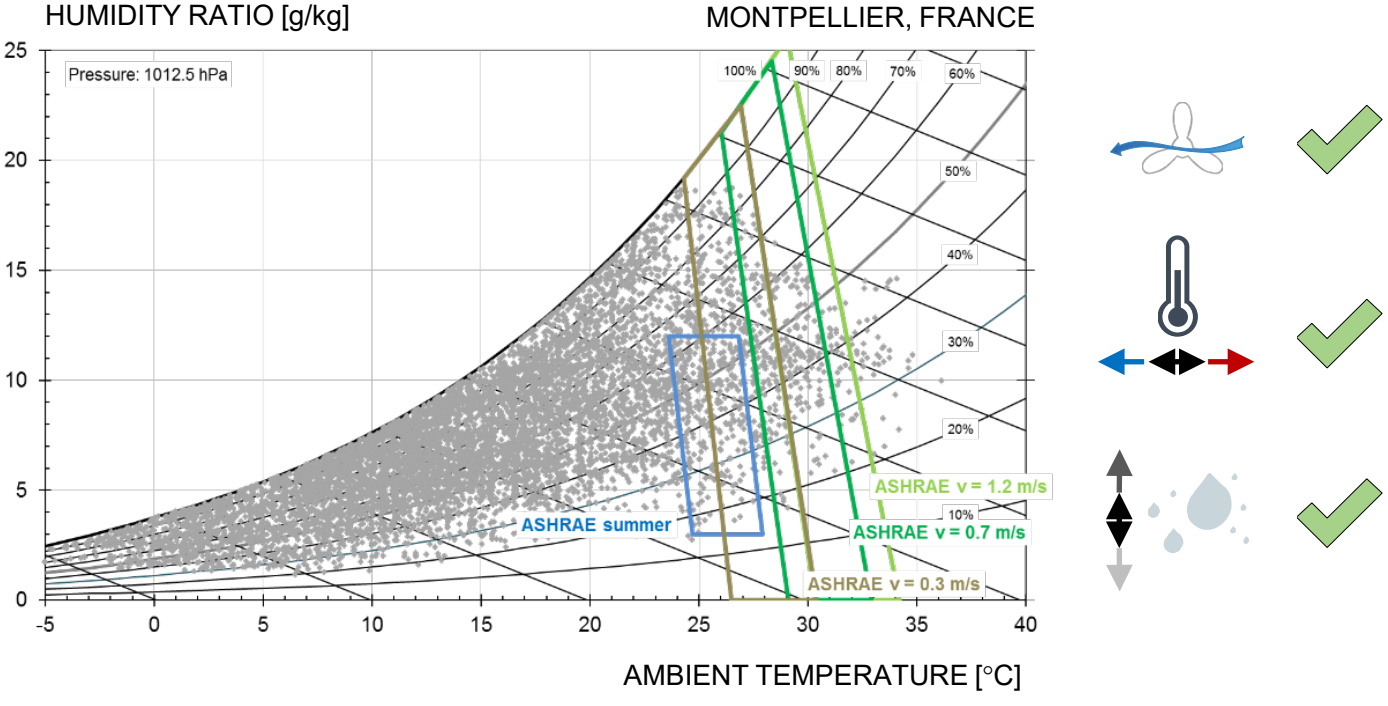
Gebäude ausgelegt mit adaptiven Komfortstandards verbrauchen

50%

Weniger Energie

Quelle: TRANSSOLAR

ASHRAE Standard 55-2013, comfort air conditioning with elevated air speed



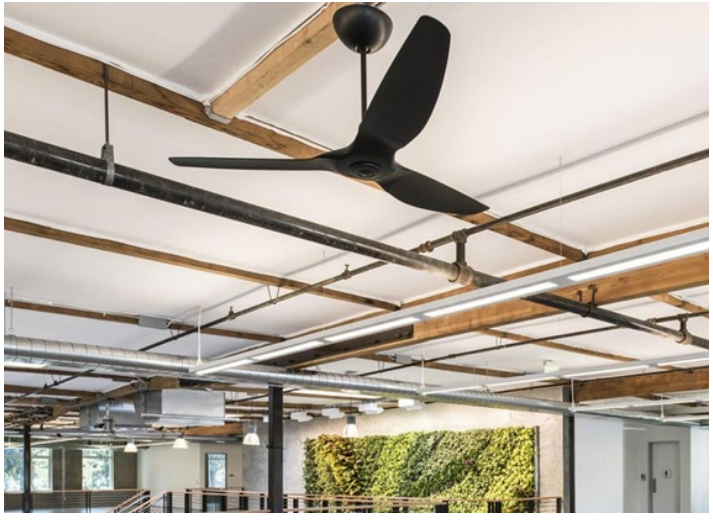
Extended temperature and humidify range as a consequence of air movement

Quelle: TRANSSOLAR

Transsolar KlimaEngineering

Elevated Air Speed

Ceiling Fans



www.bigassfans.com

Transsolar KlimaEngineering

Quelle: TRANSSOLAR

Ziele definieren

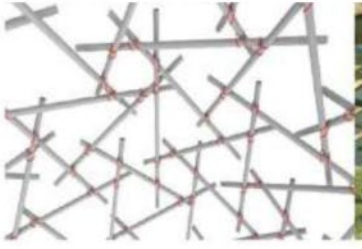
Wege flexibel gestalten

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Temperature

Quelle: Najjar&Najjar, Ahmad Nouraldeen

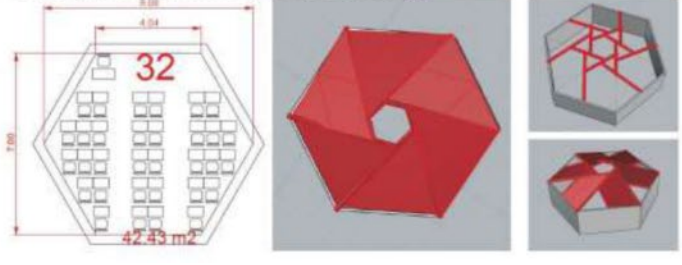
Design Strategy



No central supports are required in the resulting RF-structures, and one can also disassemble and re-assemble these structures, facilitating their transportation from place to place.

This makes RF a highly cost-effective deployable system, particularly suitable for rapid constructions of temporary structures.

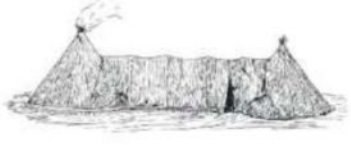
Utilizing material and structure in design



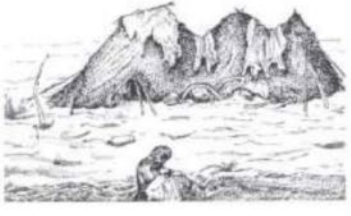
Local available material

Investigation of vernacular techniques in adapting their shelters for extreme weather condition.

Utilization of earth from the site and stacking in earth bags to form an adobe walls to use as a base for the building envelope.



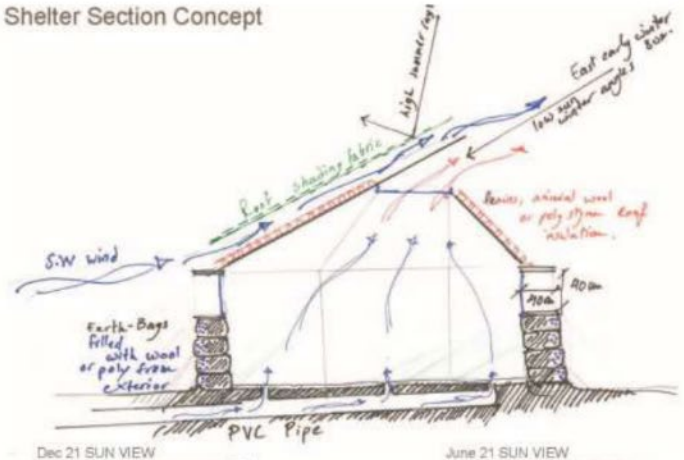
Traditional frame tent structure and envelope made of herds skin that have high insulation properties in extreme weather.

