China 30.60 Seminar Series

Green Factories and Green Buildings

Sustainable Factory Construction in China

German Centre Beijing, 2023. Nov. 16th

Topics

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Sustainable Factory Construction in China

- Introduction Kaiser Construction
- Building life cycle of factories and related costs
- Planning and Design of environmentally friendly facilities
- Realization and construction: How to implement the plan
- Examples and case studies of “Green Factories”
- Brownfield / Brownfield vs. Greenfield: Situation in China
- Future view: Holistic vision vs. feasibility today
- Conclusion

Topics

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Dalian

Tianjin

Qingdao

East China

Mechanical &Automotive___35%

Electronics___15%

Food & Pharmaceutical___25%

Logistics___12%

Others___13%

1999 Consultant Company founded

2004

2005 Kaiser Construction founded

2006

2010 1st Grade Design Qualification

2013

2014

2016 1st Grade Construction License

2019 Kaiser Building Integrity 20th ANNIVERSARY

2020

Kaiser Construction

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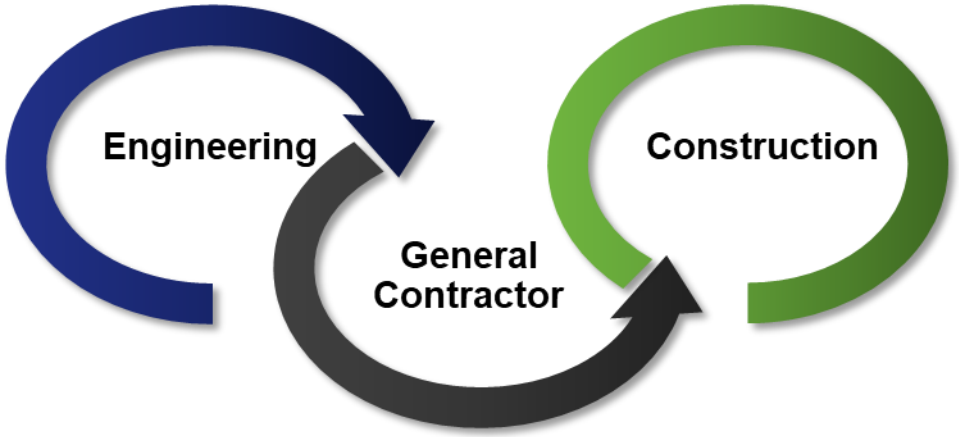

Over 600 successful projects in China delivered

- Design License: Grade A,
  Registered Capital: RMB 30 mil.
- Construction License: Grade 1,
  Registered Capital: RMB 150 mil.

