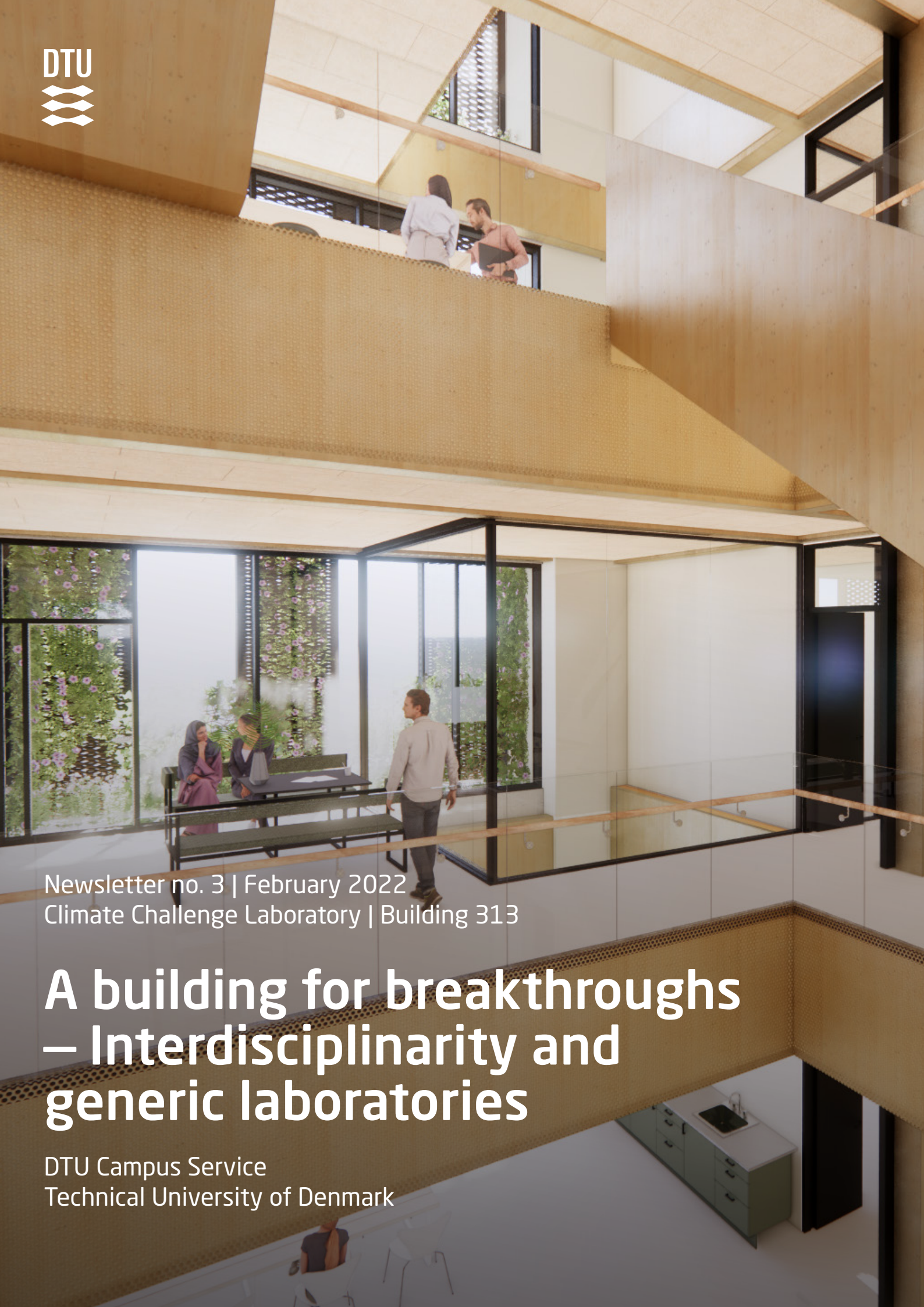


Newsletter no. 3 | February 2022
Climate Challenge Laboratory | Building 313

A building for breakthroughs – Interdisciplinarity and generic laboratories

DTU Campus Service
Technical University of Denmark

A building for breakthroughs

New ideas arise when researchers from different disciplines cross-pollinate each other's research. In the newsletter you can read about the work of developing the Climate Challenge Laboratory, which will form the framework for future technological innovations in sustainable energy technology.