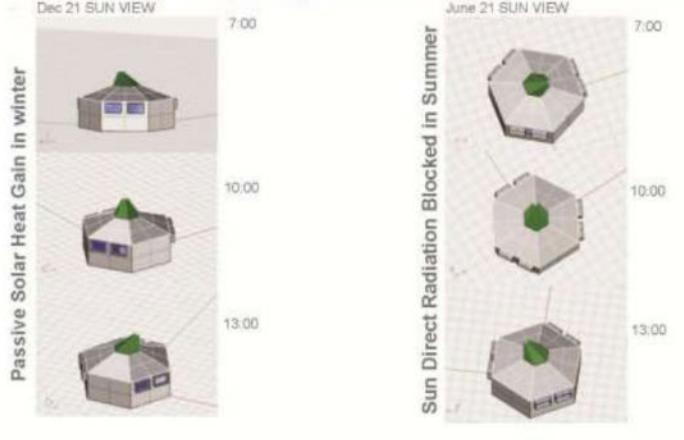


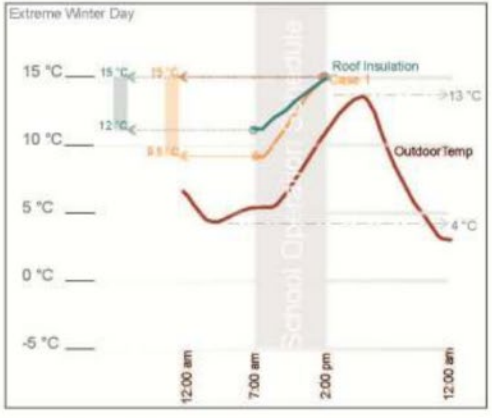
The design of roof vents for hearth and as a source of heat that would drive the ventilation mechanism inside the shelters

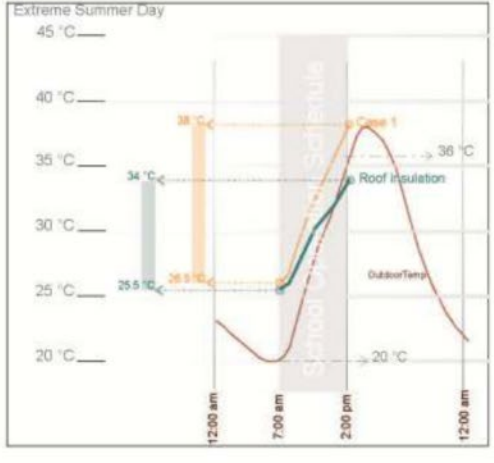
Quelle: TRANSSOLAR

Thermal Simulation









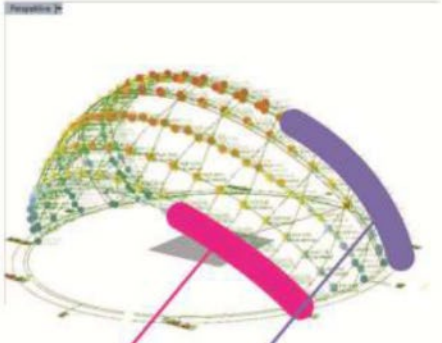
Quelle: TRANSSOLAR

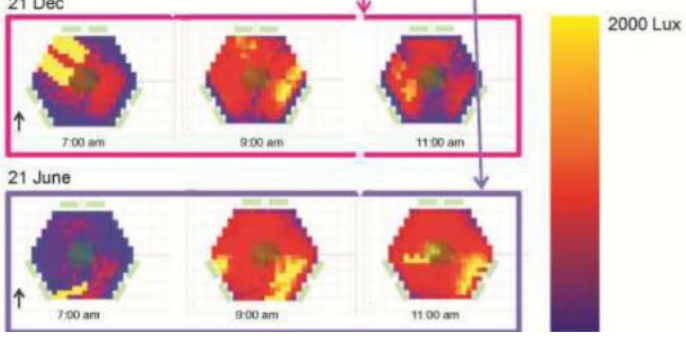
Daylight Simulation

Morning illuminance Study inside the Class room space for 6 windows configuration

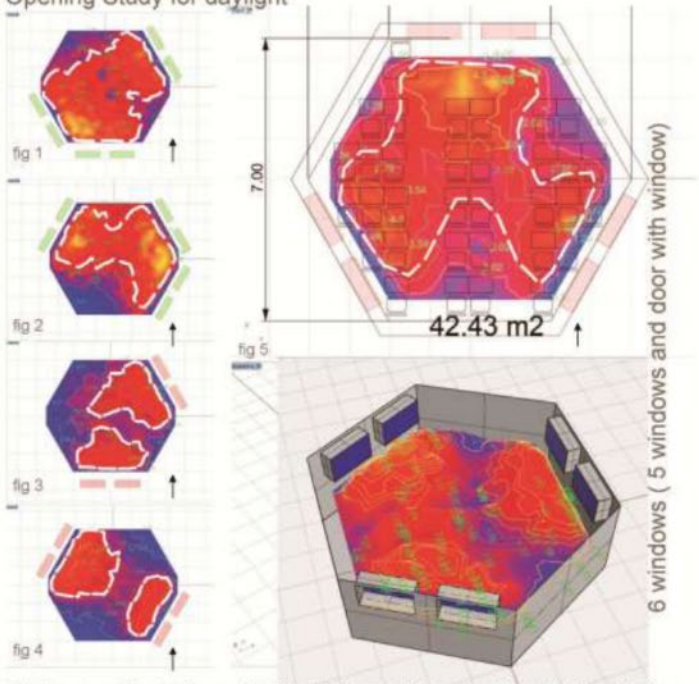
Direct Sun light is Blocked after 8:00

Summer early illuminance is minimized by skylight shading





Opening Study for daylight



Minimum of 6 windows distributed to get intended daylight levels for visual comfort in addition to the sky light with the shading element

80 percent of area has daylight level above 3% at 1 m level

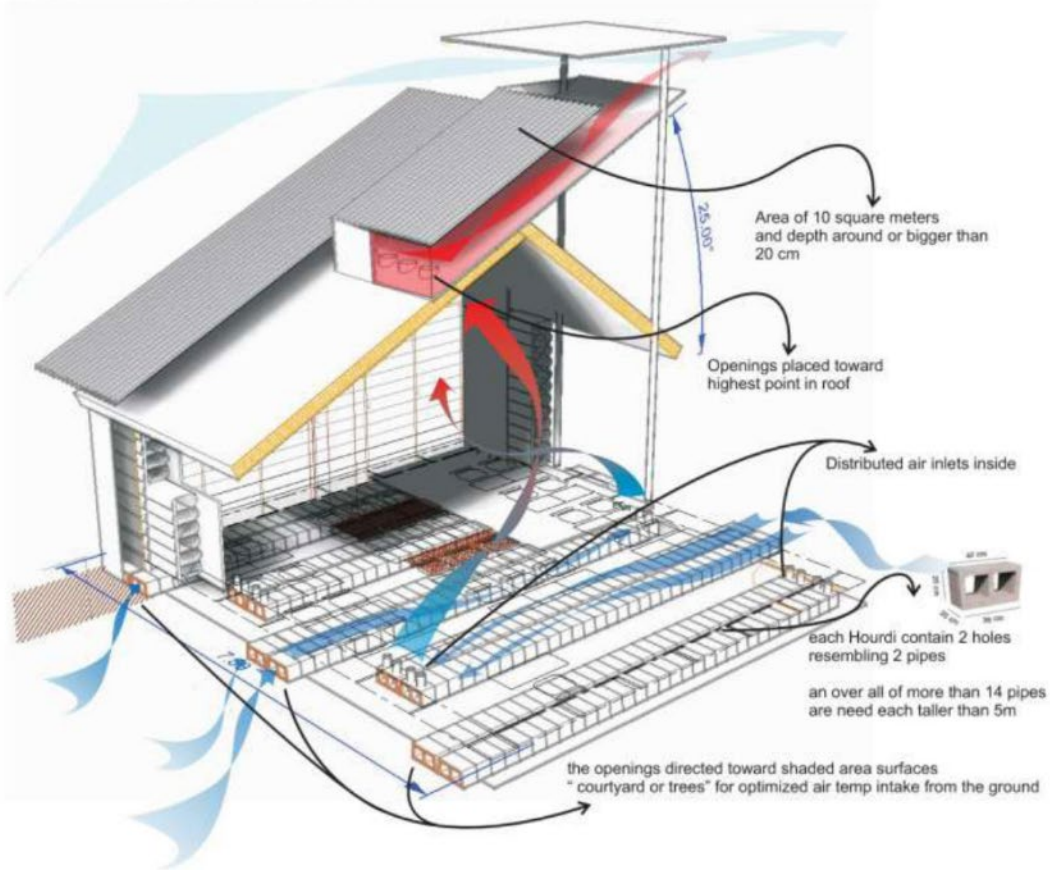
material reflectivity is set to 50% and white color

