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architecture competition

«OPPTRE »

Energy upgrading of wooden dwellings to nearly zero energy level

Norske arkitekters landsforbund

Briefly about the competition

The research project "Energy upgrading of wooden dwellings to nearly zero energy level" (OPPTRE) runs from 2018 to 2021 and is led by SINTEF Community in collaboration with NTNU Faculty of Architecture and Design. The project is funded by the Research Council of Norway ENERGIX and the partners Systemhus, Mesterhus, Ratio Arkitekter, Hunton, VELUX, Isola, Flexit, Enova and DiBK. The goal for OPPTRE is to propose a level for the renovation of small wooden houses to nearly zero energy buildings, abbreviated to nZEB.

The OPPTRE project is interdisciplinary and deals with architecture and housing qualities, extra insulation of the building envelope, ventilation solutions, solutions for heating and energy production, life cycle analyses (LCA), life cycle cost analyses (LCCA), innovation system analyses and business models. Cost-effective concepts and solutions will be developed that provide high architectural quality and a good indoor climate, and which also have a low carbon footprint. OPPTRE will provide a basis for new business models, building regulations and incentives that can lead to market change for energy upgrading of homes at nZEB level by 2030.

Detached houses, row houses and other small wooden houses account for half of the energy consumption in buildings in Norway. Energy upgrading of these dwellings will make a significant contribution to achieving the national savings target of 10 TWh / year for buildings by 2030. Half a million of 1.2 million Norwegian detached houses were built in the period 1950 - 1990. Many of these are now ready for renovation.

The research topics are organized in phases, with the architectural competition as the project's core activity. Here, the participants will propose solutions for energy upgrading of house types that are representative of the period 1950-1990. The solutions must be innovative and cost-effective and at the same time have high architectural quality, which combines innovation with respect for the character of the house types. The results of the competition will form the basis for the other research activities in OPPTRE and will provide knowledge about renovation in the direction of the nZEB level for single-family homes for the benefit of homeowners, the construction industry, and public decision-makers. The answers will be used as a basis for analysis of possibilities for comprehensive upgrading of single-family homes towards 2050 in line with EU targets as described in the EU directive (2018/844) and the national energy saving target of 10 TWh / year for buildings by 2030.

You can read more about the OPPTRE project and view the competition entries on the website: www.opptre.no.

Teams/ participants

Shared First Place/ Winners of the competition:

Title: ‘Historien min’ (My story)
House: Nesodden 1962
Moseng Poulsen Arkitektur (architect firm)
Torstein Newth (master carpenter)
Bollinger+Grohmann (consulting engineer)

Title: ‘En pluss en... er tre’ (One plus one... equals three)
House: Kristiansand 1972
Askim/Lantto Arkitekter AS (architect firm)
Tor Arvid Vik, OsloMet

The other competition entrants:

Title: ‘Hus i hage – versjon 2.0’ (House in a garden – version 2.0)
House: Malvik 1957
Arkitektbrygga (architect firm)
Bjørke Arkitektur AS (architect firm)
Fasting arkitekter AS (architect firm)
RF Arkitektur (architect firm)
Hans Helseth AS (building contractor)
Rambøll Trondheim (consulting **engineer)**

Title: ‘Åpent hus – tette vegger’ (Open house, sealed walls)
House: Hamar 1963
White arkitekter, Oslo (architect firm)
CIT Energy Management, Gothenburg
Bygg 1 Oslo (building contractor)
Norsk Gjenvinning (waste recycling contractor)

Title: ‘Malvik 2020’
House: Malvik 1989
Pir II AS, Trondheim (architect firm)
Ola Ravn Hassel (carpenter)
Vill Ved (carpentry firm)

Title: ‘Huset i Sandefjord’ (The house in Sandefjord)
House: Sandefjord 1972
Hans Hus Arkitekter (architect firm)
Ole Thorstensen (master carpenter)
Asplan Viak (consulting engineer)

Non-winning entrants are listed in no particular order.

JURY

THE JURY

Judging was carried out by a jury comprising representatives appointed by SINTEF, NTNU, Enova and NAL. The members of the jury were as follows:

Anne Gunnarshaug Lien
Jury Chair, Architect MNAL, SINTEF/ OPPTRE. E: Anne.G.Lien@sintef.no

Tor Brekke
Enova SF, OPPTRE partner.
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Philip Kvalbein Hauge
Architect MNAL, Kvalbein Korsøen Arkitektur AS, appointed by NAL.
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Energy expertise
Vegard Heide
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Elisabeth Jelstad
Systemhus (house building contractor), OPPTRE partner.
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Karin Hagen
Architect MNAL, RATIO Arkitekter AS, OPPTRE partner.
E: Karin.Hagen@ratioark.no

Katrine Hamre Sørlie
Jury Secretary, Architect MNAL, (National Association of Norwegian Architects/NAL)

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OPPTRE Energioppgradering av småhus i tre til nesten nullenerginivå
SINTEF
NTNU
ENOVA
Forskningsrådet
Norske arkitekters landsforbund

Process

OPPTRE invited homeowners to participate with their homes through the advertisement "Win an architect" which was published on 28 June 2019. A total of 160 homeowners registered their interest before the deadline of 15 August 2019. Six homeowners were selected and were offered the opportunity to take part. The six selected homes represent types of houses which were built in large numbers between 1950 and 1990.

The competition was conducted as a limited architecture competition. An invitation for pre-qualification applications was announced on 22 October 2019 with a deadline for enquiries on 5 November. The deadline for submitting the applications was at mid-day on 12 November 2019. Thirty-three applications were submitted. Six architect firms, forming teams with building contractors and consultants, were selected to take part. The teams were sent the competition documents on 13 December 2020 and were subsequently allocated the six selected homes. They established contact with the homeowners during December 2019, after which they visited the homes and produced their first design drafts during the remainder of the month extending into January 2020.

Two workshops were held while the competition was in progress. Here the teams were given the opportunity to discuss their solutions and calculations with the OPPTRE project. The teams were provided with identical guidance to ensure that as far as possible the results could be compared from the same baseline. The competition was unable to ensure full anonymity because some of the jury members had taken part in the process leading up to the competition and in the workshops. The reason for this is that representatives from the research group provided guidance while the process was underway (during Workshop 2). However, during the process, emphasis was placed on not disclosing the good ideas developed by one team to the others. Workshop 1 was held in Trondheim on 28-29 January for all participants and Workshop 2 was held on 4-6 March, during which each team was visited by the researchers for half a day.

The deadline for questions regarding the competition programme was 1 p.m. on 1 April 2020, with a corresponding deadline for responses on 3 April. The submission deadline was 1 p.m. on 20 April 2020. All the teams submitted their entries within the deadline. The role of competition administrator was held by Gisle Nataas, representing the National Association of Norwegian Architects (NAL). Competition entries were made available on the OPPTRE project website at opptre.no.

Submitted entries were assessed by a jury comprising members appointed by SINTEF, NTNU, Enova and NAL. The jury also obtained expertise from external sources on matters concerning life cycle analyses (LCA) and greenhouse gas emission and cost calculations. The jury conducted its deliberation meetings remotely on 23 April, 7 May, 14 May, 22 May and 2 June 2020 and the results of the competition were presented during a seminar held on 8 June.

Each team was paid a fee of NOK 200,000, excluding VAT, for the work carried out. Two of the teams' entries was declared winners of the competition and received a prize of NOK 100,000 each in addition to the fee. The homeowners were under no obligation to implement the upgrades/ renovations proposed for their homes, although they were free to enter into agreements with the teams if they so wished.

Jury criteria

The aim of the competition is for each team to submit proposals for a good holistic approach for their house. The following topics (in no particular order) will constitute the focus of the jury's evaluation:

- High architectural quality combined with respect for the characteristics of the existing house that are typical for its time
- High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units
- Cost-effective solutions for energy upgrading of the building envelope
- Cost-effective solutions for ventilation and energy production
- Good thermal comfort and air quality
- Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
- Degree of internal and external transformation that shows appropriate solutions with minimal use of resources.

The houses

The competition is based on six detached houses which were selected after the OPPTRE project had invited homeowners to participate. An advertisement entitled 'Win an Architect' was published at the end of June 2019, and 160 homeowners registered their interest by the closing deadline of 15 August. The six homes selected represented types of houses which were built in large numbers between 1950 and 1990. The homeowners were in deifferent life phases. They had various needs and different budgets when it came to potential house upgrades. The competition involved the homeowners putting their houses at the disposal for the competition process. They should be available to answer questions concerning their needs and wishes related to the upgrade of their houses. Homeowners should also provide information about the buildings.

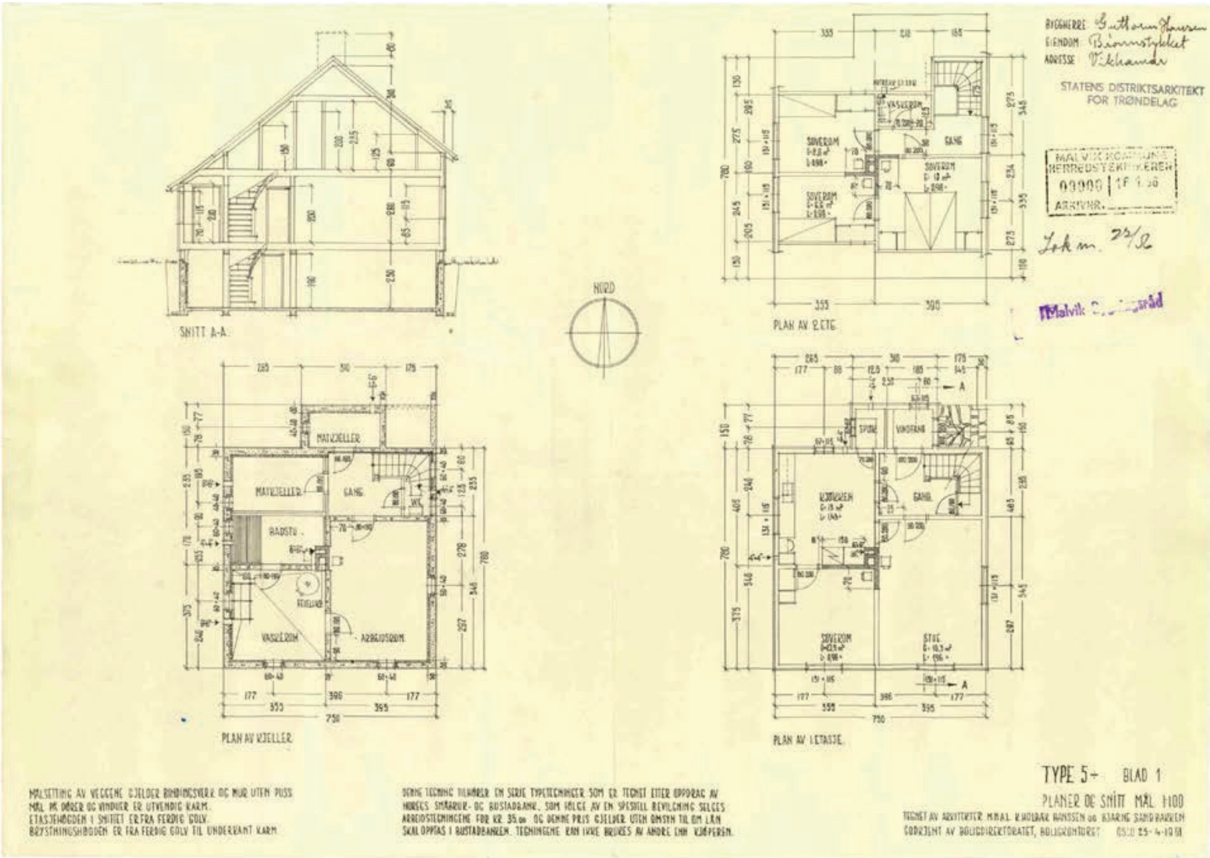
The selected houses had a more or less original standard and were in need of extensive upgrading and renovation. In response to a questionnaire, all the homeowners stated that they were looking for an architect to help them obtain more modern and more functional houses. All of them expressed a wish for modifications to the building envelope, enhanced comfort, new ventilation and energy systems, and houses that were more environmentally friendly. Also, in response to the questionnaire, they all provided a budget for the upgrades.

