REGENERATIVE ARCHITECTURE
Experience from a Transformation

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INTRODUCTION

The three articles collected here are the result within a larger survey; their aim is to map possible regenerative processes and provide information so that design decisions can be made on a more informed basis, enabling a regenerative level to be achieved in the future. The work presented in the articles seeks to identify the barriers that exist in areas such as legislation, standards, procurement methods, and ingrained habits, in order to make possible a green transition.

The work explores ways of finding solutions that go beyond traditional sustainable practices, enabling buildings to have a minimal climate footprint while restoring, enriching, and regenerating our surroundings. Regenerative principles play a crucial role in tackling climate change and biodiversity loss.

The construction industry is largely responsible for the climate and biodiversity crises. It is clear that we must either stop certain activities or change the way we do things if we are to act responsibly.

PURPOSE

The articles form part of a larger research aimed at professional builders, architects, engineers and public decision-makers. The work conducted will establish the knowledge needed to make informed decisions, on regenerative processes and solutions, through surveys, analyses, and guidelines.

Internally, this work is situated at Aarhus School of Architecture and Aarhus Centre of Regenerative Building (ACRB). The work will serve as a catalyst for the continued development of ACRB. The aim of ACRB is to provide a space for the thorough analysis of the most innovative construction projects. A further aim is to identify future interdisciplinary projects that can help push the development of the built environment in a regenerative direction.

THREE STAGES OF RESEARCH

The articles are part of research efforts comprising three work packages. The first work package involves a review of selected cases and examples of construction projects that demonstrate a genuine transition, which is defined as having a near-zero environmental impact.

The second work package identifies the barriers in the construction industry that block or hinder the green transition. This work has been conducted through interviews and case studies. A survey that aims at exploring the potential of specific barriers to the green transition and the recently adopted reduced carbon emission framework for construction in the future.

The third work package is a scenario-based vision for the future of regenerative construction. In the coming years, the industry will increase its understanding of the need to transition from degenerative to regenerative practices. To support this development and further change the way we manage resources, there is a need to see the goal not only as ambitions and benchmarks but also as visualised visions of the future.

A GLOBAL PERSPECTIVE

Mapping relevant projects has been a global undertaking, resulting in a rapidly growing, extensive list of projects. From the outset, in the case study it was decided that the selected projects should have been built in this century or be under construction. The research was initially framed to focus primarily on buildings, but as buildings are not isolated entities, their surroundings are also relevant to the analysis.

In order to select the projects, it was necessary to establish a systematic framework, not only for data collection but also for the synthesis and analysis of the collected data. Preliminary literature studies have been conducted on themes relevant to regenerative design

approaches. The aim of the work has been to create an overview of possible barriers and potentials within the selected cases.

EMPIRICAL DATA

The starting point for the study in the selected project presented here, was the formulation of research questions and the collection of data. After the data had been collected, it was studied in detail and translated into the ideas or concepts it conveys. After this conceptualisation, supplementary data was collected where needed. The data was organised into higher-level concepts over time and then divided into categories.

The selected projects were mapped and reviewed with the project owners. Interviews were conducted based on an interview guide, and the same guide, with adjustments, was used for all cases and interviews. The interviews were analysed, and themes were identified in the project.

This is a common method for exploring the meanings and processes of both quantitative and qualitative data. However, this study is primarily based on qualitative data. The method is based on 'grounded theory', which emphasises the exploration of processes: an exploration based on formulated problems, i.e., research questions, and at the same time also the way in which the study is conducted, shaping both the data and the analysis.

The work is done with an awareness of the reasons for and methods used in the collection of empirical data. The researcher has collected and analysed the data, enabling the exploration of nuances of meaning that would be lost to an outsider (Järvinen & Mik-Meyer, 2017, p. 186).

Research questions:

> The project forms the basis for a larger survey and analysis that will provide an informed foundation for a more regenerative society. The question is therefore asked: what has been done in the selected projects, and what further steps could have been taken to achieve a regenerative level? What prevented this?
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> The project addresses everyone involved in design decisions and raises the question of which services will be needed in the future to support a regenerative construction industry. In which design processes will we be involved? Which analyses need to be carried out?
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> The project examines how the relationships between culture, the economy, and nature could evolve in the future. The answers will provide important information about future collaboration, circular models, service directives, and building regulations.

A range of methods were used to collect the data. These included on-site visits, analysis of the selected project and interviews with the responsible and individual specialists. The data was collected and analysed. The text was transcribed, synthesised and categorised into themes. The conceptual categories work to unfold ideas, events, or processes in the data in an analytical and meaningful way (Järvinen & Mik-Meyer, 2017, p. 195).

Conceptual categories can be viewed as patterns of shared meaning across cases, or straightforward summaries of information related to a particular topic, in this case regenerative indicators. There is no requirement for common meaning organised around a central concept, just a common topic.

The analysis will identify positive beacons of inspiration and disseminate the results of national and international surveys on pathways towards regenerative practices. The following case study is the first of several selected examples.

LKR INNOVATION HOUSE
First Part: The Program

Heidi Merrild, M.Arch., PhD, Postdoc, Aarhus School of Architecture
Interview with Lone Feifer, Director of Sustainable Buildings, VELUX Group

FOUR CORNERSTONES

In connection with the announcement of the architectural competition for LKR Innovation House, Director Lone Feifer headed the team tasked with formulating the part of the programme that dealt with sustainability. Prior to the competition itself, a pre-qualification process was held, and four teams were selected to participate in the competition. In this connection, the steering group set out four key points. A fundamental requirement was that LKR Innovation House should become a landmark building for sustainability. In addition, it had to be a building that promoted innovation and fostered diversity and inclusion. Finally, it should be a good place to work.

