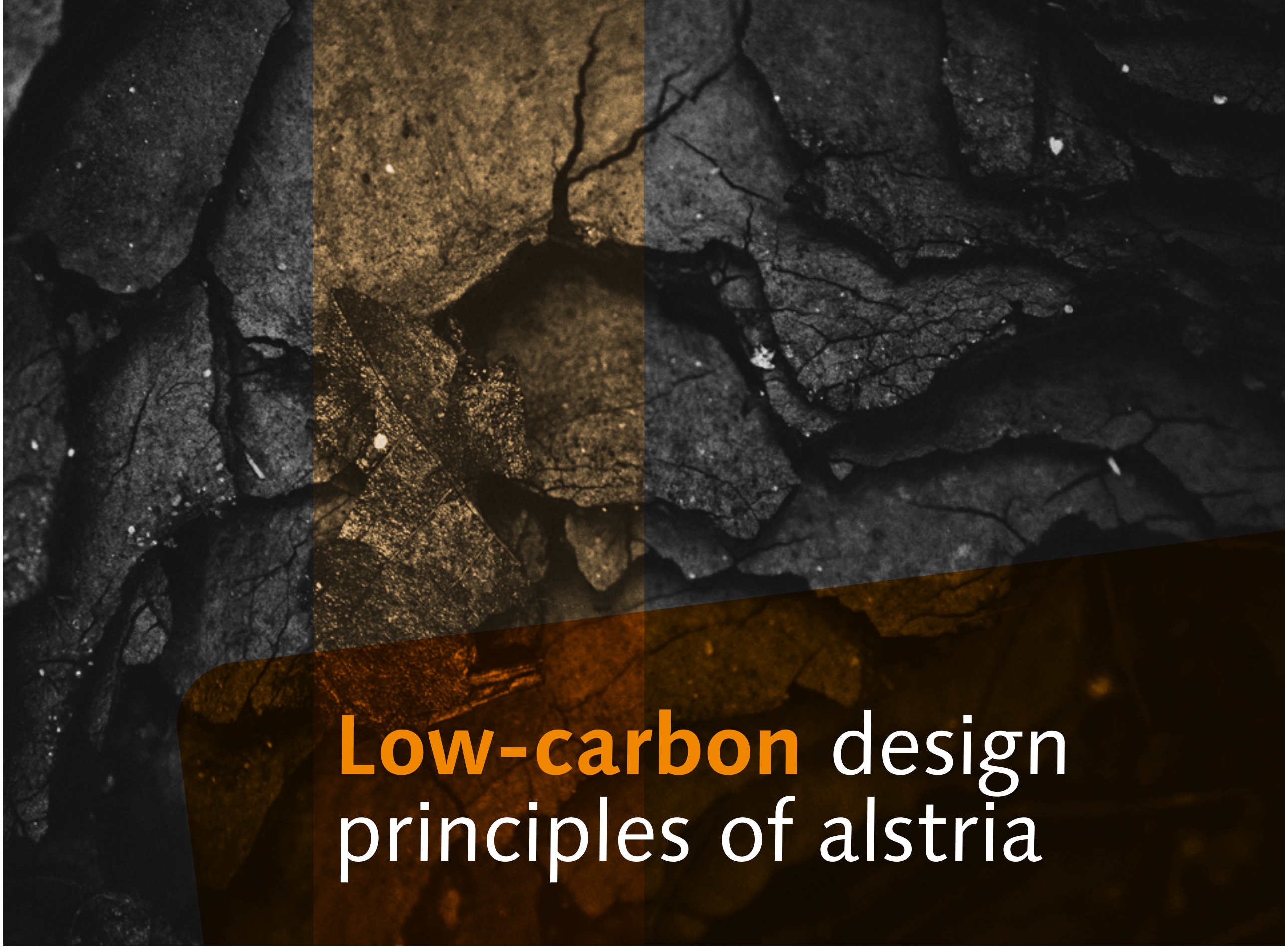
# **Low-carbon** design principles of alstria

alstria



# **Low-carbon** design principles of alstria

The following design principles are structured to help anyone involved in the design and planning process of a construction project at alstria integrate the company approach to climate change into their thinking.

