IDEA BOOKLET

Think twice before demolishing

Advice on carrying out a successful construction project without demolition

GRØNN BYGGALLIANSE
NORWEGIAN GREEN BUILDING COUNCIL

Contents

Introduction

Existing buildings are a gold mine for the future. It is crucial that you see the potential in the buildings we already have if you want to spearhead sustainability.

In this booklet, we address five common myths that contribute to the demolition of buildings:

1. It costs more to refurbish than to demolish and build anew.
2. Only new buildings can be green and environmentally certified.
3. It is difficult to utilise space efficiently in old buildings.
4. It is difficult to meet modern requirements for indoor air quality in existing buildings.
5. New buildings have a more contemporary visual expression.

At the Norwegian Green Building Council, we often hear that these five myths are determining factors for choosing to demolish a building. What's more, current fiscal regimes provide few incentives to refurbish buildings rather than demolish and build anew.

This booklet shows you how we can refute these myths by thinking about old buildings in new ways. We will give you ten tips and even more good examples of what you as a building owner, developer, or investor should think about before deciding what to do with an old building that no longer meets current requirements from tenants, the municipality, or others.

We don't reach our climate targets by demolishing.

The CEO of Statsbygg, Harald Vaagaasar Nikolaisen, has already written several articles with the title 'We can't build our way to the Paris Agreement'. He's right. The Norwegian Parliament aims to reduce energy consumption by 10 TWh by 2030, but we will not reach this target by simply building new energy-efficient buildings. New buildings account for only one to two % of total construction activity per year. Therefore, the true potential lies in existing buildings and their refurbishment.[1)]

At the same time, we demolish more than 22,000 buildings in Norway each year.[2)] This generates unnecessarily large amounts of greenhouse gas emissions and high consumption of material resources. The EU stipulates that starting in 2020, 70% of all construction waste must be recycled [3)], which will be a challenge for building owners to achieve. Transforming existing buildings rather than demolishing them is a simpler and more efficient way to reuse material resources. Production of new base structures and foundations also produces considerable greenhouse gas emissions; we can help protect the environment by preserving and refurbishing the structures we already have.[4)]

In order to achieve our national goal of having a climate-neutral building and property sector by 2050, it is also necessary to maintain existing structures. In other words, environmental and climate considerations offer many good reasons not to demolish.

'Think twice before demolishing' in three points:

- Demolishing and then constructing a new building is costly in economic terms, as well as for nature and society.
- There is great potential in utilising existing buildings and property structures better than we do today.
- Demolishing is not compatible with Norwegian or EU climate targets, the goal of a circular economy, or the Norwegian roadmap for a more sustainable construction and property sector towards 2050.

In this booklet, we show that there are a number of good solutions for providing an old building with modern, sustainable qualities that also benefit health, the environment, and the economy.

Who should read this booklet?

This booklet is written for construction clients, property owners, developers, and investors. We also believe that architects and advisers can be inspired by this booklet.

Thinking twice before you demolish is circular economy for the built environment in practice. Refurbishment is the first step towards closing the flow of materials and adapting to a circular economy. Up to now, this has not received the attention it is warranted. We want to bring this aspect into the discussion. When we started looking into this topic, we found several examples that illustrate how refurbishment can also be good business. We found construction clients, architects, and advisers who work to disprove the myths, and who have developed some of the most attractive buildings and areas we know of in which to live and work.

Good luck with your next refurbishment project!

Photo: SINTEF Community, Oslo

1) The National Budget (2018), available at statsbudsjettet.no.
2) 'Waste from building activity' (2019), Statistics Norway, available at ssb.no.
3) DIRECTIVE 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, available at EUR-Lex.
4) Fredrik Berg & Mie Fuglseth (2018). 'Life cycle assessment and historic buildings: energy-efficiency refurbishment versus new construction in Norway', Journal of Architectural Conservation, 24:2, 152-167, DOI: 10.1080/13556207.2018.1493664

Myth:

It costs more to refurbish than to demolish and build anew

Traditional cost benefit analysis often shows that it is more economically profitable to demolish and then build anew, but this result largely depends on what is included in the calculations. As our understanding of sustainability grows, the factors in the calculations will change.

Tip 1:

Has it occurred to you that you can reduce material costs through preservation?

Globally, the construction industry uses approximately 40% of society's material resources. As long as this consumption occurs in a linear economy, material resources will continue to disappear at a staggering rate. Many resources are now running out. This is especially true when it comes to metals, but it also applies to resources we thought were in abundance, such as sand used in the production of concrete. Today, material resources are priced relatively low compared to labour resources, but as materials become scarce, we should expect costs to increase dramatically. This means that refurbishment and preservation of material resources will give significant cost benefits.

Most existing buildings were not planned with change, reuse, and material recovery in mind. Norway is now in the starting phase of establishing systems for the reuse and material recovery of building materials. Many developers and professionals are working to bring about more reuse and material recovery. At this point, however, the easiest way to utilise material resources to the fullest is to leave them at their original location.

'It's great when we make (material) discoveries that fit in with our project at Tullinløkka. Several things need to fall into place in order to find the right materials. Recently, we received so-called cooling baffles, a type of cooling system, from Dronning Eufemias gate 8, that need to be refurbished' – Håvar Haugen Espelid, project manager at Kristian Augusts gate 13.

We have a long tradition of reusing materials.

Right up until the 1960s, there were strong traditions of sorting and reusing building materials in Norway, such as notched logs, joists and beams, roof structures, bricks, roof tiles, windows, and doors. Materials were expensive and there was money to be saved by reusing them. A major shift in material recovery occurred in the 1950s when we moved from using lime mortar to cement mortar. From that point, it became possible to produce very cheap building materials through industrial processes. Efficient building methods, fewer requirements regarding the service life of buildings, and lower material costs made material recovery less important for many.[5)]

We are starting to see waste as a resource.

At the same time as sorting requirements at construction sites and bans on organic waste disposal increase, the recovery rate of waste has increased in recent years. However, in Norway, much waste, and particularly wood, is used in energy recovery. Material recovery mostly involves the downcycling of materials to a lower-quality product, such as filling material or aggregate in concrete. Many contractors are also testing so-called waste-free construction sites with great success. However, while direct reuse of building materials is still uncommon, there is a growing interest in reuse, especially in large Norwegian cities. In addition to avoiding demolition by conserving and refurbishing buildings when possible, we must facilitate reuse in a more sophisticated manner. This includes recycling and upcycling when we have to take down parts of buildings or entire buildings.