When the working group formulated the programme, they did so in an unconventional way, without setting specific requirements for how far the individual proposals had to go in terms of sustainability. No benchmarks were set for each individual area, such as the CO2 footprint, indoor climate, energy, water, or daylight quality. There were no specific targets that the proposals had to meet. Instead, Velux asked for the participants' proposals to see how far they could go when they did their best and went as far as possible.

Before launching the competition, the working group spent six months formulating the programme, and the time spent on these preliminary studies proved to be a good investment. 'It was so well thought out that several of the losing architectural firms are still annoyed,' said Lone Feifer.

THE FREEDOM TO INNOVATE

The working group had experience from Active House, a project built several years ago. At that time, the Velux formulated a programme based on seven indicators that the participants had to consider. These indicators were acoustics, biodiversity, carbon emissions, daylight, energy consumption, air quality, and thermal comfort. It quickly became clear that the experience gained from Active House could also be used as parameters for sustainability at LKR Innovation House.

Measuring good daylight or good air quality can be difficult, according to Velux. Although there are building regulations and sustainability certifications, they wanted to go further with the LKR Innovation House. Velux also knew that, to foster innovation and encourage new solutions, the participants needed the freedom to work outside a fixed framework.

When the four competition proposals were submitted, it transpired that they had all reached the same level for the carbon emission parameter, which is remarkable given that the participants were naturally unaware of each other's proposals.

There was slightly greater variation in the energy parameter, but this was because the participants had chosen different energy sources with different emissions. The most significant difference was in the indoor climate, particularly with regard to the daylight parameter. The winning project achieved daylight autonomy, a notable accomplishment. This term refers to the extent to which a room or building can be lit by daylight alone. While the competition rules stated that this had to be calculated and documented using recognised tools, they did not specify a minimum target.

Lone Feifer was involved in formulating the competition brief and, subsequently, she and four colleagues were part of the jury panel alongside external participant Lars Juel Thiis, who is an architect and an adjunct professor at Aalborg University.

The competition proposals were presented to a group of Velux colleagues and members of the management team. The four teams arrived over the course of a day and gave detailed explanations of their projects, after which a winner was selected.

DOCUMENTATION

A year ago, Velux made the decision to carry out additional calculations and obtain further documentation due to the uniqueness of the project and the fact that Velux will never undertake anything similar again. The company invested more than 300,000 Danish kroner in fees for these additional calculations, which took nine months. Going into such depth was not part of the standard fee, but Velux wanted to be sure that everything was documented.

An engineer from Artelia was brought in as a third-party consultant, and Velux accepted this third-party verification for all sustainability-related matters. This means that they can confidently share this knowledge with others.

A COURAGEOUS PROCESS

This time, Velux invested more effort than usual into the design process. You might say that the project was developed at the same time as it was built. They wanted a contractor who would get involved early on, which meant that the contractor's work began before the final design was ready.

This approach created certain problems with insulation and ventilation along the way. It ended up with an acceptable solution, but it could have been solved in a different way if they had not already progressed so far. In other words, the design was lagging behind, and the construction was too far advanced to do it differently. This would have required sending proposed solutions to DBI for fire testing, but there was a five-month waiting period. The problem was not the test itself or the price, but the five-month waiting period, during which the construction site would have been at a standstill.

The architects were skilled, and we, being the client, had a team of four or five employees working full-time on the project. Velux is a factory that produces building components every day, but as clients or developers they might essentially be "amateurs". In hindsight, a lot of effort and many hours were invested in making changes. At the same time, though, the unexpected twists and turns of the project have also highlighted the strength of Velux as an organisation. This was because we approached the task in the same way we work every day. A professional developer or client would never have done it this way. They would have had less patience.

> "What has particularly characterised the project is clearly the focus on reusing the existing building and incorporating Velux's identity into the building with skylights and natural ventilation. It is rare that we work with a client who is willing to embrace the project and the principles of natural ventilation in this way," says engineer Mathilde B. Lauersen (Søren Jensen).

Although extra time and money were spent, it is felt by those involved that the right project has been achieved. The result is close to the ideal, which justifies all the time and attention that has been invested. Velux can confidently declare that the figures are reliable, as many hours have been spent accurately accounting for the materials used.

USER INVOLVEMENT

A great deal of effort was invested in involving users, and this careful consideration is reflected in both the programme and the finished building. For instance, time was invested in conducting interviews with colleagues from Velux, who were located in various offices, to understand their needs for an ideal workplace and how such a workplace could be optimally designed.

Velux has a stable workforce, and although there are many different job roles, everyone works as a team. The idea of a new Innovation House in Østbirk first emerged in 2017. In terms of the design process, considerable time was devoted to user involvement and formulating the programme. Otherwise, Velux might have done what many other companies do and simply built something new. Well, there's no way of knowing, but it's also possible that Velux might not have come up with this idea ten years earlier.

It was clear that the name was going to be the LKR Innovation House. It is innovation in the full sense of the word. The result is a living entity that no one can really define, and this is what makes it so intriguing. The participants were not pressured to close off possibilities and were instead encouraged to explore all options. The actors involved in the design process were not under pressure to close off options. Options have been kept open and continue to be kept open for longer than would have been the case if a more linear process had been applied.

A FAMILY BUSINESS

Velux is not a publicly traded company with a circle of shareholders who need to earn interest on their pension funds. The company has an owner family that is ambitious and puts its heart and soul into these projects.