The basis for the approach is the EU's climate strategies and German climate protection laws. We want to lead the way on this issue and help our sector by communicating our ideas, analyzing the results achieved and demonstrating achievements.

Tackling the climate change crisis is one of the biggest challenges the world's economies have faced in years. Economic efficiency will always be at the forefront of decisions we make as a for-profit organization. We do believe, however, that economic efficiency needs to be examined over the entire life cycle of an asset and not only at the time of its construction.

There are **five structuring concepts** that should have an overarching impact on our actions:

## I. We do not define climate change policies; we apply them

Defining and implementing a climate change policy requires the ability to act across the entire economic spectrum. The success or failure of a climate change policy depends on all economic agents sticking to the plan designed at a country/continent level. It cannot be done solely at a company level. As such, we will follow the path of the Paris Agreement set by the EU as well as the climate policies set up by the German government.

## II. alstria is a for-profit organization

As a for-profit organization, we shall essentially base all our decision-making processes on returns expectations. The returns, however, will need to be considered over the entire life cycle of an investment and not solely its immediate aftermath. The objectives of alstria will be to achieve the best economic outcome while meeting the legal climate requirements in place at the time of the decision.

## III. We need to maximize our use of the carbon already spent

Materials that have been produced in the past incorporate a substantial amount of embedded carbon. This $CO_2$ has already been emitted in the past and is present in the atmosphere. The harm is done. Maximizing the life cycle and economic benefit of the carbon that has already been spent is a necessary task as it reduces the need for new carbon emissions.

## IV. Less is the way forward

The most sustainable building is the one that we did not build. The Paris Agreement targets cannot be achieved without a fundamental reduction in our use of resources. Before adding anything that consumes energy to a design, we must question the absolute need for that addition.

## V. Compensation is not the answer

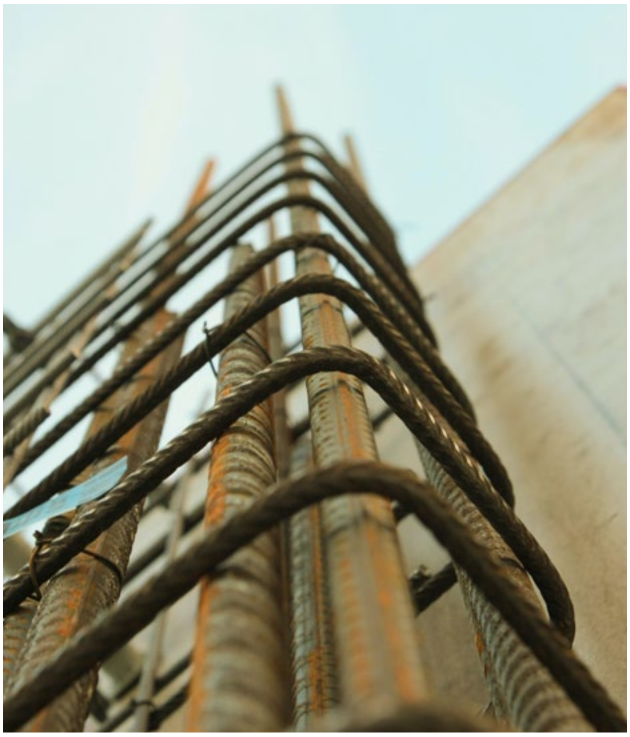
While alstria will compensate for its emissions from time to time, the company is conscious that compensation is not an appropriate approach at a company level. It is also aware that "zero emissions" are, in the current state of science, not achievable in real estate. Therefore, alstria will refrain from using "net zero" or other offsetting approaches in the project design and will favor actual carbon reduction within the set legal framework.