How to succeed when recycling and reusing.

When refurbishing, it is important to map the material resources found in the existing building structure with a view to reusing and recycling these. Advice for mapping materials:

- Map the service life of materials and building components. Materials and components should be tested by a skilled professional in order to estimate whether they meet quality requirements for the entire service life of the refurbished building.
- Identify whether the materials are technical resources such as steel, concrete, and glass, or biological resources such as wood or plant material.
- In order to retain the purity of the material, do not mix biological and technical materials.
- Ensure that the materials are not contaminated by environmentally hazardous chemicals. This is important for all types of materials and especially when working with biological resources, for which the aim is to safely return these to the biosphere.
- Make sure that building components can be dismantled when the building is used for something else, refurbished, or demolished.[6)]

This is not always easy, but we see that more and more people and companies are working on extensive refurbishment projects with great success. They are gaining valuable experience from which others can benefit. By taking the suggestions above into account, refurbished buildings can also provide a resource basis and be a 'material bank' for the buildings of tomorrow, both economically and physically.

5) 'Industrialisation of the construction processes - Status and trends' (2017), SINTEF Fag, available at sintef.no and 'What happened to houses and craftsmanship in 1950?' (2019), available at byggogbevar.no.
6) Building Revolutions – Applying the Circular Economy to the Built Environment (2016), Cheshire D. RIBA publishing

BUILDINGS AS MATERIAL BANKS

› Every brick, wall, door, and window pane in a building has a value. When buildings are refurbished or demolished, these materials are often disposed of in landfill sites or used in energy recovery. With the concept of buildings as 'material banks', buildings are seen as places that store materials that can be reused, recycled, or upcycled for new products.

In a circular economy, materials that are part of existing buildings are considered resources for the buildings of tomorrow. Information about materials used in a building can be mapped and recorded in a digital material bank, both for a newbuilt and in the course of the service life of a building. The information about the material resources of a building can be useful in the case of refurbishment, and if or when a building is to be demolished and the materials become available for other buildings or uses. [7)]

Illustration: Entra ASA/Mad

Kristian Augusts gate 13 › Entra

At Tullinkvartalet in Oslo, Entra is refurbishing and constructing a new building with used materials. This is the first full-scale circular building of this size in Norway. Entra, along with the lessee Spaces, is paving the way for a circular economy in the construction and property sector. The intent is to make circular buildings competitive with mainstream buildings. The architect is MAD, and Kristian Augusts gate 13 (KA13) is a model project in FutureBuilt.

Entra has been on the lookout for secondary materials and components that could be reused in the 1950s-era building during the refurbishing process. Much of the interior has been preserved in its original state. For example, the light yellow tiles in one of the entrances will remain in place. Old wood will receive a new lease on life. Entra wants to incorporate used materials as much as possible in roof and wall structures, sanitary installations, ventilation, and much more. The new extension will also be constructed using reused materials. Reuse means that the secondary building materials and components are used again, without being turned into something else.

In the search for secondary materials, both the logistics and legal framework made it a time-consuming task to track down relevant materials and components for reuse. Prime secondary materials were identified to be wood and steel, inner walls, and suspended ceilings. Håvar Haugen Espelid, project manager for KA13, says:
'The project will be more expensive than we first thought, but our work continues. Obviously, the long-term goal is that circular building projects are both environmentally friendly and economically profitable'.

7) Buildings as Material Banks (BAMB) is a European research project that looks at ways to increase the value of building materials in order to reduce the use of material resources and contribute to less waste. For more information, visit https://www.bamb2020.eu.

Lilleakerbyen › Mustad Eiendom

The new Lilleakerbyen aims to be a beacon of circular buildings and sustainable urban development. Mustad Eiendom has joined forces with the Danish Lendager Group in order to focus on reuse and sustainable area development. Based on a detailed material mapping of existing buildings and other structures made by Lendager, Mustad is spearheading urban development informed by an ambitious strategy for reuse of existing buildings and components. This will reduce greenhouse gas emissions by approximately 28,000 tonnes and will in addition reduce the cost of materials by approximately NOK 1.5 billion.

The Lilleakerbyen development area is comparable in size to the Bjørvika area. It will be transformed into a district that includes housing, trade, restaurants, hotels, offices, culture, education, and activities, among other things. To create a good city structure that will last far into the future, some buildings must also be demolished.[8)]

Illustration: LPO/A-lab

8) Estate Nyheter (25.06.2019), available at estatenyheter.no.

For more information:

In *the* Green Material Guide (Norwegian Green Building Council, 2017), you will find information about the suitability of different types of materials for recycling and reuse.

In the guide *Investigation of obstacles to and opportunities for involving the reuse of building materials and technical installations in buildings* (NHP network, 2018), technical, legal, environmental, and market obstacles and opportunities for reuse are investigated. The report *Recommendations for the reuse of building materials* (SINTEF 2014) looks at how reuse can become a cost-effective and practical alternative to new materials on the market.

At byggemiljo.no, which is operated by the National Action Plan for Construction Waste, there is a lot of useful information about recycling and reusing materials.

Tip 2:
Have you taken all the risk aspects of demolition into account?

Costs are relative, and the models used to calculate cost often depend on the type of company, type of project, and who is doing the calculation (owner, contractor, etc.). As of today, there is no common model or framework linking environmental aspects with economic considerations in a construction project. Price per square metre is often the only consideration in the development and construction of new buildings. There are several aspects that should be included in the equation when deciding whether to demolish or refurbish.

High-risk costs are often expected in refurbishment projects, due to structural surprises that can emerge when demolition begins. The construction of new buildings has thus far had a more predictable price per square metre. We have reason to assume that in the future, one must expect new risk costs associated with demolition and new construction alternatives. For instance, banks, investors, authorities, and others are now starting to demand greenhouse gas accounting. A demolition/newly-built alternative will normally result in higher greenhouse gas emissions compared with a refurbishment project. The calculations could affect loan conditions, willingness to invest, demolition, and building permits, as well as market appeal. This is elaborated in Tip 3.

With the EU demanding an increase in material recovery, the cost of demolition is likely to increase. This is because construction clients will become responsible for finding good solutions in a material recovery market that is currently immature. And what about the cost of a building application that takes time to process due to an increase in cultural heritage preservation considerations and environmental focus?