The Climate Challenge Laboratory, also known as Building 313, will provide a framework for a state-of-the-art research environment. From the beginning of 2024, researchers from different disciplines can move in, cross-pollinate each other's research, and develop new technologies.
In this newsletter, professor and DTU's Executive Vice President Rasmus Larsen and civil engineer and project manager in DTU Campus Service (CAS) Laila Halkjær tell how they have had to think in new directions to develop a building for the interdisciplinary collaborations of the future.
How do you design a building that supports and invites collaboration between research groups that we do not yet know and that we know have different needs? And how do you create facilities to ensure that DTU also delivers world-leading research in 20 years? And how can DTU's experiences of designing and constructing Building 313 contribute to promoting the green transformation of the building?
Finally, you will receive information about when there will be noisy construction site activities, a status of the construction project and contact information.

Professor Rasmus Larsen (left), Executive Vice President at DTU, and civil engineer Laila Halkjær (right), project manager at CAS, tell here in the newsletter how DTU develops the building Climate Challenge Laboratory, which will form the framework for interdisciplinary research collaborations and research innovations in sustainable energy technology. Photo: DTU

Breakthroughs occur in the meeting between different subjects

Climate Challenge Laboratory is in many ways an innovative building at DTU. It is new that DTU builds for research activities and researchers we do not yet know. We are doing this to lift the ambition to develop technological innovations that contribute to solutions to climate change.

"It is in the interfaces and in the clashes between disciplines that many of the great discoveries will happen.

This is why we are establishing the Climate Challenge Laboratory. We want to bring research groups with slightly different disciplines together and let them work towards the same goal."

– Rasmus Larsen, Executive Vice President of DTU

Why has DTU chosen to build the Climate Challenge Laboratory?
RL: We are building the Climate Challenge Laboratory based on the that there will be a great growth in our research activities aimed at the green transition. It is something new that we are building for future growth, because otherwise we are usually building for activities we already have. We are building the Climate Challenge Laboratory, even though we do not know in advance which institutes and centers will populate the building. The building is based on expected post-approval.
It is completely different than how we otherwise do, but we can see that there is a great need for research and that there are research funds. We believe that DTU can get a large share of them, and we will be ready to receive them. Therefore, we have planned building 313 and planned it to be the Climate Challenge Laboratory.

What is the idea in creating a platform for collaboration across disciplines - and what's new about it?
RL: It is in the interfaces and in the clashes between the disciplines that many of the great discoveries are going to happen. We want to create the best conditions for this to happen, and therefore we strive to work across disciplines.
We are in fact building a building for what in research circles is called 'serendipity'. That is, you find something you are not looking for, and you appreciate it and recognize the value of it. We do this by establishing a building where research groups with slightly different disciplines sit together and work towards the same goal.
The Climate Challenge Laboratory is inspired by the Bio-X collaboration at Stanford University, which houses bio-engineering, bio-medicine and bio-technology and has been a great success for new collaborations and research fields. This is also DTU's goal with the Climate Challenge Laboratory. We would like new research collaborations to be established across many disciplines within 3-5 years. In the longer term, within 10-20 years, our goal is to create a foundation for research results to emerge from the activities in the building.

LH: Building generically so that we can gather different disciplines under one roof is a new way of programming buildings in CAS.
We have had inspiration through a series of introductory interviews with 'inspirers' and through sparring with a permanent interdisciplinary research group to find out how we create the framework for an attractive and unique research environment. We have experienced an incredible amount of hospitality from all the users we have had a dialogue with, they have shared their thoughts on the laboratories of the future, the use of research facilities and common functions. We have also received good input and sparring about future operations, working environment and safety.

