A cyclist wearing a black and red cycling suit and a helmet is riding a road bike through a modern, glass-walled urban structure. The structure features a complex network of silver metal beams and glass panels, creating a futuristic architectural environment. The cyclist is positioned in the lower right quadrant of the frame, moving towards the left. The background shows a bright sky and a blurred cityscape. A large green graphic element is overlaid on the left side of the image, containing the title text.

THE PROPERTY SECTOR'S ROADMAP TOWARDS 2050

The roadmap has two functions:

- The roadmap is intended to be a recommendation to Norwegian owners and commercial building managers regarding their short and long-term choices in ensuring that the property sector contributes to a sustainable society by 2050. The recommendations are issued by Norsk Eiendom and Grønn Byggallianse, primarily to their total of around 180 members. The roadmap will constitute a solid basis for our further work and members will be encouraged to implement the “10 immediate measures recommended for small and large building owners” in the roadmap. Members who implement these measures will be acknowledged in various ways by Norsk Eiendom and Grønn Byggallianse.
- The roadmap constitutes input to the Norwegian Government’s Expert Committee for Green Competition, appointed on 16 June, 2015. In autumn 2016, the committee proposed a general strategy to promote green competition towards 2030 and a low emission society by 2050. The committee’s secretariat has provided valuable input to the process with this roadmap.

A number of persons have been involved in the work on the roadmap through participation in meetings, workshops, interviews and hearings. A list of these may be found at the end of the document. We would like to extend our thanks to everyone for their valuable contribution. We would also like to thank Per Sandberg, head of the secretariat for the Norwegian Government’s Expert Committee for Green Competition, and Per-Espen Stoknes, consultant from the Grønn Vekst course at The Norwegian business school for their valuable input to the work.

At Grønn Byggallianse and Norsk Eiendom, we regard this work not as an ending, but as the start of vital strategic work. The effects and challenges associated with the various measures and the prioritising between them will be considered in more detail in this strategic work. We hope and believe that the roadmap can contribute to the development of individual property companies, the rest of the construction industry, amongst their collaboration partners and within public bodies.

23/06/2016

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CONTENTS

PREFACE	2	3. VISION 2050	18
TABLE OF CONTENTS	3	An account of how we imagine everyday life will be in 2050	19
SUMMARY	4	<i>Population density is high</i>	19
RECOMMENDATIONS	6	<i>Energy is emission free and optimally utilised</i>	20
to immediate measures recommended for small and large building owners	6	<i>Our buildings are healthy, functional and flexible – without impacting the environment</i>	22
to immediate measures recommended for public bodies	6	<i>All resources are recycled</i>	23
1. THE GREEN TRANSITION PROVIDES OPPORTUNITIES	8	<i>Construction materials are climate neutral and do not contain environmental toxins</i>	24
The world is dependent on a green transition	8	4. ROADMAP TOWARDS VISION 2050	25
We know the goal, but not how to get there	10	Emerging social trends can help us	28
Environmental and business strategy are two sides of the same coin	11	Building owners	29
2. THE ENVIRONMENTAL POTENTIAL IN THE CONSTRUCTION INDUSTRY IS HUGE	12	Public bodies	34
Buildings have the potential to achieve substantial reductions in greenhouse gases	12	5. SUMMARY AND CONCLUSION	36
The construction industry can free up energy for other sectors	13	Who shall take charge of the development?	36
Existing building stock must be upgraded	13	The role of public bodies as facilitators	36
Energy consumption in buildings constitutes more than heating	14	REFERENCES	38
Large volumes of waste represent valuable material resources	14	APPENDICES 39	
It is possible to choose toxin-free building products	16	Contributors to the roadmap	39
We need goals and priorities for densification and infrastructure	16		
Major construction activity provides opportunities to change course	16		

SUMMARY

► The green transition – a challenge and an opportunity

In the years to come, the world will have to deal with the risk of major climate change and a growing scarcity of natural resources, while absorbing exponential population growth. This will require us to change our behavioural patterns to such an extent that we are talking about a completely new agenda, often referred to as the green transition. We have drawn up a scenario, or a vision, for 2050 to help building owners plan for this new reality.

► Building owners are in a great position to exert influence

The construction industry has an important role to play if Norway is to achieve its environmental targets. The reasons for this are not always obvious, partly because the sector generates low direct greenhouse gas emissions. However, the construction industry is a customer of the industrial, transport and energy supply sectors and is therefore in a great position to influence them. Building owners, and in particular professional building owners, can also exert considerable influence over other segments of the construction industry as customers of architects, consultants, contractors and building material manufacturers. If building owners choose to build and manage their buildings more sustainably, they will be able to influence many others and release significant environmental potential.

► The construction industry backs ambitious environmental targets

The roadmap demonstrates how the construction industry can help society meet its domestic and international climate obligations. Decisions made on newbuilds and redevelopment projects have long-term consequences, and it is important that building owners upgrade their buildings to meet future needs. We have created a vision for 2050 in which the construction industry is climate-neutral, materials have closed life cycles, and there is zero emission of environmental toxins. This is ambitious, but the idea is based on national and international goals and is probably necessary to meet the challenges the world faces. We also believe that the goals can be achieved and that the roadmap will help us get there more quickly.

► The main challenge is better utilisation of material resources

The biggest gaps between current practices and our vision for 2050 are our dispersed settlement patterns, inefficient use of land and our attitudes towards the use of material resources. The EU's plans for a circular economy, i.e. an economy based on reuse, repair, refurbishment/improvement and recycling of materials, are probably the main initiatives that the construction industry needs to take on board in the times ahead. This is also where the biggest commercial opportunities exist for architects, manufacturers and developers that want to benefit financially from the green transition. In terms of energy, the high level of energy consumption by our existing building stock and uneven demand for energy are the two key issues.

► Green buildings are profitable

It is important to create a broad understanding amongst all professional building owners that green buildings are profitable. It is anticipated that the framework conditions of building owners in terms of the valuation of buildings, customer demand and regulations will rapidly develop in a “green direction”. There are already clear signs that this is happening. Investors in commercial properties, banks and insurance companies are beginning to place a higher value on documented green buildings from a risk perspective. Their premise is that it will be unprofitable to be left with an out-of-date building portfolio in 10 years' time. Building owners may also wish to influence further development of the framework conditions in order to stimulate a more rapid green transition.

► Multiple measures can be implemented immediately

There are many measures that building owners can implement immediately without waiting for regulations, incentive schemes or market demand. The roadmap contains proposals for “10 immediate measures recommended for small and large building owners”. The majority of these measures attract no additional costs and can help building owners ensure that they have a building portfolio that will be in demand in the future rental market, will have high marketability and will satisfy future regulatory requirements. With more incentive schemes from public bodies, building owners can stretch themselves even further.

“Public bodies can accelerate a desired development by offering incentives to those who lead the way”.

► Regulations are necessary to ensure that everyone is on board

Players who are unwilling to change lobby against changes and in a democracy it is difficult for unpopular decisions to be made. This will be of significance to the speed of developments. Some players always wait until they are forced to change. Thus, to ensure that everyone is on board, public bodies should gradually regulate the desired development. They should notify about regulations well in advance to ensure that as many businesses as possible are able to readjust. Then there will be less resistance. It is also important that public bodies are clear about what future regulations will be to ensure that those who wish to readjust as an early stage can feel secure in the knowledge that they are moving in the right direction. The roadmap proposes several specific regulations.

► Public bodies can and should reward those who lead the way

There will always be industry players who want to be at the forefront of legislation as they see this as a way of achieving a competitive edge when the framework conditions change. Public bodies can accelerate a desired development by offering incentives to those who lead the way, for example, faster processing of building applications, increased utilisation and differentiated property tax. Experience from, for example, electric car incentives, shows that this could be really effective. Building owners who have built green buildings from scratch or transformed old buildings into green buildings are able to report that it doesn't need to cost substantially more to go beyond the regulatory requirements. However, it costs more to be at the very forefront of developments, for example, building an energy-plus building at the present time. Financial incentives for the most ambitious companies will contribute to continuously pushing innovation forwards. Upgrading existing building stock also requires additional investment and, in this area, financial support schemes are probably necessary.

An example of how optimal interaction between sectors and with public bodies can contribute to a more rapid green transition

Cement production currently accounts for 5% of global emissions. It is possible to deliver zero-emission concrete to buildings in Norway today. With the current technology and the cost of CO₂ cleaning, around €100 per tonne of CO₂, the use of zero-emission concrete for an apartment in a concrete tower block will constitute between €7,000–8,000 extra for an apartment comprising 100 m². If a construction client is given a few incentives to choose this, for example, in the form of prioritised processing of building applications or lower property tax, many companies will probably choose such a solution, as well as further equivalent investments in the building. This will help concrete manufacturers and other manufacturers increase production volume of cost-intensive green products and distribute the costs over larger volumes, causing prices to decrease. Gradually, these solutions can then be offered to everyone, without additional costs. Introductory costs are otherwise often too high for the manufacturer to manage them single-handedly, and the manufacturer depends on the market being willing to pay for such costs.

RECOMMENDATIONS



10 IMMEDIATE MEASURES RECOMMENDED FOR SMALL AND LARGE BUILDING OWNERS

- 1 Environmentally-certify the organisation (ISO 14001 or Eco-Lighthouse certification for smaller companies)
- 2 Remove fossil fuel heating (oil and gas), including for peak loads
- 3 Only purchase building products that do not contain substances that are hazardous to health and the environment
- 4 Introduce an environmental-management system, for example, a BREEAM-In-Use review, to the entire portfolio and establish a plan for continuous improvement of the buildings
- 5 Conduct a study of what roof surfaces can and should be used for, such as stormwater management, energy production, recreational area or bee-keeping

Newbuilds and redevelopment projects

- 6 Reward innovative solutions and discuss risk management, for example, through allocating a separate item in the budget for risk associated with testing new solutions
- 7 Require the architect to draw up a plan for how the materials can be dismantled and reused during reconstruction or demolition work and strive to identify solutions and materials that generate the least amount of waste
- 8 Commission an energy budget for the estimated actual energy consumption (in addition to the calculation requirements in the regulations on technical requirements for building works) and documentation of which measures have been implemented to reduce the anticipated actual energy consumption in running the building
- 9 Request and prioritise building products that produce low greenhouse gas emissions (documented through an EPD (Environmental Product Declaration))
- 10 Request fossil-fuel-free construction sites

10 IMMEDIATE MEASURES RECOMMENDED FOR PUBLIC BODIES

INCENTIVES

Green buildings, i.e. buildings that satisfy specific environmental requirements, should be rewarded through incentive schemes such as:

- 1 A dedicated building application case handler who contributes to prioritised and solution-orientated case handling
- 2 Reduced building application fees
- 3 Scope for increased utilisation of zoning plans
- 4 Lower property tax

FINANCIAL SUPPORT SCHEMES

- 5 Further develop Enova support for ambitious prototype projects and existing building stock, with requirements regarding goal achievement in actual operation
- 6 Introduce Enova support for energy management in buildings

REGULATIONS

- 7 Establish regulations on technical requirements for building works for renovation projects with functional requirements adapted to existing buildings
- 8 Establish documentation requirements for existing environmental requirements for materials in the regulations on technical requirements for building works
- 9 Introduce component requirements in accordance with the the agreement on climate policy (Klimaforliket)
- 10 Introduce requirements to document greenhouse gas emissions from buildings in the regulations on technical requirements for building works, including emissions from energy consumption and materials

1

The green transition provides opportunities

THE WORLD IS DEPENDENT ON A GREEN TRANSITION

“The green transition” has become a term to describe the need for change that the world is facing. We must be able to manage the risk of major climatic changes and an increasing scarcity of natural resources while, according to the UN, also expecting a significant increase in the global population in the years ahead, from 7.3 billion today to 9 billion in 2050. In Norway, a population growth of around 30% is expected leading up to 2050 (1).