If careful and considerate refurbishment is undertaken, the tenants/lessee can use the building while work is ongoing. This will mean sustained income from rent as opposed to an immediate loss of income in the case of a demolition/newly-built alternative.

Illustration: KLP Eiendom

The Max Building › KLP Eiendom

KLP Eiendom refurbished the old Max building in Trondheim. This project included good preparatory mapping that was important in reducing risk in the implementation phase. 'When you are aware of some of the challenges before work commences, you can adapt the project process in order to facilitate good discussions related to the final solutions', says project manager Line Gjerde Syltern. KLP Eiendom gained several advantages by utilising the building's existing structure. One such advantage was a shorter construction period. The company also reduced construction costs somewhat by avoiding the need for new load-bearing systems and reducing excavation work.

By reusing much of the concrete structure and load-bearing elements, the project also cut carbon emissions by over 60%. 'When we build, we talk a lot about reducing greenhouse gas emissions over time by reducing energy use. Often we cannot 'calculate' a building accurately before it reaches a service life of approximately 50 years. By reusing the concrete, and thereby not having to demolish and use new concrete, we reduce greenhouse gas emissions today. This is especially important, as we are acutely aware of the challenges facing the world when it comes to carbon emissions', says Gjerde Syltern. The Max Building is BREEAM-NOR certified as 'Outstanding'.

Myth:

Only new buildings can be green and environmentally certified

New and environmentally certified buildings are often highlighted as the greenest buildings. However, even though a new building can be made more energy efficient, it is difficult to defend demolishing and building anew rather than refurbishing the original building based on climate and resource calculations alone.

Tip 3:

Has it occurred to you that preservation results in a smaller climate footprint than demolition?

'The greenest building has already been built'
Architect Carl Elefante

In the future, it is likely that building owners will be required to undertake greenhouse gas accounting by both investors and the authorities, and perhaps even by banks and customers. The decision to either demolish and construct a new building or refurbish affects the climate footprint of a building to a great extent.

The climate footprint of a building is the sum of emissions from the production and transport of materials and equipment to the building, plus emissions from the actual construction process and emissions from energy use related to the operation of the building.

'.. It takes more than 50 years before lower emissions from energy use counteract greenhouse gas emissions related to the construction process'. Fredrik Berg & Mie Fuglseth [9)]

Emissions associated with the production of materials are comparable to the emissions associated with energy use throughout the service life of a building

Even if a building requires a high input of energy, total emissions will rarely be lower if the building is demolished and a brand new and more energy-efficient building is built. In Norway, where we rely mainly on hydropower for our energy supply for buildings, emissions associated with the production of building materials are significant.

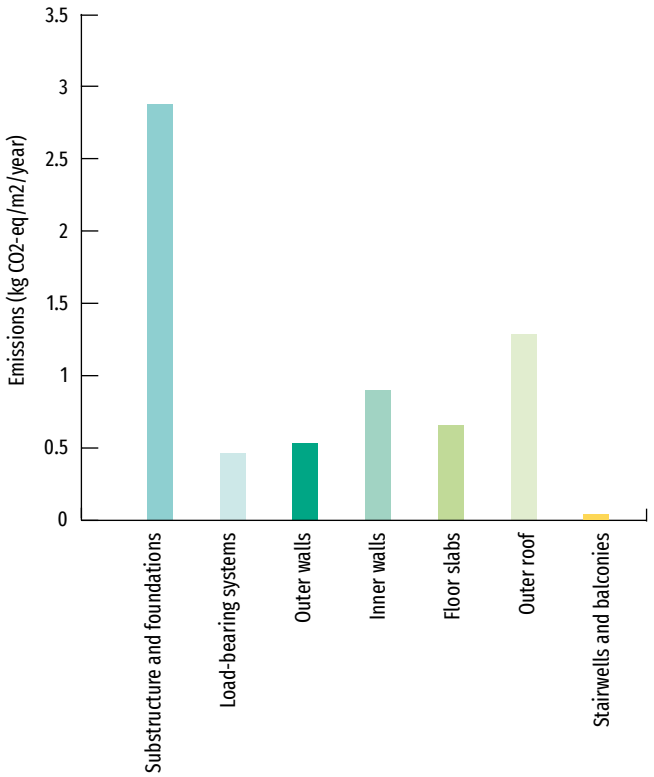
Climate calculations will vary, depending on the selected emission factors for electric and district heating, type of building, and the materials used. The choice of climate-efficient, new materials, such as wood and low-carbon concrete, will reduce the net greenhouse gas emissions of a new building. However, it will remain challenging to reduce emissions through conservation and refurbishment. Emissions related to the production and transportation of materials often account for half of the total emissions produced during the service life of a building.

The largest share of emissions tends to come from materials used in substructures and foundations, because these consist of carbon-intensive materials such as concrete and steel. Therefore, preserving substructures and foundations will almost always result in the smallest climate footprint. It is important to always include emissions related to substructures and foundations in greenhouse gas calculations. Groundwork should also be included. If not, the result of the assessment will be misleading and may even prompt a developer to choose demolition due to climate considerations. NS 3720 Greenhouse gas calculations for buildings (Norwegian Standard 2018) indicates which elements of a building and what work to include.

Energy-saving measures in existing buildings provide the best climate benefits.

Older buildings are often considered the worst environmental offenders, as they are often poorly insulated. Therefore, many believe that demolishing old buildings and replacing them with new, more energy-efficient versions is a good climate initiative. [10)]

EMISSIONS DISTRIBUTED ACROSS A BUILDING'S VARIOUS PARTS; REFERENCE BUILDING IN KLIMAGASSREGNSKAP.NO, CIVITAS.



9) Fredrik Berg & Mie Fuglseth (2018), Life cycle assessment and historic buildings: energy-efficiency refurbishment versus new construction in Norway, Journal of Architectural Conservation, 24:2, 152-167, DOI: 10.1080/13556207.2018.1493664

In the report *Zero emissions - is it possible?* (Norwegian Green Building Council, 2013), calculations show that the projects with the lowest net greenhouse gas emissions are refurbishment projects, where:

› the foundation and facade remain
› additional insulation is added where possible
› windows are changed, or inner windows are inserted
› technical installations are upgraded.