### Be open-minded!

We will remain open-minded to design ideas and proposals that fit within the five overarching concepts we have defined and allow us to explore new avenues to reach a carbon-light real estate portfolio.

We deduce from the above concepts the **following principles** that we apply in the design and construction of any project at alstria:

# 1 Continue using the building fabric



## Continue using the existing building fabric and build only things you really need.

During the fabrication of building products, especially with concrete and steel, very large amounts of carbon are generated. Therefore, we must try to reuse as much of these materials as possible in refurbishment and renovation projects. The carbon footprint of new buildings and constructions is so large that not even the best new energy-efficient buildings will be able to become carbon-neutral by 2050.

This principle derives from concepts III and IV.

# 2 Build low carbon

Use as little new concrete and steel as possible — use products that have a low carbon footprint and are durable and robust.

Planners and builders in all our construction projects are called upon to offer low-carbon alternatives to com-mon building products. This applies particularly to concrete (aggregates, amount of cement, production) and steel (recycling, production). Likewise, the use of natural, renewable and light materials such as wood should be the rule rather than the exception—assuming that the materials are suitable and economical. The implementation of measures should be climate-positive i.e. the emissions from production should be lower than the carbon savings in operations resulting from the construction measures.
In the future, specifications from the circular economy (cradle2cradle) will play a more important role, because a planned dismantling and recyclability of building products not only helps save resources but also lowers carbon emissions.

Use cement replacements (e.g., PFA and GGBS) produced in Europe but avoid those imported from other continents.
The potential for the reuse of building components with a large carbon footprint is most apparent when one considers the entire life cycle. For this reason, the main components of a building should be examined for their reusability through a

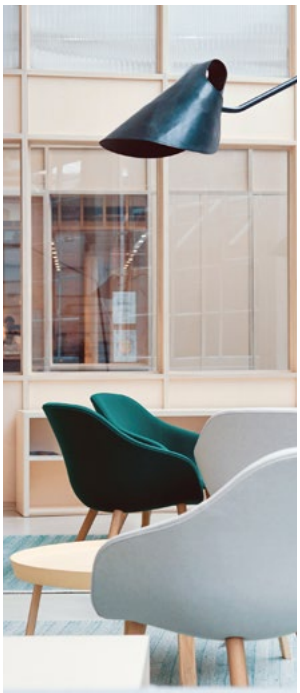
life cycle analysis (LCA) prior to a project; these particularly include foundations (~17% of embedded carbon), ceilings and columns (~48% EC) and the building envelope (~16% EC).

This principle derives from concepts III and IV.