When it comes to transformation, you can only truly understand the nature of the building you are working with right before you start 'opening it up'. We knew it was a cold building, but when we started taking it apart, we found a lot of surprises. Was it too late to change course? With transformation projects, it's impossible to know whether what you're doing is wise until you're further along in the process.

The key is to develop the ability to manage an extremely risky and unpredictable process while remaining in it. Ultimately, it's about your ability to innovate, because, by definition, innovation, involves doing something new that is outside your comfort zone.

Being close to the decision-makers is the key to achieving an exceptional good result that is not standard. You cannot talk about standards for such projects. Velux wanted to compare its project with Tscherninghuset, in Hedehusene, and Thoravej 29, in Copenhagen NV, but as there were no figures available at the time for carbon emissions of the materials used in the two projects, this was not possible.

The biggest challenge has been the obstacles, surprises, and quite significant problems that arose along the way, but which could not have been tackled in any other way. It is uncertain whether the contractor would have had more control over the construction process earlier on, because effective collaboration within the project team was also essential to achieving a challenging goal. This is what created the positive outcome.

WE SHARE THE RESPONSIBILITY AND THE RISK

The lesson learned from LKR Innovation House is that the industry must become better at tackling risks, risks, and yet more risks. That's how it is when you're doing something you've never tried before. Roughly speaking, it's easy enough to experiment with other people's money. The project group would like to see more players who are willing to get more involved in these projects and say, yes, let's figure this out.

It was made very clear to Velux that if they chose natural ventilation, it would be at their own risk. It was not recommended that the solution should be based on natural ventilation alone.

> "We would have liked a higher degree of involvement so that we could tackle the challenges on an ongoing basis and together. Not because we wanted to dictate the solutions, but to be able to challenge and put solutions into perspective on the go." In that way, we have probably been a somewhat atypical client, says Esben Lundsgaard Haubjerg, senior project and programme manager (Velux).

Most people have heard a great deal about timber construction and the challenges involved. The question that might be asked is why it is only the clients who have to take the risk. Discussions are underway about setting up a fund to assist in mitigating the risk associated with the utilisation of novel materials and solutions. The Danish Association of Clients is taking the initiative because it is the developers who are facing the problem. The problems and solutions could be shared. This would undoubtedly be the right approach.

If we are to develop forward-looking solutions and transform our industry, we need a model, even though it will probably be a new model each time. Both architects and engineers need to adapt and become more skilled in relation to transformation projects the challenges related to them in the industry.

Currently, research in this field is lacking. At a recent conference, Lone Feifer and Jørgen Søndermark from Realdania By & Byg agreed to regularly share information. Having both carried out development projects over the past 15 years, they recognise the importance of collecting data. If there were a transformation model, it would not be necessary to start from scratch every time. Therefore, these learning processes need to be documented by the industry and its practitioners, and their practical application needs to be explained.

LKR INNOVATION HOUSE
Second Part: Transformation

Heidi Merrild, M.Arch., PhD, Postdoc, Aarhus School of Architecture
Interview with:

Esben Lundsgaard Haubjerg, Senior Project and Program Manager (Velux)
Martin Lyskjær Nielsen, Facility Manager (Velux)
Mette Tony and Jakob Lind Hansen, architects and partners (Praksis Arkitekter)
Mathilde B. Lauersen, engineer (Søren Jensen)

One of the most interesting projects in recent years was the transformation of a 30-year-old warehouse into a heated office and laboratory building, known as the LKR Innovation House. Another noteworthy element is the materials used, with wood being a prominent feature. The project's approach to managing the existing structure is also commendable, as evidenced by the addition of an effective, increased usable area in the form of a wooden floor deck.

NATURE AND BIODIVERSITY

The starting point was that the existing buildings in Østbirk, inaugurated in 1995, were of a quality that was considered worthy of preservation and transformation. The three warehouses were built contiguously in a longitudinal direction. They were cold buildings with an uninsulated concrete floor and load-bearing structures made of glued laminated timber. The facades were clad with untreated spruce from Denmark and Sweden. The patinated wooden facades and their detailing gave the building a certain beauty. The warehouse spaces were beautiful, and both the client and the architects wanted to preserve them. As architect Mette Tony puts it, it was the design with the large roof that she found particularly interesting.

The task facing Praksis Arkitekter was to rein in the framework and create a new openness. It was a closed and beautiful building, but the big question was whether it could remain just as beautiful when it was opened up. This was in line with the perception that it was important to connect the house with the surrounding landscape. Initially, the surroundings of the entire building were a stone desert. The main architectural focus of the transformation project was to bring light and nature into the building. Praksis Arkitekter suggested perforating the large roofs in several places to create two courtyards. "It has become a landscape of skylights," says Mette Tony.

REUSED WOODEN CLADDING

The building was constructed in 1995 as an ambitious project by Velux. At the time, the aim was to give the warehouse a facade that could support itself. The approach which was developed as a pilot project in 1995 involved cladding the facade with untreated Danish and Swedish spruce, which had been grown under specific conditions to ensure a particular quality.

Large overhangs and flashings were incorporated as part of the constructive wood protection, ensuring that the cladding did not require any additional treatment. The intention was also to observe how the wood would develop depending on whether it was installed on a north-, south-, east- or west-facing facade. The goal was to observe how the untreated wooden cladding would change over time.

Source: Author's own photos, 2025.

Figure 1.
Front of the newly dismantled and remounted wooden facade.