It is also difficult to argue in favour of demolishing a facade from a climate and environmental point of view. A new, well-insulated facade will have relatively little impact on energy and emission calculations, especially in the case of office buildings. All projects should therefore make an assessment of the facade's heritage value, technical condition, permeability, and how much daylight it lets in. This can be done to estimate the benefits of demolition in relation to emissions and costs associated with new materials. There are also other energy-saving measures that can help, such as technical installations or insulating the outside of the building. This applies to both new buildings and refurbishment projects. What is more, these kinds of measures will reduce pressure to demolish.

We need to make emission cuts now

In addition to the amount of emissions, it is important to assess when emissions occur. Emissions associated with the production of materials are happening right now, at a time when it is most critical to reduce them. By reducing our material consumption, we will therefore reduce the emissions related to the embodied carbon of the building immediately. Reductions based on reduced energy consumption i.e. for heating, cooling and electricity, produce far less of an effect per year throughout the service life of a building.

Illustration: Photo: T. Lauluten/FutureBuilt

Fredrik Selmers vei 4 › Entra

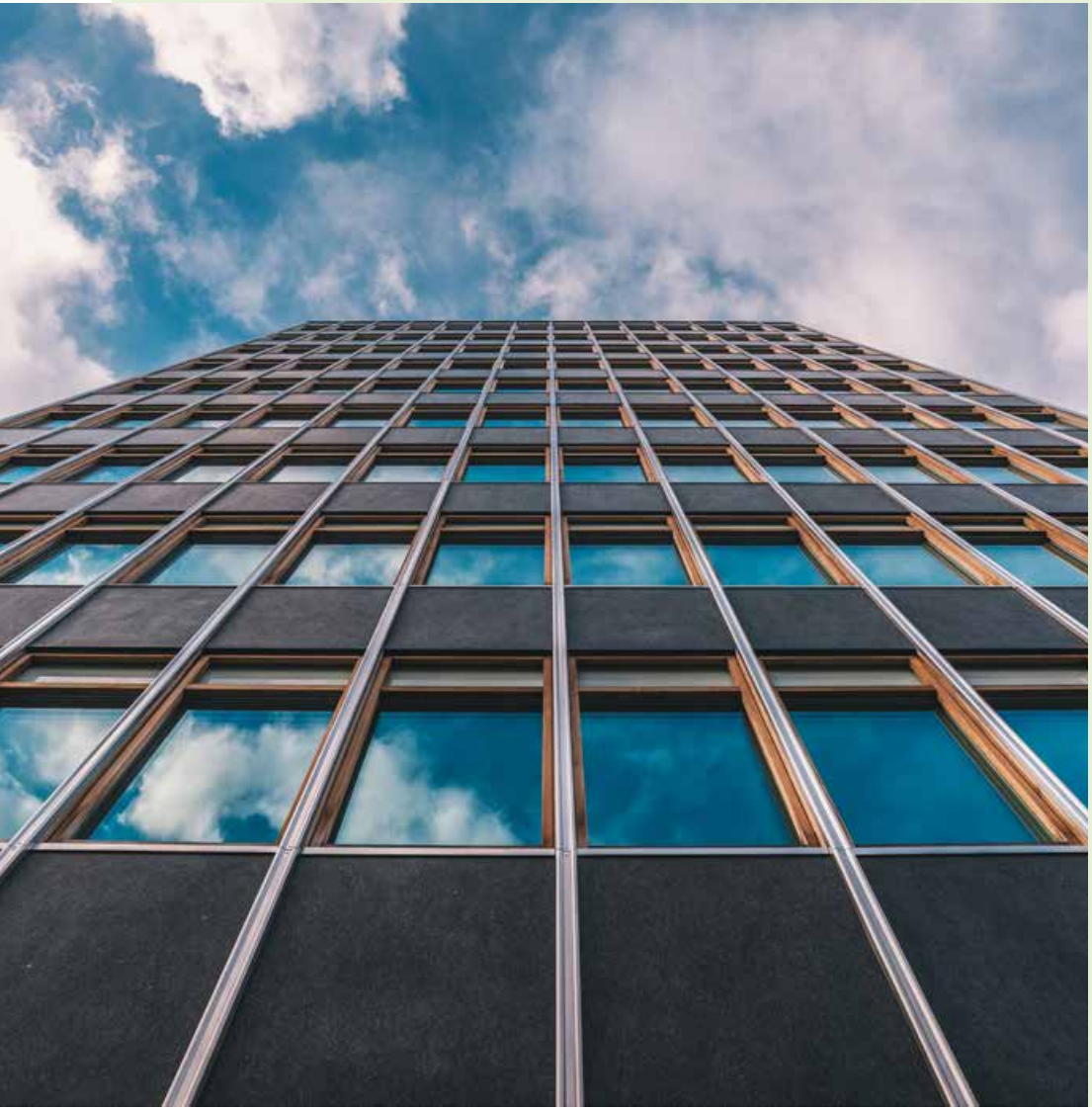
Fredrik Selmers vei 4 is an example of refurbishment being worthwhile when viewed from a climate perspective. The substructure, foundations, and load-bearing systems have been reused as part of the total refurbishment of the high-rise buildings from 1982. The new areas are connected to the existing load-bearing system between the five blocks of buildings, and low-carbon concrete has been used. The basement and roof have received additional insulation. The original facade has been demolished, and a new climate wall made of wooden elements has been fitted on the outside of the load-bearing system of concrete. This wall includes 350 mm of fibreglass insulation and is clad with two layers of recycled aluminium.

The most important climate measures are proximity to public transportation hubs, energy-efficiency measures, and strict requirements regarding the environmentally friendly use of material through BREEAM-NOR, among other things. For example, 95% recycled aluminium has been used on the facade. Structural steel (50% recycled steel) has been used in the load-bearing system, as well as recycled plaster in plasterboard and environmentally friendly paint and joint filler. Greenhouse gas emissions for the planned building were reduced by 49% compared to the reference building, which is calculated according to TEK 10.

The 'in operation' calculation provides a 45% reduction in greenhouse gas emissions. Fredrik Selmers vei 4 is a FutureBuilt model project.[11)]

10) Energy and climate (11.10.2019), available at energiogklima.no.
11) FutureBuilt (04.06.2019), available at FutureBuilt.no

Photo: Höegh Eiendom



Wergelandsveien 7 › Höegh Eiendom

The facades of Wergelandsveien 7 were in poor condition; Höegh Eiendom wanted to upgrade these to the highest possible standard. Taking cultural heritage into consideration, the facade had to look as it did when it was new in the 1960s. When the building was fully leased, Höegh Eiendom and the planning and building authorities in Oslo reached an agreement that the new facade could be mounted on top of the old one.