# 3 Simple and robust construction

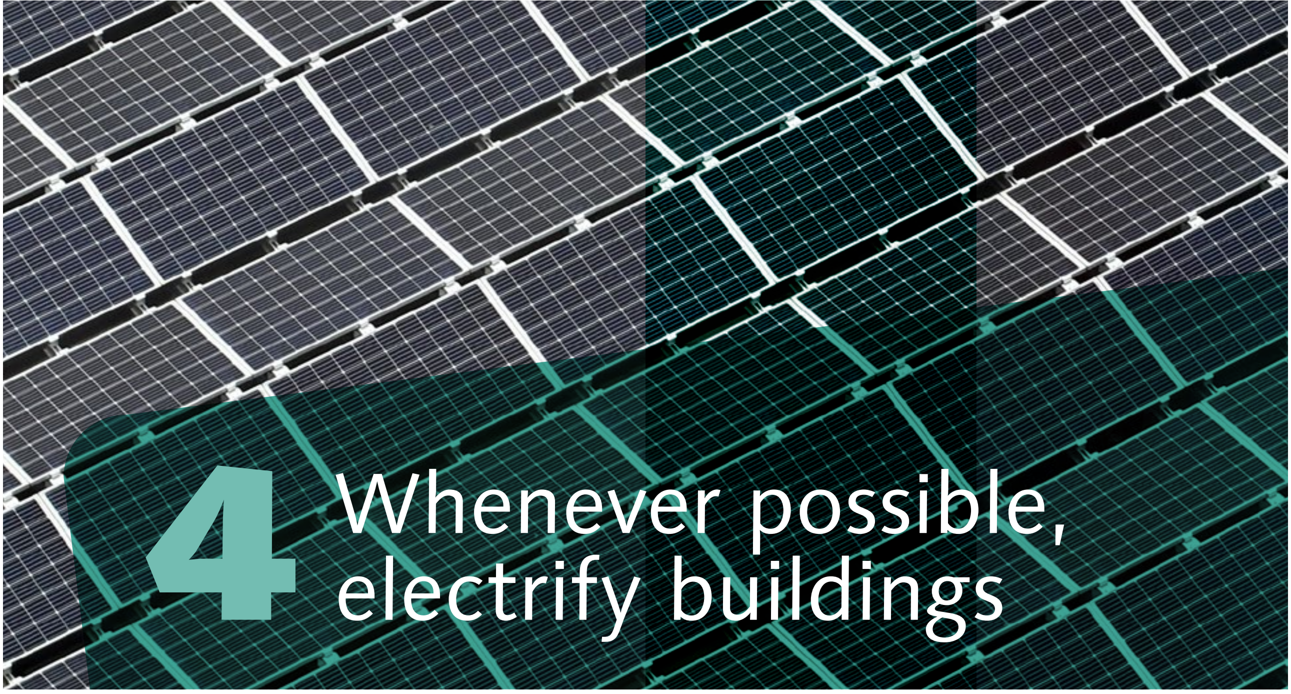
Everything that is not built or used does not consume energy and cannot break down.

We build according to the current building regulations and, as a rule, do not exceed those specifications without good reason. We try to achieve the maximum effect with the means at our disposal. This method is known as BATNEC (Best Available Technology at No Extra Cost). In most cases, clever combinations of simple, robust solutions are more efficient in the long run than complicated and maintenance-intensive high-tech products. That is why we prefer passive elements that require little active technology to achieve the desired effects, such as natural ventilation instead of mechanical ventilation or external sun protection instead of air conditioning.



The situation is similar with the leasable floor area in buildings—the more flexibly the layout can react to different tenants and requirements, the less extensive the necessary conversions.

This principle derives from concepts I and II.



# 4 Whenever possible, electrify buildings

The most efficient way to decarbonize the economy is through decarbonization of the electricity grid. Therefore, we need to increase the electrification in our buildings and support the conversion of the best possible grid—even if it means lower initial carbon efficiency.

Due to the increasing share of volatile renewable energy sources in power from solar and wind plants, buildings with flexible and "grid-compatible" consumption patterns will be able to save on costs in the future. Energy-flexible behavior requires a predictive operational building control and quick adaptability of building energy demands. Essentially, this means that load curves (electricity & heating) are smoothed, e.g., by pre-conditioning (preheating/cooling) buildings. This also means that energy-hungry systems and services (charging of electric vehicle or air conditioning units) are automatically throttled if energy is expensive or not available in sufficient quantities. Power generation and storage in buildings promote energy flexibility/autarky particularly well: energy is buffered in the event of oversupply and can be sold to the grid at a profit when demand is high (virtual power plants), thus also helping to stabilize the grid.

The best results can currently be achieved in buildings/quarters that are fully electrified; electric heat pumps provide heating or cooling and are fed at the site from PV systems and batteries (i.e., electric vehicles).