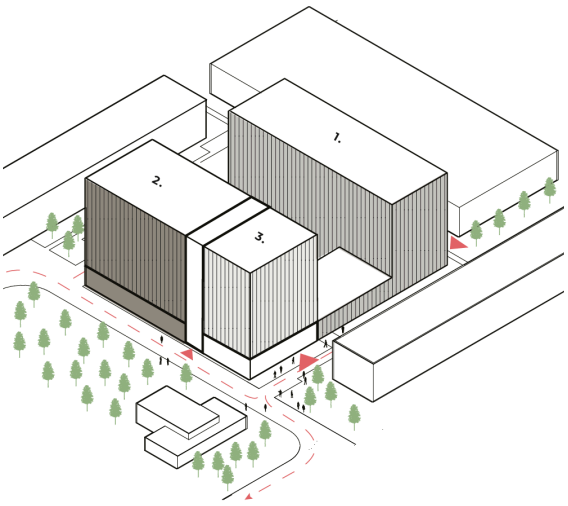
Clark Center, Bio-x, Stanford University

The Bio-X collaboration at Stanford University is a pioneering project for interdisciplinary research collaborations and an inspiration for DTU in the development of the Climate Challenge Laboratory. Bio-X was formed in 1998 as an interdisciplinary institutional framework for bioengineering, biomedicine, and biotechnology. In 2003, Bio-x inaugurated The Clark Center on Stanford University's campus, which, as something completely new, was designed to allow researchers to interact with each other.

We strive to create a framework that makes you want to move from your professional affiliation, e.g. bio-technology or physics, to a new professional community with some others. That understanding is crucial for us to be able to create a building with facilities and a unique research environment that will be as attractive as possible.

> "We have experienced an incredible hospitality from all the users we have been in dialogue with. They have shared their experiences and thoughts about the needs of the future. That dialogue has been crucial for us to create a building which we hope will be so attractive that researchers will almost queue to get to."
>
> – Laila Halkjær, project manager at DTU CAS

The heart space must support relationships and collaboration across disciplines
There will be space for both experimental research work in laboratories and theoretical research work in the Climate Challenge Laboratory's office part. The laboratory part and the office part are bound together by the 'heart room', which embraces several common functions, which are the key for employees to meet each other across disciplines and floors.



The Climate Challenge Laboratory, also called Building 313, will be built west of Building 310 (1). The building will have laboratory facilities (2) and offices (3), which will be connected by an atrium and the 'Heart Room', which houses several common functions. Illustration: DTU / CCO.

How to program a generic building?
LH: Users want a building that can be easily adapted to new projects without disturbing what is going on. This must be possible without compromising the working environment and safety, and then the building must be futureproof in relation to supplies. Many of the old buildings here at DTU are gradually

running out of capacity. And the equipment you use and the processes you have today often require more different kind of supply.
We have tried to have this as a focal point through the design of the laboratories. In addition, we have a disposition of the building with a clearer division of laboratory and office part which is connected by the 'Heart Room'.

"The heart of the building is exactly designed to create opportunities for meetings across laboratories and offices, across floors, across professionalism."

— Rasmus Larsen, Executive Vice President of DTU

What subjects and research areas do you expect to use the Climate Challenge Laboratory?
RL: We expect that it is especially the departments DTU Physics, DTU Chemistry and DTU Energy that will deliver disciplines to the Climate Challenge Laboratory, but probably also others.
In addition, we already know that the building will be home to highly specialized research infrastructures, including the national unit EMAT and the basic research center VISION, which DTU hosts. In addition, Professor Jens Kehlet Nørskov with CATTHEORY will move into the office part. The three become strong attractors and are interesting for other users to collaborate or interact with.

LH: Here we could also mention that we have prepared the building so that microbiological laboratory work can also take place in the building. We have had representatives from bio engineering in the permanent interdisciplinary research group, which we have sparred with all the way. So we have created a framework for research where microbiology and physics meet.