Current resource consumption by humans is equivalent to 1.6 planets (2). And while economies, populations and the demand for resources keeps increasing, the size of the earth remains the same. Norwegians have one of the largest ecological footprints in the world. According to the WWF, we will need a total of 2.8 globes if everyone lived like the average Norwegian.

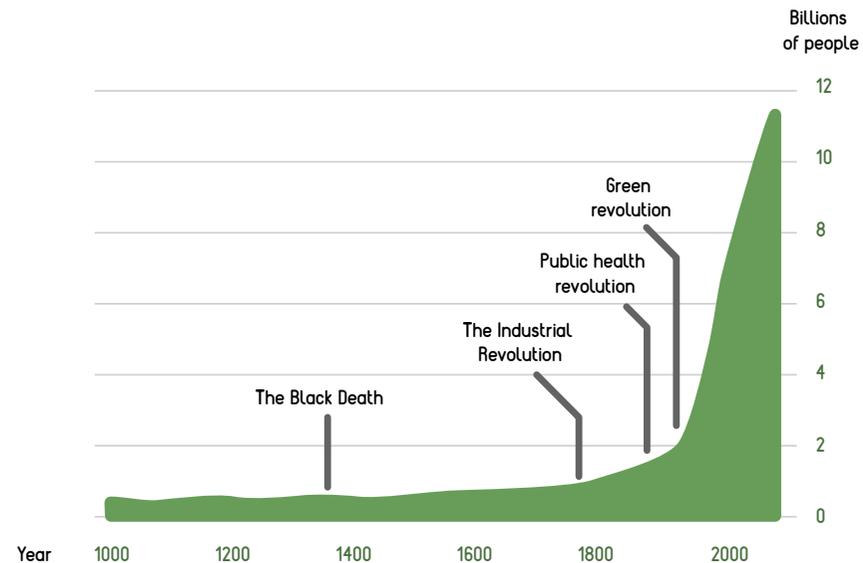


Figure 1: The expected population growth will require a radical increase in resource efficiency
Source: UN

This requires us to manage things differently than we do today. Equally, our lifestyles are generally experiencing a more rapid change than previously. Technological development is accelerating, young persons today change their domiciles and occupations more quickly than previous generations and new industries are regularly emerging. This makes planning challenging for both public bodies and businesses. However, the will to change is a prerequisite for addressing our need for a fundamental change in the “green direction”.

When planning for a rapidly changing future, it is difficult to formulate strategies based on extrapolations of variables such as population growth, demographic composition, level of prosperity and transportation requirements. Thus, we have elected to draw up a roadmap based on scenario methodology, i.e. a desired and not an expected future. Our future scenario is called Vision 2050 and we have described a roadmap that contains vital directional choices to get there.



*The will to change and new technology
make a green transition possible*

WE KNOW THE GOAL, BUT NOT HOW TO GET THERE

The starting point for the work is the desire of building owners to assume their share of responsibility for a sustainable society on commercial terms. What is of interest to property players, for whom this roadmap has been primarily created, is how they are able to adopt a long-term perspective while also operate in the present in order to address “the green transition”. In this respect, the time perspective is vital. It could be costly to make adjustments prematurely before the demand for green buildings is in place and while new, green solutions are associated with high costs. Waiting too long could also be costly because it takes a considerable amount of time to transform a building portfolio.

A tangible change is already underway. Major property players such as Entra, the Norwegian Defence Estates Agency and Statsbygg are now constructing energy-plus buildings, i.e. buildings that produce more energy than they actually use over the year and which are far ahead of even the latest tightening of the building regulations. Another sign of change is that solar technology has matured and expanded and has grown considerably less expensive.

The market itself is also beginning to develop tools that ensure an overall approach to green construction, such as the environmental certification tool BREEAM-NOR, which is spreading quickly without being spurred on by either customer demand or the authorities. Property players like Statsbygg have developed and started utilising methodology and tools for overall greenhouse gas calculations for buildings in project planning (3). The current development of green construction is largely driven by the building owners themselves, because increasingly more of them are aware that change is on the horizon and they want to be at the forefront of such change.

As well as the time perspective, it is important that property players operate based on a degree of predictability and knowledge of which primary solutions are appropriate in the long term. This applies to:

- 1 Location of the building or area to be developed
- 2 Choice between demolishing and building from scratch or renovating
- 3 Choice of functions for the building
- 4 Choice of quality level of flexibility, energy efficiency and indoor climate
- 5 Choice of materials
- 6 Choice of energy supply

“Increasingly more of them are aware that change is on the horizon and they want to be at the forefront of such change”.

ENVIRONMENTAL AND BUSINESS STRATEGY ARE TWO SIDES OF THE SAME COIN

Our assertion is that you can no longer talk about an environmental strategy or a sustainability strategy as an “add on”. We believe that amendments to regulations, market demand and market prices will change so substantially that a sustainability strategy will have to be identical to the future business strategy of a company that wants to survive.

The inspiration behind our work with the roadmap is from a roadmap that 29 major international companies, including Storebrand ASA and Alcoa, drew up in 2010. The work took place under the direction of the World Business Council of Sustainable Development (WBCSD), an organisation of which these companies were members. They created a roadmap towards their Vision 2050, which was: “Our vision is to build a world where nine billion people are living well and within the boundaries of the planet, by 2050” (4). THE WBCSD emphasises the business opportunities inherent to an environmental approach.

There will be a new agenda for business leaders. Political and business constituencies will shift from thinking of climate change and resource constraints as environmental problems to economic ones related to the sharing of opportunity and costs. A model of growth and progress will be sought that is based on a balanced use of renewable resources and recycling those that are not. This will spur a green race, with countries and business working together as well as competing to get ahead. Business leaders will benefit from this change by thinking about local and global challenges as more than just costs and things to be worried about, and instead using them as an impetus for investments that open up the search for solutions and the realization of opportunities (1).

We believe the future business winners will be those who, in their core business strategy, combine global social and environmental challenges with their own profitable growth and we hope that our roadmap can stimulate the property sector towards this end.

“Amendments to regulations, market demand and market prices will change so substantially that a sustainability strategy will have to be identical to the future business strategy of a company that wants to survive”.

2

The environmental potential in the construction industry is huge

BUILDINGS HAVE THE POTENTIAL TO ACHIEVE SUBSTANTIAL REDUCTIONS IN GREENHOUSE GASES

Buildings generate few direct greenhouse gas emissions. Generally, only buildings heated by fossil fuel and fossil-fuel energy consumption at construction sites are included in public-sector accounting (5). CO₂ emissions of “Heating in other industries and households” constitute only 2.4% of Norwegian greenhouse gas emissions (6). Thus, public-sector policy instruments directed at the construction industry in order to reduce greenhouse gas emissions have primarily been linked to targets for reducing the fossil-fuel heating of buildings.

The construction industry can trigger a major climate-saving potential by paying greater attention to the impact it has on indirect emissions, i.e. emissions from the industrial, transport and energy sector.

Through its role as buyer, the construction industry has a major impact on emissions from these sectors as well. Construction industry players have started creating greenhouse gas accounting for both direct and indirect emissions as referred to above. This accounting is used to

Emissions
(kg CO₂-equiv./m²/year)

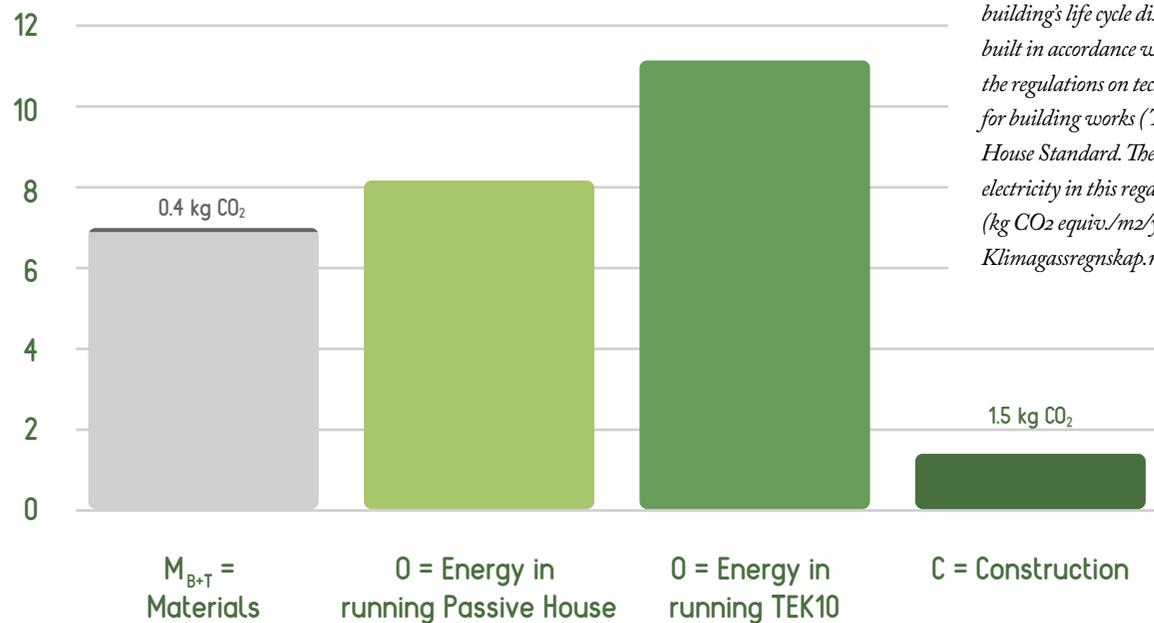


Figure 2 Example of distribution of greenhouse gas emissions through a building's life cycle distributed per year built in accordance with, respectively, the regulations on technical requirements for building works (TEK 10) or the Passive House Standard. The CO₂ emission of electricity in this regard is based on ZEB. (kg CO₂ equiv./m²/year) (Selvig, Cívitas, Klimagassregnskap.no).