> ” The building has undergone several condition assessments, and no rot has been found in the wooden facades. As no maintenance of any kind has been carried out on the wooden facades for 25 years, no costs have been incurred.”
>
> “The west gable, which has no doorways or extensions, has been exposed to sun, wind, and rain, and is the most aesthetically pleasing. This may also be related to its west-facing orientation.”
>
> "The immediate conclusion is therefore that the facades are in good condition after 25 years. Although, they may not look so great, especially in rainy and humid weather." (Tidskriftet Skoven no. 11, 2020).

At the time, the facade was constructed in such a way that it could be taken down and put up again, although time was spent transforming the facade so that it could easily be replaced, dismantled, and reassembled today. The facade elements were carefully recorded and numbered, after which they were dismantled and stored in a depot while the layers now required for insulation and fire safety were built up. The result is a facade that has been updated and reused. For Praksis Architects, it was an exciting task to come in and have the opportunity to reassemble the facade, especially in relation to the openings that had to be made to bring daylight into the building and to be able to create a whole house again.

EMBEDDED ENERGY

Praksis Arkitekter believed that preserving the existing ground floor was the right way to go, but it also became one of the biggest challenges of the project and caused a number of unforeseen problems. Among other things, this meant that all piping had to be visible and that the installations had to be relocated from the new inserted floor slab downwards, rather than being located in the ground beneath the ground floor slab moving upwards, as is typical in new buildings.

> "We spent a lot of time preserving the existing ground floor slab. This meant that, in many places, the floor had to be cut open and recast."
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> "The first three months of the construction process involved breaking up concrete and cutting down the concrete wall between the storage rooms in order that we might reuse them. It's probably not the fastest solution," says Esben Lundsgaard Haubjerg (Velux).

It was particularly challenging for the engineers to prove that retaining the concrete floor was a viable option. This involved not only practical issues, but also calculations within a tight energy framework. Despite the heat loss through the floor, the engineers succeeded in meeting the demands of the building regulations. This is mainly because the three halls are connected, giving them a high volume to area ratio. Breaking up the existing concrete floor and replacing it with a modern one would provide greater comfort and require less energy for heating. However, the embedded energy and materials in the discarded floor would be lost.

> “We need to think about balancing climate impact with comfort. This issue raises considerations that are new to us. We are accustomed to prioritising the indoor climate for building users. However, having to compromise in certain areas and determining what is acceptable to building users versus climate savings is a new concept for us."
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> “This is possible because the building is a certain size and volume. We have been restricted by certain geometries that are appropriate in this context.”
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> “If you consider this solution for new construction, I think edge insulation would be the minimum requirement,” concludes Mathilde B. Lauersen (Søren Jensen).

The decision to retain the existing ground floor is also connected with a positive narrative. One aspect is the architectural element in relation to the memories associated with the building's history and the traces left behind by preserving an existing floor. Another ethical aspect is that we, the architects, should not tear down and rebuild the same thing again.

Source: Author's own photos, 2025.

Figure 2.
Interior office with existing floor and new floor creating a new first floor.

The transformation of this cold warehouse into a modern office building seemed like a difficult task. Employees had previously been physically active working in the warehouse, but now the building was to become a well-functioning office. This would require not only preserving the building's fine appearance but also an extensive design process and documentation to ensure that it complied with building regulations.

> " We can perhaps test our way of finding high-quality materials, but basically there is no guarantee. If we take existing elements and move them, we cannot use them, but if we leave them where they are, we can," says Esben Lundsgaard Haubjerg (Velux).

This solution raises a number of questions about how it should be built and what is needed to create the framework for well-functioning workplaces and homes. The embedded energy proved to be of great importance in the overall material accounting, and the floor is typically a building component that weighs heavily in the overall accounting.

It should be noted that today standard life cycle assessments do not include pipes and elements in the ground as part of our considerations. For too long, we have focused on energy in relation to operation, but it is important to compare operation with the embodied energy in the materials and the derived effects such as repair and maintenance. Today, the building is a "modern" office building with visible installations, offering greater flexibility in terms of maintenance, modifications, and reuse in the future.

'NEW' MATERIALS

The client and consultant wanted to use alternative insulation materials, but in Denmark there are many obstacles that make it difficult for both consultants and clients to choose alternative materials. The fire safety requirements of the authorities and conditions of insurance companies are not adapted to biogenic materials. The building was intended to be insulated with wood-fibre insulation and other biogenic insulation materials, but due to Denmark's interpretation of the EU's fire testing requirements, this could not be implemented.

Other EU countries, especially France, the Netherlands, and Germany, are working more extensively with biogenic materials. For example, German legislation has introduced a special class E, which allows for the experimentation and testing of new materials that can subsequently be used in the built environment.

> "A further novel strategy is the "Building Type E" (Gebäudetyp E). The ''E'' stands for "simple" (einfach) and "experimental" (experimentell). This classification is designed to provide more flexibility in building design and construction by supporting deviations from the standard, extensive building norms, especially in non-safety-critical areas, for both new buildings as well as building refurbishments.
>
> "The legal framework for the "Building Type E" is currently under development. Examples represent promising initial steps in removing unnecessary regulative barriers…",
> (*Detroy, Rathgens, Ilvonen and Becken 2025)*

The use of biogenic materials for insulation became impossible in the LKR innovation House. If these materials were to be used, many requirements would have to be met, including a costly and unprofitable addition of fire-resistant plasterboard and a completely different visual expression. Even accepting plasterboards, it would still require carrying out a full-scale construction, as well as a fire test, which would probably show that the requirements could be met. However, this was not done due to time constraints, as the issue and challenge were not recognised until after construction had begun, and producing the necessary documentation would have been too time-consuming.