The budgets submitted varied from NOK 500,000 to NOK 5 million. The teams were obliged to adhere to the budgets set out by the respective homeowners. However, in the case of homes with low budgets, proposals should be included for later additional upgrades. Description should also be included of prioritisations and the order in which stepwise upgrading should take place. The proposals should benefit and serve as examples to homeowners with similar houses at different stages in the upgrading process.

MALVIK 1957

The house was built in 1957 and is located in the town of Malvik close to Trondheim Fjord.
General information: Entrance facing south, living room facing north with a view across the fjord.
Ground floor: Entrance, toilet installed in 1980, living room and kitchen.
First floor: Three bedrooms, bathroom without WC.
Basement: Storage rooms, laundry room, original WC.
Plan area: The basement and ground floor make up approx. 60 m²; the first floor covers approx. 45 m².

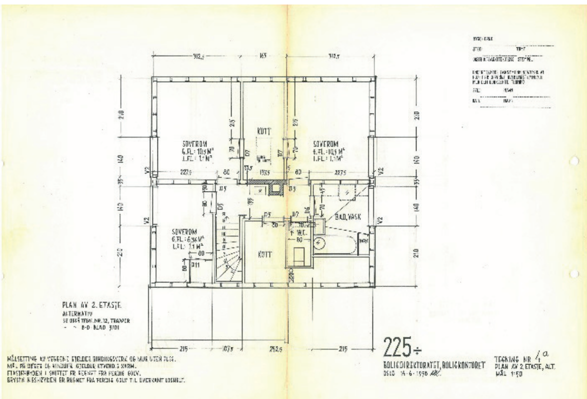
The occupants are a married couple in their sixties who have recently taken over the wife's childhood home. They are planning to live in the house for a long time. The house is in good condition, but no major renovation has been carried out in the past. The house needs to be upgraded both indoor and outdoor and the owners wish to extend the ground floor to include a bedroom and a bathroom. The house is located on a steep slope, and it will be possible to construct an exit from the basement. The occupants are looking for 'energy solutions for the future'.

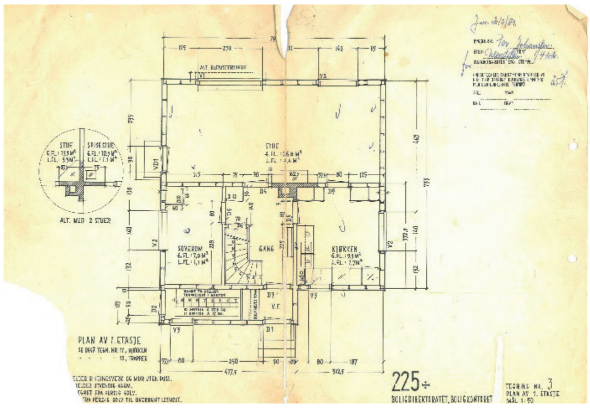


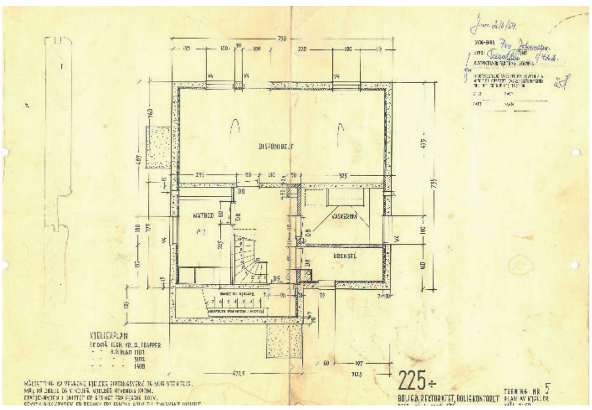
NESODDEN 1962

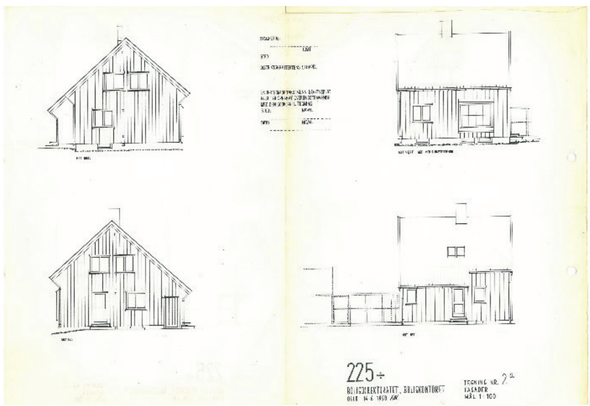
The house was built in 1962 and is located in Nesodden outside Oslo. It is located in a quiet and open area. General information: Entrance facing east and a living room opening towards a terrace facing south.
Ground floor: Entrance, WC, living room, kitchen, and homeoffice. First floor: Three bedrooms and a bathroom. Basement: Laundry room, living room, storage space. Plan area: 55 m² on each floor.

The occupant is a woman in her fifties who bought the house five years ago. Her mother, three adult sons and a grandchild live in Oslo, and visit her often. She has refurbished the kitchen and living room. There is a need to renovate the entire exterior of the building envelope, as well as the first floor interior. The occupant wants to rebuild and extend the entrance hallway and raise parts of the roof. Her dream is to live in an interesting house that encourages a lot of visits and activity.





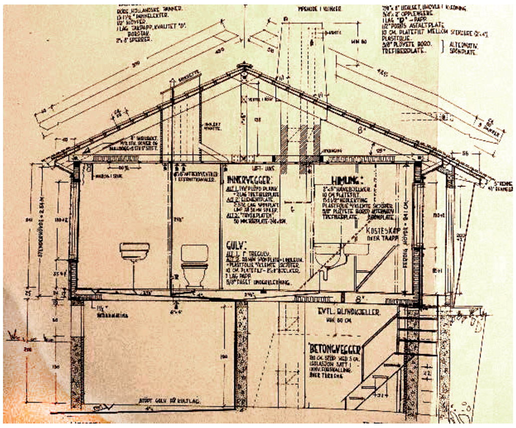


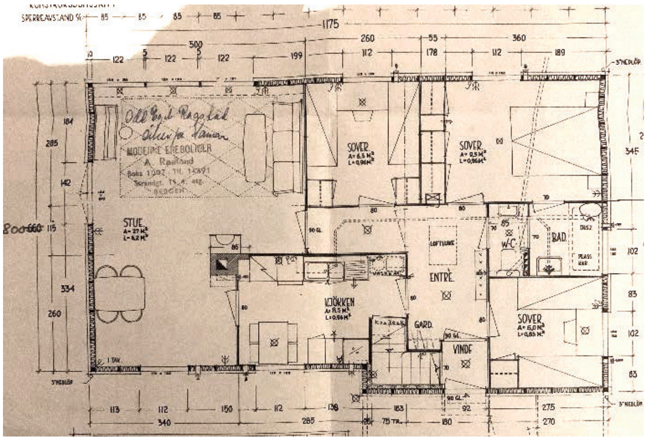


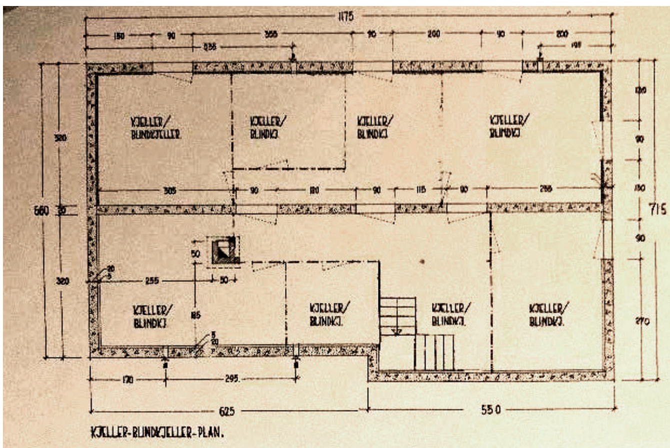
HAMAR 1963

The house was built in 1963 and is located in the Smeby/ Solvang area that has many homes built during General information: Entrance facing north with a living room opening onto a terrace facing both east and west.
Main floor: Entrance, living/dining room, kitchen, two bedrooms and a bathroom.
Basement: storage space.
Plan area: Approx. 80 m² on each floor. the same period and have undergone extensions and/or rebuilding.

The owners, in their twenties and thirties respectively, have lived in the house since 2014 and want to live there for a long time with hopes of raising a family there in the future. The house requires extensive exterior renovation. Much interior work has been carried out, including the fitting of a new kitchen, bathroom and new surfaces. The occupants are looking to extend the living area and possibly build an extension that can be rented out. The house is ideally located with excellent sunlight. The occupants want to make the best of the views they have from the house and to develop the outdoor areas.