B = Building, T = Technical installations

design separate climate goals (7) and as criteria in the industry's dedicated programmes such as FutureBuilt and Zero Emission Building (ZEB), as well as certification schemes like BREEAM-NOR.

As shown in figure 2, emissions associated with materials used in construction constitute a substantial part of a building's total emissions. Material emissions (MB+T) are then regarded as emissions in the transportation of raw materials and the production of building materials (light grey) and technical installations (dark grey). These emissions are usually calculated in the industrial sector, but can be significantly influenced by the construction industry as buyers of building materials and equipment. Emissions from the actual construction (c) (construction machinery, building heating, transportation of goods and workforce) are also of significance. Emissions from the transportation of persons to and from the building are also substantially influenced by the building owner. This largely depends on the location and mode of transport.

In figure 2, significant greenhouse gas emissions have been included from energy for operation of the building (o). The main element of this energy is electricity. How to calculate emissions from electricity in the construction industry has been much discussed and various players operate with different emission figures. In this accounting example, the calculation method from SINTEF/Norwegian University of Science and Technology has been used (ZEB). Its premise is that Norway is part of the European energy system and a scenario that assumes that the electricity supply in Europe will gradually become more renewable, approaching zero emission by 2050 (8). This calculation methodology is used by, for example, Statsbygg, FutureBuilt and BREEAM-NOR. Other calculation methods are based on emissions from Norwegian or Nordic energy mixes, and the NORWEGIAN WATER RESOURCES AND ENERGY DIRECTORATE's product declaration also includes the consequences of trading with guarantees of origin.

THE CONSTRUCTION INDUSTRY CAN FREE UP ENERGY FOR OTHER SECTORS

Electricity comprises a high proportion of energy consumption in Norwegian buildings. Close to 100% of Norwegian electricity production is derived from renewable hydroelectric power that produces no greenhouse gas emissions. Hydroelectric power is a valuable resource that should be optimally utilised. To achieve the climate goals, electricity must be used to phase out fossil forms of energy in the transport and industrial sector, and it can be exported. Several Norwegian building owners already want to make provision for clean Norwegian electricity to be freed up for other sectors and for export, and are building energy-efficient buildings using local sources of energy.

“Several Norwegian building owners already want to make provision for clean Norwegian electricity to be freed up for other sectors and for export, and building energy-efficient buildings using local sources of energy”.

EXISTING BUILDING STOCK MUST BE UPGRADED

The Norwegian Parliament has approved a goal of a 10 TWh reduction in energy consumption in existing buildings by 2030 compared to the current level. With an annual newbuild rate of 1–2%, the main part of the building stock will be constructed in accordance with previous building regulations for a long time, with significantly less stringent requirements for energy efficiency. The challenge is to upgrade this building stock cost effectively, and without this impacting other environmental challenges such as greenhouse gas emissions associated with the production of new materials. Older buildings with substantial heating requirements engender problems with high energy demands when it is particularly cold, and consumers are rarely aware of the significance of removing high energy demands. In this respect, there is a great potential for avoiding the development of unnecessary network capacity.

An important reason for a high level of actual energy consumption in both older and new buildings is low energy prices. Building owners therefore have little incentive to upgrade building stock or use it in an energy-efficient manner. Current calculation methods, both as a basis for processing building applications, energy labelling and Enova support, are based on estimated net consumption (NS 3031). The calculation is made on the basis of adjustable values based on the building's condition (such as insulation, windows, density and technical systems) and with fixed values for user-dependent energy consumption (such as the use of technical equipment, lighting, snow-melting systems, data rooms and hot water). In practice, user-dependent energy consumption often constitutes considerably more than building-related energy consumption. The calculation methodology often results in planning personnel or building owners not prioritising measures that could reduce user-related energy consumption.

ENERGY CONSUMPTION IN BUILDINGS CONSTITUTES MORE THAN HEATING

A great deal of attention has been focused on additional insulation in order to reduce energy consumption and energy consumption in buildings is often equated with heating the building (5). The Norwegian Parliament's agreement on climate policy (Klimaforliket) from 2012 and Enova's Passive House initiative have primarily concentrated on reducing energy consumption for heating rooms. In older buildings, the energy requirements for heating rooms usually constitutes 30–45% of energy requirements (private homes usually have a greater heating percentage than commercial buildings).

A substantial proportion of actual energy consumption in commercial buildings is taken up by equipment such as computers, chargers, telephones, control systems and audio equipment. THE EU estimates that this energy consumption will increase in the years ahead (9). Directives like the Ecodesign Directive will help reduce energy consumption per unit but the number of units will probably increase and negate the benefits of energy efficiency.

In a new or renovated building that complies with new energy requirements, the room heating requirements will constitute a significantly smaller proportion, from 5–15%, depending on the type of building.

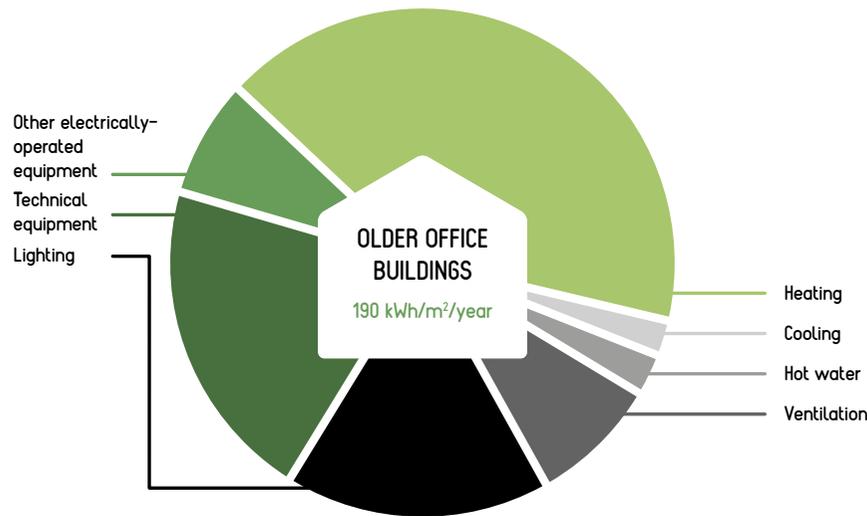


Figure 3 Example of actual energy consumption of an older office building with total energy requirements of 190 kWh/m² per year (separate SIMIEN calculations of an example building)

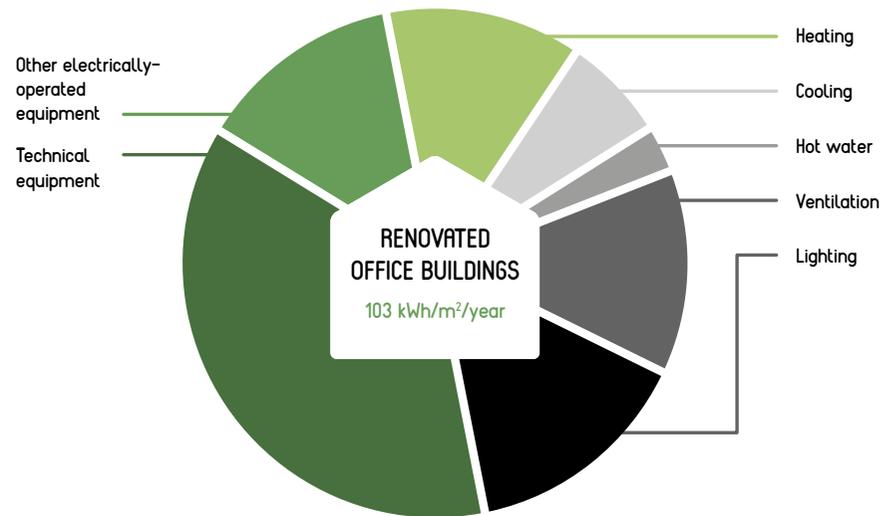


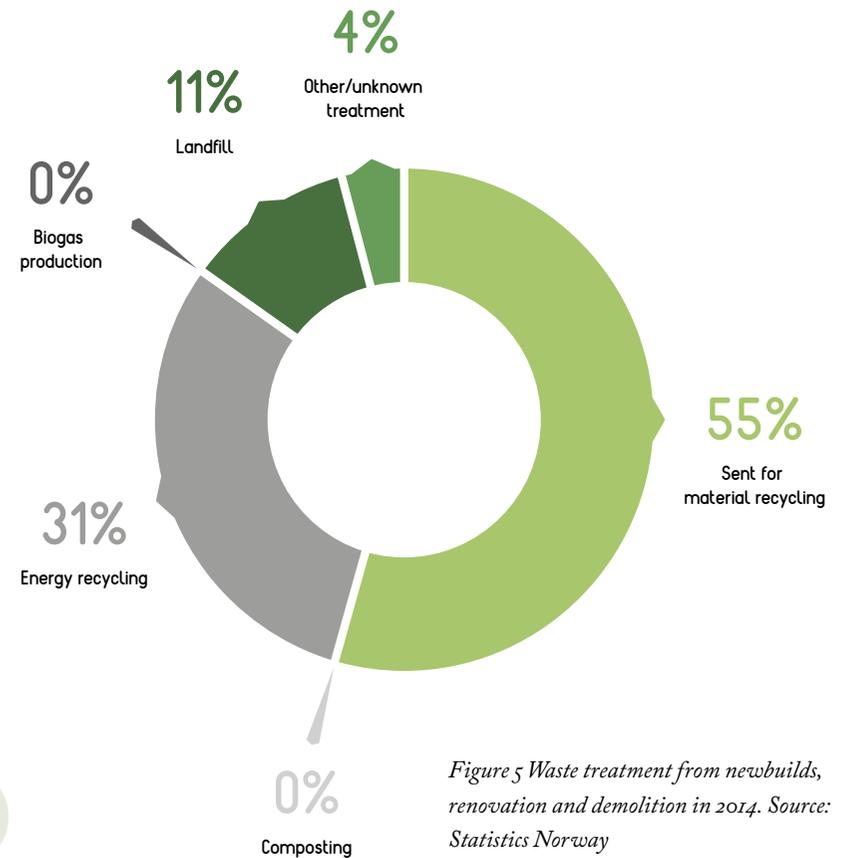
Figure 4 Example of actual energy consumption after the office building in figure 3 was renovated in accordance with the Passive House Standard and energy class A (103 kWh/m² per year) (separate SIMIEN calculations).