> 'We would have liked to use biogenic insulation materials and a breathable outer wall, but it is almost impossible to get this approved without carrying out a full-scale test. These are absurd rules that make no sense and leave no other solution than using mineral wool.'
>
> 'I think it's a shame that we have a house that is built entirely of wood, but we've had to put up a plastic bag inside,' says Esben Lundsgaard Haubjerg (Velux) with regret.

Companies working with mineral wool have greater resources at their disposal, than those supplying alternative biological fibre insulation. Mineral wool has been approved and used for many years. When new materials are used, the authorities require third-party certification, which is time-consuming and complicates the process. If in Denmark we are to make progress phasing out resource-intensive and outdated materials, testing new materials will have to be less difficult.

LKR Innovation House was a large-scale project involving many square meters and a long construction process. For this reason, there was a significant risk if the materials were not properly managed. A lot is currently happening in Denmark in terms of alternative building materials, because greater demands are being placed on the carbon emission of materials. When using third-party assessments to determine whether to accept a given solution, there is now a greater willingness to accept tests carried out in France and Germany. However, the process is still sensitive because it is a third party that has to provide the name and, not least, the certification scheme. This situation really ought to change as the process seems cumbersome. Going forward, we should include trials and tests as an integral part of the design process, preferably in collaboration with researchers in the field.

> 'We are actually completely ready to use straw walls. We can also get clients on board, and we can do it ourselves, but we cannot get through the regulations, and we cannot meet the requirements. We are unable to take the next step because the material manufacturers lack the necessary tests,' says Mette Tony (Praksis Arkitekter).
>
> 'It has to be all-encompassing. It shouldn't just involve architects. We also need to involve engineers that are equally keen to calculate moisture, sound, and fire aspects, and we need methods other than the pre-approved solutions,' says Jakob Lind Hansen (Praksis Arkitekter).

BREAKING POINT

Architects want to reintroduce good or used materials in construction, and in all projects these days, we are getting closer to addressing the issue of materials. There is a growing awareness that we need to conserve and reuse as much of the materials we are already employing.

LKR Innovation House is a good example of the way the architect's intuitive and more experiential approach is consistent with the engineer's quantifying and calculating approach. Praksis Architects initially believed that they could create new frameworks by activating and intensifying the positive and valuable elements that already existed. As things stand now, many tests need to be carried out; but in many situations, it can be said that if a solution works in one place, it will also work in another. Common sense and an intuitive sense of what is valuable and should be preserved are needed.

According to Mette Tony from Praksis Architects, there are fantastic works such as Arne Jacobsen's SAS Hotel, complete with all its original furniture and fixtures. It is a *Gesamtkunstwerk*, a concept we love to keep in mind. It is, however, difficult to build on Arne Jacobsen's work, which should preferably remain frozen in time. These days a new perception of architecture is emerging. A city is something you inherit and manage for a period of time, and then others come along and continue to manage it. The same applies to buildings. Mette Tony's philosophy is that we inherit buildings and cities, then we crochet them together into something else, so that they become more rooted in their location. Buildings are part of a large fabric, which is our physical world, which we build on, and then we remove them from the equation as part of a large circular flow.

A WORLD OF LIGHT AND AIR

Velux was founded on the invention of the "rooflight" and a vision of bringing light and air into homes, thereby utilising unused roof space. This is also the starting point for the LKR Innovation House. By breaking through the three large roof surfaces, a world of light and air has been created. In this way, the project has become a showroom for the company's own windows, but perhaps something is missing?

The original idea was to create a project using only natural ventilation, but this would have had noticeable effects – both positive and negative. The summer period would offer many hot days, and the winter months would offer cold periods, thus perhaps creating variation and uncertainty in terms of indoor climate and comfort. Velux was unable to proceed with this step because the necessary solutions were not in place. Simply instructing employees to bring a jumper depending on the weather was not enough.

> "Natural ventilation is not a standard solution in our projects. This means it has been a solution that has required a great deal of analysis and dialogue in order to create an acceptable level of comfort for users.'
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> "The mindset, the solutions, and the willingness to work with natural ventilation in this project are something I will take with me going forward,' says Mathilde B. Lauersen (Søren Jensen).

Instead, a hybrid solution was chosen for the project, combining mechanical and natural ventilation. This means that the project does not achieve building ventilation by means of natural ventilation only. However, it could be argued that it would be interesting to conduct the necessary research to understand what it would take to achieve a well-functioning house based on natural ventilation only, as well as the positive and negative impacts of doing so.

The LKR innovation house appears to be close to an optimal solution as it combines roof lights and inner courtyards. The building's layout is good, and an important part of the main concept is the two courtyards with the canteen located between them. This is a good way to bring light into the workplaces and create an inner and outer life.

Source; Author's own photos, 2025.

Figure 3.
New courtyards and internal facades with openings bringing light and air to the spaces of the office. Climatised courtyards provide biodiversity.

With this project, Velux, in collaboration with Praksis Architects, has managed to realise what is needed to create a living building, based on an intuitive approach that relies on light and air. The client's visions, the architects' intuition and the engineer's calculations all came together. To achieve our goal of future regenerative processes and buildings, we need both the intuitive and the calculated.