When using principle 3 above and assuming a BATNEC approach, the order of energy priorities for heating and cooling in assets should be as follows:

**a.** Electricity
**b.** District heating/cooling
**c.** Alternatives to fossil fuels
**d.** Natural gas

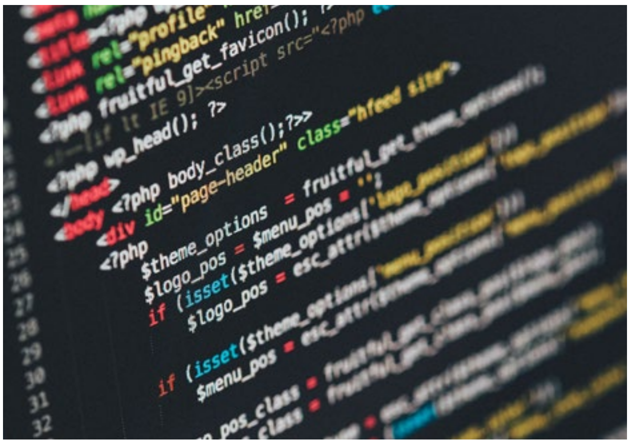
This principle derives from concepts I, II, III and V.

# 5 Low-tech is the future

Technology requires a substantial amount of resources to be built and then to be operated. It accelerates the pace of obsolescence of the building in which it is incorporated. A low-$CO_2$ design should incorporate technology only when it provides a substantially superior benefit compared to a low-tech alternative.

Sensors and other building automations should be limited in buildings to cases where there is a substantial added value and no alternative non-tech viable option. Designs and solutions that cannot operate without substantial help from technology should be avoided. If connected, building technologies need to offer a proper API.

This principle derives from concept II and IV.



# 6 First reduce energy demand

An airtight facade with enough mass is a proven temperature buffer and reduces heating requirements. The remaining equipment should be appropriate, and the technical installations should be as flexible as possible and not oversized.

Energy requirements and/or the demand for heat, temperature conditioning and electricity should be questioned and reduced first in the course of optimizing the existing building. The building envelope is essential in this respect: insulation, glazing (proportion of mass to glass, type of glazing), airtightness, solar shading and green areas (green roofs insulate better and protect against overheating) are the central topics here. A further crucial factor is the choice of comfort and equipment features (is a canteen or a large server really needed?), as well as the dimensioning of the central building technology (is active cooling or mechanical ventilation really necessary?).

An energy optimization scheme should look first and foremost at passive, natural solutions and only use technology as a last-resort solution when all passive approaches have failed. Any need for technology that is the result of a "look-and-feel" design decision should call into question the initial design.

This principle derives from concept III and IV.

# 7 Then, increase efficiency

Many efficiency gains can be realized immediately at little cost. It is worth checking the settings on building services and readjusting them. For existing permanent energy drains such as lighting, pumps or motors, there are highly efficient solutions that have very short return-on-investment periods.

Studies in our portfolio show that the configuration of central building services is often not optimal. Many wrong settings can be identified and eliminated with the help of sensors or real-time data (e.g., using SmartMeter). Among the improvements that can be introduced quickly and cost-effectively are the following:

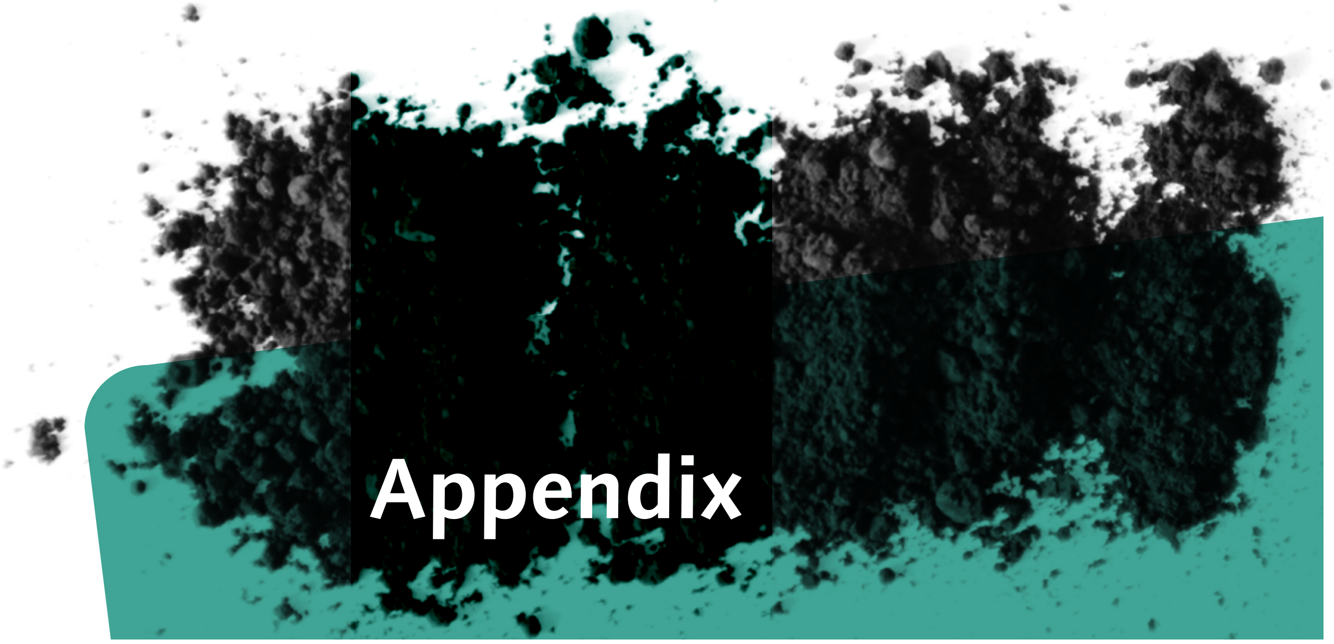
**a.** Checking, optimizing and adjusting the running times of heating, ventilation, cooling, lighting and other central services at sensible intervals (at least annually) and adapting them to changes.

**b.** Fine-tuning settings of building services to different seasons and tenant requirements as well as optimizing energy flows (heating/ventilation check, hydraulic balancing, night cooling, cooling vs. heating).

**c.** When replacing existing technology, systematically relying on highly efficient variants (LED lighting, efficiency pumps, ventilation with heat recovery and frequency converters, heat pumps).

**d.** Designing building controls in a user-friendly and smart way (motion detector) and, if possible, using a system that can independently correct misuse (rebound effect). Ideally, user comfort will increase in addition to energy savings.

This principle derives from concepts III and IV.