Earth bag best to be white for reflectivity and also window frames

Quelle: TRANSSOLAR

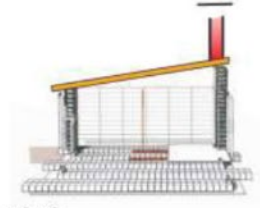
Passive strategies

Guide Line for the solar chimney design
and the earth duct for the refugee school



Optional geometry for solar chimney

option 1

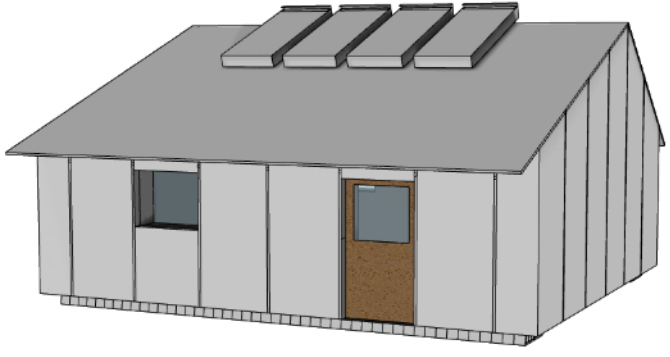


option 2

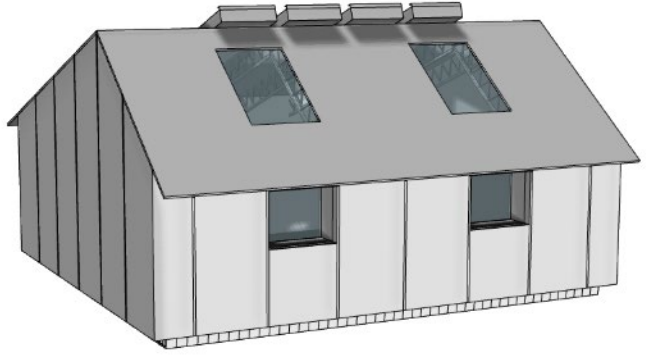
option 3

Quelle: TRANSSOLAR

Model



South Facade



North Facade

Quelle: TRANSSOLAR

Earth ducts assemblage

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Footings assemblage

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Frame system filling with sandbags

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Plaster testing

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Insulation material filling

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Locals participation in implementation

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Locals participation in implementation

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Locals participation in implementation

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Quelle: Najjar&Najjar, Ahmad Nouraldeen

Angepasstes Design

Ausbildungs-Campus, Tatale, Ghana

Bauherrschaft Salesians of Don Bosco Anglophone West Africa Province, Salesians of Don Bosco Mission Austria-Tatale **Fertigstellung** 2024 **Architektur** Studio Anna Heringer **Bauherrenvertretung & Koordination vor Ort** Fr. Nichodemus Chinazo **Technische Planung und Ausführung** Christian Zigato **Projektkoordination** Benson Boateng **Sponsor des ersten Gebäudes 2020** Heini for Africa, GEA/ Waldviertler **Mentor und Sponsor** Peter Reischer **Fotos** Studio Anna Heringer