A NEW DEPTH AND THICKNESS

Østbirk is yet another of these landscapes characterised by industry, detached houses, and production landscape. It consists of three sharply divided zones that show clear traces of an era of production. The fields are characterised by uniform crops with only few windbreaks and livestock. The green lawns of the villa gardens are bordered by hedges. The old industrial building was an expression of a technology linked to mass production. One might imagine a future development project in which the transformation was continued, further dissolving this division. The buildings would be more closely interwoven with their surroundings, and new connections would be created, breaking down the harsh transitions and divisions.

Based on this building and its location, the project has found a narrative about the place and its characteristics. This makes it possible to see the location-specific quality and potential of the place. It opens up the possibility of listening to the place, identifying its characteristics and utilising what is already there. The materials must be woven together and incorporated into new constructions, and future projects must be interwoven with existing projects. It is the potential of the place that is brought into play, rather than architectural icons.

> "Renovation, transformation and maintenance need to reorient their centers of attention. Instead of the imposition of blueprints from above, instead of reflexive recourse to expected materials and practices, let's look to the narratives that emerge from below, from the tiles, cement, and stones. What would a closer reading of the capacities, resources, and needs of the local, existing site offer as guidance for new structures and practices?" (*Pihlmann and Dickinson 2025)*

LKR Innovation House could be interpreted as being about finding answers to what it means for a project to be regenerative. The aim is to question how we use resources in relation to earthly thinking. This could be the beginning of creating something that regenerates connections between the human and the non-human. The project is based on indicators that point towards a way of relating to the world that, over time, may contribute positively to planetary boundaries more than they actually consume.

This should not only be weighed in measured units but also seen as experiential qualities. It is no longer a static but a dynamic connection. We must work with the idea that nature is not one or unique and develop a new earthly thinking and exchange.

By using the term 'earthly', we abandon the modern view of a future of abundance. It is not about the local or global but about the depth and thickness of the place. Earthly existence is bound to the earth and the land, but it is also a way of being in the world because it has no boundaries and transcends all identities.

Source; Author's own photos, 2025.

Figure 4.
Internal connection with courtyards as an extension of the space with air and light and a high degree of biodiversity.

'The building design evokes two pieces of nature / two large green light boxes, two large courtyards arranged with frames and flat surfaces.'

'Both courtyards are arranged with a fixed frame and centrally with a landscape and wild character. The frame is an elegant transition to the building base, creating a setting for recreation and connections between outside and inside as a fluid transition. The frame and the project's green character contribute a lively and varied expression both outside and inside.' *(DET BLÅ, Landscape Architects).*

LKR INNOVATION HOUSE
Third Part: The Future

Heidi Merrild, M.Arch., PhD, Postdoc, Aarhus School of Architecture

REGENERATIVE STRATEGIES

By drawing on the regenerative potential identified in the previous analysis of the Velux Innovation House, the material can serve as a basis for projecting regenerative indicators and opportunities.

We should realise that everything is part of a larger cycle and that everything is interconnected. This means that a building or a place is not only part of a physical, functional, and aesthetic context but also represents the idea of life as a changing and recurring process.

The reversible solutions of the future will be created by combining experiences from pre-modern construction, which incorporates circular principles, with the modernist idea of functionality and the good life. This must be done within the framework of today's scarce resources and as a new approach in architecture.

For a building to be reversible, joints, and materials must be carefully selected and assembled in such a way that they can be reused, recycled, and eventually return to nature. It is an approach that also considers the cycle and engendering of materials. It involves thinking in layers, where all layers have functions and temporal properties. This means that the architecture can change and become smaller or larger, but also that each layer can be replaced or reused.

Regeneration is a larger and more comprehensive concept that includes reversibility. For something to be regenerated, we need to understand buildings, materials, and their engendering but also the place and its inherent culture as part of our thinking about processes and change over time. Everything is constantly in a state of change and is not static.

A *Gesamtkunstwerk,* and its concept, is something that we as architects have in mind and which should preferably remain unchanged. A new approach to architecture might perceive a city or a place as something we inherit and live with for a period of time, after which others come along and manage it further. The same applies to buildings. We take them over and then assemble them into something else that is anchored in their place. According to this view, buildings are part of a large generational project, which is our physical world, and which we continue to build on in a circular situation.

LKR Innovation House is a sustainability landmark, that promotes innovation and diversity and inclusion while also serving as a central workplace in Østbirk. The creation of this large-scale workplace will have an impact on infrastructures and on the local and global economy. This requires a responsible and careful approach to resources and culture.

The current situation calls for a new, fluid concept of nature. A new way of thinking that will break down the boundaries between the 'separated' and restores the connection between the Earth and the atmosphere. The term 'separated' refers to the division of zones in the form of detached houses in suburbs, industrial districts, and monocultural production landscapes.

LKR innovation House and its context is an industry in transition and is characterised by closed surfaces with asphalt and concrete coverings. But also by closed buildings that we need to open up and reconnect with nature, so that new connections and places to live can emerge. Suburban neighbourhoods are zones with sharply divided plots, which often prevent greater biodiversity, and where each individual homeowner has control. Agriculture is characterised by uniform crops, which, with the help of excessive amounts of nutrients, prevent biodiversity. One way out of this is to map biodiversity and nature. This effort to create new connections will also include Østbirk.

We must begin with a comprehensive mapping of resources before we plan and transform landscapes, cities, and buildings. The mapping will not only cover individual buildings but must be expanded to include the city, the region, and, ultimately, a national and international perspective.

The concept of resources must also be expanded to include not only materials for reuse but also societal issues. We must create a model that can contribute to a holistic strategy, creating robustness in the local economy and resource thinking, and that has a global impact, especially with regard to reducing carbon emissions. This might include small pop-up stores, innovative workshop activities, cultural initiatives such as a book cafés and local food festivals. These initiatives would breathe new life into the empty high street in Østbirk and lay the basis for a new alternative agriculture.