How does the Heart Room help to facilitate the unique research environment?
RL: We want to create space for the planned and the unplanned meetings and connect research groups with different disciplines. They are thus connected by the heart of the building, which is designed to create opportunities for meetings across laboratories and offices, across floors, across professionalism.
We also strive to build with a special focus on the indoor climate. Climate Challenge Laboratory is a building that will promote conversations across disciplines, and in this context, it is important that the air quality, acoustics, heat - and in this way also the architecture, together create a good indoor climate.

LH: The Heart Room is a common term for all the areas where you can meet formally or informally. We have been very careful to define some features that support those meetings. For example, we have informal spaces for knowledge sharing and we have ad-hoc places where there is room to settle down.

The 'Heart Room' is, among other things, the atrium that connects the laboratory part of the building behind the concrete wall and the office part. Here there is an opportunity for formal and informal meetings between researchers to occur. There are, among other things, knowledge sharing rooms, ad-hoc spaces, and kitchenettes, which are common functions. Visualization: DTU / CCO.

These are some of the things that have been requested by the users.
Laboratories that can be adapted to different needs
Climate Challenge Laboratory is built generically within selected laboratory types. This principle has been chosen to accommodate different research areas and to facilitate end-user adaptation.

"Even though the laboratories are generic, there is a great adaptability for the end users. The size of the laboratory can be changed modularly, and researchers can pick furniture from a 'catalog with a wide selection', depending on whether you need a fume cupboard, a work table or a bridge that comes with installations."

— Laila Halkjær, project manager at DTU CAS

What does it mean that you build generic laboratories?
RL: The building was born with some framework and some capabilities in terms of supply. We have strived to make it as generic as possible with the possibility of specialization, so that you can accommodate as many different activities as possible within the limits of what is possible.

LH: The generic principle means that we design a building with selected laboratory types (Physics, Chemistry and Microbiology) and that the building is modular - also in terms of installation. It provides flexibility in relation to possible sizes of laboratories and the supplies needed. Similarly, support rooms for laboratories are modular, so that these can be adapted to laboratory activities. Of course, the generic principle also has its limitations, so there will also be some lab work that one cannot perform in the building. The building is designed with a good capacity for supply facilities, but also futureproof for a possible expansion of e.g. ventilation capacity.

How do you find out if the generic principle is sustainable?
LH: We are facing an imminent end-user process - and here the generic principles will stand the test of time and then it will become clear whether we can adjust as smoothly as we had expected. We do not have the full experience of it yet. It is also important that we in the subsequent operation and in future adaptations remember the premises in relation to the working environment and safety that lie for the use of the laboratories. The worst that can happen is that someone thinks you can use the labs for something other than what you actually can.

How will the building be operated if there is no institute?
LH: When we build institutes, they are 100% responsible for receiving goods, handling waste, and washing glassware from laboratories. In the Climate Challenge Laboratory, we must create an organization about it that will support everything else that goes on in the building. It is important that this is going to work well. We have a good example in SkyLab, which radiates great activity and facilitates collaborations both internally and externally.
It is clear, that if one is to have a building that not only accommodates someone but also exudes a community, then there must be someone who binds things together inside and reaches out for collaborations outside. It's not going to happen by itself, because who has the ball? It's a difficult thing, but important to make this building come alive.

RL: That's a good point. We are not finished on the day the building is completed and handed over to the users. There is also a great deal of work for the building's users to unleash the visions and potential we

Facilities in the Climate Challenge Laboratory

An interdisciplinary, department-independent research group has provided input to CAS on how to create the framework for a research environment for different professional groups. The outcome is seven benchmarks in the design of Climate Challenge Laboratory:

1. Laboratory facilities that can be used by several disciplines
2. Laboratory facilities that can be easily adapted to new projects without compromising the working environment and safety
3. Laboratory facilities with future-proof supplies
4. Research facilities with space for knowledge sharing
5. Research facility with space for immersion
6. An organization that supports interdisciplinary collaboration and that reaches out to new collaborative relationships.
7. Well-functioning common functions (washing dishes, goods receipt, chemical waste management) which support research activities.

believe the building has, not least on how to organize oneself overall towards the vision of addressing climate change.
New standards for more sustainable construction
Sustainability is central at DTU. Just as DTU will create new technology for a sustainable future, we will also be front-runners in creating the necessary transformation. Therefore, we work to ensure that DTU can use our experiences from the design and construction of Building 313 in future buildings at the same time as our experiences benefit society.