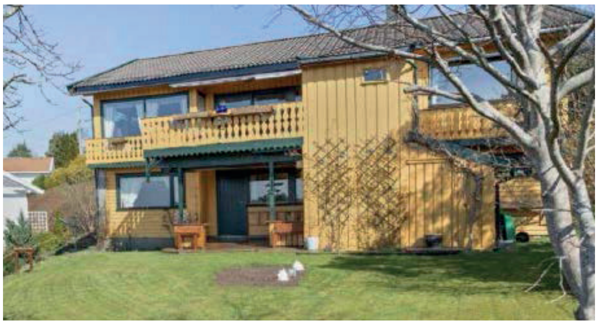


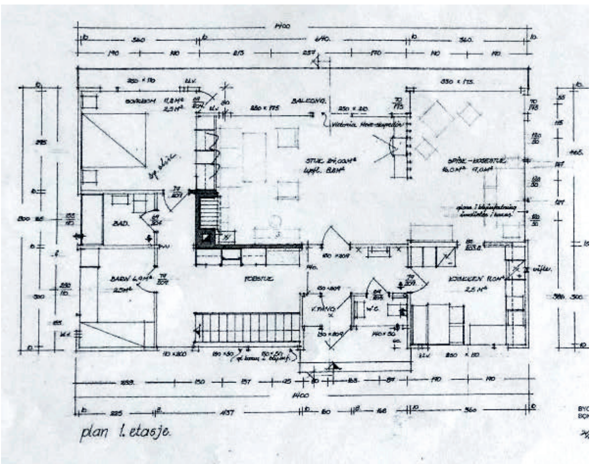


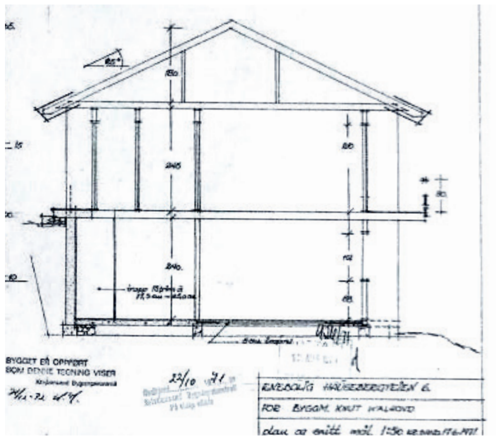
KRISTIANSAND 1972

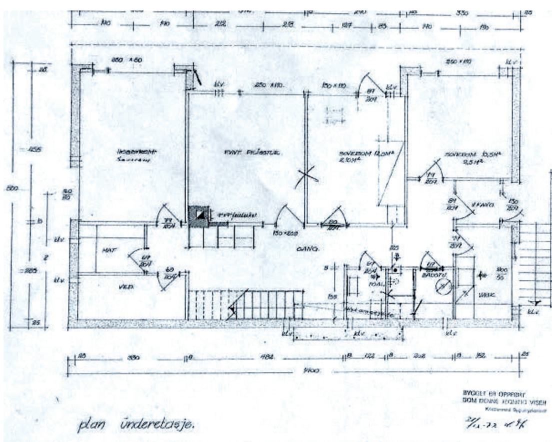
The house was built in 1972 and is located at Hamresanden, close to Kristiansand.
General information: Living room with a view towards the south-west.
Main floor: Main entrance, living room, kitchen, two bedrooms, bathroom and WC.
Daylight basement: Living room, two bedrooms, storage space, bathroom and laundry room. Entrance from the north-west.
Plan area: approx. 130 m²

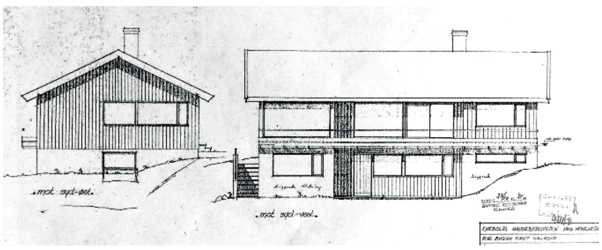
The owners are a couple in their thirties with two small children. They currently live in Oslo and are planning to move to Kristiansand as soon as the house has been renovated. The house is virtually in its original state and requires extensive upgrading. The family wishes to better exploit the lovely views from the house by fitting large window areas and, if possible, by increasing headroom on the main floor. They want to establish a new and more practical entrance area and to create a more functional layout, suitable for a variety of activities. They also want to build an extension that can be rented out.

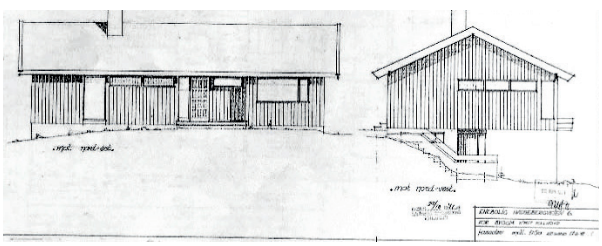








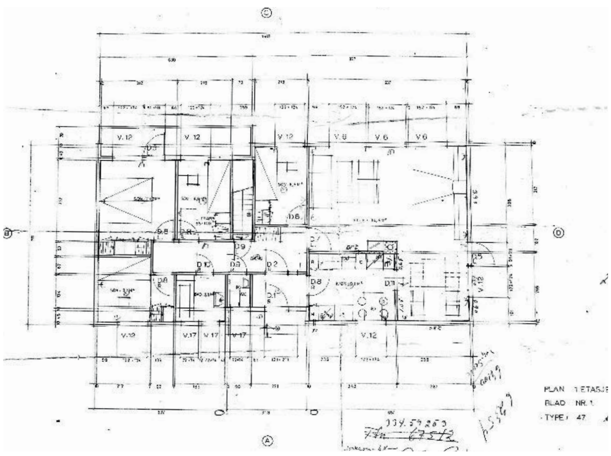


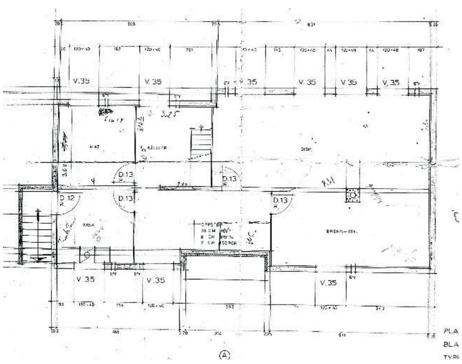


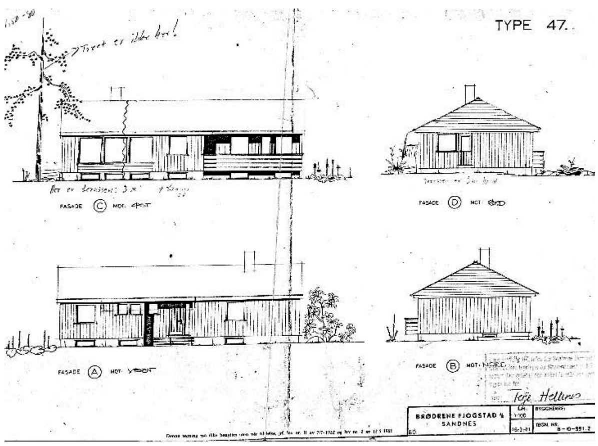
SANDEFJORD 1972

The house is a catalogue house known as a 'Fjogstadhus', built in 1972, and is located by the sea in Sandefjord. General information: Living room and views facing the north-east and towards the sea.
Main floor: Living room, kitchen, three bedrooms, large bathroom and WC.
Basement: Laundry room, storage space, a bedroom, daylight living room, WC and an entrance from the north.
Plan area: approx. 110 m².

The owner is a man in his fifties living with a teenage son. He is a competent builder and has upgraded many homes in the past. He is looking to do much of the work himself according to a prepared plan. He envisages that part of the house can be rented out and that he can live there for the rest of his life. The house is located by the sea, and the owner is a keen kayaker. He wants to remove some soil and debris from in front of the basement and to install a door without steps that will enable him to carry his kayak and other outdoor equipment through his garden and directly into the basement for storage. A house for an active family.



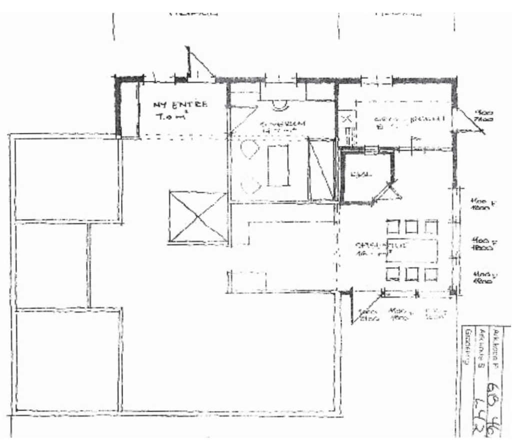


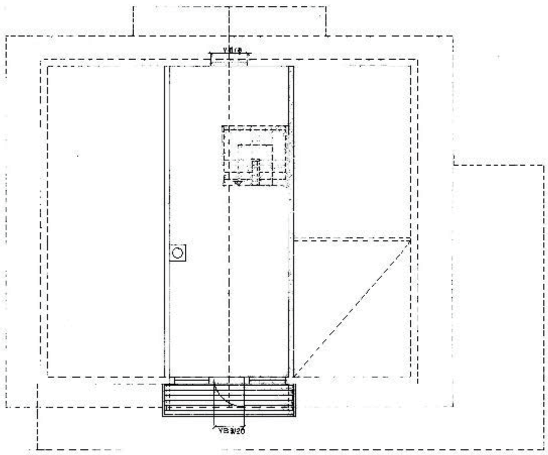


MALVIK 1989

This house is also located in Malvik close to the Trondheim Fjord. The area was developed in the period 1988 to 1989 and contains many houses with similar construction features. A generational transition is taking place and many of the houses are in need of upgrading.
General information: Living room with views towards the fjord to the north; entrance facing south.
Ground floor: Living room, kitchen, laundry room, three bedrooms and a bathroom.
First floor: Attic living room and bedroom.
Daylight basement: Bathroom, WC, hallway, rental flat.
Plan area: The original ground plan area is approx. 105 m².

The owners are a couple in their thirties with two small children. There are also two people renting the a unit in the basement. The house requires extensive renovation, and the owners are looking to modify the layout and make the best of the fine view. The house was modified in 2004 involving extending the kitchen and construction of a new laundry room, as well as extension of the entrance area, one of the bedrooms on the ground floor and completing a similar area in the unfinished basement.





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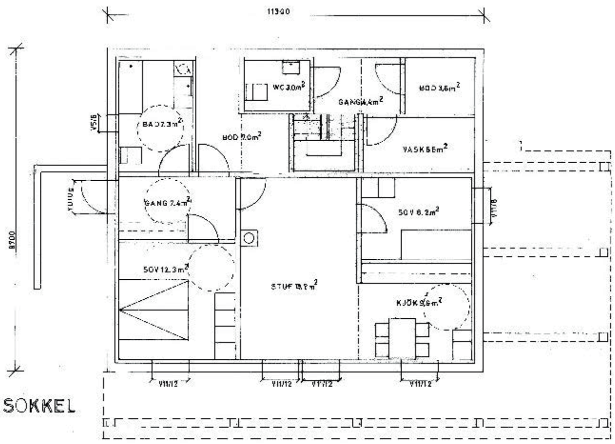

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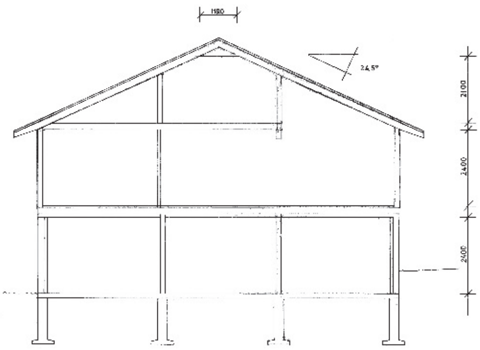


SNITT

THE JURY'S GENERAL ASSESSMENT

The six teams participating in the competition have submitted a wide variety of proposals for the upgrade of the six houses for owners in very different life phases. The proposals provide valuable input to the OPPTRE project, to the six homeowners, and to others who are planning to upgrade their homes. A summary of the jury's general assessments of both the submitted proposals and the competition in general in the light of its aforementioned criteria is presented below.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time
The competition has resulted in six different approaches to the transformation of existing standard detached houses aiming to promote lower energy use and enhanced living quality. The teams received input from the owners and the architects have to a great extent succeeded in meeting their wishes.