LARGE VOLUMES OF WASTE REPRESENT VALUABLE MATERIAL RESOURCES

The construction and property industry is the largest consumer of material resources in Norway (10). The industry also generates a high volume of waste, as much as the waste generated by households and industry individually (approx. 20% each) (11). Waste is evenly distributed between newbuild activity, renovation and demolition.

Most of the waste comprises materials that are comparatively clean and which can be reused without any particular environmental considerations. 40% comprises bricks and concrete, 14% is wood and 13% is asphalt. In 2014, 55% of total waste was delivered to material recycling, 31% to energy recycling and 11% to landfill (12). There is a huge potential for increased material recycling, particularly in the case of wood, for which less than 1% of sorted wood waste currently goes to material recycling.

The construction and property industry uses a high proportion of renewable resources, like wood, and resources that are generally not scarce, such as stone and sand for concrete. However, the industry also uses non-renewable resources which are very scarce, for example, copper, zinc and rainforest timber.



IT IS POSSIBLE TO CHOOSE TOXIN-FREE BUILDING PRODUCTS

Our buildings contain several thousand different building materials and many of these contain substances that are hazardous to health and the environment. Several of the substances may be found on official lists of the most hazardous substances: the priority list, approval list and/or candidate list (10). Even if use is on the decline, the building and construction sector is a major consumer of products containing substances that are hazardous to health and the environment.

Most of the hazardous substances are found in chemicals such as paint, glue and caulking compound but hazardous substances are also found in solid building products. An overview of the substances that are regarded as being hazardous to health and the environment, and where they are included, can be found, for example, at www.erdetfarlig.no. There are toxin-free alternatives for nearly all building products.

The use of a number of hazardous substances has gradually been prohibited but the substances still exist to a considerable extent in existing buildings that were built before such restrictions were introduced. Mapping such substances is a statutory requirement if a building is being renovated or demolished, so that products containing hazardous substances can be delivered to an approved waste disposal site.

The regulations on technical requirements for building works (TEK10) stipulate a number of requirements for materials:

- “Materials and products shall have properties that provide low or zero contamination to indoor air” (Section 13-1 g Air quality)
- “Products suitable for reuse and material recycling shall be selected for structures”. (Section 9-5 Waste)
- “Products that contain zero or a low level of substances that are hazardous to health and the environment shall be selected for structures”. (Section 9-2 Substances hazardous to health and the environment) (14)

Documentation and tools with which to follow up the requirements are available, but are scarcely used. All chemicals have statutory requirements regarding Product Data Sheets, in which the composition of substances appears. Solid products do not require Product Data Sheets, although increasingly more building products include an environmental declaration in accordance with an international standard (EPD – Environmental Product Declaration, www.epd-norge.no). To a limited extent, these are requested in certain BREEAM projects and special prototype projects. There are also tools to stipulate requirements for environmental performance, for example, maximum greenhouse gas emissions/material units, based on the information in an EPD.

The voluntary market-driven environmental-certification system BREEAM-NOR, which was introduced in 2012, has operationalised the statutory requirements by awarding points for documenting them. There is a minimum requirement to document an absence of the worst kinds of environmental toxins. Beyond this, material points are not a main priority (16). This is confirmed by the fact that there is no tradition for stipulating environmental requirements for materials even in the most ambitious environmental projects, even if there is a statutory requirement to do so.



Statsbygg has implemented statutory requirements for materials in TEK10 in its environmental strategy (7), as well as other more ambitious material requirements. Statsbygg has also stipulated the requirement that all its construction projects must document greenhouse gas emissions from transport, production of materials and energy consumption in its operations and shall reduce greenhouse gas emissions by a minimum of 30% and down towards a zero-emission level. At Evenstad Campus in 2016, Statsbygg completed the first Norwegian zero-emission building, which achieved the so-called ZEB-COM level, i.e. the building's production of renewable energy will compensate for the building's emissions in terms of construction, transport, material use and operation during the building's life cycle.

Statsbygg has developed a dedicated tool for this: Klimagassregnskap.no (www.klimagassregnskap.no), which has also been used for several years in BREEAM projects (ngbc.no) and FutureBuilt projects (www.futurebuilt.no).



Oslo and Akershus have succeeded in a regional collaboration regarding a densification and infrastructure plan

The Regional Plan for Land Use and Transport in Oslo and Akershus, approved in December 2015, is a positive example of a plan that has clear goals and priorities for densification and infrastructure.

The plan's clear goal is that the pattern of development shall be space effective based on principles of multi-core development and the conservation of general green structure. The transport system shall be efficient, environmentally friendly, with accessibility for everyone and with the lowest possible need for car transport. Oslo Municipality and Akershus County Council also share a goal of halving greenhouse gas emissions by 2030. (17)

The protection of green structure and arable land will be prioritised, yet balanced against the need for densification. Growth shall take precedence over the protection of agricultural areas and regional green structure in prioritised growth areas, while protection should be stronger outside such areas. Some local towns and communities will be prioritised where population growth could provide a customer base for a wide range of trade and service industries, public transport which is efficient enough to become a natural first choice, and where the inhabitants can walk and cycle to work, leisure activities and other day-to-day tasks. At least one community in each municipality has been prioritised and the public transport links from these communities and into the regional towns shall be strengthened in line with the respective community's growth (17).

WE NEED GOALS AND PRIORITIES FOR DENSIFICATION AND INFRASTRUCTURE

The location of buildings is of major significance to transport requirements and patterns. We currently lack regional land use and transport plans with clear goals and priorities for densification and infrastructure. This leads to the development of residential areas, hospitals, industrial areas and shopping centres on agricultural land far from public transport that is not very sustainable. An example is the new Central Hospital for Østfold, completed in 2015 along the E6 on a field in Kalnes.

MAJOR CONSTRUCTION ACTIVITY PROVIDES OPPORTUNITIES TO CHANGE COURSE

7 billion out of a global population of 9 billion in 2050 is expected to live in cities by this time. Population growth is expected to be in and around the largest cities in Norway, too (1). This will generate major construction activity in the cities. Buildings in Norway are well built compared to most other countries when it comes to energy efficiency, but we have significant potential to reduce greenhouse gas emissions from material use, reduce emissions of environmental toxins and streamline resource use.

3

Vision 2050

- OUR VISION IS:**
- A climate-neutral Norway by 2050
 - 40% reduction in emissions by 2030
 - Closed life cycles by 2050
 - Zero emission of environmental toxins by 2050

A vision is not a prediction of what the world will look like in the future, but a future scenario of how it ideally should look. Our vision is based on what we believe is necessary to succeed with an expected population increase within the earth's tolerance limits and what this will mean to the way we live in Norway in 2050.

The vision expresses an optimal goal for resource use and pollution, but is also based on a few political goals:

- The goal of zero net emissions or climate neutrality in Norway by 2050. This means that all greenhouse gases emitted shall be balanced by measures that remove greenhouse gases, such as CO₂ capture or absorption in forests. This goal was approved by the Norwegian Parliament in 2012 (18)
- The Paris Agreement COP 21 is a legally-binding agreement under the Climate Change Convention framework agreement, which was approved at the Climate Summit in Paris in December 2015. Norway has undertaken a binding commitment to a minimum 40% reduction in emissions by 2030, compared to 1990.

- THE EU's goal of a circular economy is based on recycling, repair, refurbishment/improvement and circular recycling of materials in which the fewest possible resources are lost. THE EU's action plan for a circular economy was presented by the EU Commission in December 2015. If approved, the action plan will be of major significance to, for example, Norwegian waste directives, including the framework directive for waste and the landfill directive (19).
- Norway has a national goal to stop the use and emissions from prioritised environmental toxins by 2020 (20).

In our vision, the construction industry has taken these political goals seriously and assumed its part of the responsibility for achieving them. The headings in this chapter represent the functional requirements we believe will fulfil the vision, i.e. subsidiary goals we believe have to be fulfilled to achieve the vision. It is impossible to guess what decisions will be the correct decisions in 2050. The solutions described under each heading are therefore just scenarios of anticipated solutions, based on our current understanding, as well as forward-looking solutions that already exist.

AN ACCOUNT OF HOW WE IMAGINE EVERYDAY LIFE WILL BE IN 2050

POPULATION DENSITY IS HIGH

All new buildings are concentrated close to traffic hubs

Many people want to move into cities. This gives us the opportunity to protect natural and agricultural land, in spite of the huge population growth and the possibility of being able to build an efficient infrastructure. Previous cities and communities have been densified in accordance with a clear national plan. The vast majority of buildings are located close to communication hubs for public transport or car parks for rental pools for zero-emission vehicles. We look back in wonder at a time when we built housing estates, hospitals and shopping centres on fields of fertile soil and ineffective infrastructure. We believe the simplest and least expensive solution is to share vehicles and bicycles, and most people subscribe to a sharing scheme rather than buy a car or a bike.

The requirement for densification has given a new meaning to effective preservation

Densification has resulted in us building vertically, including on top of existing buildings, and all old industrial and port areas have been transformed. We like to highlight history by looking after buildings worthy of preservation and protection. In itself, preservation is resource efficient, although preservation does not necessarily mean that the buildings have been left alone and untouched. Instead, emphasis has been placed on visually distinguishing between the old and new parts of the building.



The city centre is car free and the streets are used for cyclists and pedestrians, recreation and as meeting places

Densification has resulted in an even greater need for utilising the streets for recreation, play and as meeting places. Traffic in the largest cities is relieved by light rail or underground rail systems. It is also normal to cycle or walk. "Exercise bikes" (i.e. not powered by electricity) and electric bikes are easy to hire. There are dedicated, marked cycle paths, so cyclists don't come into conflict with pedestrians. Traffic between cities is via train and for shorter distances it is easy to get hold of driverless zero-emission vehicles. Parking for private cars is very limited.

ENERGY IS EMISSION FREE AND OPTIMALLY UTILISED

All energy is emission free and comprises a combination of local and collective production

All buildings are now supplied with emission-free energy. The energy is produced locally in buildings or in collective systems, all in accordance with the energy and power requirements in the system, location and what the building owners themselves desire. Some building owners chose local production as a profiling measure 20–30 years ago when this still had a profiling effect. Other building owners chose it in order to have documented emission-free energy. The demand motivated the energy companies so that, as early as 2030, they were able to document zero emission in all collective systems, including district heating systems. Some building owners continue to choose in-house energy production as an energy-efficiency measure.