How can you use the experience from building 313?
RL: Building 313 is first and foremost a prototype for how we can imagine building in the future. At DTU, we are looking into a growth of our activities. We only have an expectation that the research and innovation work at the university will grow. Therefore, we also expect that we will need more space for our laboratories and experimental activities across disciplines in the future.
As I said earlier, it is also in the interfaces that the breakthroughs happen. Therefore, we can easily see the programming and execution of building 313 as a model for how we will build in the future.

How do you disseminate your experiences and knowledge in other contexts?
LH: Climate Challenge Laboratory has been registered as a case for the voluntary sustainability class, which in the future will be part of the building regulations in Denmark. Right now, a pilot phase is underway, where we and others are constantly reporting our experiences.
The project has a target for a maximum number of kg CO2-eq / m2 for the construction of the building's office part, which is carried out with wooden construction. It will not be possible to meet this target for the laboratory part, primarily due to the large amount of concrete that the vibration requirements entail.
In the long term, the building regulations will set requirements for the maximum number of kg CO2-eq / m2 when constructing new buildings, so that our experience with buildings of this particular nature highlights that there will probably be a need to be able to differentiate on these targets in the building regulations.

RL: Finally, I would like to add that it is not just the construction in Denmark that is at stake. We are moving towards 2/3 of the world's population by 2050 living in million cities. India alone has the challenge of increasing the population in the cities by 400 million people over the next 10-20 years. That is why the whole world is facing a very large expansion of cities, and we must strive to make it more sustainable than we have done in the past. We would very much like to help explore how to do it. Construction is the sector that has the largest material consumption - both in the consumption of natural resources and on the other hand in residual materials and surplus materials. In terms of volume, construction is the sector with the greatest environmental impact.
Therefore, it becomes important to consider what circularity can be established in these material flows? What is the actual natural resource consumption and what is the actual environmental impact - all the way down to the individual building?
It is a large research area at DTU, and it will only get bigger in the future. Therefore, we also want to contribute to the fact that when we build at DTU, we help to create the experience that is needed for us all to get better.

The voluntary sustainability class

The voluntary sustainability class is a government initiative to promote a sustainable conversion of construction.

The Government's goal is to introduce requirements for sustainability in the building regulations in 2023 on a well-proven and documented basis and with broad involvement of the construction industry.

The goal of the sustainability class is to embrace the three dimensions of sustainable construction:

1. The environmental and climate quality, which has an impact on nature, the environment, climate and resources.
2. The social quality which in a broad perspective relates to human health and well-being.
3. The economic quality, which means that there is a balance between the total costs and the quality of the construction.

Source: Housing and Planning Agency

Basis information

Byggearbejder
Until March 2022 there will be construction work that periodically causes vibrations, noise and dust. Until April 2022, the contractor will dig out to prepare the foundation of the building

Status på projektet
In January 2022, the work on the execution project startet. In this phase, consultants and the main contractor prepare the material on which the building is built. The material is also the basis for the final offer, which will be submitted in mid-April.
In parallel, the project is processed by the authorities and the main contractor establishes the construction pit on the construction site.

Contact information, DTU CAS' project team

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Time schedule

Winter 2020/2021	Spring 2021	Late summer 2021	Autumn 2021	Winter 2021/2022	Spring 2022	Summer 2024
Project Start-Up	Program	Outline proposal	Project proposal	Execution project	Construction on site	Users move-in

Construction site