Reversibility must be included as a strong parameter where standardisation in construction is no longer relevant. This must be considered in relation to existing buildings and a new reuse strategy. New projects must be considered based on the resources that are available. The new design strategies for obsolete functions and buildings also mean that we must consider the concept of "unbuilding".

> “Unbuilding is a forward movement, an optimistic take on the aftermath of modernity. Perhaps we already have enough building—buildings, building materials—and what is needed and most novel at this point is rearranging, reorganising what already exists. This is essential to a nonextractive, or less extractive, practice of design and building.” *(Moe 2025).*

We must create transformation with light and air in mind and not allow ourselves to be governed by fixed figures and calculations. Regulations are designed with new buildings in mind. In transformations we cannot separate the body and the building in the design. When we create user-driven buildings, we must work with resistance and comfort in relation to the current project. We must raise new awareness of materials and their significance in order to achieve the necessary connection between outside and inside, as well as light and air. This also means that including the core and mass of the building has a decisive effect on our use of energy for ventilation and heating.

> We need to rethink what constitutes “comfortable”, we are getting used to having buildings and surroundings that generate as little friction as possible. However, in a world in which comfort is underwritten by fossil fuels, it is imperative that we redefine the concept in more sustainable ways. Comfort is largely a cultural construction built on expectation, routine, and fashion. (*Pihlmann and Dickinson 2025).*

Drawing inspiration from the initial programme at LKR Innovation House, we should not allow ourselves to be restricted by regulations, guidelines, and specific goals, but aim to go beyond them. This will enable us to create a new, responsible architecture based on trust in creativity and experience. This also means that we must dare to experiment as we create. Moving forward, we must unite with a new hybrid model that blends tradition and innovation.

> "If everything were purely focused on CO2 reductions or strict environmental parameters, there would be no room for creative initiative."
>
> "It's not just about reuse. If the sole focus was on maximising reuse, you could hand over the job to a technician or an engineer, who could calculate precisely how much to recycle, run a life cycle assessment, and call it a day. Where's the poetry in that?
>
> My excitement comes from discovering what the building itself wants – it's a gut feeling, its inherent character – this is where it becomes intriguing to me." *(Pihlmann Architects. 2025).*

User involvement is crucial when we want to work with regeneration as a framework. It is largely a matter of expanding the framework for co-determination to include future generations, and we need to think long term. This expansion also means that future generations must include the voice of nature and that we must care for the all actors of the future, whether they are human or non-human.

It is clear that each of us must take responsibility for our access to and management of resources. This also requires us to share knowledge and experiences when experimenting. In the future, however, we must dare to share risks and uncertainties.

REGENERATIVE ARCHITECTURE
Ten Points - LKR Innovation House

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The following ten points is a summary of the data collected in the study of LKR Innovation House and the article presented.

POINT NO. 1: FREEDOM TO INNOVATE
When renovating a building, you never know what you might find. As every project is unique and can present unforeseen challenges, it is important to be prepared for the unexpected. Rather than imposing drawings created from a distance or from above, we should learn from what emerges when we open up the building and examine the materials closely. It's an approach that allows for closer examination of buildings and materials as opposed to a more distant viewpoint. It is a model – a design or transformation process that is not bound by fixed, measurable sustainability parameters, keeps the possibilities open, and allows for more creativity.

POINT NO. 2: WE SHARE THE RISK
Where there is experimentation, there is greater risk. When we transform, we need a new model for sharing the risk. We need to create a community around the development of new solutions. Creating such solutions requires testing and flexibility, but it is an expensive process that requires us to rethink rules and standards. We need an open framework for experimentation and the development of future solutions. It is a risky process, and we need a model for sharing the costs.

POINT NO. 3: NATURE AND BIODIVERSITY
Transformation is linked to biodiversity. The earth and soil are valuable resources. The atmosphere must have access to the earth in order that plants can grow. We must open up sealed surfaces, break down barriers, and connect species. Transformation creates openness in existing cities and buildings, and connects buildings with the landscape. When we break down hard and closed boundaries and surfaces, we not only preserve what we have – nature, buildings, and cities – but also add new species and create diversity. We must stop moving soil around and instead see it as a valuable material. We must rely more on experiential and sensory mapping, and include biodiversity in our calculations.

POINT NO. 4: EVERYTHING COMES FROM SOMEWHERE
How are the materials brought to life, what are their historical uses and conditions, how do the materials behave physically on site, and how are they connected? We must map the existing materials and local sites and create new narratives that follow the production and transformation of the materials. We must build on what we already have and create different interpretations of places and their inherent potential. This can be done in collaboration with other disciplines using a diversity of methods and approaches.

POINT 5: CONSERVATION AND REUSE
Materials are affected by time and weather. Some materials decay, while others become more beautiful over time. Modesty is a response to the demand for reorientation and the need to minimise, reuse, and recycle. Time and production are part of the circularity of craftsmanship and detail. Trusting in the materials and their patination over time is essential for this work. Time and weather have become new narratives, with value for the materials. Although it is challenging, it can be worthwhile when you recognise the value and inherent quality of existing materials.

POINT NO. 6: THE EMBODIED ENERGY
We have placed too much emphasis on lowering energy usage during operation and use, while overlooking the importance of embodied energy in materials and building components. We must use the energy that is already present by existing materials. We must establish a new basis for assessing materials in relation to operation and maintenance, allowing for existing materials and creating friction in everyday comfort. It's just common sense: we save energy by reusing materials. There is an ethical aspect to the act of not breaking down and rebuilding.