Integrated solar cell panels are offered by all roof, window and façade manufacturers, but because of dense building patterns and structures being in each other's shade, not all façades are suitable for solar panels. Many people also use their roofs as gardens for recreation and stormwater management as the green areas at ground level are less attractive, although there are optimal solutions for the multi use of roofs.

Local energy production contributes to a levelling out of peak loads

With the present efficient and inexpensive local storage options for energy in batteries and water pools, local energy production contributes to the levelling out of energy requirements in power grids and district heating systems. Certification and labelling schemes reward energy efficiency and contribute to the levelling out of peak loads. Energy prices amongst consumers are determined by energy requirements, and solutions that provide an even energy requirement throughout the day and year are most cost effective.

Buildings are controlled by smart technology

Buildings are fitted with sensors that register how we use the building and what our needs are and mean we only use the energy necessary to cover our needs. Many companies have emerged that help building owners choose appropriate solutions and software operators have been kept busy.

Buildings have minimal heating requirements

Buildings constructed or renovated over the last 30 years have minimal heating requirements because the building structures are well insulated. The buildings also have heat storage on the roofs and in the walls that evens out the temperature throughout the day, for example, through massive structures and PCM (Phase Changing Materials) in more lightweight structures. A few older buildings continue to have substantial heating requirements, although the building owners have been able to choose between making the building structure more energy efficient or producing energy inhouse. Cost-benefit assessments and assessments of energy requirements have formed the basis of the choice of solution.

Buildings no longer have mechanical cooling. Users have become accustomed to accepting that it will be slightly warmer inside on the hottest days of the year when, in any case, they will be lightly dressed. However, heat storage on roofs and in walls, as well as via automatic systems that ensure façade ventilation during the night and on colder days, mean that the indoor temperature rarely rises above 26°.



Thermal energy is normally distributed using water in built-up areas and via electricity in rural areas.

In built-up areas, which are clearly more prolific, the buildings' thermal energy requirements are covered by water as an energy carrier, i.e. to the buildings that have a substantial heating requirement. The thermal energy is supplied to the system from both local and collective systems and district heating networks also distribute between local manufacturers and consumers. Local thermal storage is widely used to manage surplus energy. In more rural areas, of which there are still a few, energy carriers other than water are more effective between buildings. Collective thermal production primarily comprises heat pumps or geothermal wells. Very little waste for combustion is generated as most of the waste is sent for material recycling. There is also less surplus heat from industry than previously, because industry has become more energy-efficient.

More than 90% of energy consumption in buildings is associated with lighting, ventilation and equipment

Virtually all energy requirements for buildings comprise electrical energy for lighting, ventilation and equipment. In this area, energy requirements have also seen a significant reduction over the last 35 years. A lot of daylight is required in all public rooms and artificial lighting is daylight controlled and LED based with great effectiveness. Ventilation is generally a combination of natural and mechanical ventilation to achieve a basic system with low energy consumption. Equipment such as computers and chargers are energy efficient and all power supply is automatically shut down during the night.



Fjernkontrollen.no 2015 is a service that was started by Norsk Fjernvarme as early as 2015. The aim of fjernkontrollen.no is to provide customers, developers and other stakeholders with updated information about which energy sources are being used for district heating systems throughout Norway. In the beginning, only the the distribution of the energy sources in % was displayed but gradually, emissions from each system were also displayed so that all manufacturers could meet the customer requirements regarding emission-free thermal energy mixes. (Fjernkontrollen.no)



Entra led the way with Powerhouse

The first energy-plus building was built as early as 2014. At the time, the Powerhouse alliance, which comprised the property company Entra, project developer and contractor Skanska, architect office Snøhetta, environmental foundation ZERO, aluminium profile company Sapa and consultancy firm Asplan Viak, renovated a 1980s building into a building that had extremely low energy requirements. Over the year, local production covered as much energy that was required to operate the building, as well as the energy that had been used in the production of the building materials.

OUR BUILDINGS ARE HEALTHY, FUNCTIONAL AND FLEXIBLE – WITHOUT IMPACTING THE ENVIRONMENT

Green buildings by default

Buildings no longer impact the environment through greenhouse gas emissions or emissions of environmental toxins. Due to a scarcity of resources, new materials are so costly that everyone strives to look after existing buildings. Older buildings with a high level of negative environmental impact have either been dismantled or renovated to present-day standards. All clean materials have been carefully preserved for reuse or material recycling. Building owners who possessed a building portfolio that contained high energy consumption and built-in environmental toxins have faced major financial challenges. Those building owners who did nothing before new market and regulatory requirements were introduced in earnest, went bankrupt. There is no longer a market advantage in building what we called “green buildings” since all new buildings are built this way. And those companies that started early, benefited financially from this for a long time.

A lot of daylight and flexibility are the qualities that are most in demand in buildings

A well-built building:

- adds to its surroundings
- is amenable to constantly changing use
- allows a lot of daylight in
- has good air quality
- is well insulated against noise from outside as we live so densely

Urban life is important. Buildings have open ground floors for the general public and are located with attractive outside areas in mind, offering both sun and shade.

We do not accept bad odours or health risks when we are indoors. So, materials, fabrics, furniture and cleaning and maintenance products do not emit substances that are hazardous to health and the environment. Good air quality is taken for granted, but old tales saying the more fresh air the better, no longer exist. During the winter, less fresh air is supplied than during the summer, otherwise the air will be too dry. If we require some extra fresh air, we open the windows. There is not much external pollution after petrol and diesel vehicles disappeared. Otherwise, the requirement for fresh air is controlled automatically by occupancy sensors and temperature detectors.

Because we now live so closely together, sufficient daylight is a challenge. Thus, buildings that provide optimal daylight conditions are in demand. Built-up areas require an architectural design that takes into account access to sunlight and also the view of neighbouring buildings.



We maximise on the building's area

With major population growth and limited resources, we have taught ourselves to utilise our buildings to the maximum extent possible. The space solutions we previously adopted, for example, canteens that were only occupied two hours per day or single-function buildings that were only used for parts of the day, virtually no longer exist. There is a high degree of multi use and joint use. Buildings that still have canteens and which do not use cafés for lunch have been fitted out so that they can be used as meeting rooms outside meal times. And kindergartens can be used, for example, as youth clubs in the evenings and at weekends.

Not many people have permanent work stations. A few large companies still have their own office buildings, but then with space for only a maximum of 50% of employees. In any case, no more than 50% of employees are present at any given time. Smaller companies depend on "office hotels", which employees can rent, either as part of a project team, close to where they live, or close to colleagues with the same type of duties. Telecommuting is popular, although the desire for social interaction also engenders the need to be in physical proximity to other people.

Companies that lease their own premises are also in a constant state of flux and we work in a more project-based manner across organisations. Few buildings remain that have static premises and there are few buildings that have fixed leasing agreements of more than three years. Rebuilding work against a background of such rapid change is costly, not least because of problems with disposing of old materials containing toxins and because new materials are expensive. Thus, it is crucial for building owners to have flexible buildings in which neither building elements nor technical equipment prevent rapid rebuilding work.

ALL RESOURCES ARE RECYCLED

Buildings are dismantlable and building elements are reused

The attitude towards waste has completely changed. Virtually everything that was previously defined as waste is now reused.

Buildings are not converted into waste if the building's function has to be changed. Buildings can be easily rebuilt to other functions without the building components having to be thrown away. It is like building with Lego. The attitude to new and stylish has changed and it is now regarded as inconceivable for a tenant to require building components that are in good condition to be replaced and disposed of.

Architects and building material manufacturers now use 3D technology to design and print building elements that are easy to industrialise, replace and reuse.

Material residue is used in new products

Construction waste is utilised in the production of new materials and building materials also contain a high proportion of demolition waste and waste from other sectors. Buildings are now composed of fewer materials than previously so that building owners can more easily gain an overview of their material content and more easily be able to recycle the elements.

Older buildings are more difficult to dismantle for direct recycling than new buildings that have been planned with this purpose in mind. Owners receive less payment for building elements that have to be "downcycled" (incorporated in the production of new materials) than those building elements that can be directly recycled.



Industrial cluster earns money from the upcycling of waste

Ressource City's vision:

"Ressource City is an idea about a project that will make a difference to an entire local community – and to the whole country. Ressource City wants to create production and jobs based on the resources available in the area.

Ressource City shall help solve a number of the planet's most pressing issues: lack of resources, environmental impact and the climate challenge. We want to create a green industrial cluster that is particularly focused on upcycling. An industrial cluster comprising enterprises, entrepreneurs and educational institutions. Ressource City provides them with practical knowledge about collection, sorting and recycling of waste products, and all participants work on developing new products from what others regard as waste – upcycling".

www.ressourcecity.dk



CO₂-neutral concrete

As early as 2016, cement manufacturer Norcem and its parent company Heidelberg Cement had a vision of zero CO₂ emission throughout the product's life cycle. They intended to achieve this through energy streamlining, increased use of biofuels, the development of new cement brands, utilisation of the carbonation effect and carbon capture. In 2016, Norcem delivered cement for low-carbon concrete with approx. 40% lower greenhouse gas emissions compared to traditional concrete to customers who requested the product, and were soon able to deliver zero-emission concrete for pilot projects.

www.norcem.no

BUILDING MATERIALS ARE CLIMATE NEUTRAL AND DO NOT CONTAIN ENVIRONMENTAL TOXINS

The proper life cycle is not always a long life cycle

To reduce the need for rebuilding, new buildings are always planned with a high level of flexibility in floor plans and technical facilities. The materials have the proper life cycle, which does not necessarily mean a long life cycle. Supporting structures, façades and surfaces generally have a long life cycle, while internal walls have a shorter life cycle. Life cycles are no longer determined by general standards that specify equal life cycles regardless of physical impact and function, but are determined based on the building component's use. This means, for example, that not all wooden products need to be treated to withstand damp and it means that concrete with low process emissions can be used for a number of functions.

Materials are CO₂ neutral and toxin free

All building materials are CO₂ neutral. All energy consumption for production and transportation of materials is energy efficient and emission free, and minor levels of processing emission from, for example, cement production, are managed via local CO₂ capture. CO₂ capture is expensive so materials with low greenhouse gas emissions at the point of production are the least costly.

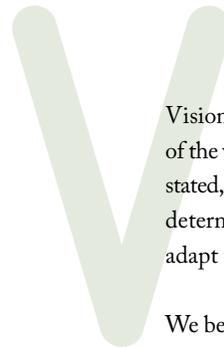
All building materials are also toxin free. With no substances hazardous to health and the environment, the risk of degassing to the indoor climate and contaminating the environment during production and recycling is reduced (landfill sites are no longer used).