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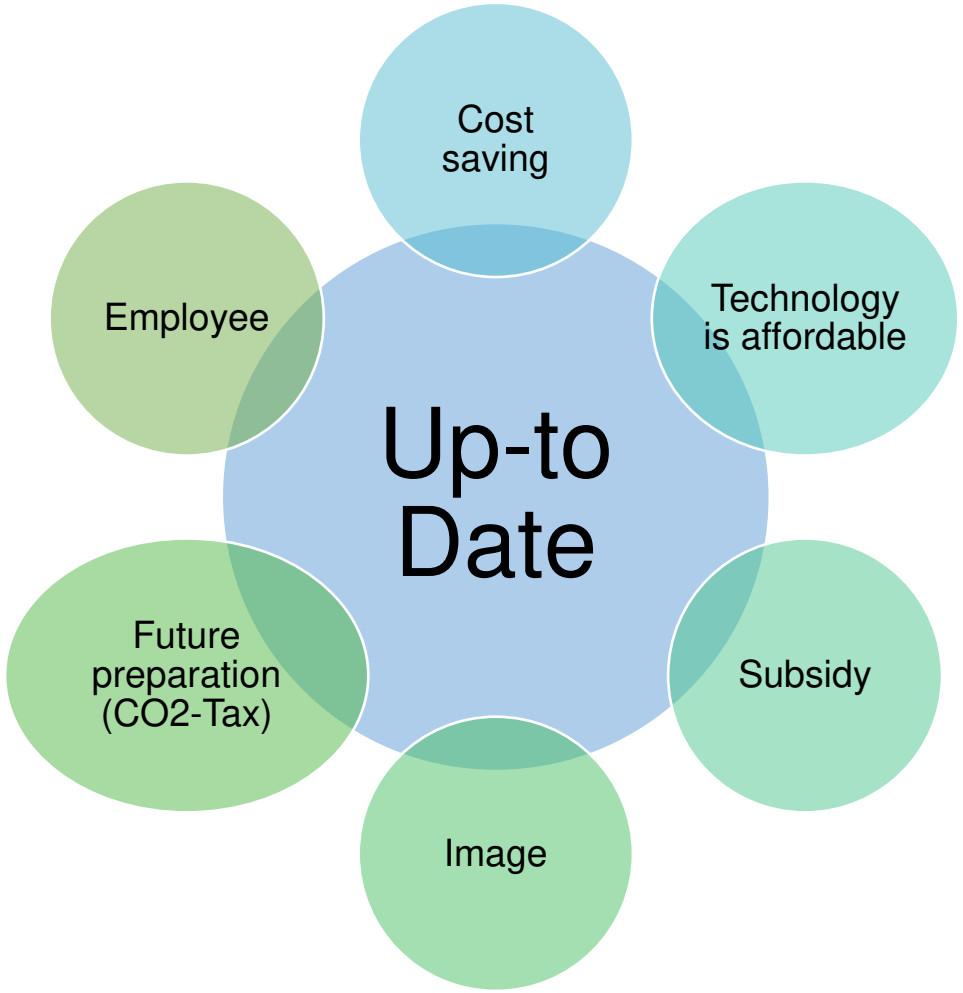
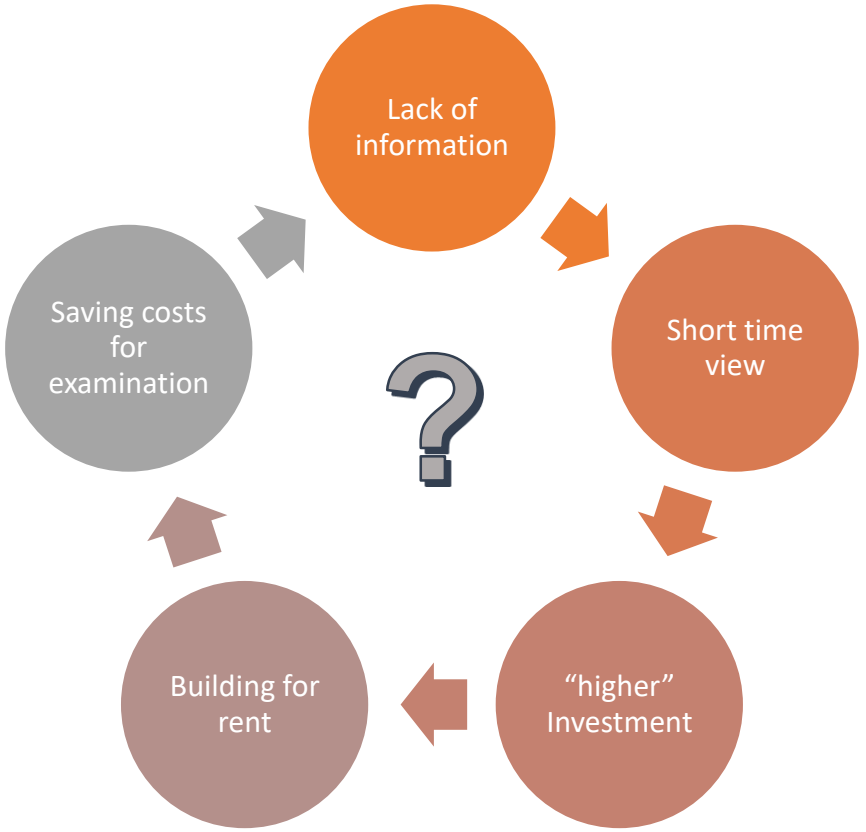
Why building a “Green Factory” – “Sustainable Factory”?



Why investors do not building a “Sustainable Factory”?