A conventional facade solution would have led to a large extension in order to achieve the ambitious energy-reduction goal. This would have produced aesthetic challenges and caused problems with the building boundaries. New technology, involving the innovative Q-Air facade solution, resulted in the thickness of the facade being almost halved, while the insulation capability was doubled in relation to what an alternative conventional element facade would have allowed.

The new facade measures far below the passive house standard, resulting in a 60% reduction in the building's energy consumption for heating and cooling. The building's indoor climate and comfort levels are now very good, and the building has become considerably easier to operate. [12)]

12) Enova (11.11.2019), available at Enova.no

Tip 4:
Did you know that existing buildings can become environmentally certified?

Environmentally certified buildings have good reputations, provide access to green loans, and are becoming increasingly attractive to tenants. It is certainly possible for existing buildings to be environmentally certified.

BREEAM-NOR is a widely-used certification scheme for new buildings and refurbishments. Many of the topics in BREEAM-NOR favour preservation, and many topics specify various requirements depending on whether the building is new or a refurbishment project. This means that refurbishing does not become an obstacle when it comes to getting points in BREEAM-NOR. There are many examples of refurbishment projects that are certified at the highest levels in BREEAM-NOR, Excellent and Outstanding.

If you only make a few alterations to the existing building, you can use the international certification called BREEAM In-Use. BREEAM In-Use, unlike BREEAM-NOR, is not adapted to the Norwegian context, but is available in a Norwegian-language edition. BREEAM-NOR International can be used for all types of commercial buildings. The first Norwegian BREEAM In-Use certificates were issued in 2015, and we are seeing a rapid rise in the number of certificates in Norway. BREEAM In-Use is equally popular with banks, investors, and tenants/lessees as is BREEAM-NOR.

The Nordic eco-label 'Swan' also offers certification of refurbishments. This certification includes small houses, flats, kindergartens, schools, office buildings, and housing for the elderly or people with disabilities.

For more information:
You can read more about the Nordic Swan eco-labelfor refurbishments here.

In a report from the Norwegian State Housing Bank (2016), you will find information about sustainable material choices in the Swan eco-label criteria for refurbishments.

In a report written by Asplan Viak (2017) for the Directorate for Cultural Heritage, it states that it takes 52 years of operation before the demolition and construction of new buildings becomes more climate friendly.

Photo: Entra ASA/Lars Petter Pettersen

Powerhouse Kjørbo ❯ Entra ASA

Powerhouse Kjørbo has become Norway's first energy-positive office building and is probably the world's first energy-positive refurbished building. The buildings at Kjørbo were ordinary office buildings built in the 1980s. They have now been upgraded through optimisation with known technologies applied in new ways. The refurbishment has reduced the building's energy demands by more than 86%. This has been achieved by minimising energy demands, while at the same time producing more renewable energy on site than the buildings consume throughout their service life. As part of the energy accounting, energy use related to the production of building materials, transportation, construction, operation, and disposal of the building is included.

Powerhouse Kjørbo's energy facilities include a geothermal well park and a heat pump as base load. The most important measures are to reduce energy use through super-efficient ventilation, insulation, and lighting. Energy used for heating and cooling is reduced with the help of energy wells. In addition, the buildings receive energy from a nearby solar park.

The energy surplus produced in the operational phase is approximately 21 kWh per square metre of heated usable floor area. Lessees report improved indoor climate, acoustics, lighting, and a more comfortable temperature than before the refurbishment took place.

Powerhouse's first two office buildings at Kjørbo have achieved the BREEAM-NOR classification of Outstanding.[13)]

13) Powerhouse Kjørbo (11.10.2019), available at Powerhouse.no

Myth:

It is difficult to utilise areas efficiently in old buildings

A common argument for demolishing buildings is the need for increased space efficiency or more square metres to increase profitability when selling or renting. But what can be done to utilise usable floor area more efficiently in the existing building?

Tip 5:

Has it occurred to you that you can build onto or expand upon what is already there?

'The most environmentally friendly thing we can do is to utilise the areas we already have in the best possible way, address new needs without constructing new buildings, and try to convert or extend'.

Harald V. Nikolaisen, Director General of Statsbygg

If the load-bearing structure has surpluss load-bearing capacity, it may be a good idea to add one or more extra storeys. The load-bearing capacity of existing structures can be a challenge, but extensions made of wood are a possibility that have several advantages. Wood is both light and strong. Its light weight in relation to its strength makes it easier to carry out building extensions in cities. Fewer ground reinforcements are needed compared to other materials, which saves time and costs. Several suppliers offer prefabricated wooden elements that allow for short construction time and low levels of noise whilst mounting. Since this causes limited disturbance for tenants or habitants, use of the premises may be possible during refurbishment.

Photo: Umehem

Embla 5 › Umehem

At an existing office building in Umeå, Sweden, the construction client Umehem has received 6,500 square metres of newly-built wooden premises. In addition to seven new adjacent storeys, three storeys have been added on top of an existing office building. The elements are made of cross-laminated timber supplied by Martinsons, Sweden's largest supplier of glulam timber.

Photo: Katharina Th. Bramslev

'Today's knowledge workers are always looking for new connections, new ways to share experiences with others'.
The EDGE Olympic

The EDGE Olympic › EDGE Technologies

The EDGE Olympic in Amsterdam is designed to minimise the environmental footprint of the building. Instead of demolishing the original office building, the building was refurbished and converted. In order to increase space efficiency, the building received a two-storey extension. A detachable, wooden load-bearing structure was chosen so that the existing building could support the weight of the new storeys. When combined with other materials such as steel, concrete, and natural stone, the choice of material added contrast and warmth to the interior.

Tip 6:

Has it occurred to you that you can develop space-efficient solutions in existing buildings?

Many old buildings are not furnished with space efficiency in mind. They often include cubicle offices and a lot of unused walking space. By moving or taking down interior walls and allowing daylight to enter dark areas, floor plans can be changed and areas used more efficiently.

By taking down certain inner walls or parts of floor slabs, new areas can receive daylight from windows in the facade or via skylights.