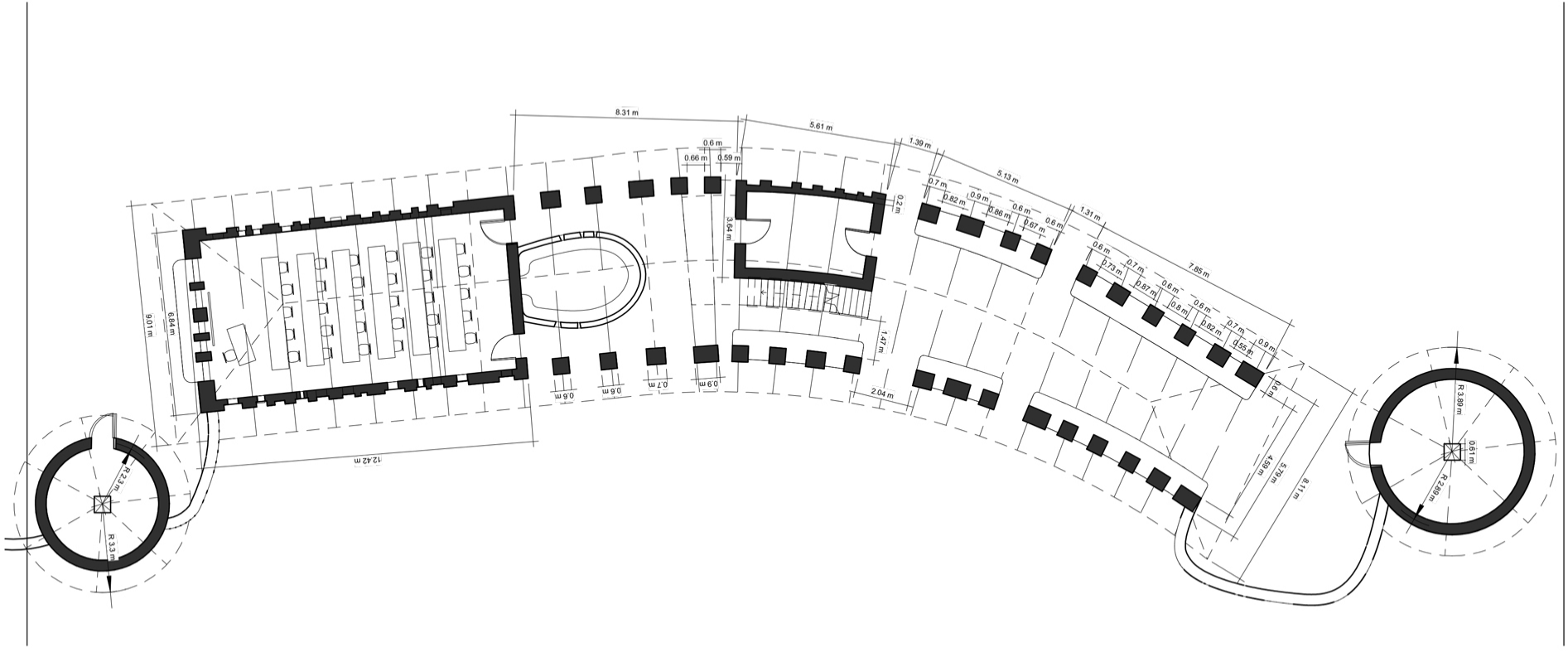
Quelle: Studio Anna Heringer

Ausbildungs-Campus, Tatale, Ghana

Quelle: Studio Anna Heringer

Ausbildungs-Campus, Tatale, Ghana

Quelle: Studio Anna Heringer



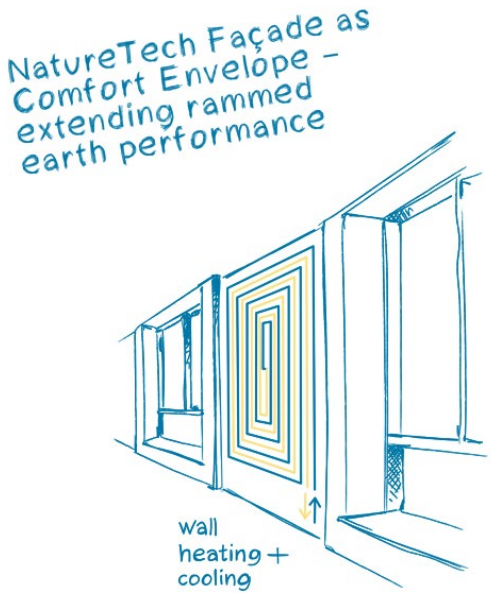
Planverfasser:	Planung:	Projekt:	Planinhalt:		
Studio Anna Heringer	**Studio Anna Heringer**	**Tatale Campus**	Sustainable construction workshop plan		
				1 : 200	04/23/20