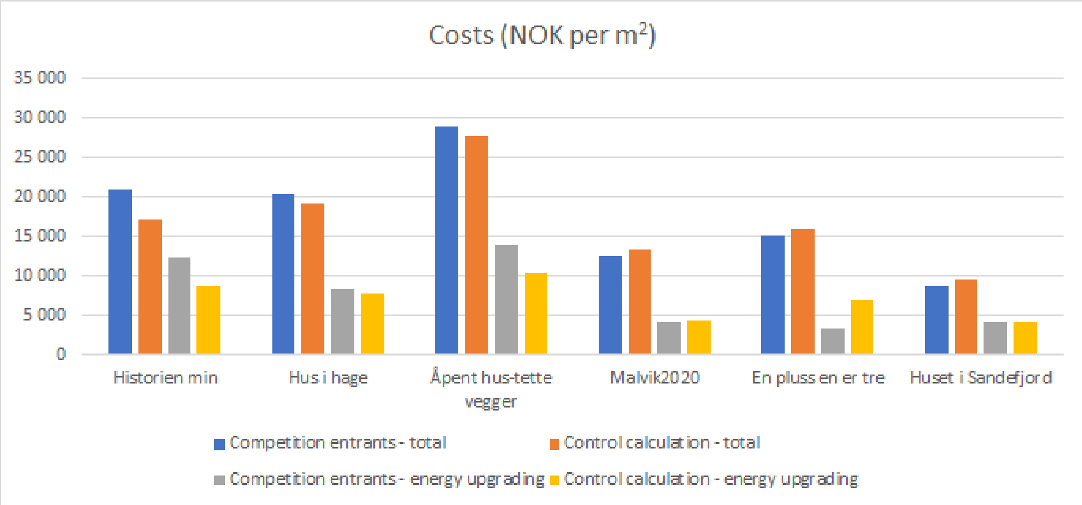
It is in the nature of standard house types that they are often poorly adapted to the sites on which they are built, the neighbourhood, sunlight conditions, wind directions and access. This means that modernisations and upgrades also commonly involve relatively major modifications in order to better adapt such houses to site-related factors.

The proposals submitted display a broad range of solutions to the modification of the existing homes. Some offer complete facelifts that in many ways draw a clear distinction between the old and the new. Others offer smaller modifications that preserve the original aesthetics more clearly after upgrading. Both approaches may be appropriate answers, and the jury has enjoyed fruitful discussions on the issue of what is really meant by 'respect for the characteristics of the existing house typical of its time'.

High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units
The proposals submitted offer excellent and well considered solutions designed to create new qualities for the existing houses. The jury views the results of the competition as an excellent resource for others who are planning to upgrade their houses. The projects and their associated costs provide an excellent insight into what the various approaches entail in terms of financial outlay. The jury regards this knowledge as very valuable. It is a demanding task to balance the relationships between investment, architectural quality and energy issues/carbon footprint, and to a certain extent, this balance can only be achieved based on value judgements. Quantitative impacts will always be weighed up against architectural qualities and the jury believes that the six project proposals have in their different ways highlighted what is a very interesting issue.
For the most part, the projects contain area-efficient solutions. Many of them offer opportunities to create space for renting out, either by modification or by building extensions, thus providing additional income for the owners. Moreover, many of the projects demonstrate how a house can be utilised during the different phases of its occupants' lives and how it can be adapted to changes in occupant numbers.

Cost-effective solutions for energy upgrading of the building envelope
All the proposals involve significant reductions in heat loss from the building envelope, and in some cases perhaps by amounts greater than what may be considered cost effective. A common thread is the use of standard measures such as window replacement, the installation of additional exterior insulation and wind-proofing, and the insulation of roofs and basement walls. For the most part, the projects maintain the integrity of the building envelope, and many recommend better exploitation of existing areas as an alternative to the owners' original wishes to build extensions. Such solutions result in compact building envelope that offer a good starting point for achieving energy efficient homes. Three of the projects contain proposals to construct simple extensions, although only some of these are heated.
The costs of both the total upgrading and for energy upgrading have been calculated for all the projects. The OPPTRE project has also carried out identical control calculations for all the projects, using the same baseline costs for both materials and working hours. In practice, there will be local variations in hourly rates, which can probably explain some of the differences observed between calculations submitted in the proposals and the control calculations. There is good agreement between the calculations used.
The graph below illustrates a comparison between the costs per square metre provided by the competition entrants and those resulting from the control calculations.

Cost-effective solutions for ventilation and energy production All of the proposals result in significant improvements in energy efficiency.
For the most part, the houses fall well within the delivered energy requirement as set out in the Norwegian TEK17 regulations (for net energy requirement). The 'Malvik 2020' project is an exception, being 13% above the requirement. If this project is calculated with the same leakage figures as the most optimistic projects, it falls just below the TEK 17 requirements. However, we regard the most optimistic leakage figures (e.g., 0.3) as unrealistic for upgrade projects of this type.



The graph show costs per square metre provided by the competition entrants and the control calculations.

Energy performance kWh/m²			Nesodden-62 (Historien min)	Malvik-57 (Hus i hage-2.0)	Hamar-63 (Åpent hus-)	Malvik-89 (Malvik 2020)	Kristiansand-72 (En + en er tre)	Sandefjord-72 (Huset i Sande)
Before	Measured	Delivered energy	174		156	115	102/184*	131
	Standardised calculation	Net energy demand	214	183	356**	202	281	216
After	Standardised calculation	Net energy demand	79	118	88	143	112	110
	Realistic calculation***	Delivered energy	52	76	61	120	84	68
		Net delivered	31	76	16	120	84	68

*Energy performance kWh/m2. * Different occupants, **Probably includes heating of the entire basement, ***Local climate, temperature zoning*

For all the projects the measured delivered energy prior to upgrading was kWh/m²*year) significantly lower than the standardised calculated energy demand (131-184 versus 183 - 356 kWh/m²*year). Thus, it is clear that the occupants are often quite thrifty in their energy use, with a lower energy consumption than a calculation using standard values for air replacement, interior temperature, hot water use, etc shows. This is often referred to as the prebound effect and may result in overestimation of the real potential for energy savings.

Calculated estimates for delivered energy excluding the use of solar panels are for the most part as low as between 50 and 80 kWh/year. The two projects that include the use of solar panels achieve net delivered energy estimates as low as between 16 and 30 kWh/m²*year. These can be regarded as nearly zero energy buildings.

None of the houses were originally equipped with a hydronic heating system. Four of the six proposals include investment in hydronic heating. Two involve systems mainly using radiators and the other two primarily with underfloor heating. This may not necessarily be cost-effective but contributes towards reducing the delivered energy requirement because a greater proportion of the heating demand is supplied by a heat pump. The two houses for which water-based heating is not included ('Malvik 2020' and 'En pluss en... er tre') exhibit the highest delivered energy estimates. An interesting issue that arises in this connection is why the installation of a water-based underfloor heating system, combined with a heat pump, has been recommended in the smallest house, while in the largest house, the proposal is to install new heating cables, thus continuing to use electricity as the only source of room heating for the entire house.

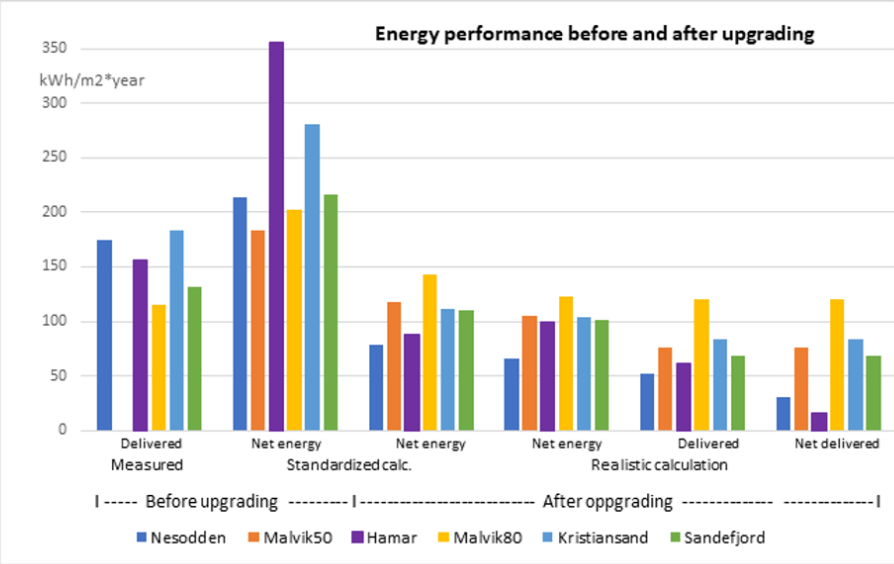
In principle, the larger the house, the more cost-effective a combined water-based heating system and heat pump should be. It is proposed that all the houses should retain their existing chimneys, although only two of the proposals recommend the use of wood stoves or fireplaces for peak heating on the very coldest days.

Good thermal comfort and air quality

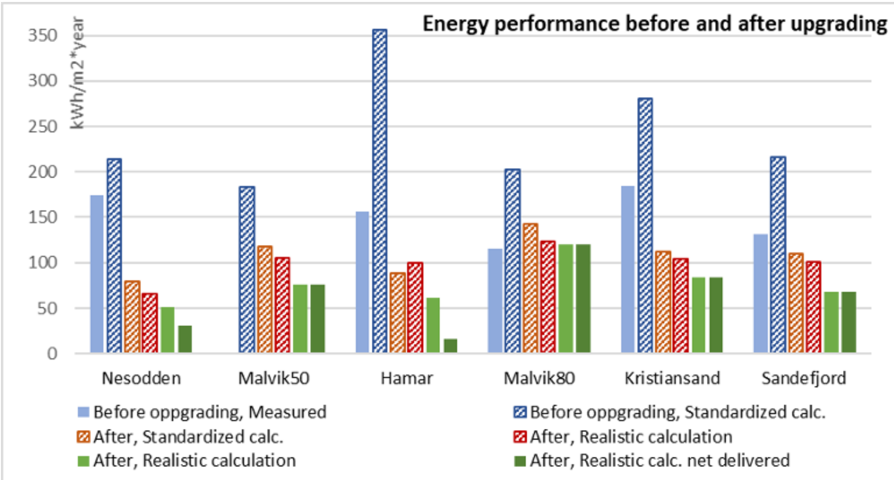
All of the proposals recommend systems that guarantee good thermal comfort and interior air quality.