Lysaker Park › Storebrand

Lysaker Park was refurbished and converted into the main offices of Storebrand ASA in 2009. Ten years after the transformation, it is still considered an iconic building in the heart of Lysaker.

When Storebrand Eiendom started planning to refurbish Lysaker Park from the old head office of Aker Kværner, they wanted to increase the amount of daylight that entered the building. Link Arkitektur designed large light shafts both in the roof and for the facade where the interior was very dark. They also opted for solar shading that incorporated transparent and moving glass slats. The slats are partially transparent and let in filtered daylight, even when the windows are completely covered by the solar shading.

A former underground parking garage in Lysaker Park was transformed into a gallery for Storebrand's significant art collection. The facade has been opened and large windows have been added. This has turned the former parking garage into an attractive room.

The building is half a kilometre long. Five existing office buildings have been given a new longitudinal communication structure. This provides ample amounts of daylight and space-efficient modern office landscapes.

The project team saw that there was little to gain from adding additional insulation in the existing walls compared to introducing new technical measures. Therefore, they deliberately worked on reducing the cooling load, which included installing external solar shading. The goal was to keep the heat out while letting light in, whilst providing visibility.

The recreational zone was positioned on the opposite side of the building to avoid noise from the E18 highway. Here, park facilities such as water features and wooden terraces were refurbished, offering quiet and vibrant surroundings. Environmental friendliness, reuse, and universal accessibility were the project's key qualities.[14)]

Photo: Storebrand

Photo: Storebrand

14) Rewritten from Link Arkitektur.com and Bygg.no (25.02.2010).

Myth:

It is difficult to meet modern requirements for indoor air quality in existing buildings

A common argument for demolishing older buildings is that it is not possible to achieve good ventilation and cooling solutions. One often thinks that the ceiling height is too low to install the necessary ventilation ducts and that technical rooms are too small to house planned equipment. However, there are alternative ways to achieve good air quality and a good indoor climate.

Tip 7:

Has it occurred to you that you can achieve better air quality in old buildings by thinking about ventilation in new ways?

It is very common in Norway to use balanced ventilation with cross ventilation and ventilation cooling. In other countries, such as Denmark, Germany, and Austria, it is just as common to use natural or hybrid ventilation, or balanced ventilation with displacement ventilation and free cooling. It is also becoming more common to use to the moisture and temperature regulating properties of the materials. These solutions are often more suitable compared to new cross ventilation when wanting to upgrade existing buildings. They do not take up as much vertical space and one avoids destroying existing structures and interiors with large ventilation ducts.

There is little knowledge of and a lot of prejudice towards different types of ventilation solutions in Norway. To contribute to skill development, the Norwegian Green Building Council has prepared a guide entitled 'Advanced versus simple technical systems'.[15)]

'It's pretty much expected that I have an answer for everything, and this is usually how I give advice. Therefore, when I don't have knowledge of a specific product/system/ technology, I feel obliged to put on my conservative hat...'
Ventilation consultant

It is important to ask how much air is needed before focusing on the restrictions of existing buildings. In Norway, there is a tradition of having large air flows, more so than in other countries, without there being documentation that this is necessary to ensure good indoor air quality. We often overestimate the need for both cooling and air flows, in part because we often assume that more people will use the premises than what proves to be true. Other times the building regulations may be misinterpreted. For example, many continue to calculate dimensions with high emission materials in mind, even though TEK-10 and later TEK regulations consistently stipulated that low-emission products should be used. It is a pity if buildings are demolished as a result of out-dated knowledge, myths and prejudice, lack of creativity, or wrongly-dimensioned technical facilities.

For more information
The guides *'Simplification of technical systems'* and *'Advanced versus simple technical systems'* (Norwe-gian Green Building Council, 2016) provide advice on the simplification of technical facilities.

The idea booklet *'Heat pumps for heating and cooling in buildings'* (Norwegian Green Building Council, 2016) provides useful tips about heat pumps and the technology behind them.

15) Norwegian Green Building Council, University of Aarhus, Enova (2016)

Photo: Lars Petter Pettersen

Sentralen › The Savings Bank Foundation

The multicultural venue Sentralen shows that modern ventilation requirements and reusing existing buildings are not necessarily contradictory. However, this requires innovative thinking and combining several ventilation principles. In addition, it requires assertive developers who challenge the status quo and allow for new solutions.

At Sentralen, a number of strategies have been used to achieve the ventilation solution. Office areas with strict ventilation and air flow requirements have traditional, balanced mechanical ventilation, but with visible ducts. This is how sufficient ceiling height can be maintained in all rooms.

It was not possible to produce enough air to ventilate all the areas in the parts of the building facing Akersgata, Tollbugata, and Øvre Slottsgate. Therefore, an alternative strategy was chosen for these areas. By covering an existing, open courtyard, it was possible to use this new room in the ventilation strategy that involved facade areas facing the former courtyard. The glass-covered Winter Garden is used as an air supply and climate control chamber for office area ventilation. With efficient night-time ventilation, including heat storage in the heavy walls of the glass-roofed hall, the adjacent zones can reach designated temperatures without the use of mechanical cooling.

It was difficult to install enough ducts by using traditional mechanical ventilation in the Marble Hall and Dance Hall. Therefore, a solution was chosen where balanced, mechanical ventilation was combined with natural pulse ventilation during breaks, when the zones have to tackle heavy loads.

Automatic window motors were installed on existing windows in the Marble Hall at Øvre Slottsgate 3. Here, natural ventilation is now a valuable contribution to cooling and ventilation during events. In addition to the natural ventilation, fire ventilation is also located in the ceiling. In the Dance Hall, natural ventilation supplements the balanced mechanical ventilation. Natural ventilation is modulated when room temperatures become too high, and is controlled in coordination with heating control (radiators) and solar shading.

The Former U.S. Embassy › Fredensborg AS

The former U.S. Embassy at Henrik Ibsens gate 48 is to be refurbished for reuse. The building is listed and therefore has strict requirements for conservation, and this also includes the interior. A structurally integrated ventilation system is chosen as part of the refurbishment. Vertical ventilation ducts will mainly be installed inside the original ventilation shafts, which have been retained when possible. Existing ducts were considered for reuse, but as these generally had insufficient capacity and were in poor condition, they inevitably had to be changed. Therefore, the ducts have been recycled through a material recovery processes, and new ducts have been installed in existing shafts.