2m 4m

Quelle: Studio Anna Heringer

Integration Technik

Alnatura-Campus, Darmstadt



Quelle: HCZ – Studio 2050

Copyright: PK Odessa: Lanz, Schels

Funktion bewerten

Reduktion von Gebäudetechnik

Suffizientes & Robustes Design einer Kita

JOHNNY architecture
Architektur und Baumanagement

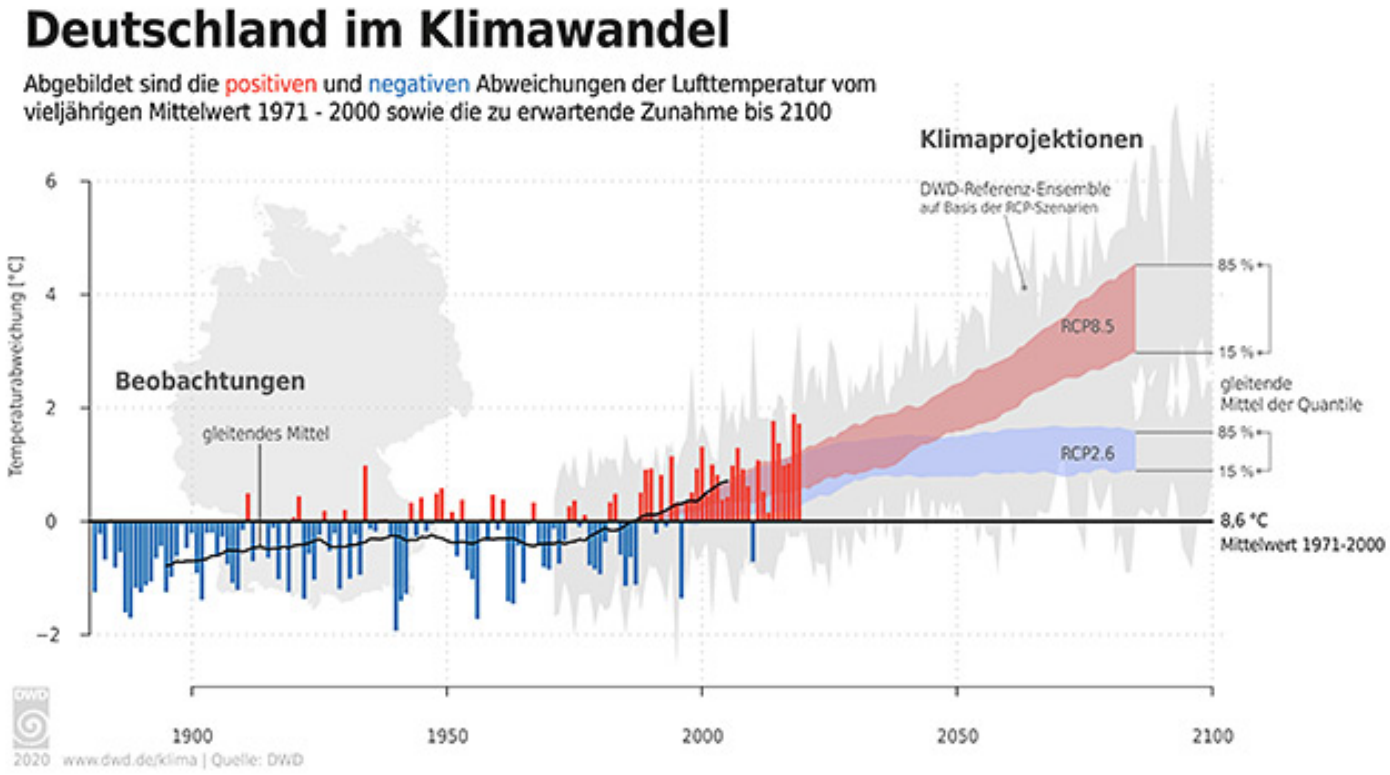
Rahmenbedingungen und Zielsetzungen

Kita Heerstraße Bremen

Ziel ist ein **passiv funktionales** Kita-Gebäude mit dem **„richtigen Maß“**

Transsolar KlimaEngineering

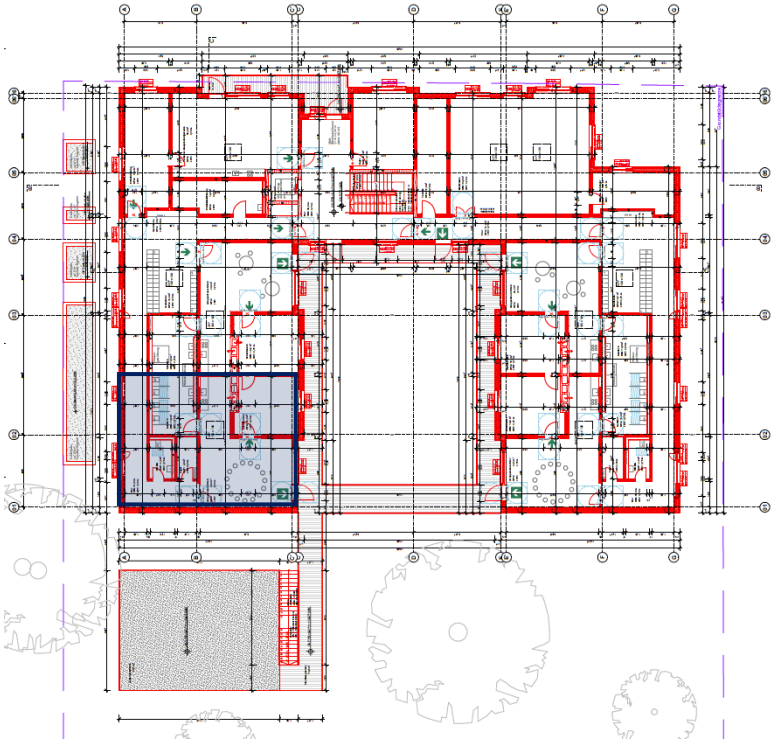
Adaptive Gebäudekonzepte

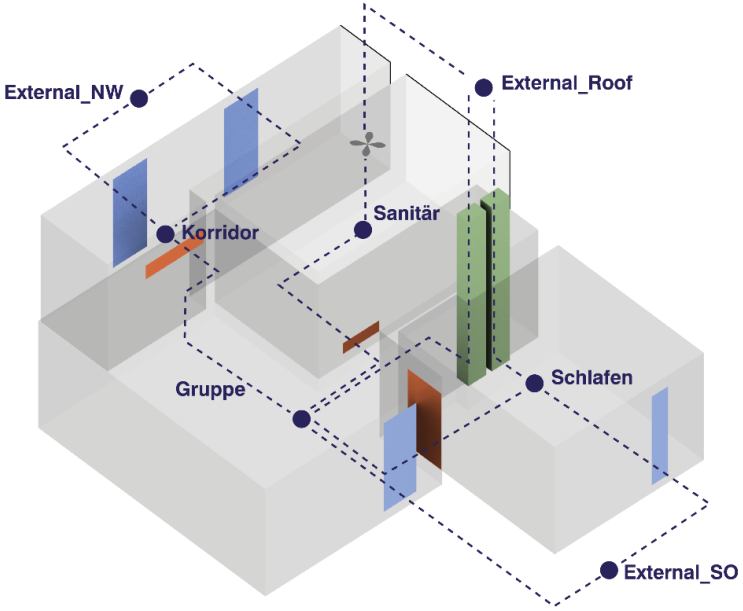


Transsolar
KlimaEngineering

Lüftungsbewertung

Simulationsaufbau





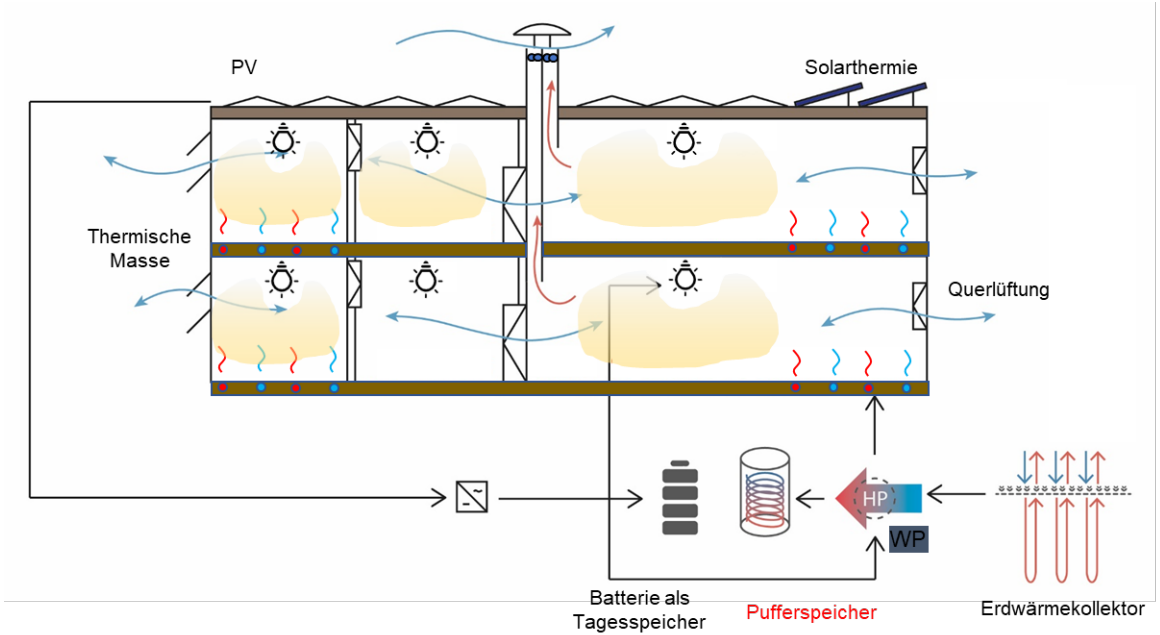
Quelle: JOHNNY architecture links, TRANSSOLAR rechts

Transsolar
KlimaEngineering

Konzept

Kita Heerstraße Bremen

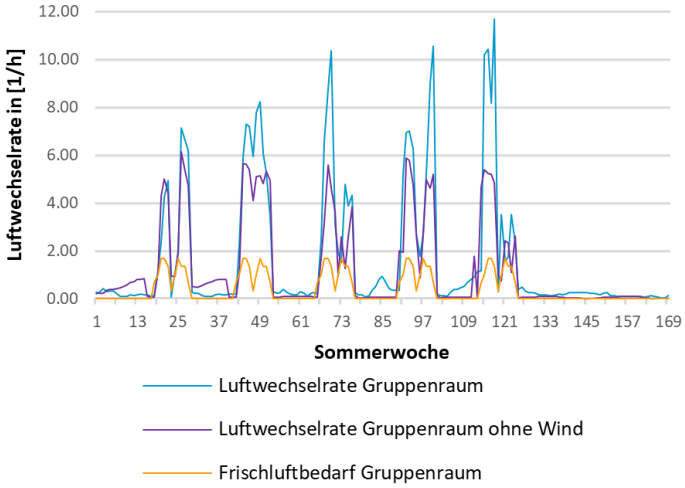
- **Holz**-Rahmenbaukonstruktion mit **Lehmpanelen** (thermische Masse, Feuchteschutz)
- **Natürliche Lüftung** mit Lüftungskamin
- Heizleistung 50% konventionell über **Fußbodenheizung**, 50% über **direkten Stromeinsatz** (Kunstlicht, Wandgemälde)