Planning and Design

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Sustainable construction means using

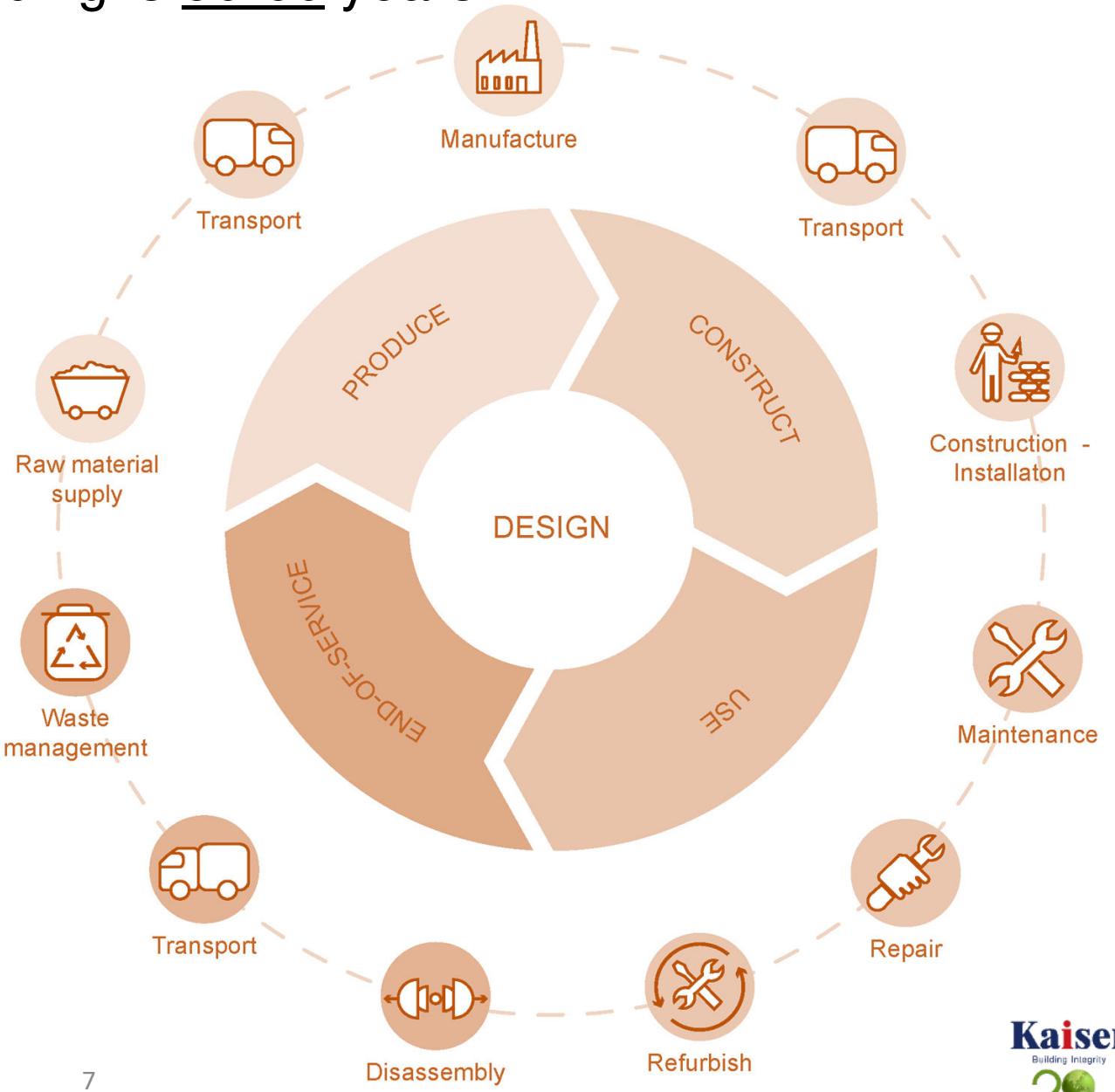
- Recyclable and renewable materials
- Minimizing energy consumption and waste production
- Consider the lifecycle