Diffuse ceiling ventilation directs the air supply through plastered ceiling panels that are mounted in wooden coffers in the suspended ceiling. The coffers are installed in the technical grid along every two metres of the facade. The coffers are partly air supply chambers and partly sound absorbing devices. This principle ensures that interior walls can be assembled and dismantled without structural changes having to be made to a new grid. Along with the possibility of varying air flow from cubicle office requirements to meeting room requirements, this gives a very flexible area that meets modern lessee specifications.

The principle of plastered ceilings was chosen to achieve an appearance that resembles the building's original 'Rabitz' plaster fabric ceilings as much as possible. They measure no more than 200 millimetres and therefore provide a relatively large ceiling height. Air is extracted through an atrium in the middle of the building via an extractor fan placed in a technical room on the roof. This leads the air through an air and water extraction recycler.

Watch the interview with environmental adviser Bodil Motzke from Undervisningsbygg at byggalliansen.no.

Tip 8:

Has it occurred to you that you can solve the need for more daylight by using new daylighting systems?

Low ceilings and deep, dark premises are some of the common reasons for demolishing existing buildings. You can allow more daylight to enter the building by creating additional and larger openings. You can improve floor plans by moving walls and rethinking your actual needs.

Photo: LundHagem

Photo: Undervisningsbygg/Finn Ståle Feldberg

Nordseter School › Undervisningsbygg

At the new Nordseter School, pupils can now walk through open and bright areas. By employing smart solutions, an old building from the 1960s has been refurbished to current standards.

Daylight now enters through large windows and high ceilings. All classrooms now have large windows facing south, west, and north, and have automatic exterior screens that can be controlled by pupils and teachers as they wish. A glass-sectioned facade solution (curtain wall) that stretches all the way up to the floor divisions has been chosen, and the height of the classroom ceiling has been maximised towards the outer walls. This was done to access as much daylight as possible. In addition, transparent solutions have been used in the vicinity of corridors and group rooms. These allow daylight to enter and provide (indirect) views from areas that previously did not have any.

Myth:

New buildings have a more contemporary visual expression

Architects like to put their mark on a project. This can seem easier when starting with a clean slate. However, there are also great opportunities for new visual expression in the transformation of a building. We challenge architects to use their creativity in order to create new visual expressions with existing structures.

Tip 9

Has it occurred to you that you can transform and open an old, closed facade?

The desire to renew the facade and give a building a contemporary visual expression causes many to choose demolition and then build anew. However, you do not have to demolish the entire building in order to change the building's expression.

Photo: Frank Holtschlag, Nyebilder

Torgbygget in Nydalen › Avantor

Torgbygget is located along the banks of Akerselva River in Nydalen in Oslo. The project focused on sustainable design and has achieved a BREEAM-NOR certification of Very Good. The building was originally completed in 2003 and was upgraded and expanded in 2015-16. It contains offices on the upper floors and commercial areas below, and is located above one of the entrances to the underground. The building received a new facade and interior finish as part of the refurbishment, as well as improvements to the entrance of the underground station.

Although the Torgbygget was relatively new, its design and function were outdated. It did not meet the requirements of what a modern district should offer its residents, students, workers, and tenants. The building appeared closed off and introverted. The goal was to make Torgbygget a contemporary, functional, and public-friendly building. Apart from the facade facing the hotel to the west, all facades have been upgraded with a new facade system. To the north, steel inserts were installed, and new elements were added. The recessed fifth floor was extended to the foundation wall.

The new facade has a complex shape including several characteristic 'office boxes' facing Akerselva River to the west. The design and planning also had to solve challenges associated with thermal bridges. However, the expansion, including a few square metres in the intermediate building, provided the additional areas and the new design that the owners wanted. The redevelopment yielded between 1000 and 1500 square metres of new floor space. More than half of approximately 8,000 square metres is used as office space.

The redevelopment also included significant outdoor work at ground level along Akerselva River. This provided much better accessibility around and to the building.[16)]

16) Byggeindustrien (27.09.2016), available at bygg.no.

Photo: Frank Holtschlag, Nyebilder

Watch the interview with the general manager of Avantor, Øystein Thorup, at byggalliansen.no.

Nydalsveien 28 › Avantor

Avantor transformed Nydalsveien 28 into an efficient and modern office building with a focus on indoor climate, energy, and the environment, while preserving parts of the original building. The building was originally built in 1941 as the headquarters of Christiania Spigerverk (nail factory). Over the years, the building has been redeveloped and extended a number of times, but still remained a rather closed-off and introverted building. Therefore, they chose to cut away a fairly large part of the ground floor and made it transparent, so that good contact with the urban space on the outside was achieved.

The building is centrally located in Nydalen, and currently consists of 24,000 square metres of offices and an activity centre. The environmental ambition for the building was thoroughly assessed before design and engineering started. Among other things, assessments were made regarding whether it was environmentally correct to demolish and dispose of windows and facades that had significant remaining service life in order to achieve the highest certification and labelling. The decision was made to keep some of the windows and facades from the late 1990s.

Tip 10

Has it occurred to you that the identity and charm of old buildings are of great value?

'One never regrets allowing a building to stand, but one very often regrets demolishing a building.'
Hanna Geiran, director of the Directorate for Cultural Heritage, Building Quality Conference 2019.

Every building has a story to tell. Older buildings help create good environments in which to live and work, and can also contribute to an area's identity. Buildings provide an experience of belonging, which says something about who we are and about our culture.

Nydalen, developed by Avantor, and Vulkan, developed by Aspelin Ramm, are examples of two successful development areas in Oslo where many old industrial buildings have been preserved. These buildings add character to the areas, and the general manager of Avantor, Øystein Thorup, is well aware that Nydalen would not have been as attractive without the old brick buildings. Originally, the developer wanted to demolish much more, but are now happy that the buildings were preserved. To prevent old buildings from being left empty, it is important that developers are allowed to make necessary adjustments so that they meet modern requirements and can be utilised effectively.

In a survey conducted by the Directorate for Cultural Heritage in 2017, 96% of participants said that cultural heritage sites and monuments can create a basis for tourism and business. 68% said that cultural heritage sites and monuments are important to them. The Directorate for Cultural Heritage states that cultural heritage sites and monuments are the new oil.