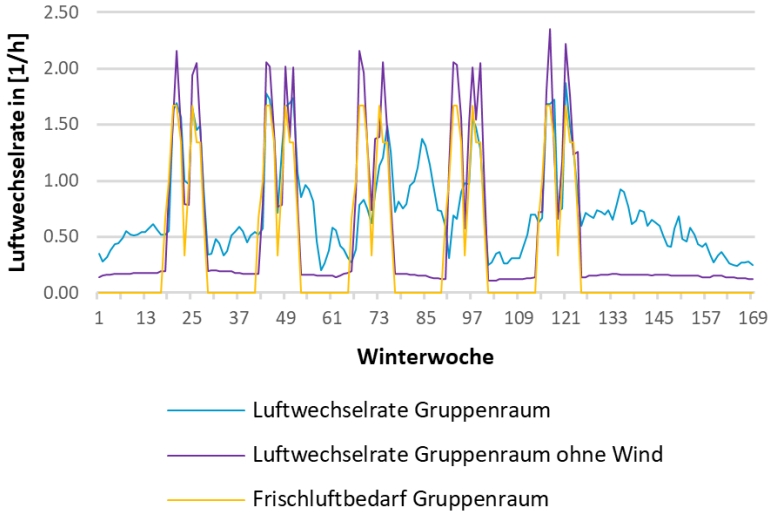


Quelle: TRANSSOLAR

Modellergebnisse

Kita Heerstraße Bremen





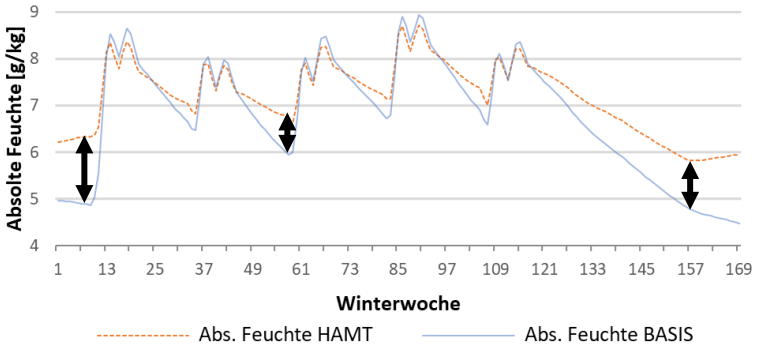
Quelle: TRANSSOLAR

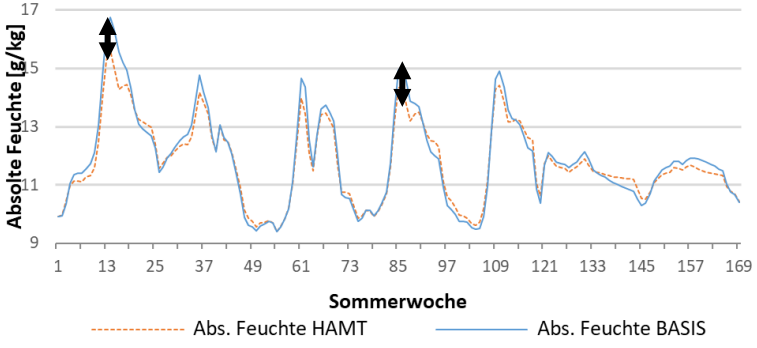
Transsolar KlimaEngineering

Hygrothermische Untersuchung

Kita Heerstraße Bremen

Spitzen sowohl in Sommer als auch Winter reduziert



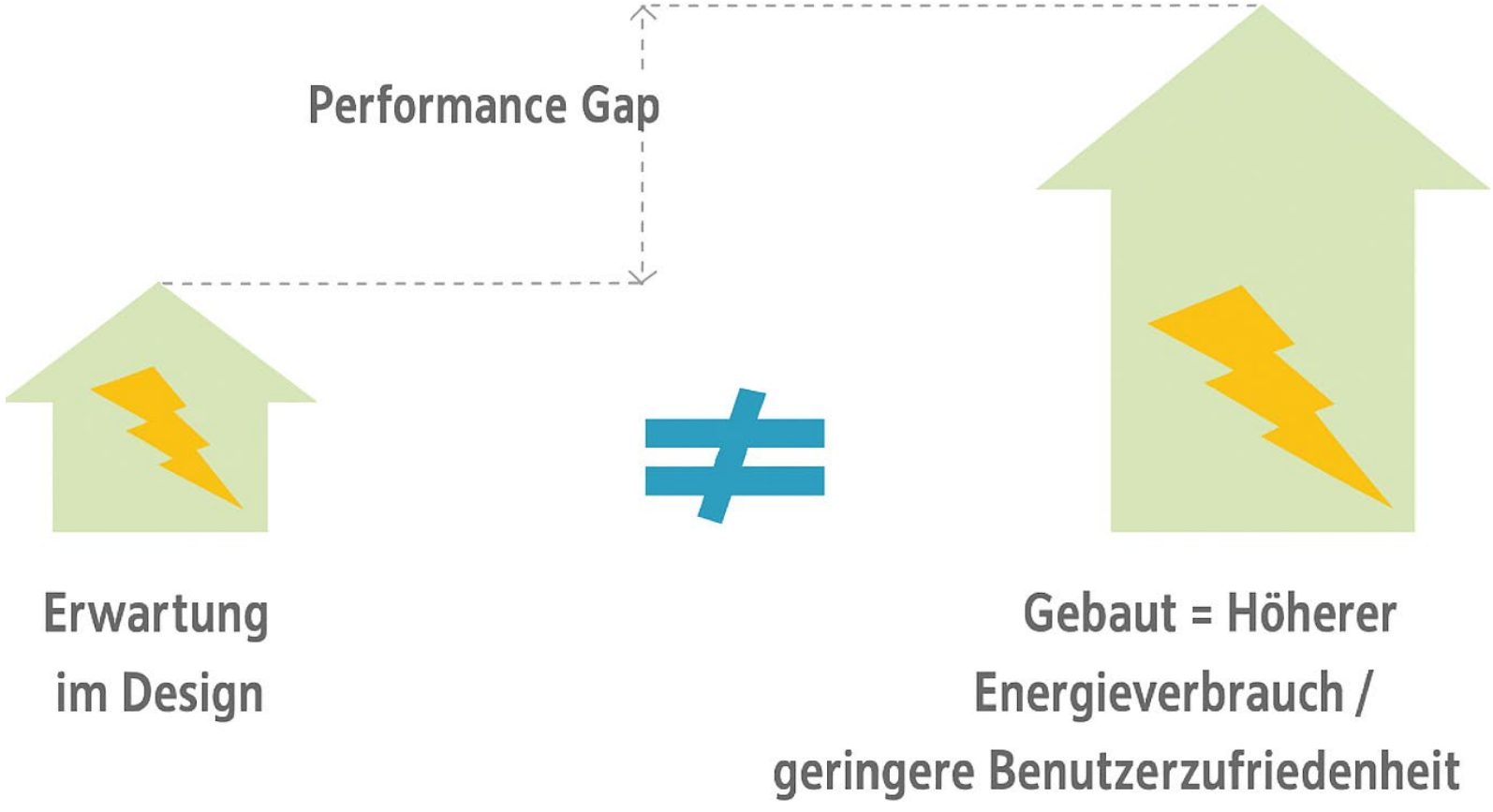


Quelle: TRANSSOLAR

Transsolar KlimaEngineering

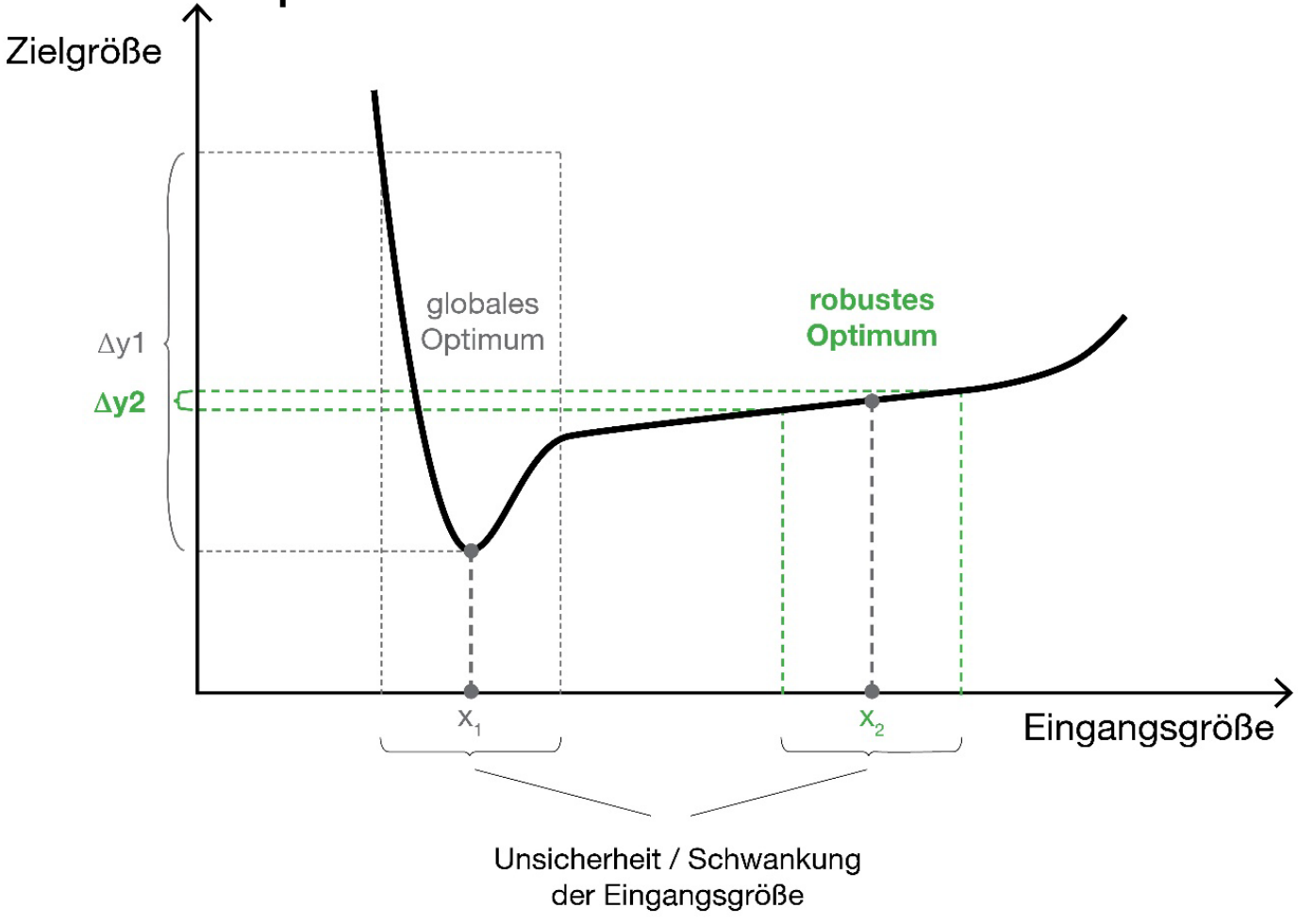
Potentiale aufgreifen

„Better spaces for learning“ (Royal Institute of British Architects - RIBA)



Quelle: TRANSSOLAR

Theorie: Robustes Optimum



Unterschied zwischen einem globalen und einem robusten Optimum; eigene Darstellung nach:
B. Rhein. 2014. Robuste Optimierung mit Quantilmaßen auf globalen Metamodellen. Dissertation. Universität zu Köln

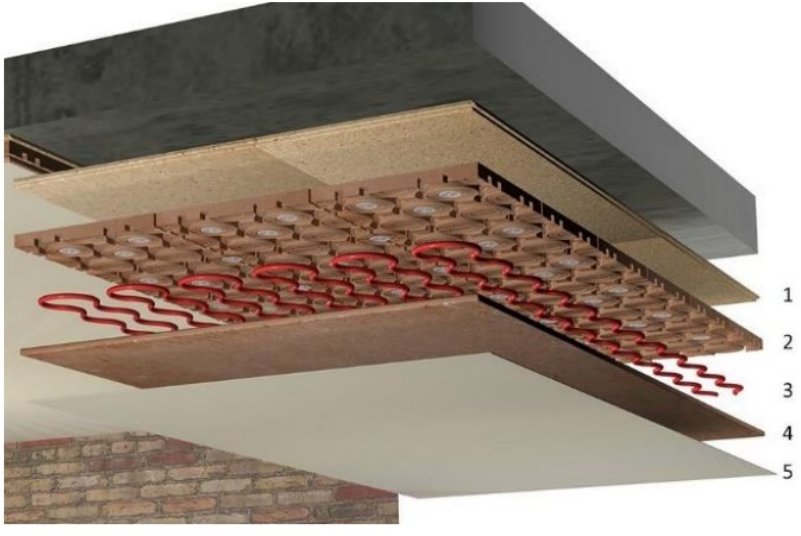
Natürliche Materialien

Stampflehmwand und Lehmpanele

Sättigungsfeuchte = 375 kg/m³

Quelle: TRANSSOLAR

Sättigungsfeuchte = 700 kg/m³

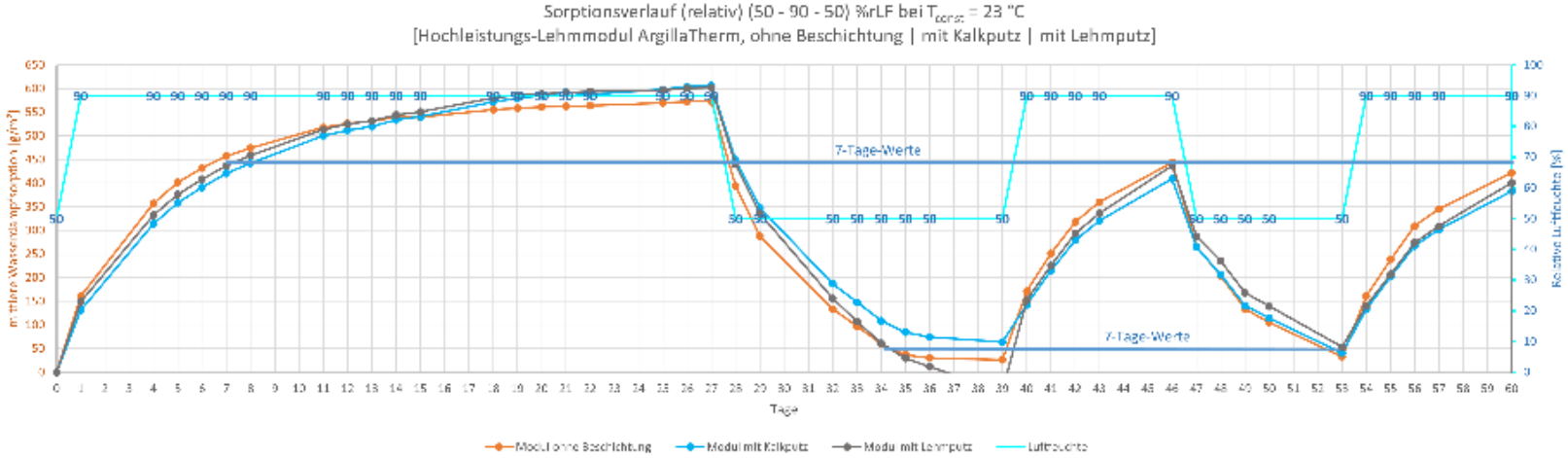


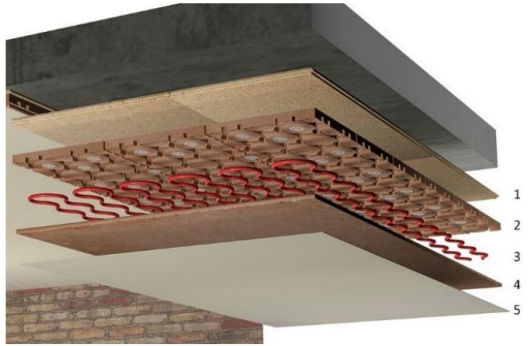
Quelle: https://argillatherm.de/

Natürliche Materialien zur Kühlung

Lehmpanele

=> Vermeiden Sie Kondensationsrisiken durch die die Eigenschaften von Lehm!!





HochLeistungsLehm-Module verlegt mit eingelegtem Kühlrohr.
https://argillatherm.de/

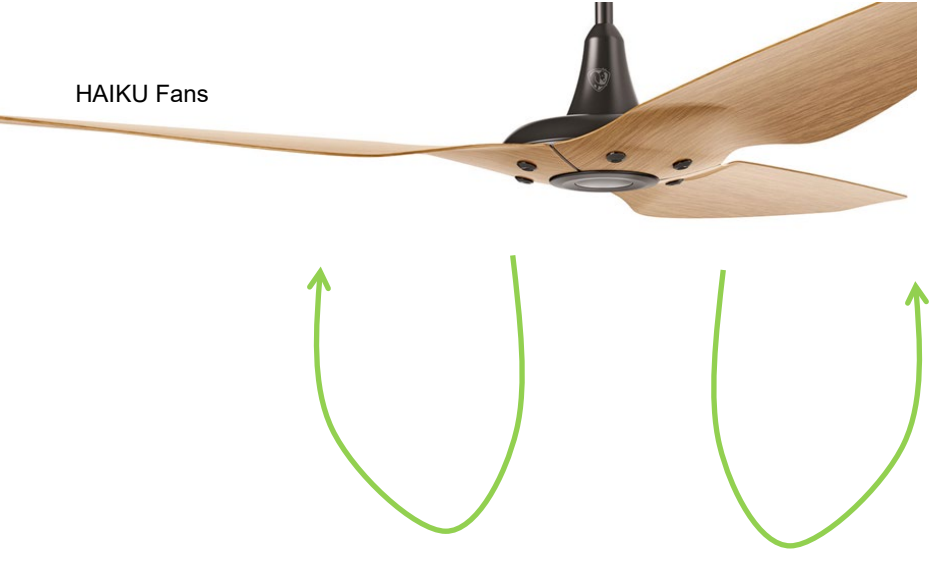
HochLeistungsLehm-Module verlegt mit eingelegtem Kühlrohr nach Fertigstellung.