POINT NO. 7: 'NEW' MATERIALS
Resource- and process-intensive materials must be phased out, and testing together with the certification of new materials should be made easier. Currently, testing biogenic materials is too time-consuming, expensive, and complicated. These tests are costly, and creating certification schemes is a challenging task that does not carry much weight with large companies but is extremely important to small start-ups. We need to find alternative testing solutions and learn from the experiences of other countries. We must create new regulatory frameworks that accommodate and are flexible in their approach to the use of biogenic materials.

POINT NO. 8: BREAKING POINT
In the future, we will perceive the city and its architecture as a large carpet on which we continue to embroider. We inherit our surroundings and manage them for future generations, ensuring a sustainable environment for years to come. In the past, architecture was regarded as a *Gesamtkunstwerk*, meaning it could not be altered and was constructed to stand still in time. Architecture for future generations must be created differently, forming a built environment that can continue to evolve.

POINT NO. 9: A WORLD OF LIGHT AND AIR
The way we think about architecture changed completely when light was brought into the building. Installing skylights enabled attic space to be used. Liveable spaces, both inside and outside, are created by the interaction of light and air. Mechanical ventilation has become the norm because control and measurement are favoured over relying on something 'natural', where one is subject to fluctuations and seasonal variations. Friction is feared when it comes to comfort, but it is also what creates a living house and a connection between the inside and outside. The concept of comfort is heavily influenced by cultural norms and expectations, as well as personal routines and habits.

POINT NO. 10: NEW DEPTH AND THICKNESS
We must listen to the place and sense its inherent stories, creating new connections, new species, and breaking down boundaries and opening sealed surfaces. We need to work in a more localised way, thinking about the areas as a whole rather than as separate parts. This means that areas should not be seen as isolated islands divided into zones, such as industry, residential areas, and production landscapes. Going forward, we must look at human and non-human resources woven together. The number of connections directly corresponds to the depth and thickness.

THE FUTURE IN ØSTBIRK
Text for the Drawings

CJ Lim, Professor, The Bartlett School of Architecture, University College London
Heidi Merrild, M.Arch., PhD, Postdoc, Aarhus School of Architecture

Two drawings have been created based on a dialogue between the undersigned and CJ Lim, a well-known experimental architect and professor, assisted by Ivan Chan. The drawings offer a vision for the future of Østbirk. CJ Lim has 32 years' experience working with architectural storytelling as a teacher and researcher. This is evident in the drawings, which take existing research as a starting point and use fairy tales as a medium to develop a vision for the future.

The two drawings should be read as metaphors and allegories of Østbirk's futures – visions, not literal representations. They also serve as a catalyst for dialogue and future development. At their heart stands the protagonist: a young generation as guardians of opportunities and enlightenment. Through drawn visions of the future, we can reinvent opportunities based on the what we have, where buildings and places provide opportunities for new learning.

> " At first people refuse to believe that a strange new thing can be done, then they begin to hope it can be done, then they see it can be done, then it is done and all the world wonders why it was not done centuries ago".
> *(Burnet 1911).*

FIRST DRAWING: 'LOVE FOR CHILDREN AND NATURE'

At the core of this vision are children – the embodiment of continuity, care, and hope. The future is imagined not through fleeting quick-fixes, but through slow, strategic growth that honours generations to come.

Investments and activities – whether tangible or philosophical, physical or ephemeral, permanent or temporary, rooted in tradition or hybridised with innovation – are going to shape the evolving narrative. Stakeholders and emerging economies will arise both within Østbirk and beyond its borders, each bringing intentions that may harmonies or provoke.

As in a game of chess, every move – every monetary, cultural or spiritual investment – must embody adaptability, multi-purpose use and value, and strategic foresight, engaging both society and the realities of climate change. Yet, all visions and decisions begin with one immutable principle: a commitment to sustainable love, care, and compassion for both children and nature.

Source; CJ Lim

Drawing 1: Østbirk's Future

Ostbirk's future is imagined as a game of chess, each move shaping what is to come. Velux's vision serves as a tool to embrace these challenges and provide resilient responses to unpredictable changes. Within this game, tokens representing the seasons, weather, animals, and plants become part of the decisions, reminding us that nature and community are inseparable from future planning.

Drawing 01

DRAWING 2: WINDOWS TO THE FUTURE

If children symbolise tomorrow, new openings offer the lens through which tomorrow is embraced and envisioned. Windows become portals – openings that invite an embrace of resilience, of nature and climate, and of collaborative opportunities both local and global.

A glance invites us to dream – dreams of sustainability in all its dimensions: health, social cohesion, environmental harmony. While offering security it also reminds us of the romance of nature and the innocence and wonder of childhood, echoing through timeless stories: the longing of Peter Pan, the curiosities of The Secret Garden, and the yearning between Romeo and Juliet.

New openings frame these possibilities – not only as architecture and environmental facilitators, but as an ethos: a window to well-being, to culture, and to a sustainable Østbirk.

Source; CJ Lim

Drawing 2: Moonviewing through the Velux skylight

Beyond providing ventilation, fresh air, and natural daylight, the Velux skylight offers a framed view of the moon — a threshold to its gentle light. It becomes not only an opening to the sky, but also a doorway to dreams, where imagination begins.

Drawing 02

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Tidskriftet Skoven nr. 11, 2020.Træbygning i fin form efter 25 år.