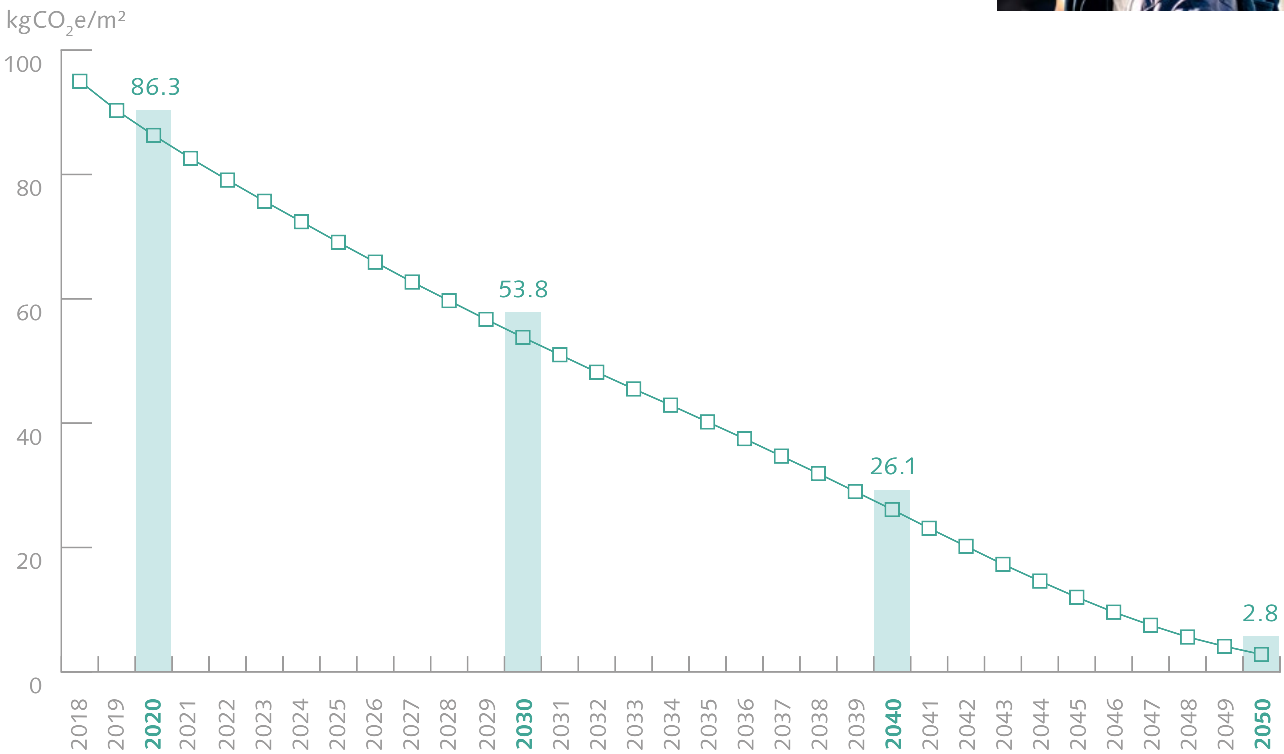
# Appendix

## EU decarbonisation pathways

The EU targets for decarbonisation of the real estate sector are published via the CRREM tool (www.crrem.eu) since the beginning of 2020. The tool indicates the maximum annual carbon emissions in kg per square metre gross internal area (kg$CO_2$e/m²a) per country and type of use that is in line with the EU climate targets.

## Decarbonization pathways for office buildings in Germany

from the CRREM tool, version 1.4



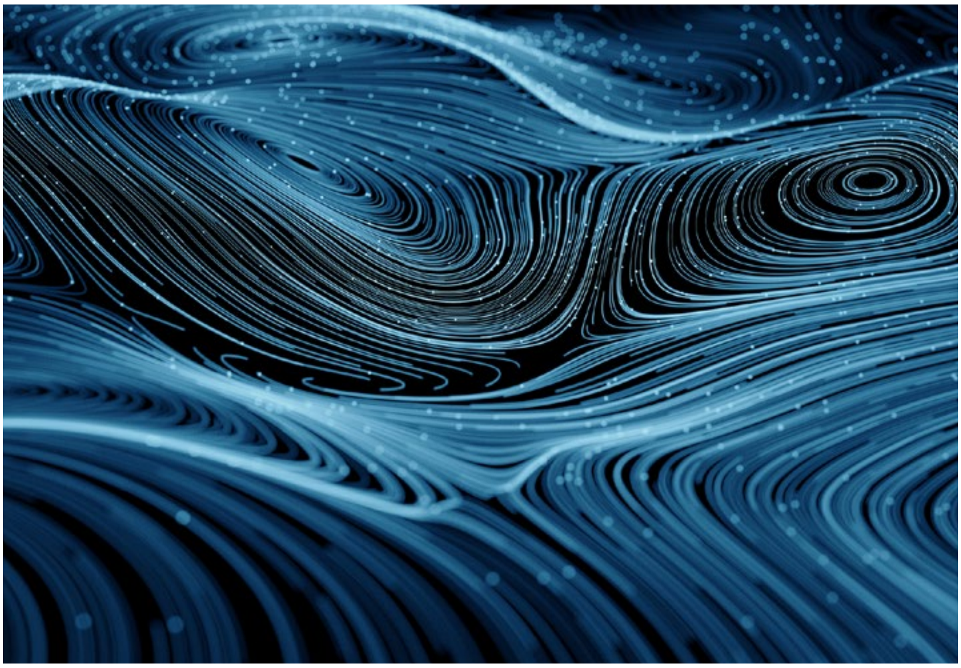
## Electric vehicles in office buildings

The transportation sector is in the midst of its transformation towards new forms of electrified mobility. This poses many challenges for buildings, as charging points for electric vehicles require electricity loads for which existing buildings are not equipped.
However, efficiency measures can release power reserves that can then be used for electric vehicles. It is to be expected that almost every third parking space is to be electrified by 2030. The necessary charging infrastructure will only be possible with intelligent charging management including load balancing. An additional supply from solar power and/or building batteries will also help.