The primary goal of the sustainable construction method is to reduce its impact on our environment.

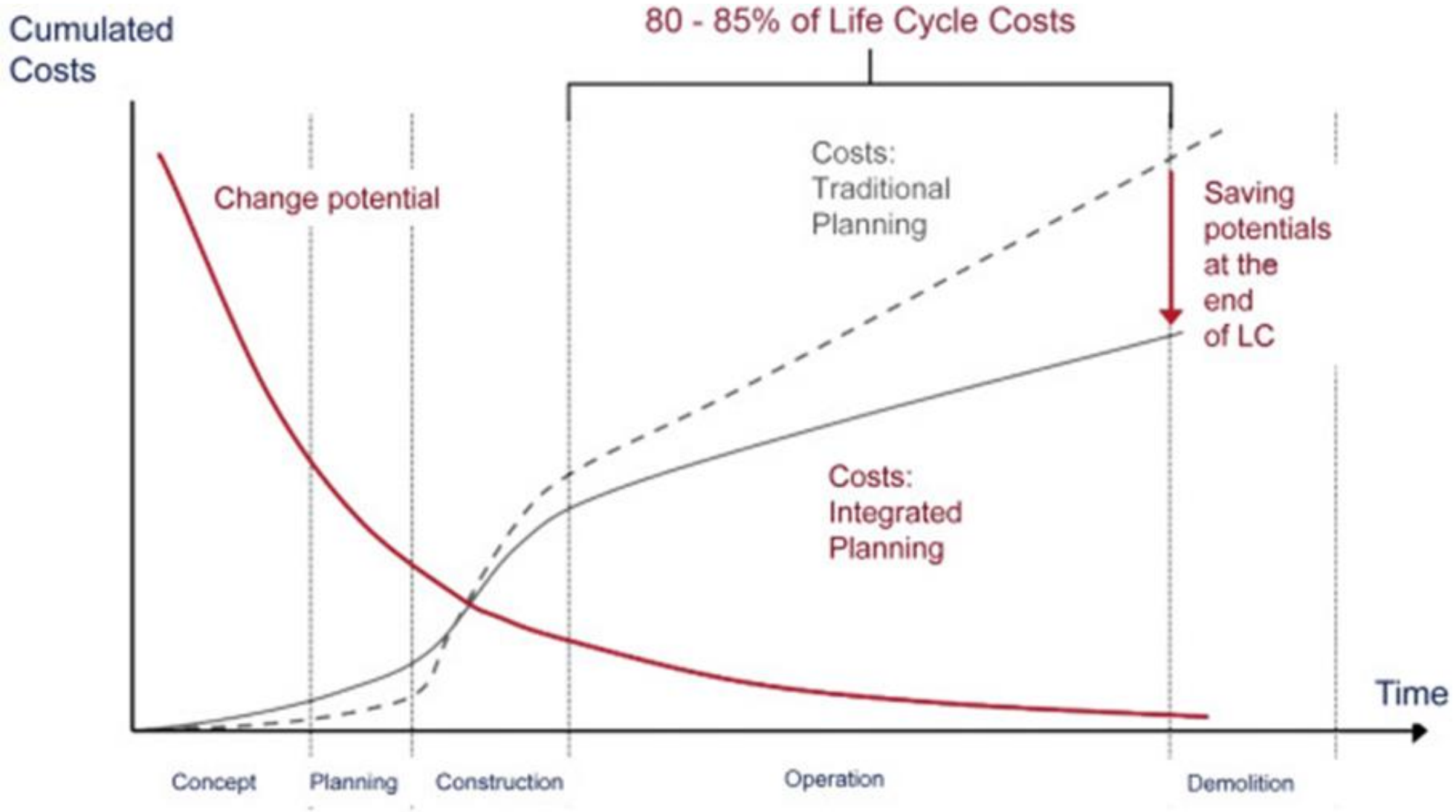
The average life span of an industrial building is 50-60 years.