Effective wind-proofing and retrofitted insulation will eliminate draughts and cold floors. Balanced ventilation offers a stable air change rate and the preheating of ventilation air. All the projects would need window ventilation on warm summer days, although none has described burglar-proof solutions to make this work optimally in real. This is a topic that generally deserves greater focus. All of the projects appear to offer adequate sun screening systems.

Many of the proposals address the wish for cool bedrooms and distinct temperature zones, and these issues are addressed in varying degrees by specific recommendations. Balanced cascade ventilation with efficient heat recovery, combined with a highly insulated building envelope, will limit the temperature differences between different rooms. A balanced ventilation system involving shared input air temperature will transfer heat from the warmest to the coldest rooms. Rooms that are not supplied with additional heat using radiators or underfloor heating will still not become very cold because the heat loss through their exterior walls is so low.



PV production is included only in Net delivered.



Net energy demand - hatched, delivered energy - non hatched.

Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
A house's carbon footprint is determined by the materials and energy that are consumed during its lifetime. In an upgraded building, energy consumption will typically be greater than in a new building, whereas the use of materials will be significantly lower. The calculated estimates demonstrate that all of the proposals have a significantly lower carbon footprint compared to a typical home of the same size built according to today's standards. The homeowners' wishes have for the most part been met without proposing additions to the existing house. Some of the proposals place an emphasis on modest upgrading, while others set the bar high. This is also reflected in the resulting carbon footprint. In some of the proposals, the homeowners are presented with options, where they can balance costs and environmental considerations. They can for instance choose a stepwise upgrade or they can increase the environmental ambition through adding solar panels or using materials with a low carbon footprint.

Moreover, several of the proposals focus on flexibility, enabling adaptation of the function of the house as the needs change. For example, parts of a house might be converted into a flat or bedsitter when the owner no longer needs so much space or reducing energy consumption through different temperature zones. Reuse on its own was not included as a jury criterion in this competition, but many of the teams have provided descriptions of how local reuse of materials can contribute towards further reductions in carbon footprint.

The magnitude of such reductions will depend on the condition and remaining service life of the materials. Figure X illustrates three different perspectives of the carbon footprint relating to the six homes. The blue column indicates the total carbon footprint. On its own, this tells us very little about a house. Our assessment must be based on its function and by asking; "what do we get for our carbon footprint?" The orange and grey columns show the results per bedroom and per m²*year, respectively. The latter represents the total carbon footprint divided by the heated usable floor area over a period of 60 years.

We can also compare the carbon footprint for these six homes with other types of houses, and in doing so ask the question; 'What might we have obtained elsewhere for the same carbon footprint?'. Figure Y shows the carbon footprint for a typical newbuild (blue), compared with an older building without any upgrading (orange) and an OPPTRE upgrading project (grey). We can see that all the upgrades provide better results than those for a newbuild, although there is greater variation if we make comparisons with older buildings of the same size. However, the quality of the houses is very different when we compare the upgraded buildings with their older equivalents. This demonstrates that we can obtain an upgraded building with high level of living quality using approximately the same climate budget as for an older building.

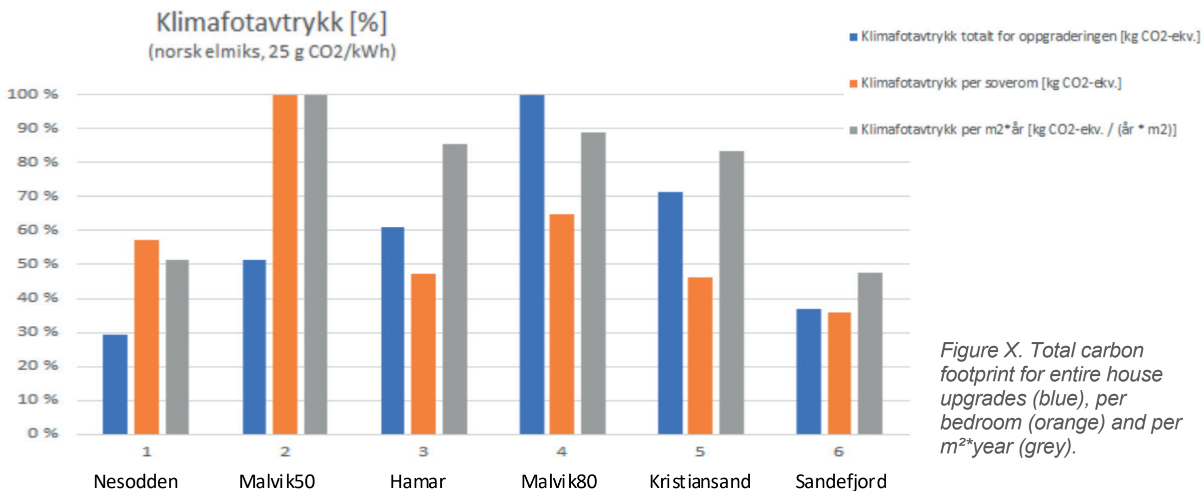


*Figure X. Total carbon footprint for entire house upgrades (blue), per bedroom (orange) and per m²*year (grey).*

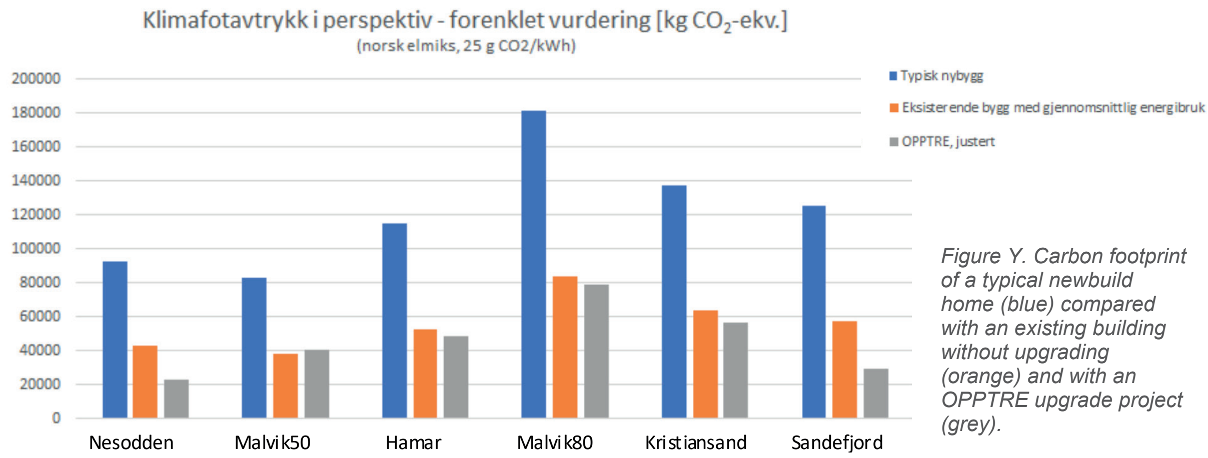


Figure Y. Carbon footprint of a typical newbuild home (blue) compared with an existing building without upgrading (orange) and with an OPPTRE upgrade project (grey).

*About the calculations: A building's carbon footprint is calculated over a 60-year period using electricity generated in Norway (25g CO2/kWh). The results are divided into life cycle modules, based on Norwegian standard EN 15978 (Sustainability of construction works), and building components, based on Norwegian standard NS 3451 (Table of building elements). In the case of the OPPTRE homes, carbon footprint is calculated for materials consumption (life cycle modules A1-A4 and B4) and energy consumption while in operation (life cycle module B6). For existing houses, only electricity consumption is included (198 kWh per m²*year), while for the two others materials consumption is also included. In the case of newbuilds, carbon footprint is calculated on the basis of 8.1 kg CO2 per m²*year for materials consumption (life cycle modules A1–A3) and approx. 2.8 kg CO2 per m²*year for energy consumption (25 g CO2/kWh * 110 kWh per m²*year). The assessment is simplified, and the system boundaries are not identical. For example, a replacement factor is not included for newbuilds. It should be noted that Norwegian electricity has a very low carbon footprint per kWh. A consequence of this is that carbon payback period for solar panels is very long. Some adjustments have been made to the submitted calculations and obvious errors, such as the expression of material volumes in square instead of cubic metres, have been corrected.*

Degree of internal and external transformation that shows appropriate solutions with minimal use of resources
The submitted projects exhibit very different degrees of resource use. This is related to a variety of different factors, economic constraints and the wishes of the homeowners. This issue addresses the problem of identifying the balance between resource use, what we achieve, and project finances, although it has proved difficult to arrive at definitive conclusions.

Concluding summary
The aim of this architecture competition has been to generate innovative solutions for the upgrading of houses to nearly zero energy buildings (nZEB) status with a focus on factors such as architecture, living quality, energy use, energy production, carbon footprint and low cost. The six teams participating in the competition have submitted a wide variety of proposals for the upgrade of the six houses for owners in very different phases of their lives. The upgrade budgets also exhibit significant differences. New layout layouts have been presented, involving a variety of exciting proposals for rebuilding and extensions, combined with innovative architectural expression.

Overall, the jury is very pleased with the broad diversity of solutions presented by the competition entrants. All the teams have done an excellent job in terms of presenting good construction solutions for energy upgrading, as well as their proposals for energy systems and carefully considered use of materials.

THE JURY'S DECISION

The jury's mandate has been to evaluate the proposals and to declare a winner of the competition. The jury's decision is final. The winning team will receive a prize of NOK 100,000 (not liable for VAT) in addition to its fee for completing the work.

The jury has decided that the projects 'Historien min' and 'En pluss en... er tre' are the joint winners of this competition. The decision was unanimous. Both teams will thus receive a prize of NOK 100,000.

The project 'Historien min' distinguishes itself in that the team has demonstrated in an exemplary manner how to confer new qualities on the house by means of simple extensions. The extensions are differentiated from the original construction by the introduction of a variety of design details. They offer excellent legibility between the new and the old and are neither subordinate to nor do they overwhelm the existing house construction. The north-east facing extension offers an excellent contrast between the somewhat confined parts of the house and the surprisingly spacious 'table-tennis room', which lends variation and a dynamic element to the overall experience of the house. 'Historien min' has only a limited need for new materials, generates little waste and demonstrates that the reuse of existing building components can contribute towards relating its history as the house moves into a new phase of its useful life.

The project 'En pluss en... er tre' meets the owner's wish to modify the house's existing building envelope without resorting to extensions or annexes. The new layout has been laid out in an exemplary manner and a new, more open plan has been achieved by demolishing only very few of the existing interior walls. This project makes a number of excellent and effective interventions to achieve upgrading of the building envelope and the team must be given credit for the structured presentation of their calculations. The result is a sensitively crafted textbook example that will provide inspiration to others. Aspects related to living quality, comfort, resource use and construction engineering details have been effectively resolved.