## Data Management

Consumption data is used for tracking of efficiency measures, running an energy management system, CSR reporting and rating, preparing of energy performance certificates and monitoring of EU decarbonization pathways. This data needs to be reliable and accurate. The aim is to collect and evaluate this data as automated as possible. SmartMeters, smart sub-meters and other meters/ sensors with communication modules are particularly suitable for this purpose.

The best quality of performance data is generated from real-time data points, collected at appropriate time intervals (electricity = 1–60 seconds; natural gas/ heat = 15–60 minutes; water = hourly–daily). Real-time data can easily be used to detect incorrect equipment settings and to expose malfunctions and defects in the central building services. Moreover, this also eliminates the tiresome manual reading of the meters.



## Refurbishment roadmap – essential questions

### 1. What are the main energy drains (central services) in the building? → equipment database

- Heating (system, type of energy, age, alternatives to fossil fuels, hot water)?
- Ventilation (natural/cross ventilation, mechanical, frequency controlled, heat recovery)?
- Cooling/air conditioning (system, coolant, legionella, alternatives)?
- Server, canteen, special solutions (laboratories, test stands)?
- BMS, control/management, automation?
- Lighting, access (lifts), safety/security?

### 2. Is consumption data collected and evaluated? → energy monitoring

- Are historical consumption records from all main meters available (>3 years, heating, electricity and water)?
- Are SmartMeters installed? Is the data flow active and data collected from all main meters?
- Is the planning showing the energy distribution/use in the building? Schemes or energy management software?
- Is there a management level/BMS that can be centrally overridden by a smart predictive system (e.g. Meteoviva or Recogizer)?
- Is there an annual evaluation of the data (Digital Audit) and fine tuning of the building settings?

### 3. How can the energy demand be reduced? → pre-development/life cycle analysis

- Is there sufficient knowledge on the façade and the building envelope (type, material, thickness, age of insulation and windows/glazing, solar control and tightness)?
- Is there sufficient knowledge of the main building components (materials and age of foundations, slabs and columns) and are they are reusable (type, material, age, structural/static system)?

### 4. How can the building be operated more efficiently? → efficiency check

- Are the settings of central building services of the optimally adjusted (on-times, day/night or summer/winter settings, sensor triggered)?
- Is the facade illuminated? Is it required? Have LED lamps been installed (staircases, elevators, garages, exterior lighting)? Automatic on-times/ motion detectors?
- Is heat recovery used for e.g. air ventilation, IT server or waste water?
- Are highly efficient pumps (heating/water) and motors (ventilation/cooling) used?
- Can automation (sensors or motion detectors) help to increase energy efficiency and comfort of the tenants?

### 5. How flexible is the building on energy use, onsite produced or storage? → energy/load management

- Are load curves available? Can load peaks be smoothed (load management)?
- Can energy/load heavy systems (ventilation, canteen, EV charging) be automatically throttled?
- Can renewable energy be produced onsite (PV, $H_2$-CHP, Power-to-X)?
- Can energy be buffered or stored onsite (heat/cold storage or electric batteries)?

# BUILDING YOUR FUTURE

*The most sustainable building is the one that was not built.*

**Contact us**
Robert Kitel
Sustainability & Future Research
+49 (0) 40 226341-300
sustainability@alstria.de

alstria office REIT-AG
Steinstrasse 7
20095 Hamburg, Germany
www.alstria.com