6-7 Stages of a building

1. Raw material extraction
2. Manufacturing
3. Construction 1-2 years
4. Operation and maintenance
5. Renovation, reusing **Brownfield**
6. Demolition
7. Disposal and recycling



Building life span



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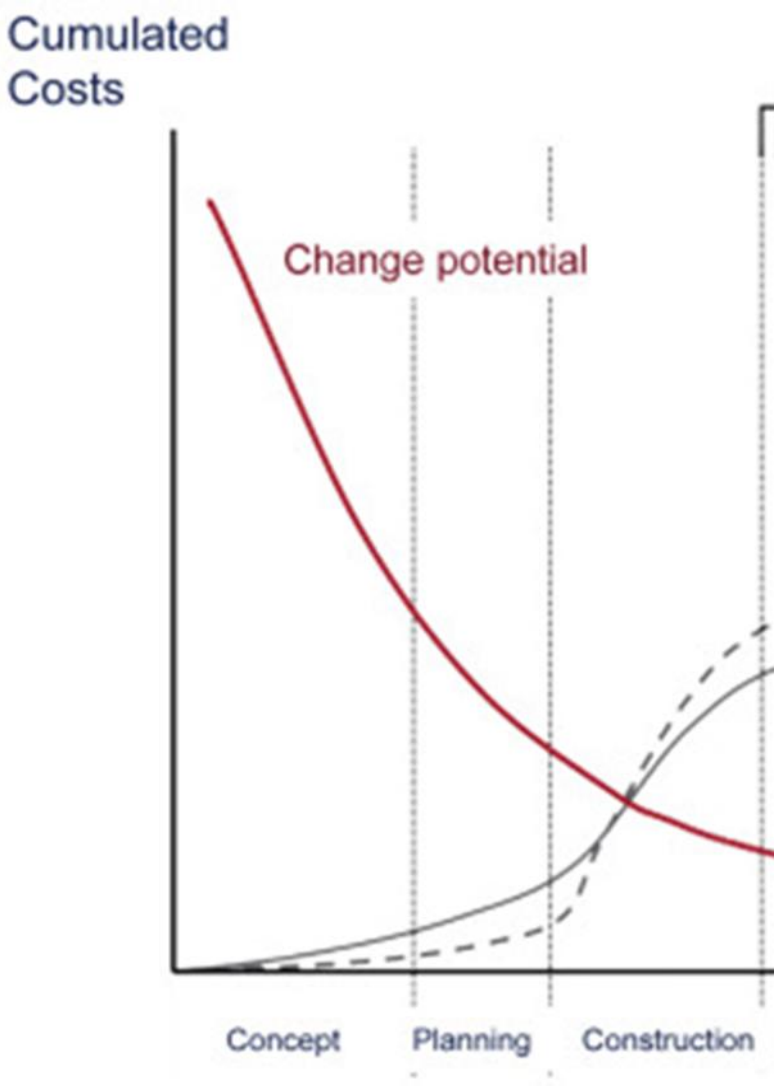
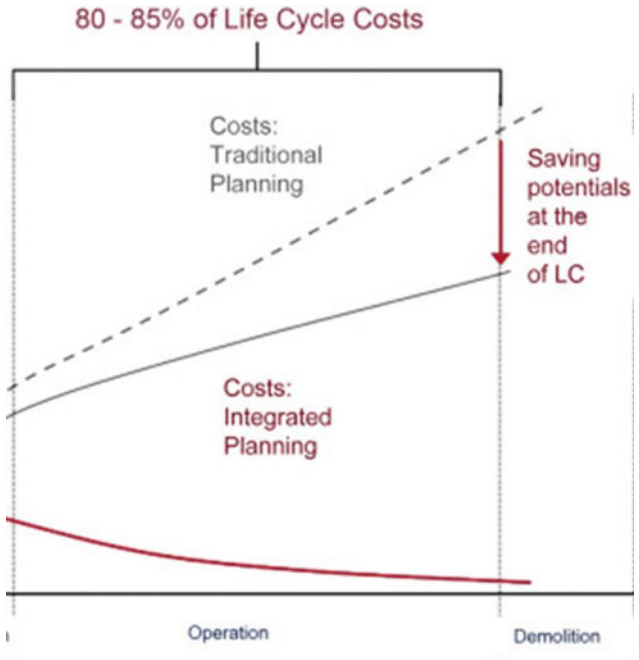
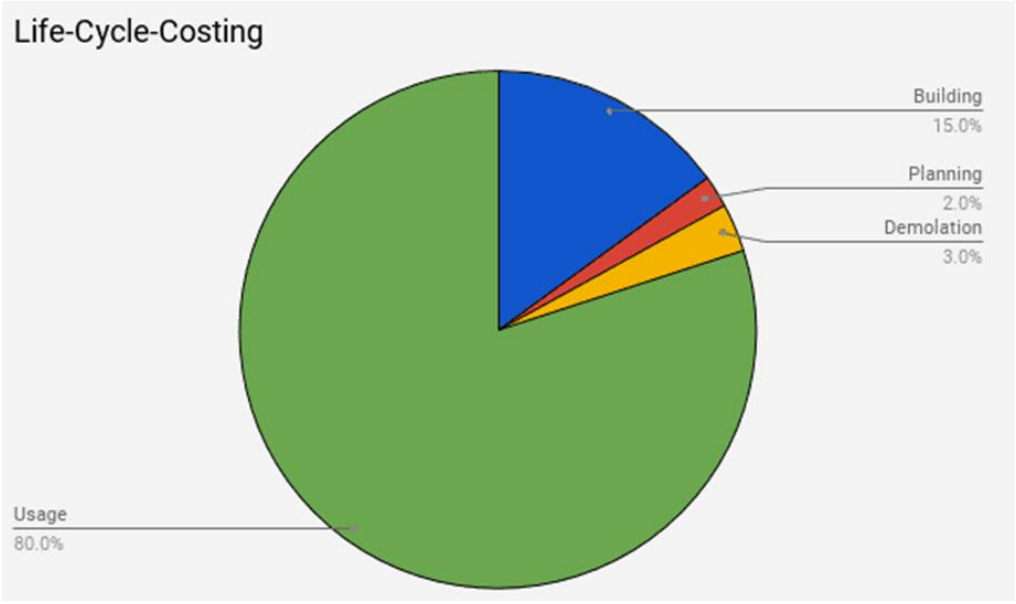