The remaining competition entries have not been ranked.

JURY SIGNATURES

Juni 2020

Anne Gunnarshaug Lien
Juryleder, arkitekt MNAL, SINTEF/OPPTRE

Tor Brekke
Enova SF, OPPTRE partner

Vegard Heide
Energi-kompetanse, PhD stipendiat, NTNU/OPPTRE

Elisabeth Jelstad
Boligprodusent, Systemhus, OPPTRE partner

Karin Hagen
Arkitekt MNAL, RATIO arkitekter as, OPPTRE partner

Philip Kvalbein Hauge
Arkitekt MNAL, Kvalbein Korsøen Arkitektur AS, oppnevnt av NAL

Katrine Hamre Sørlie
Juryens sekretær, arkitekt MNAL, Norske arkitekters landsforbund

«HISTORIEN MIN» (My story)

NESODDEN 1962

Shared 1st prize

TEAM:

MOSENG POULSEN ARKITEKTUR

MOSENG POULSEN ARKITEKTUR
TØMRERMESTER TORSTEIN NEWTH
BOLLINGER+GROHMANN

Gross Floor Area (GFA): 199 m² including basement, 56 m² and extension 23 m²
Heated area (HA): 142 m² (used in energy calculations), including extension, excluding basement.
Delivered energy before and after upgrade: 174 kWh/m² (measured) and 31 kWh/m² (local climate)
Estimated net energy requirement before and after upgrade: 214 kWh/m² and 79 kWh/m²

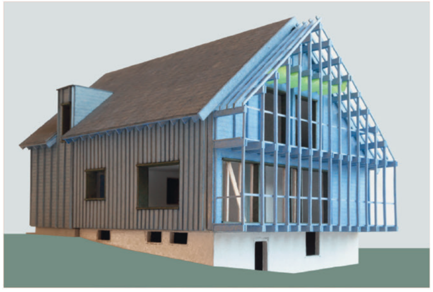
The proposed energy upgrade concept involves installing a semi air-conditioned area enabling adaptation to unforeseen conditions.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time.
The project 'Historien min' is based on Standard House '225 Minus', as defined by the Norwegian Housing Directorate (Boligdirektoratet). This is a compact, efficient home with a generous picture window in the living room. The architects suggest two separate extensions, one on each gable end (multi-use room to the north and east, balcony with sun shading to the south and west). The extensions have different details, making them distinctive from the outset. This provides an effective differentiation between the old and the new, with the extensions neither being overshadowed by nor dominating the existing house. This is a very good result. The architects display good understanding, and the result appears as a continuation of a story, rather than as a fresh start.

High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units.
The existing house already makes very efficient use of the available area. Maybe this represents part of the challenge: how to give the building new qualities without losing valuable content. The living room and kitchen have been opened up to provide a more social layout. Nevertheless, the L-shaped combined-use room provides a certain amount of differentiation between functions.

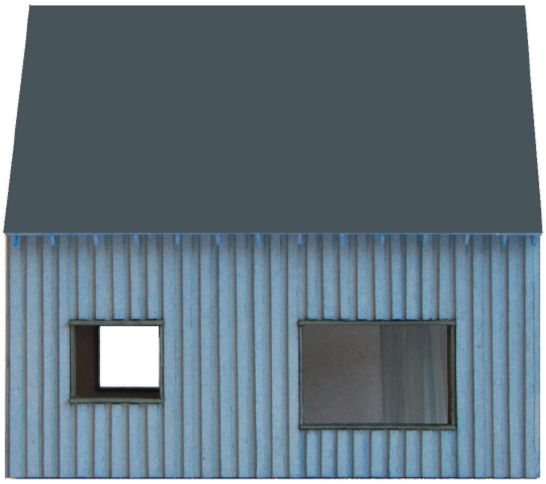
BOLIGDIREKTORATETS ILLUSTRASJON FOR TYPE 225 minus: tegnet av Boligdirektoratets arkitekter i 1958

HILDES HUS PÅ NESODDEN: Bygget i 1962. Tilstand i 2020



HILDES HUS PÅ NESODDEN: Opprinnelig bygget i 1962, med energioppgradering utført i 2021

TILTAK NORD; TILBYGG



ENERGIOPPGRADERING OG RESTAURERING

TILTAK SYD; SOLSKJERM

The jury believes this will function well. Instead of using the basement as a living room, an extension has been added, providing a more unstructured, flexible area. This is a sort of programmatic escape valve for the house, an area for playing tennis towards a high wall and many more activities. It is an exciting feature that nevertheless allows the rest of the house to retain its rational nature. The differentiation of the exterior expression continues inside. Two different features combine to complement each other.

The house is not fully adapted for wheelchair users and modification of the ground floor bathroom and step-free access to the extension could have been planned with this in mind.

Cost-effective solutions for energy upgrading of the building envelope.

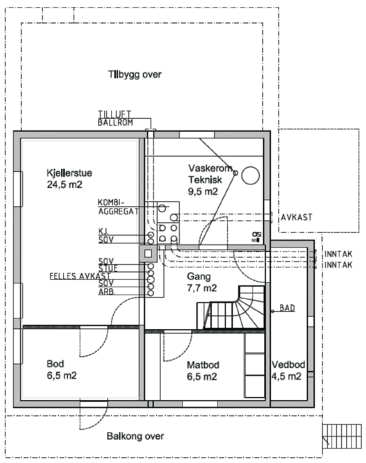
'Historien min' has a compact building envelope with plenty of south-facing windows and few windows facing to the north. This is a good basis for an energy-efficient building. The upgrade includes added insulation of the roof and three of the four outer walls, new windows and insulation of the floor above the basement. The fourth wall becomes an interior wall towards the new extension.

The total cost of the project is estimated at NOK 2,979,000, not including VAT. Divided by an area of 142 m², this gives NOK 20,700 per m². The cost of energy upgrading of the existing building envelope (119 m²) is estimated at NOK 1,756,300 (NOK 14,700 per m²).

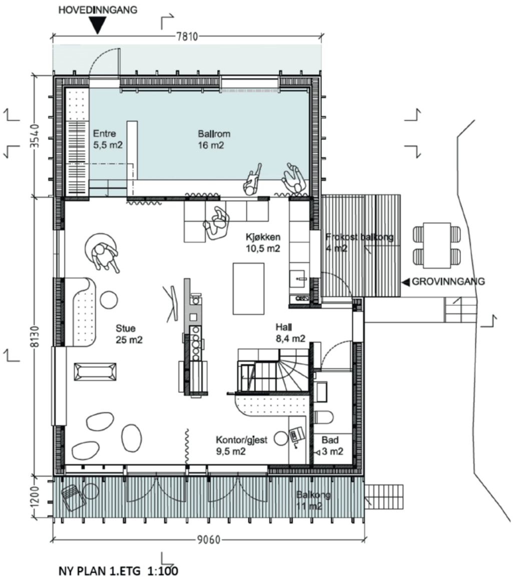
A subsidy from Enova is estimated at NOK 187,500, which will reduce the cost of the energy upgrade by NOK 1,600 per m². Control calculations show a 20% lower total cost and 30% lower cost for the energy upgrade of the building envelope.

For parts of the building that will be re-insulated, U-values corresponding to TEK17 level are specified. The proposed upgrading solutions for roof and wall are considered sensible and familiar. Triple glazed windows containing krypton are specified, with U-value 0.61-0.65. The energy estimates a air change rate of 0.3 h-1 at 50 Pa. This is considered unrealistic for an upgrade of this type. It is particularly difficult to achieve low measured air change rate in renovation projects.. It is difficult and many working hours are requiredto achieve satisfactory sealing of the existing floor between ground floor and basement, especially when vertical ventilation ducts are present. By using more realistic values of air change rate, for example, 1.5, the estimated energy demand will increase by 5-10 per cent.

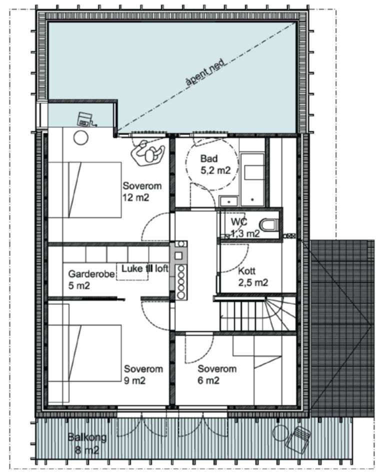
Added insulation of the basement was not given priority because the basement area is kept at a low temperature most of the time. When insulation of the separating floor above the basement is improved the basement may become colder and more humid. When constructing the northerly extension, the north-facing basement wall should be insulated. This wall will not be accessible for external added insulation if the basement is later to be included in the heated area. . Added insulation of all basement walls should be considered instead of insulating the separating floor. With insulated exterior walls, the basement will become warmer and heat loss from the floor above will be reduced.



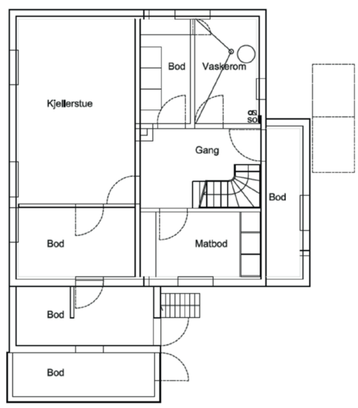
NY PLAN KJELLER 1:100



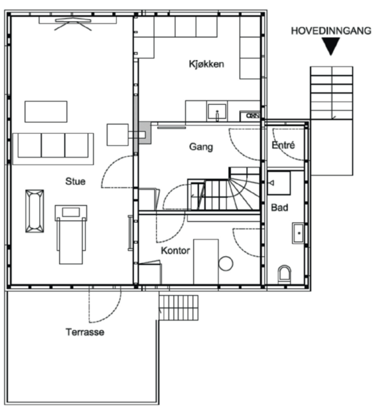
NY PLAN 1.ETG 1:100



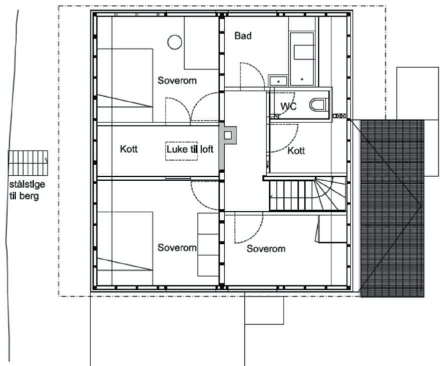
NY PLAN 2.ETG 1:100



EKSISTERENDE PLAN KJELLER 1:100



EKSISTERENDE PLAN 1.ETG 1:100



EKSISTERENDE PLAN 2.ETG 1:100

Ensuring a slight underpressure in the basement relative to the remainder of the building will prevent air containing radon from leaking into the living areas of the house.. This is an important measure, since we know that the bedrock potentially produces radon. The guidelines for TEK17 specify that a separate radon barrier on the ground surface is not necessary in the case of ‘a ventilated ground level that does not contain rooms for continuous occupation, where the ground level is separated from the floors above by concrete or some other separator with equivalent airtightness, including sealing at penetrations, shafts, stairways and doors’. Depending on how one interprets this, air sealing using wind barrier material may be sufficient. Installing a vapour-tight radon barrier on the cold face of a structure can nevertheless be challenging. The installation may be prone to condensation and enclosure of moisture.