We rarely use virginal non-renewable resources

We now use building materials based on renewable resources, recycled resources or abundant resources like stone. Virtually no products are based on virginal non-renewable resources. Metals such as zinc and copper are only used in the renovation of buildings worthy of preservation that have already incorporated these materials and, in such cases, recycled metal is used. The timber industry has developed considerably. Fast-growing trees are cultivated on scrubland and low-quality timber from this source is used in the production of insulation and building panels, for example. We now recycle wood from old materials rather than burn it.

4

Roadmap towards Vision 2050



Vision 2015 may appear inevitable and simple. Very few people would challenge the goals of the vision, even though the appropriate solutions could be open to discussion. As previously stated, the specified solutions are just scenarios. The actual solutions in 2050 will be situationally determined, depending on the available technology and how different players choose to adapt to the various challenges. Nearly all the solutions described already exist.

We believe the greatest gaps between the vision and current solutions are as follows:

- ▶ our building patterns, which are dispersed and not coordinated with collective infrastructure
- ▶ our material consumption, in which we impose minimal requirements regarding the products' environmental properties, even though some of these are already regulated by law
- ▶ our attitude to waste reduction and to waste as a resource
- ▶ energy consumption in the existing building stock, which is an average of 2.5 times as high per square metre compared to what new buildings are expected to use (21)

Figure 6 shows key decisions that we imagine were made, for our vision to become a reality. Below we have elaborated on the development opportunities available to building owners, tenants, investors and public bodies in order to reach our vision.

- Oslo city centre became car free
- A ban was introduced for all fossil-fuel heating of buildings
- Regulations on technical requirements for building works for energy consumption in kWh/person
- The energy labelling scheme took power consumption into account
- Members of Grønn Byggallianse demanded low-emission materials

- Regulations on technical requirements for building works regarding a maximum of 80% waste sorting at construction sites
- Regulations on technical requirements for building works for waste per m² of new builds in the construction phase

- All substances on the priority list were banned

- Documented green buildings were given prioritised and solution-orientated case handling in Oslo
- Municipal case handlers received training in sustainable construction
- All Norwegian banks and insurance companies adopted sustainability as a risk parameter
- Members of Grønn Byggallianse and Norsk Eiendom started using an environmental management system for their property portfolio
- Members of Grønn Byggallianse and Norsk Eiendom implemented 10 immediate measures in the roadmap
- Commercial brokers started using the industry norm for requirements specifications that contained environmental requirements

- The city centres of the remaining cities became car free
- Regulations on technical requirements for building works for power consumption per person
- Regulations on technical requirements for building works to document the total greenhouse gas emissions of buildings
- It was determined that all district heating would be emission free
- Regulations on technical requirements for building works for virtually zero-energy buildings

- Documented green buildings were given prioritised and solution-orientated case handling throughout Norway
- Members of Grønn Byggallianse and Norsk Eiendom BREEM certified all new builds and renovation projects to BREEM-NOR (at least Very Good)
- All manufacturers chose to prepare EPD for their products.

2030 — 2035 — 2040 — 2045 — 2050

- All counties and major cities received plans for clear densification and infrastructure goals
- A ban on private car parks was introduced in cities
- Regulations on technical requirements for building works for a maximum of 50% CO₂-equiv./person emissions compared to the 2015 level
- All public-sector building owners required zero-emission materials

- Regulations on technical requirements for building works for a maximum of 20% CO₂-equiv./person emissions in the building's life cycle compared to the 2015 level

- Regulations on technical requirements for building works for a maximum of 20% CO₂-equiv./person emissions in the building's life cycle

- A ban on landfill sites was introduced

- Documented green buildings received differentiated property tax
- Sustainability became the most important parameter in the assessment of risk and profitability when investing in buildings
- All public-sector tenants stipulated requirements regarding BREEM-NOR (at least Very Good)
- All developers required fossil-fuel-free construction sites

- A priority list was introduced for the phasing out of new substances

- A priority list was introduced for the phasing out of new substances

- A priority list was introduced for the phasing out of new substances

▶ A CLIMATE-NEUTRAL NORWAY BY 2050
> 40% REDUCTION IN EMISSIONS BY 2030

▶ ZERO EMISSION OF ENVIRONMENTAL TOXINS BY 2050

▶ CLOSED LIFE CYCLES BY 2050

GOAL 2050



EMERGING SOCIAL TRENDS CAN HELP US

Pronounced social trends represent both key framework conditions and important tools in the ongoing work towards Vision 2050. Used wisely, the trends could make a positive contribution to the development towards a circular and climate-neutral property sector.

URBANISATION is a strong trend both internationally and nationally. The trend necessitates densification as a policy instrument. Smart guidelines regarding densification must be prepared in order to create long-term, attractive urban environments suitable for society in 2050, i.e. urban environments that are highly resource efficient as well as being attractive to live in.

DIGITISATION will play a key role in the work to streamline the construction and operation of properties. Digitisation is also vital for assessing goal achievement. Digitisation will be based on open formats and the seamless exchange of data based on Building Information Modelling (BIM). The climate-neutral society will also have to address the energy-related challenges inherent to the storage of vast volumes of data.

INDUSTRIALISATION of what has traditionally been production on construction sites is already a reality in many projects and its scope is expected to increase. This trend provides us with a tool that can contribute to ensuring good quality and the closure of material life cycles. We have to ensure purchasing competence so products with good life-cycle data prevail in the market.

THE SIMPLIFICATION OF REGULATIONS is a government objective that affects the development of regulations. We must ask ourselves what are the most important areas of focus for the regulations and what is the appropriate level of detail? The interaction between goals, regulations and achieved results has to be dynamic. Documentation of the development towards the 2050 vision must form the basis of how we “tighten” and “slacken” the level of regulations.

SIMPLIFICATION OF BUILDINGS is an important corrective trend in relation to the current dominating direction towards increasingly more advanced control systems. There are costs associated with technology at the investment, operational and replacement stages and these costs include material and energy resources, as well as monetary resources. Operational problems resulting from buildings that are too complicated also engender a trend towards simplification. It has to be possible for all technology to be incorporated into a circular economy and we must possess sufficient knowledge to weed out “smartness” that is not fit for purpose.

FLEXIBILITY AND INDIVIDUALISATION will be vital framework conditions that will need to be considered. Customising buildings for first-time users can result in significant change requirements for subsequent users. A high level of industrialised “Lego principles” for buildings will make adaptation less resource intensive. It must also be possible to adapt the buildings to the different ways we want to organise ourselves and interact in the buildings.

All the aforementioned trends, as well as other trends such as the sharing economy, are incorporated into our vision of the future. However, the vision can only be achieved if all industry players interact in utilising the opportunities that the relevant trends provide, and controlling such trends when they challenge the ambitious goals of the vision.

BUILDING OWNERS

Construction industry players, and particularly building owners as buyers, have enormous purchasing power. Building owners order building materials and technical solutions from the industry. Building owners are customers of energy companies and, to an increasing extent, produce their own energy. And building owners are premise providers to the transport sector through their choice of location and make provision for various forms of transport. Thus, building owners can use their customer power to achieve major change in other sectors than their own.

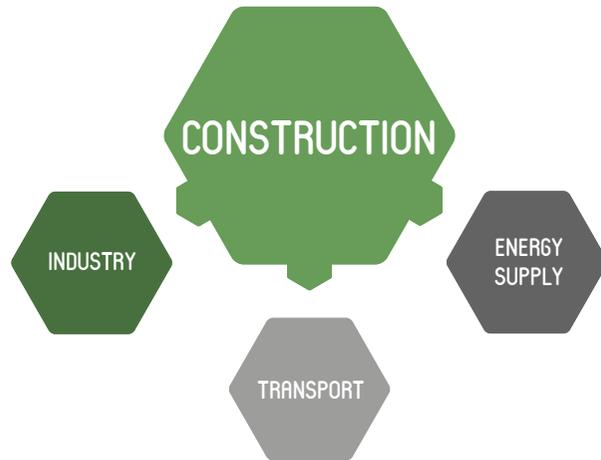


Figure 7 the construction industry has a major effect on other sectors of society

As buyers, building owners can be a crucial driving force for the rest of the construction industry. Many people point out that the construction industry is conservative. However, in recent years it is the building owners who have been the driving force in the industry and who have stipulated increasingly clearer requirements for defined environmental qualities. Projects such as Powerhouse, newly-built schools in Oslo and all BREEM-NOR projects have demonstrated that the market can deliver when the construction client has high environmental and quality ambitions.

Prototype projects have often included the most talented people on the team and there has been a high level of creativity and the will to think innovatively. The projects have shown that solutions for fulfilling ambitious environmental requirements already exist.

New solutions could represent a risk and it is a challenge to identify risk-sharing models that contribute to innovation and new ways of thinking. Nevertheless, we must start using new solutions. The major negative impact of buildings in terms of greenhouse gas emissions, resource utilisation and the dispersal of environmental toxins is attributable to the past and, to a large extent, also the current ways in which we we construct and operate our buildings.

Several of the prototype projects with high environmental ambitions document additional costs of only 2–5% of the total project costs. When building owners calculate the added value of green buildings, the additional costs constitute only 2–3 per mille of the investment (22). A proportion of the additional costs are regarded as beginner costs because it is more time-consuming to try something new and because some of the solutions are not yet ready for market. This is expected to change so that green buildings will become even more profitable in a short period of time.