Phase I – Planning and Construction

- Once the building is in place, the costs are largely fixed and can only be changed slightly.
- The greatest influence can be exerted on the life cycle costs in the planning phase.
- For cost-effective buildings it is essential to consider all elements connected to the building, the production and using at the beginning of the planning.





Phase II Usage, 80% of the costs

- Operation costs
- Maintenance costs
  - Quality
  - Service and inspections
  - Cleaning and repairs
- Renovation
- Taxes, Insurance, Fees

Early planning Stage

- Define Project Milestones
- Information collection from all related department
- Can the production benefit the building? Process heat
- Involve all shareholders from the beginning

Site Selection	Building related (Phase I)	Production related (Phase II)
Weather conditions	Green Building certificate	Energy using
Employee situation	Size and usage	Energy wasting
Local supply chain	Air-conditioned	Energy recovery
Logistic	Layout	Peaks
available energy type	Type of structure	Dependency
	Energy system	Temp. requirements

How do build an energy saving “Green Building”?

“Average energy saving 25%-30%”

DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen
German Sustainable Building Council

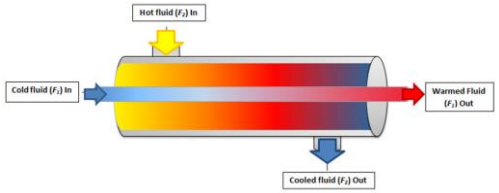
ecobuild TECHNOLOGY

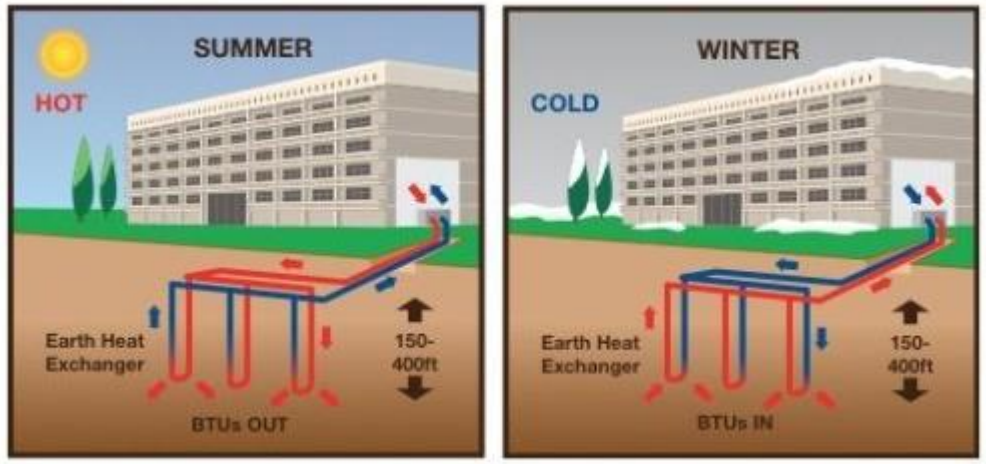
BuildingGreen

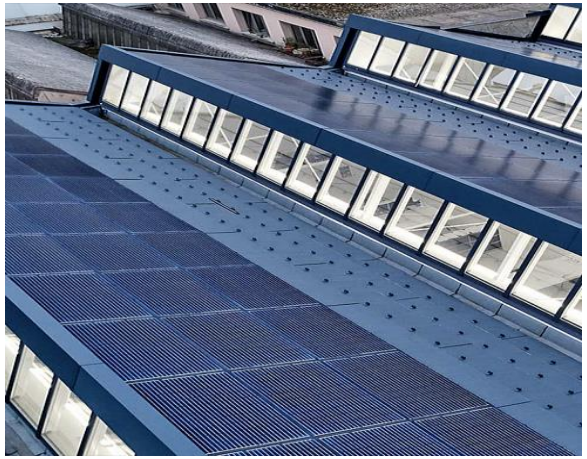
Technologies for Green Factories

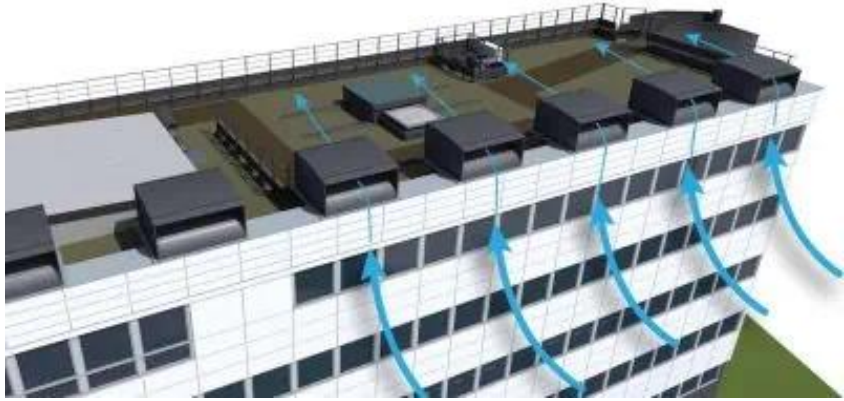
Energy

- Building direction
- Geothermal energy
- Photovoltaic for roof and parking lot, if possible façade
- Wind energy
- Heat exchanger (AC, Fresh air, process energy)
- Waste water heat recovery









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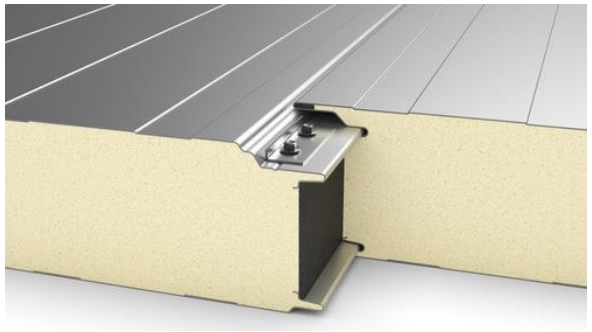
Technologies for Green Factories

Energetic effective Façade*

- Thermal insulation composite system
- Thermal insulation glazing
- LED lighting (standard)
- Daylight optimization



Heating and Cooling

- Floor heating
- Infrared heater
- AC, airflow optimization

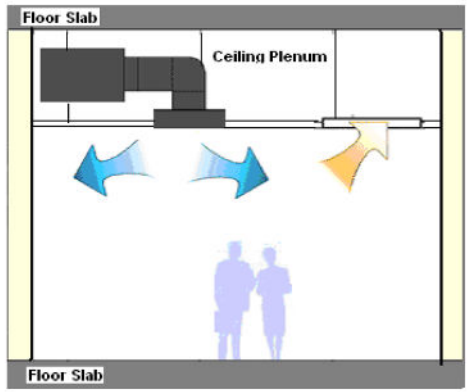


Fig -1 Conventional System

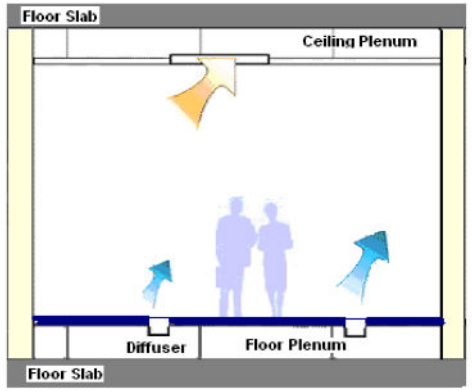


Fig - 2 Underfloor Air Distribution System

*A high-performing facade reduces the amount of heat gain or heat loss through the building envelope. This can eliminate the need for mechanical heating and cooling systems, resulting in lower energy bills and reduced greenhouse gas emissions.