The south-facing structure consisting of sun shading and balconies is cantilevered, without supporting pillars. This may present challenges regarding attachment and support and may be expensive.

Cost-effective solutions for ventilation and energy production

The concept includes a compact unit with balanced ventilation with heat recovery, and a heat pump utilising exhaust air and outside air (Flexit Econordic WH4). Ventilation ducts are situated on the warm side of the envelope and are short and well organised. The location of the vertical shaft somewhat reduces the potential for installing a wood-burning stove. Since the house is fitted with a chimney, a wood-burning stove could address peak heating requirements in cold periods and be useful in the event of electrical outages and crises. The exhaust heat pump provides heat energy for both hot water and space heating. Heating is by means of three wall-mounted radiators (downstairs living room and corridor, upstairs corridor). Hydronic heating is also installed in both bathroom floors. The ground floor bathroom is however in good condition, and it may not be very cost-effective to modify the floor here. However, it is possible that the existing floor structure will enable the installation of heating pipes from beneath, working from the basement.

The estimated delivered energy consumption without solar panels is as low as 52 kWh/m². This is partly the result of installing water-based heating and an efficient heat pump. If 20 m² of solar panels mounted on the sloping roof facing east-southeast also are included, the estimated supplied energy becomes as low as 31 kWh/m².

EKSISTERENDE FASADE NORD 1:100

EKSISTERENDE FASADE VEST 1:100

EKSISTERENDE FASADE SYD 1:100

EKSISTERENDE FASADE ØST 1:100

Baldakinen over inngangdøren viser vei inn, fra vinduet vinker Hilde.
Hun sitter i karmen og hviler ut etter matchen.

I karnappet på soverommet er et lite arbeidsbord, siste solstråler fra vest lyser opp bordplaten.
Det originale blomstervinduet spiller fortsatt førstefiolin.

Store åpninger mot syd bringer lys og varme inn i boligen, herfra kan du se havet.
På varme sommernetter sover du på terrassen i 2.etg, beskyttet bak solskjermens blågrå filter.

Morgensol mot øst gjør frokostterrassen varm, den ligger i le for vinden.
Knausen og furutrærne kommer tettere på.

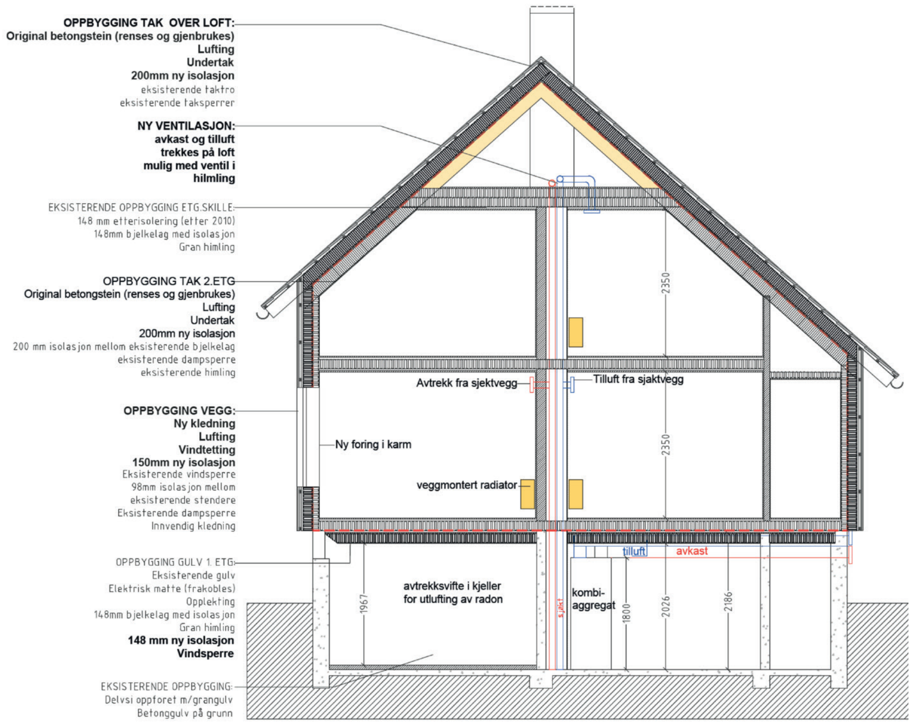
ALTERNATIVSPLANER 1:200

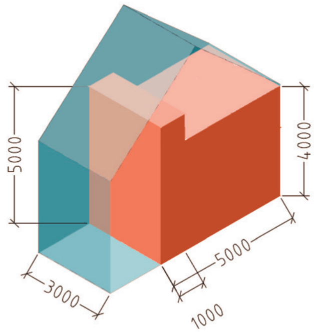
Good thermal comfort and air quality
No space heating is described in the bedrooms and table tennis room, since lower temperatures are desired or accepted here. Heat from adjacent rooms and from ventilation with heat recovery is considered adequate. A desire for cool bedrooms is described. However, efficient heat recovery from ventilation air, combined with an efficiently insulating climate screen, will limit temperature variations between the various rooms. It would have been helpful to have an analysis of the sun shading effect of the slat structure on the south-west-facing façade. The upper floor contains two bedrooms with extensive windows that are exposed to afternoon sunlight.

Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
Two principal measures have been taken to reduce the carbon footprint of materials. The first is to reduce the amount of material used in the upgrade (among other things by facilitating re-use), and the second is to select materials with a low carbon footprint. Existing insulation and vapour barrier are retained, reducing materials consumption in this project and therefore lowering costs and carbon footprint. Simultaneously, consideration has also been given to the fact that a balance must be achieved between environmental benefit and cost. This has been taken into account by allowing for a choice of concepts with even higher environmental aims, such as materials with a very low carbon footprint or additional solar panels. Compared with the other two upgrades, the carbon footprint is low, totally, per bedroom and per m²*year.

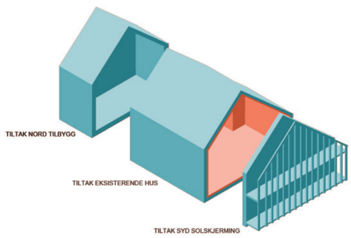
Degree of internal and external transformation that shows appropriate solutions with minimal use of resources
The project provides an alternative method of developing existing, efficient homes, by introducing new elements instead of making big changes to the existing structure. In this case, this is a room that provides the occupants with the opportunity to decide for themselves how this area is to be used. It is easy to conclude that a slightly cramped, efficient layout has to be changed fairly drastically to provide more space and flexibility to deal with unforeseen circumstances. The architects have in an exemplary manner provided the house with new qualities using a simple extension. The contrast between the somewhat confined parts of the house and the surprisingly spacious ‘table tennis room’ lends variation and a dynamic element to the overall experience of the house. The concept has a limited need for new materials, generates little waste and demonstrates that the reuse of existing building components can contribute towards relating the house’s history as it moves into a new phase of its useful life.

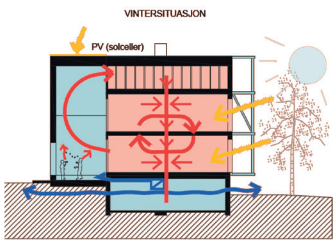
EKSISTERENDE HUS ETTERISOLERES FRA UTSIDEN. OPPGRADERING AV KJELLER AVVENTES

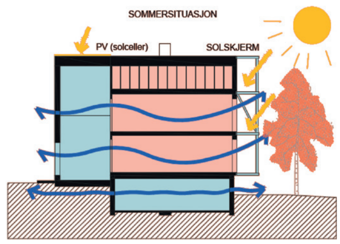




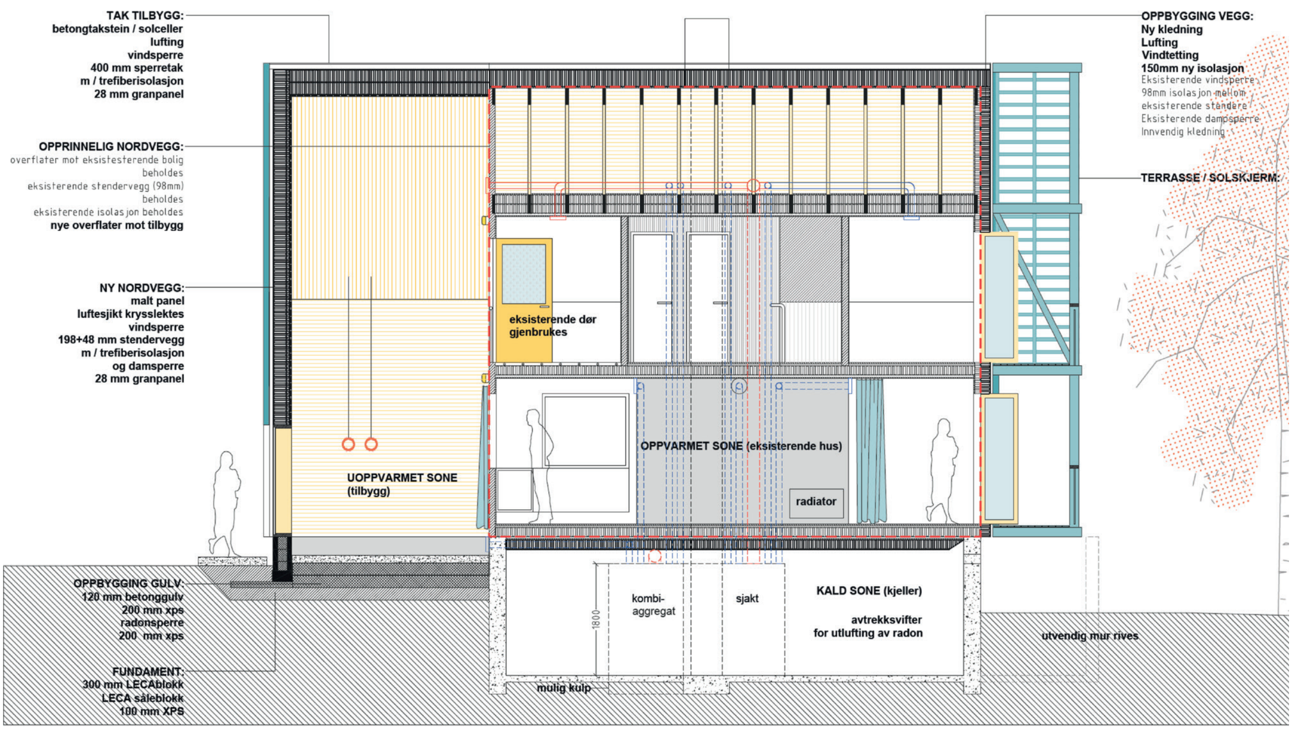
NYTT BALLROM OG NY ENTRÉ: Hildes krav til mål for ballspill (rødt)