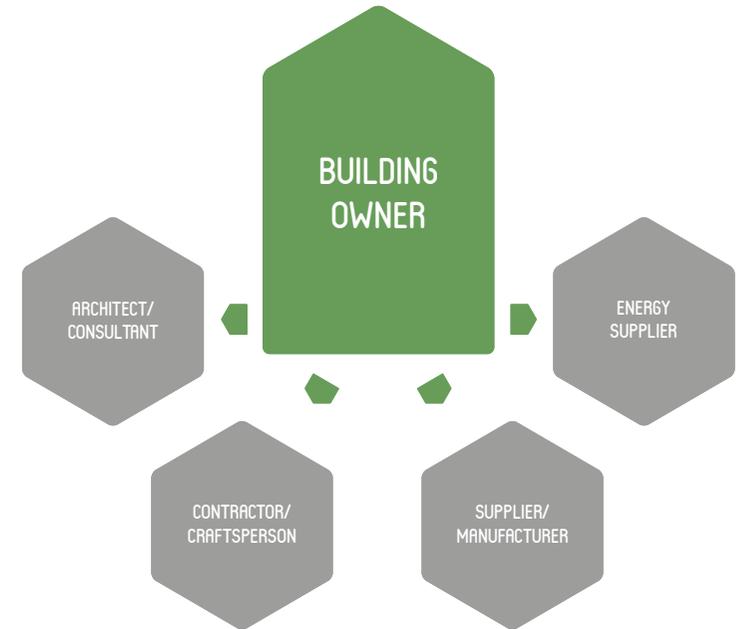


Figure 8 Building owners are buyers for the rest of the construction industry

In 2013, Aspelin Ramm and ncc Property Development estimated additional costs of around NOK 100 million for four of their green buildings. The added value of the green buildings compared with a building constructed in accordance with current building regulations was based on the following:

- higher rental (2–6%) as a consequence of the tenant receiving a lower energy price and a more attractive building
- lower required return (6.5% instead of 6.7%) because investors believe the buildings will be more valuable
- lower owner costs (5% instead of 6%) as a consequence of reduced requirements for future renovation



10 immediate measures recommended for small and large building owners

There are a number of measures that building owners can implement right away and we have established 10 such immediate measures. Based on experience from a number of prototype projects, very few of these measures will result in substantial costs and are suitable for both small and large building owners. If a building owner is uncertain about the costs, it could be an idea to start by requiring all the measures in each project to be assessed and those that do not cost any extra should be implemented. Own experience will then demonstrate which measures can be made mandatory to all projects.

“When building owners calculate the added value of the green buildings, the additional costs constitute only 2–3 per mille of the investment”.

- 1 Environmentally-certify the organisation, either through ISO 14001 or Eco-Lighthouse certification. Also, build an internal culture for using the certification to constantly improve, so that the certification does not become counter-productive to its purpose.
- 2 Remove fossil-fuel heating in the building (oil and gas), including for peak loads. The exception is emergency generators at hospitals, for example, if no reliable alternative options are available.
- 3 Only purchase building products that do not contain substances that are hazardous to health and the environment. This is a statutory requirement (REGULATIONS ON TECHNICAL REQUIREMENTS FOR BUILDING WORKS (TEK 10) and in the Substitution Duty, Section 3a of the Product Control Act). Tools for formulating functional requirements for this can be found at www.byggalliansen.no.
- 4 Introduce an environmental-management system, for example, a BREEAM-In-Use review to the entire portfolio and establish a plan for continuous improvement of the buildings. The tool may also be used as a separate mapping tool without a requirement for 3rd party certification.
- 5 Conduct a review into what roof surfaces can be used for: stormwater management, energy production, recreational areas for employees or beekeeping, such as in Bjørvika in Oslo, and select the most optimal utilisation based on location and project type.

For new builds and renovation projects

- 6 Enter into early dialogue with the architect, consultants and contractors and clearly state that you want new, innovative solutions. Reward consultants who propose new solutions that promote energy efficiency, flexibility, lower greenhouse gas emissions and other environmental qualities. Allocate a separate item in the budget for risk in connection with the testing of new solutions. Cease collaboration with project participants who do not want or do not dare to try out new solutions.
- 7 Require the architect to draw up a plan for how the materials can be dismantled and reused during reconstruction or demolition work and strive to identify solutions and materials that generate the least amount of waste.
- 8 Order an energy budget for the estimated actual energy consumption in addition to the mandatory calculation required in the processing of building applications. The energy consultant must also document which measures are being implemented to reduce the anticipated actual energy consumption when operating the building. As an aid to establishing such an energy budget, see the guideline “Discrepancy between actual and estimated energy consumption”, Tip folder 1–14, Grønn Byggallianse. 2014.
- 9 Request and prioritise building products that have low greenhouse gas emissions. The manufacturer must document emissions through an EPD (Environmental Product Declaration in accordance with EN-NS 15804) www.epd-norge.no. Tools for determining the functional requirements for emissions for a number of product groups can be found at www.byggalliansen.no.
- 10 Request fossil-fuel-free construction sites. Electrically-powered machinery and equipment are generally also cost-effective for the contractor. Building heating should be electrical or from district heating in areas where this is offered.

Vital directional choices in the longer term

Building owners should prepare a strategy with clear goals and measures distributed between their own office operations, construction client operations and administrative operations. The strategy should include goals for greenhouse gas emissions, energy consumption, energy supply, material consumption and transport, for example, in the same way as Statsbygg (7).

Our description of the future has highlighted key measures for achieving the vision. Based on this, vital directional choices for building owners in the years ahead will be:

- build close to public transport hubs
- plan energy consumption and any energy production with the goal of low and even energy requirements throughout the day and over the year.
- think in terms of multi use and joint use of premises
- build and renovate into flexible buildings, through avoiding the customisation of function for first-time users of the building, among other measures
- avoid the use of materials that cannot be broken down into individual components and be recycled or sent for material recycling
- prepare greenhouse gas accounting for own operation and building portfolio and, based on such an assessment, prioritise measures for reducing emissions

Building owners can steer the framework conditions in a green direction

Building owners must heed requirements from tenants, investors, financial players and public bodies, but are also in a position to influence them. The most progressive building owners work to change the framework conditions in order to make it profitable to build green. This is one of the most important tasks of Grønn Byggallianse.

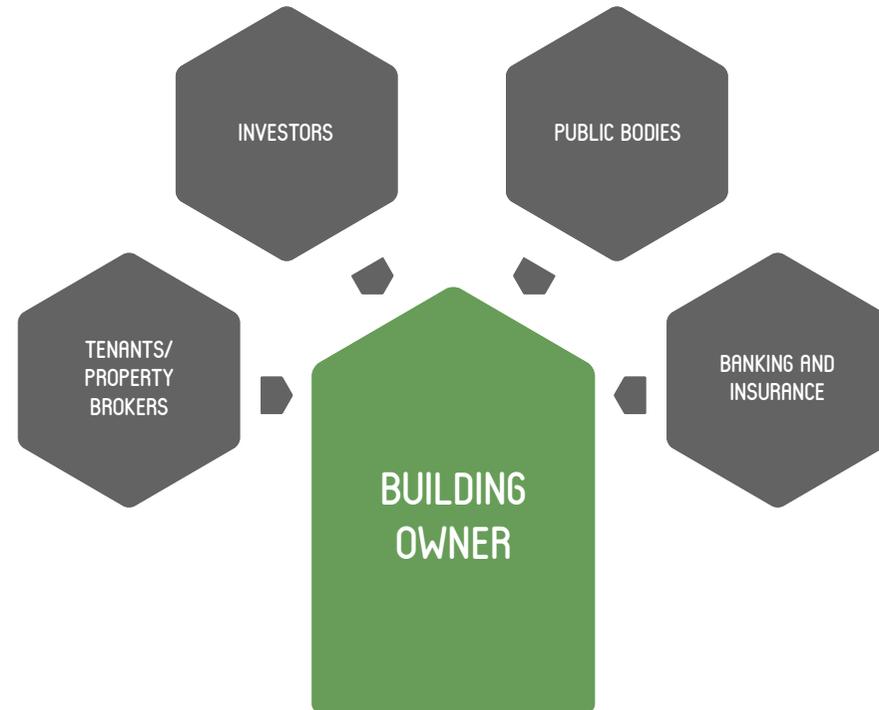


Figure 9 Key premise providers for building owners

Tenants

As important customers for commercial buildings, tenants and their commercial brokers can be a vital driving force by requesting green buildings. Public bodies can require public-sector tenants to lead the way by imposing stringent environmental requirements for the buildings they lease. In return, the tenants of green buildings will benefit significantly from lower operational costs, a high level of comfort, healthy premises and those who want to can incorporate their premises into part of their green image.

Some building owners express the belief that the demand from tenants will come, but also that presently only a small number of tenants request green solutions. (23).

A myth prevails among some tenants that aesthetics, daylight and an optimal indoor climate run contrary to energy efficiency and low climate gas emissions. It is therefore important that building owners help commercial brokers and tenants enhance their knowledge of environmental qualities, so they know longer cling to such myths, but can formulate specific quality requirements that are compatible with optimal environmental qualities.

Brokers point out that tenants do not necessarily demand environmental or green buildings as a concept, but require specific qualities that qualify for points in BREEAM-NOR, such as optimal daylight, good air quality, a location close to a transport hub and secure bicycle parking. These qualities often have a side effect that is positive for the environment (such as low energy consumption and less car use).

Building owners should encourage tenants to enter into lease agreements in which both the building owners and tenants are responsible for the gradual upgrading of the building. The lease agreements should include requirements for energy management, as well as user requirements for procurements and the use of technical equipment.



“The most progressive building owners work to change the framework conditions in order to make it profitable to build green”.

Investors

Many building owners and brokers report that both Norwegian and foreign investors demand environmental qualities. Experience suggests that foreign investors are particularly focused on the security that certification provides in an unfamiliar market.

“Foreign investors are probably more focused on environmentally-classified buildings as a mark of quality, which provides security for the purchase and simplifies the due diligence process. However, this should not be construed to mean that they are further down the path than us with regard to engaging with the environment and knowledge” (Commercial broker Anne Bruun-Olsen, DTZ Realkapital Eiendomsmegling AS. 10 people on the environment, NE news. 19 January 2016).

“Foreign property investors are very focused on green buildings, whether the building is environmentally certified and the company they are investing in has an environmental control system. Our perception is that they wish to make a “green” investment to reduce risk and more easily be able to make comparisons with known certification schemes”. (Managing Director Gro Boge, DNB Næringseiendom AS. 10 people about the environment. NE news. 18 January 2016).

For an investor, risk is a crucial criterion when selecting an object of investment. Some investors have already started calculating the risk of investing in buildings with low environmental standards. Once legislative environmental requirements are tightened, tenants increasingly demand environmental qualities and rebuilding work becomes costly, a building that satisfies high environmental requirements will have a lower financial risk. However, knowledge about this should be communicated to all investors, both commercial and public-sector investors (such as municipalities).

GRESP is an international method that has been developed for this purpose and is used by many banks and investors in Norway as well. (www.gresb.com). Building owners can influence the extent to which such tools are implemented in the appraisal of buildings.

PUBLIC BODIES

Proposals for new statutory requirements

Public bodies can use both the carrot and stick. We propose a number of specific national regulations:

PLANNING WORK

- Public bodies must require all regions to prepare and implement regional land use and transport plans with clear goals and priorities for densification and infrastructure, as Oslo and Akershus have now done.
- Public bodies must require all regions, including smaller units where applicable, to prepare long-term energy supply plans, in which socio-economic assessments form the basis of the most sensible location to develop local renewable energy and infrastructure for district heating.