Solutions

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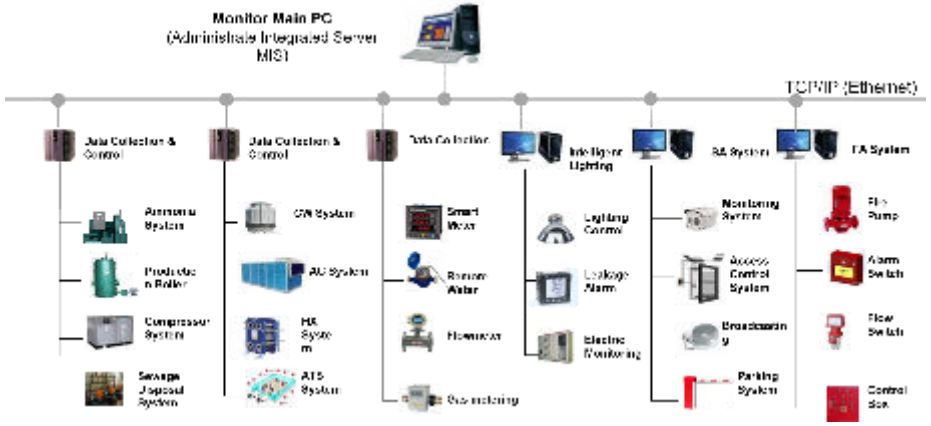
Intelligent (smart) building management system

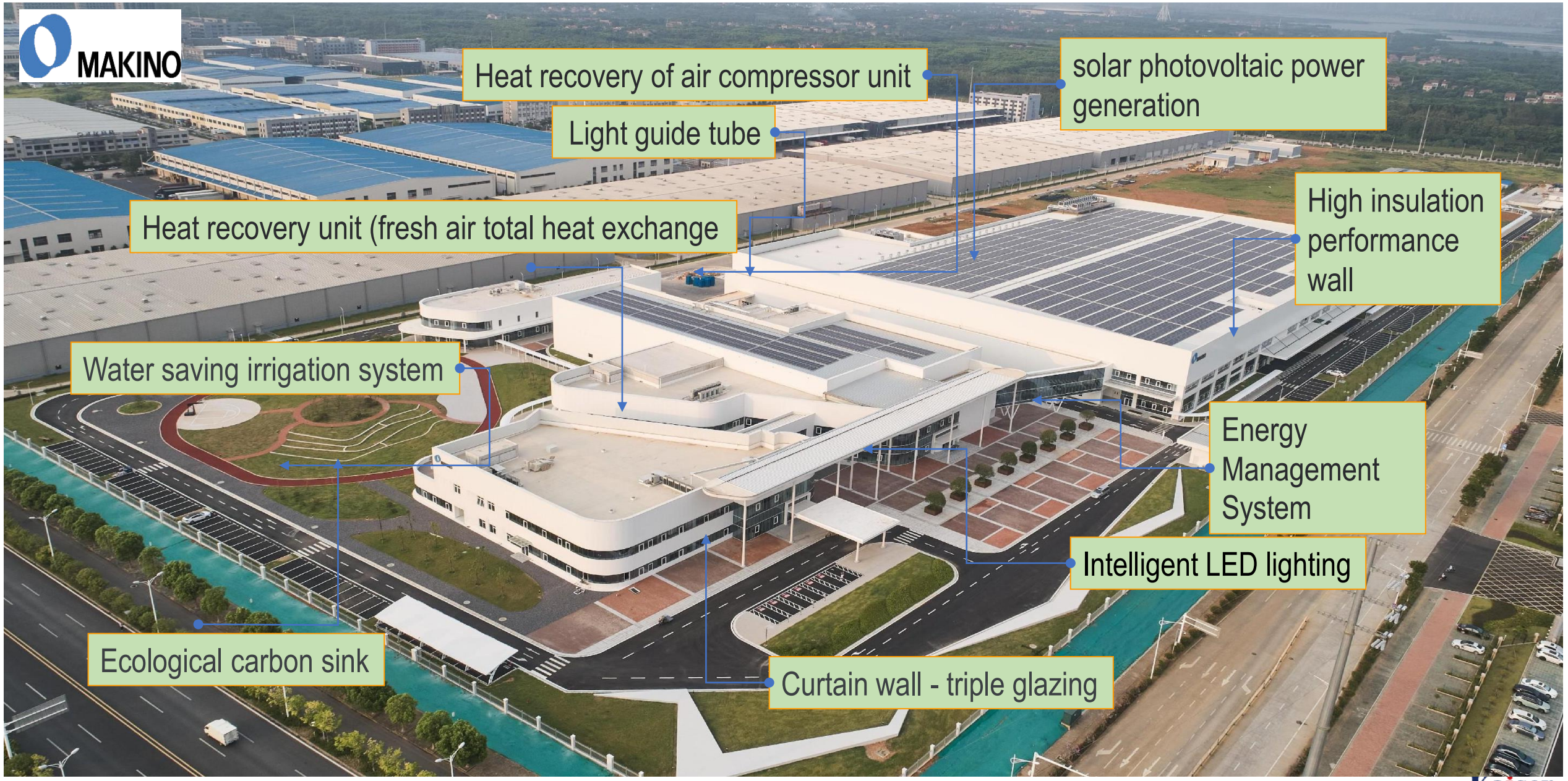
In a “Smart Building”, diverse subsystems are integrated. They communicate and interact to optimize operating costs and occupant comfort. Some of the integrated subsystems include:

- Heating, ventilation and air-conditioning (HVAC)
- Sunshade
- Power distribution
- Lighting control (motion sensor)
- Security and Access control
- Fire and Life Safety
- Plumbing
- Conveyance (elevators, lifts, etc.)
- Water usage measurers
- Improvement of energy purchase
  (market price, night shifts, battery recharge, State Grid)
- Rain water usage
- …