Cultural heritage management is beneficial for the state, the municipalities and the owners. A report by the Directorate for Cultural Heritage shows a growing willingness to pay for properties in areas of conservation. For example, they find an increased value of between 17-22% for buildings in Fredrikstad's Old Town, and an increase of 2.4% regarding flats in the vicinity of Birkelunden in Oslo. The study also found an increased willingness of between 14-18% to pay for views over areas of preservation.[17)]

Verket in Moss, developed by Höegh Eiendom, is another example of the successful transformation of an old industrial quarter into modern use with charm and identity.

However, the benefits that preservation provides do not end with an increased willingness to pay. Cultural tourism contributes 15% of the total value creation in Henningsvær and employs about 20% of the workforce. Many things suggest that the demand for cultural tourism is on the rise in many parts of the country.[18)]

There is a big difference between buildings built before and after 1950. Buildings built before 1950 give the impression that it was a time when materials were expensive, and labour was cheap. Therefore, the construction was usually of high quality with an eye for detail. [19)]

Buildings should be built with quality to last for many hundreds of years. Today, buildings are planned to last for 60 years or less, and many modern buildings are demolished long before this. Today, we also see that many magnificent buildings with a strong identity are empty. How can we work with these buildings to ensure they become bearers of culture in the future?[20)]

Nydalen in Oslo, where the old brick buildings add character and charm to the district. Photo: Tom Kolstad, Aftenposten/NTB Scanpix

Photo: Höegh Eiendom

17) Menon Economics commissioned by the Directorate for Cultural Heritage (2017): The Value of Cultural Heritage, available at riksantikvaren.no.
18) Menon Economics commissioned by the Directorate for Cultural Heritage (2017): The Value of Cultural Heritage, available at riksantikvaren.no.
19) 'What Happened to Houses and Craftsmanship in 1950?' (2019), available at byggogbevar.no.
20) Aftenposten (28.10.2018), available at: Aftenposten.no.

Illustration: Norwegian Property

Vinslottet › Norwegian Property

The old, unique buildings that are a part of Vinmonopolet's old production facility are receiving a new lease of life. Vinslottet will be completed in 2020, after undergoing a comprehensive, interdisciplinary process. Here, a confined and introverted facility will be transformed into something that meets requirements regarding good living standards, good public areas, and housing communities.

The original building was robust, but lacked life and content. The development has 223 flats, while the ground floor houses trades and services needed in a city. With its 50,000 square metres of floor space, the building was the largest of its kind in the Nordic region when it was completed in 1932. As an industrial facility, it was 'state of the art', and the building was considered an icon of its time in architectural terms.[21)]

21) Haslelinje (17.09.2017), available at Haslelinje and Økern and Løren.

On reflection

To challenge the myths about what is beneficial when left with the choice to either demolish or refurbish, we recommend that you regularly browse through this booklet. Construction clients can set the standard so that sustainability becomes a natural part of all projects. This can be achieved by establishing clear goals for the efficient use of resources and ensuring that the goals are followed also through the tender allocation criteria.

Architects can plan and engineer more adaptable buildings by creating designs with dismantling and reuse in mind. They can also facilitate an extended service life, and can choose materials and construction methods that support reuse and recycling.

Advisers can request goals and planned measures. It is especially important that advisers familiarise themselves with and offer feasibility studies on resource optimisation well before decisions are made regarding whether to refurbish or demolish. In this way, advisers will also be able to facilitate local reuse.

Contractors can make sure they have routines that ensure tidy construction sites, good sorting of waste, and documentation of waste management. They can also order materials as and when they are needed. Reduced storage time at the construction site may contribute to safer storage as well as reduced waste. Not least, open and ongoing dialogue with the project manager is important. [22)]

Good luck, and think twice before demolishing!

22) Norwegian Green Building Council (2017), How to plan for less waste, available at byggalliansen.no.

Terminology

Below is a list of the terms used in this booklet and their meanings.

DOWNCYCLING Where a material is recycled into another material of inferior quality. Examples include the use of crushed concrete as filling material, or the recycling of different types of plastic into an indefinable plastic fraction.

ENERGY RECOVERY Is often used regarding the utilisation of energy from waste, i.e., incinerating waste and utilising the energy produced to power district heating.

ENVIRONMENTALLY HAZARDOUS CHEMICALS Chemicals that are known environmental pollutants, regardless of whether they are included in waste regulations or similar regulations.

LANDFILL SITE A place where waste is permanently disposed of.

MATERIAL RECOVERY All types of recycling, with the exception of energy utilisation and reprocessing of waste for materials that are to be used as fuel. However, the directive on waste approves energy utilisation as a form of recycling if energy efficiency is better than 0.65.

RECYCLING Any utilisation where waste materials are processed into products, materials, or substances that are either used for their original purposes or other purposes. This includes the processing of organic material, but not energy utilisation and processing for materials that are to be used for fuel or landfill purposes.

RECYCLED AGGREGATE Crushed concrete where reinforcement bars and other foreign material have been removed to a sufficient degree, and where the fraction is sifted into desired grain sizes.

REUSE PREPARATION Any utilisation in the form of inspection, cleaning, or repair, where products or product components that have been disposed of are prepared so that they can be reused without any other pre-treatment.

REUSE A word that means the utilisation of materials and other residual products by using them again and recycling them. Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

UPCYCLING Recycling waste materials into new materials or products of better quality, such as utilising old newspapers to create insulation material.

WASTE and CONSTRUCTION WASTE A collective term for waste from the new construction, refurbishment, and demolition of buildings.

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The Norwegian Green Building Council aims to promote processes of change so that sustainability becomes second nature for more and more people. We want to be one of the most important catalysts for a more sustainable built environment.

We want to be a driving force that helps the industry to change attitudes, increase knowledge, and show that thinking, wanting, and operating sustainably is good, profitable, and fun.

The Norwegian Green Building Council is a non-profit member association, where businesses and organisations throughout the entire value chain of construction, property, and installation can be members (Org.no 987 297 689).

Visiting address:
Norwegian Green Building Council, Schweigaards gate 34C, 0191 OSLO.

Postal address:
Norwegian Green Building Council, c/o Greenhouse Oslo, Schweigaards gate 34C, 0191 OSLO.

Read more about the Norwegian Green Building Council at byggalliansen.no.

Requests to copy parts of this publication should be sent to the Norwegian Green Building Council at post@byggalliansen.no.

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