REGULATIONS

- The current ambitious environmental requirements for materials in the building regulations must be followed up by requirements for documentation. BREEAM-NOR has demonstrated that it is possible to formulate verifiable criteria and the market has now developed tools to the extent that this is ready for market.
- The building regulations should introduce requirements to document greenhouse gas emissions from the entire life cycle of the building, including material consumption. Projects under the direction of Statsbygg, FutureBuilt and BREEAM have been doing this for five years and this should be ready for market.
- Separate regulations on technical requirements for building works for renovation projects should be introduced, (RehabTEK), in which the functional requirements are adapted to the existing building stock. This was proposed by the Ministry of Local Government and Modernisation in 2012, but has been postponed.

- Component requirements for buildings should be introduced, as approved by the Norwegian Parliament in 2012, i.e. stipulate regulatory requirements for selected components when, in any case, they have to be replaced. How this can be achieved in practice has been investigated, but the measure has been delayed until a later point.
- Requirements for energy flexibility for thermal energy should be determined by the location and the need for thermal energy, for example:

- In built-up areas with existing district heating systems, water is required as a thermal energy carrier in buildings, with the exception of buildings with very low heating requirements. Then, direct-acting electricity can be used.
- In sparsely populated areas and in areas without existing district heating systems, flexible energy carriers connected to energy production are required in or close to buildings, except in buildings with very low heating requirements. Then, direct-acting electricity can be used.

Such a requirement takes into account the use of district heating where this is justified on socio-economic grounds, prevents high energy demands resulting from a substantial requirement for electricity for heating and provides an incentive to building owners to have very low heating requirements.

- The building regulations should stimulate floor space efficiency by stipulating requirements for energy consumption per person or function instead of square metres.



Proposals for incentives

In order to reward those who voluntarily lead the way, we strongly believe in incentives from public bodies. Leading the way with prototype projects in a municipality can result in additional costs for the construction client because the market is not mature enough. Incentive schemes could contribute to financing such additional costs while there is also an inherent environmental benefit in densification.

The incentive to achieve actual energy savings once the building is being used should be strengthened, for example, through Enova stipulating requirements for measuring the actual energy consumption after one year of operation or offering support in the form of a loan that is written off if the energy saving is as planned.

If Enova gave its support to energy management in buildings in the same way that it provides support to energy management in other sectors, construction clients would achieve increased focus on actual energy consumption in existing buildings.

There are a number of incentive schemes that can be utilised beyond the regulations and financial support. The 10-year prototype programme Futurebuilt (2010–2020), which is a collaboration project between Oslo, Drammen, Bærum and Asker municipalities, has tested some incentive schemes that have proved to be triggering factors for a number of ambitious prototype projects in these municipalities. It could be advantageous to make these incentive schemes permanent and spread them to other municipalities, either individually or packaged together in a programme. FutureBuilt has defined criteria for what constitutes an ambitious environmental building that could be included as a prototype project. The projects must, for example, prepare greenhouse gas accounts for the entire life cycle and demonstrate a 50% reduction in emissions compared to a reference building.

Proposals for incentives for green buildings:

- 1 A DEDICATED BUILDING APPLICATION CASE HANDLER WHO CONTRIBUTES TO PRIORITISED AND SOLUTION-ORIENTATED CASE HANDLING**
Ambitious environmental buildings often require the use of untraditional innovative solutions. This requires flexibility and the knowledge to be able to manage the project in relation to current regulatory requirements which are based on yesterday's solutions. FutureBuilt has been practising this for 6 years.
- 2 REDUCED BUILDING APPLICATION FEES**
- 3 SCOPE FOR INCREASED UTILISATION OF ZONING PLANS**
- 4 PRIORITY IN PROCESSING BUILDING APPLICATIONS**
- 5 LOWER PROPERTY TAX**
Like today, the amount of property tax will vary from municipality to municipality, but all of them can differentiate between green and grey buildings, and introduce zero tax for green buildings, for example.

5

Summary and conclusion

WHO SHOULD TAKE CHARGE OF THE DEVELOPMENT?

No significant social changes have solely been the result of changes in law. It has always been an interaction between industry, public bodies and society, but, as a rule, it is industry that has led the way. Creativity has always been a driving force for product development. The industry players who have been successful, have been those who have been open to new ideas and trends, combined with the ability to think long term and to think visionary.

The time to extract economic benefits from the green transition is now. There is a lot that suggests that we are still in a phase that is right before the arrival of the great transition. At this time, there are also opportunities for the players who see the transition coming to adapt to it. Once the transition has arrived, a rapid adjustment will be required and there will be no advantage in being a “front runner”.

A number of building owners and manufacturers have already started the development and we currently have buildings that are well on the way to fulfilling the 2050 vision without statutory requirements or customer demand (for example, Powerhouse). Architects, consultants, contractors and building material manufacturers who adopt the circular economy trend, who reduce their emissions and environmental toxins and demonstrate that there can be both “cool” and attractive solutions, will probably be in the most in demand going forward. Based on the analyses in our work, we see particularly significant innovation and earning potential for the construction industry in thinking in terms of upcycling, standardisation, flexibility and the levelling out of peak loads.

THE ROLE OF PUBLIC BODIES AS FACILITATORS

The challenges faced by democracy is that the elected representatives depend on the support of the people to impose requirements. This applies on a global, national and local level. The willingness to price CO₂ sufficiently high so that the quota market can work, and the incentive to develop more renewable energy are perhaps the most critical factors for ensuring that the whole of society achieves the goal of zero emission. The Paris agreement, stringent EU directives and the goals of Oslo’s new City Council are evidence that it is possible to pass ambitious political resolutions. However, it will require strong leaders who have the knowledge and understanding of the changes that are required going forward. They must be able to resist strong lobbying forces, because there will always be losers in times of major social change.

Public bodies should provide notification of stringent regulations well in advance so that as many players as possible are given time to adjust. Then there will be less resistance. It is also important that public bodies are clear about what future regulations will be so that those who wish to adjust at an early stage, can feel secure in the knowledge that they are moving in the right direction.

But as well as the importance of being a regulator, public bodies have a vital role to play as facilitators by implementing incentive schemes for those who lead the way. These could be financial incentives, for example, Enova support, but we have also highlighted a number of other incentives that will stimulate professional building owners to construct and operate green buildings.



REFERENCES

- 1) STATISTICS NORWAY. 2014. Population projections, 2014–2100. Procured 2 May <https://www.ssb.no/befolkning/statistikker/folkfram/aar/2014-06-17>
- 2) www.wwf.no
- 3) www.klimagassregnskap.no
- 4) WBCSD. 2010. *Vision 2050 A new agenda for business*. Procured 29 January <http://www.wbcsd.org/pages/edocument/edocumentdetails.aspx?id=219&nosearchcontextkey=true>
- 5) Norwegian Environmental Agency 2015. *Climate measures and emission pathways towards 2030 Knowledge basis for low-emission development*. M-386/ 2015. Procured 17 April <http://www.miljodirektoratet.no/Documents/publikasjoner/M386/M386.pdf>
- 6) STATISTICS NORWAY. 2016 b. *Greenhouse gas emissions 1990–2014*. Procured 17 April <http://www.ssb.no/natur-og-miljo/statistikker/klimagassn/aar-endaelige/2015-12-18#content>
- 7) Statsbygg. 2014. *Environmental strategy 2015–2018*. Procured 4 May 2016. <http://www.statsbygg.no/files/samfunnsansvar/miljo/Miljostrategi2015-2018.pdf>
- 8) EU, 2011. *EU's roadmap 2050 for low carbon economy*. www.roadmap2050.eu
- 9) EU Commission 2011. *COMMUNICATION FROM THE COMMISSION on the implementation of the ENERGY STAR programme*.
- 10) Ministry of Local Government and Modernisation. 2012. *Good buildings for a better society. A forward-looking building policy* White Paper no. 28 (2011–2012). Procured 16 April 2016 <https://www.regjeringen.no/no/dokumenter/meld-st-28-20112012/id685179/>
- 11) STATISTICS NORWAY. 2015a. *Waste accounts*, 2013. Procured 2 May <http://www.ssb.no/natur-og-miljo/statistikker/avfregno>
- 12) STATISTICS NORWAY. 2015b. *Waste from construction activity*, 2013. Procured 17 April <http://www.ssb.no/avfbygganl>
- 13) Ministry of Local Government and Regional Development 2009. *Buildings for the future. Environmental action plan for the housing and construction industry 2009–2012*.
- 14) Directorate for building quality 2010. *Regulations on technical requirements for building works (TEK10)*. Procured 1 May 2016. <https://www.dibk.no/no/byggeregler/tek/>
- 15) Directorate for building quality. 2007. *Regulations on technical requirements for building works (TEK07)*. Procured 1 May 2016. https://www.dibk.no/globalassets/byggeregler/tidligere_regelverk/tekniske_forskrifter_2007_komp.pdf
- 16) Havn Nordes, 2016. *Subject portfolio in BREEAM-NOR classified buildings*. Master's degree at Østfold University College
- 17) Akershus County Council and Oslo Municipality. 2015. *Regional Plan for Land Use and Transport in Oslo and Akershus*. Procured 12 March, 2016 <http://www.akershus.no/ansvarsomrader/samferdsel/samferdselsplanlegging/regional-plan-for-areal-og-transport-i-oslo-og-akershus/>
- 18) Agreement on climate policy (Klimaforliket), 2012. <https://www.stortinget.no/no/Saker-og-publikasjoner/Publikasjoner/Innstillinger/Stortinget/2011-2012/inns-20112-390/>
- 19) EU's action plan for a circular economy. 2015. <https://www.regjeringen.no/no/dokumenter/eus-handlingsplan-for-en-sirkular-okonomi/id2465510/>
- 20) Ministry of Climate and Environment. 2015. *An environment without environmental toxins. Action plan to halt the emission of environmental toxins*. Procured 3 March <https://www.regjeringen.no/contentassets/odf9e168e67344d384a1ca8a32cd6792/t-1551.pdf>
- 21) Enova's building statistics 2014. <http://www.enova.no/innsikt/rapporter/byggstatistikk-2014/sammendrag/1060/o/>
- 22) Petter Eiken, Managing Director ROM Eiendom, lecture at the Oslo Future Living conference, May 2016).
- 23) Lecture Roy Frivoll, CEO Avantor eiendomsforvaltning AS. 30. March 2016. Seminar *Less Is More*. FutureBuilt, etc. Oslo

APPENDIX > CONTRIBUTORS TO THE ROADMAP

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8. Jan Eldegard, CEO, Byggutengrenser
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11. Lene Elizabeth Hodge, consultant in energy efficiency, Bellona
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