Soft skills
Staff trainings
Rewards

Planning and Design



Green Energy

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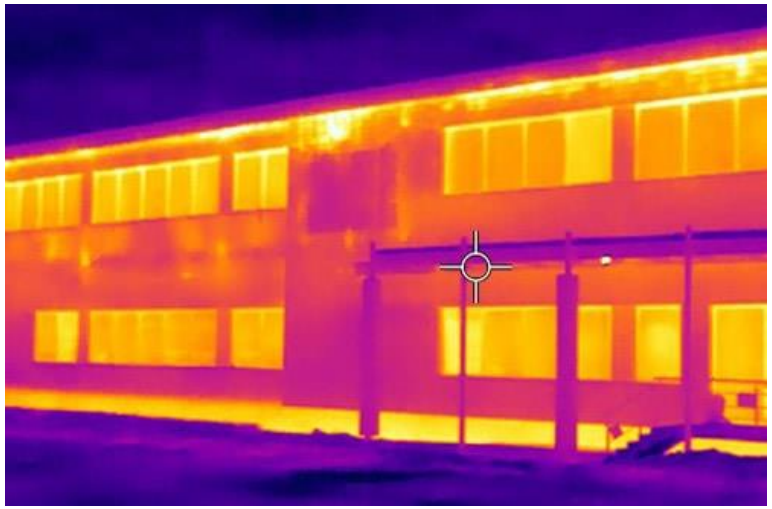
Tools for defect detection

- Wind proof** (Blower Door Test)
- thermal bridge optimization
- equipment leakage tests (air pressure)
- …



**Blower Door Test

A blower door is a machine used to perform a building air leakage test. It can also be used to measure airflow between building zones, to test ductwork airtightness and to help physically locate air leakage sites in the building envelope.

Advantages of Brownfield Construction Projects

Better site quality (centrality, public, transport, urban environment, closer location to business partners)

Stable increasing value or of the property, especially in regions with a declining population

Less risk of vacancy due to a broad utilization spectrum, especially when mixed use applied

Lower construction cost thanks to available infrastructure, and lower
allocated costs because of the utilization of public infrastructure

Savings on ecological compensation measures
Financial incentives and support
programs
Marketing advantage and longer life cycle of buildings with special flair

Disadvantages of Brownfields

Risks, e.g. contamination and its Handling

Less flexible (span, light, crane)

Not for every industry (special requirements)

Supply capacity (water, electricity)

Logistic (urban area)

- Reactivation of Brownfield saves resources and enhances the surrounding location

- Sustainable Facilities conserve the natural resources
- Sustainable Facilities save operation and maintenance cost
- Long-term usage of facilities causes less pollution

- Increases the public life satisfaction
- Increase the lifetime of a building, using a building as long as possible

- Supporting the long-term 2030/60 agenda

Future Improvements

Building material

- optimized production process for cement, steel and glass can be reduced
- Development of CO2 optimized concrete, “first prototype samples in progress”
- Optimize mix of material, increase renewable, recycled material
- Implementation of laws and regulations for quality and minimum rate of energy savings

Building types

Zero Energy Buildings -	is a building with net zero energy consumption, meaning the total amount of energy used by the building on an annual basis is equal to the amount of renewable energy created on the site The annual energy balance is independent from public provider.
Energy-Plus Buildings -	is a building that produces more energy, over the course of a year, than it imports from external sources. (interesting for EV Cars)

According to recent studies, buildings are responsible for **40%** of global CO2 emissions.

One of the most used material for buildings is **cement**.

The cement used for facilities accounts for **8%** of global greenhouse gas emissions.

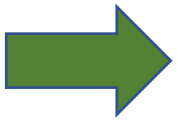
(3 billion ton CO2 for cement production)

The Production of		**emits CO2**	**Areas**
1 m3	Reinforced concrete	320 – 340 kg	Foundations, Floor, Columns, Roof, Road, Basements
1 ton	Steel for structure	1500 – 1800 kg	Structure, Beams, Supports, Crane
1 ton	Construction glass	500 kg	Windows, Curtain Wall, Skylights
1 m3	Mineral wool	168 kg	Around all building sides But the energy input for the production exceeds many times the energy savings during the usage phase.

Future View

- The investment cost 20%, usage 80%

- Every building needs an own consideration due to
  - possible usage of process energy,
  - location (including weather conditions) and
  - available power resources.



ALREADY DURING THE PLANNING PHASE

- Using CO2 friendly materials

- Increase the lifetime of a building, using a building as long as possible

- Consider a design which is adaptable

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WeChat: CHTR1980

Christian is graduated Dipl.-Ing (FH) Civil Engineer.

He worked over 10 years in China in different construction related positions. In 2010 he started his China experience as supervision engineer on the new built Shanghai – Kunming High speed passenger railway project. After completion of the project, he changed as project manager into China's private construction industry and supported investors during their project realization. Since 2022 Christian is working for Kaiser Construction after he worked for other construction companies in Qingdao, Shenyang, and Guangzhou.

Now, he is involved in BD & Marketing for Kaiser, but do not only focus on Wuxi Branch. In addition this he supports Kaiser Projects with technical expertise and take part construction project management.

Contact Details

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List of figures

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