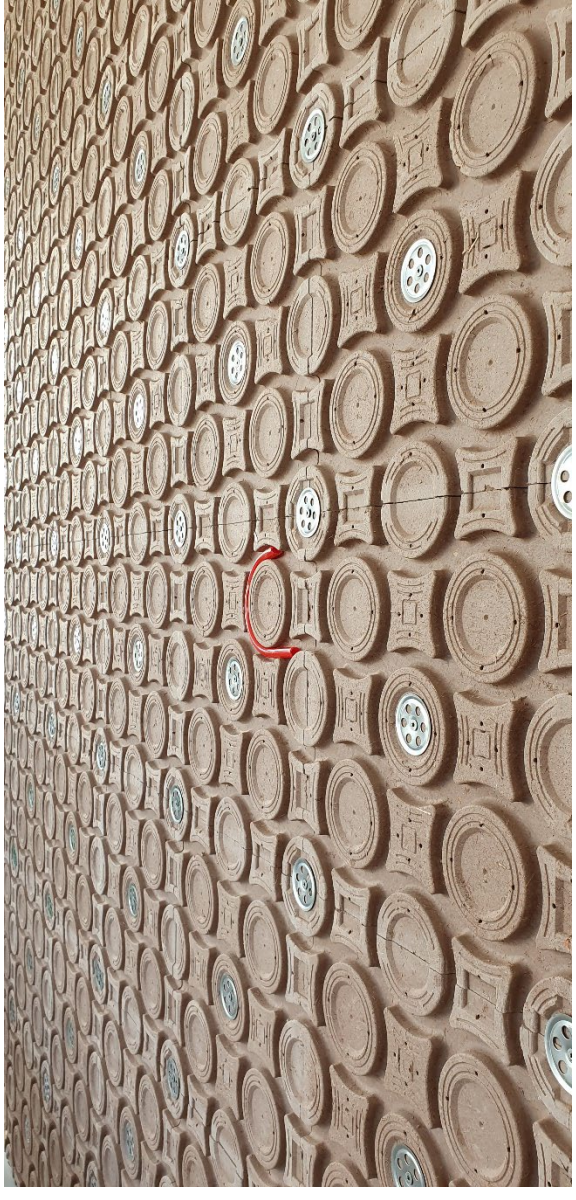
Adaptiver thermischer Komfort

Nutzerinteraktion

Optimieren der Materialeffizienz durch die Kombination mit passiven Technologien

HAIKU Fans



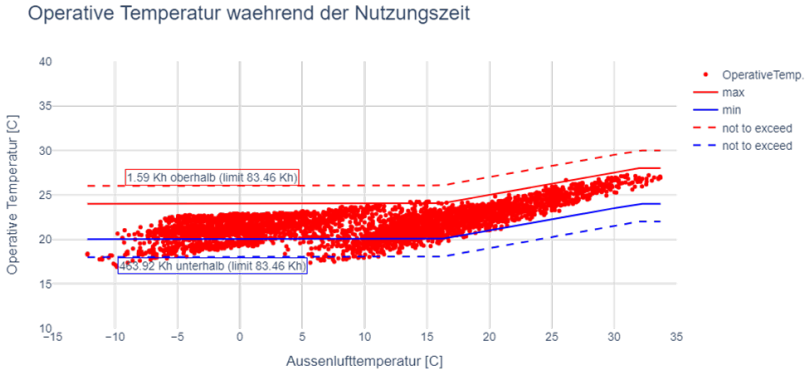


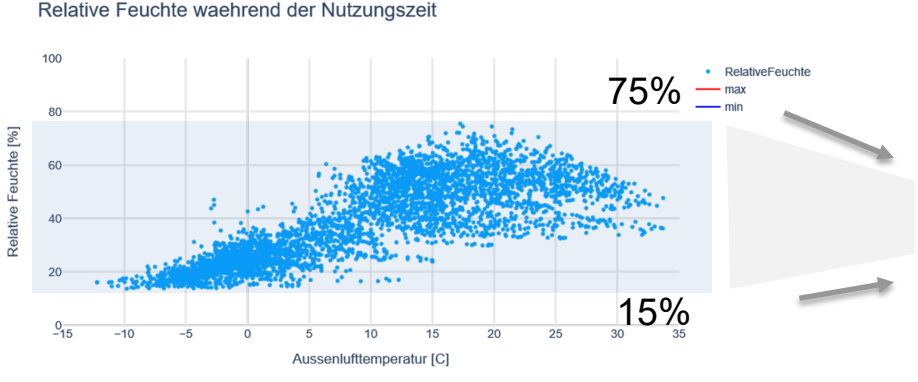
Quelle: TRANSSOLAR

Lehmbaustoffe

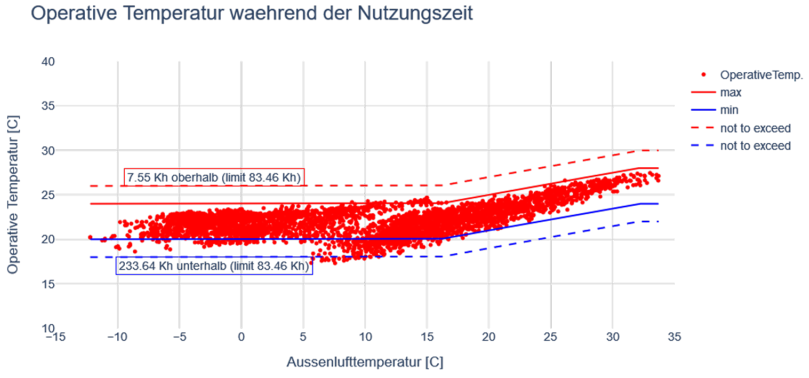
Potenzieller Materialeinfluss auf den Komfort in einer Produktionshalle mit geringer Belegungsdichte - einschließlich Feuchtigkeitsaustausch in optimiertem Verhältnis der Lehmoberflächen

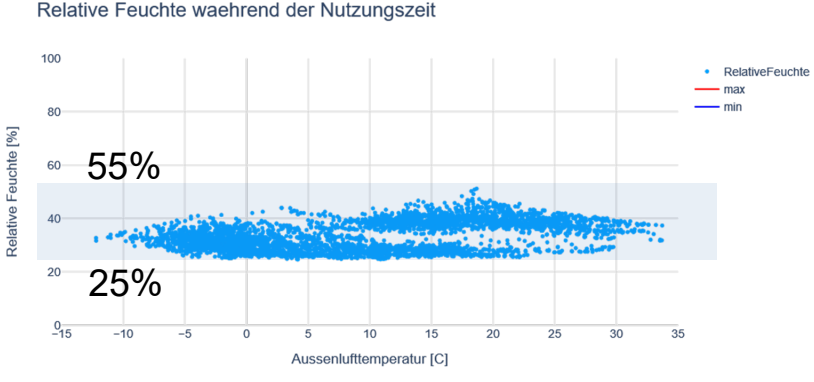
Thermische Studie - konventionell





Hygro-Thermische Studie unter Berücksichtigung von Lehm





Quelle: TRANSSOLAR

Transsolar KlimaEngineering

Vielen Dank für die Aufmerksamkeit!

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