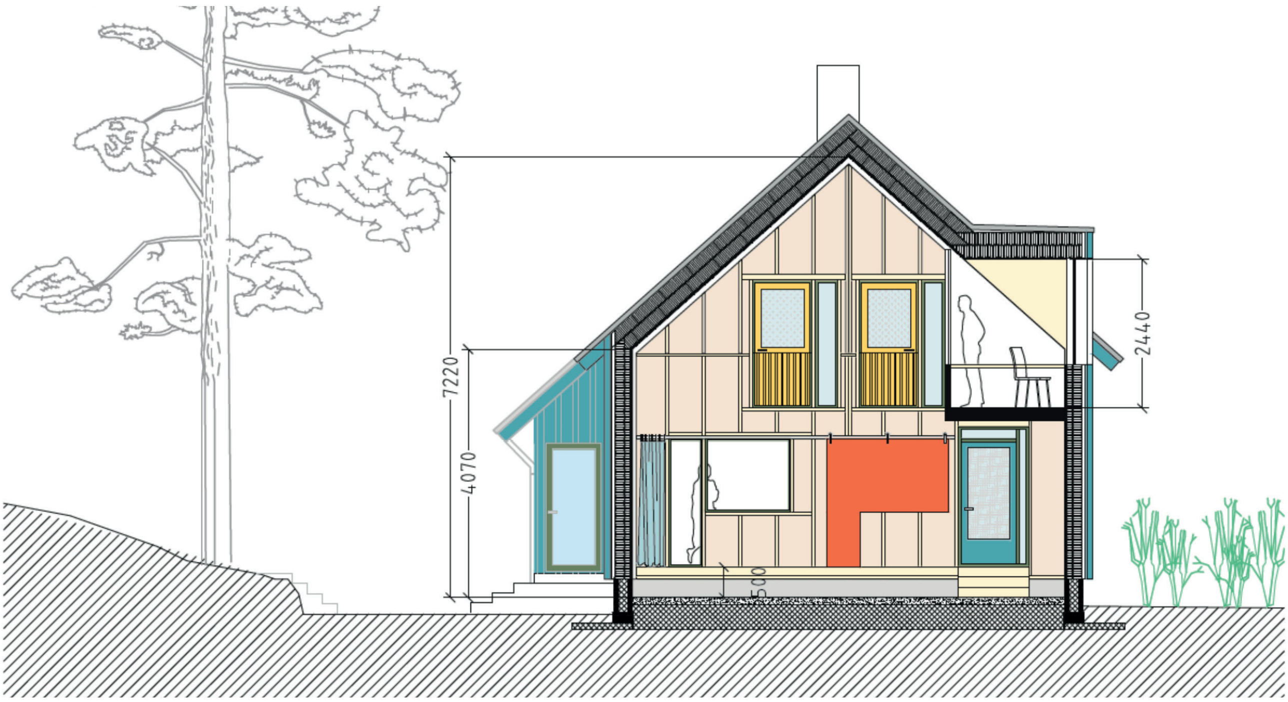


ENERGITILTAK MOT KALD NORDSIDE ER BESKYTTENDE TILBYGG, ENERGITILTAK MOT VARM SYDSIDE ER ÅPEN FASADE MED SOLSKJERM



Døra står på gløtt inn til den lyse og varme stua, oppe på badet bader barnebarnet mens Hilde trener på tennisserven.

Tilbygget er huset forhage, et luftig rom så annerledes enn resten av det kompakte huset. I gavlen er det utsyn til veien i nord.



«EN PLUSS EN... ER TRE» (One plus one... equals three)

KRISTIANSAND 1972

Shared 1st prize

TEAM:

ASKIM/LANTTO ARKITEKTER AS

ASKIM/LANTTO ARKITEKTER AS
TOR ARVID VIK, OSLOMET

Gross Floor Area (GFA): 210 m²
Heated area (HA): 210m² (used in energy estimates)
Delivered energy before and after upgrade: 102/184 kWh/m² (measured) and 84 kWh/m² (local climate)*
Estimated net energy requirement before and after upgrade: 281 kWh/m² and 112 kWh/m²
** Previous and current tenants*

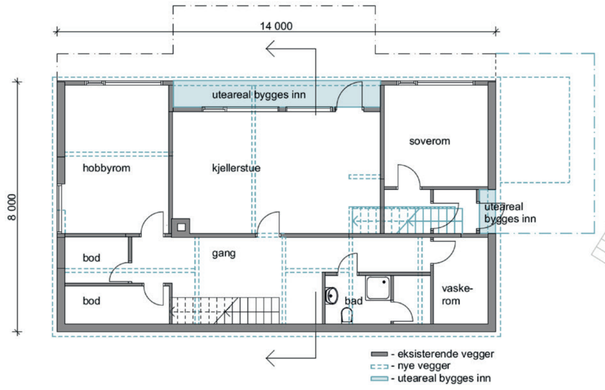
A house type that is found in large numbers and with a view that many would envy is simplified and improved within its existing volume. The use of prefabricated renovation elements may provide potential for fast, simple and cost-effective energy upgrading of the façades.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time

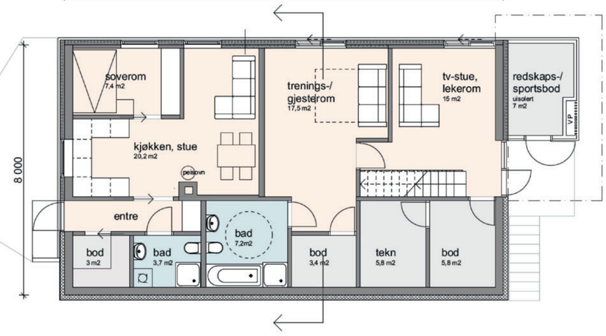
The house is a relatively well-preserved standard house type from the 1970s in an established residential area and with a fine view toward the south-west. The architect's aim was to satisfy the owner's wishes within the existing footprint and volume. The deliberations carried out in this respect are good and the focus is on improving the efficiency within the building envelope in line with rational energy consumption.

The selected energy upgrade concept involves 'filling out' small, recessed areas to create a more compact form, and the installation of prefabricated renovation elements on the outer walls. The result is true to the house's original overall appearance. The jury considers this a good example of a combination of preservation and effective development of a very well-known Norwegian house type.

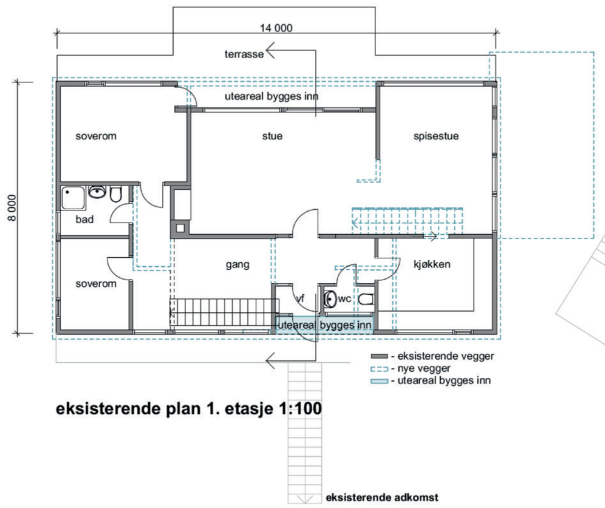
The architect has chosen to modify the original window sizes and locations, to optimise the view and daylight admission. The original house has a good balance between open and closed surfaces and varied daylight access. The horizontal nature of the façade, the variation and articulation are to some extent lost in the proposal. These could have been retained as characteristics typical of the period.



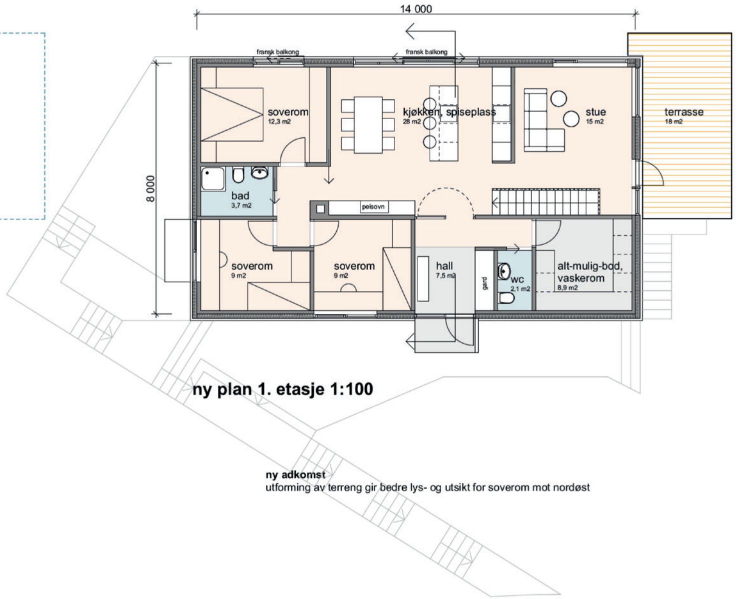
eksisterende plan U etasje 1:100



ny plan U etasje 1:100



eksisterende plan 1. etasje 1:100



ny plan 1. etasje 1:100

High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units
The layouts are arranged in an exemplary manner as regards efficiency of use and satisfy the owner's requirements. The corridor area is incorporated into the living space. Moving the staircase leads to better interconnection between the two floors. The arrangement of the lower floor, with a combined guest room and training room and a new bathroom is an excellent addition to the living quality. Moving the terrace to the gable end is positive with regard to the view and contributes to better daylight access in the long façade. Replacing the balconies with sliding doors with a glass railing in the façade creates new housing quality in warmer weather, blurring the distinction between outdoors and indoors.

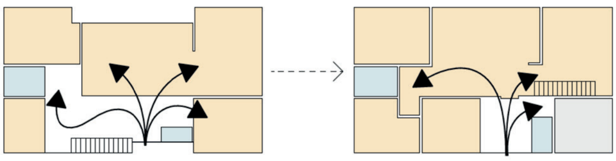
The living unit in the basement is functional and provides flexibility for future variations in use. The arrangement of the new access to the house and basement is effectively dealt with.

The jury would have liked to see that the functional, adapted layout concept also contained an element of surprise in its profile and space use, to satisfy the owner's wish for increased ceiling height in the living spaces.

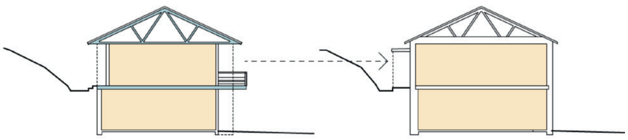
Cost-effective solutions for energy upgrading of the building envelope
The energy upgrade consists of added insulation of the roof, walls and basement walls and floor, as well as new windows.

The total cost of the project is estimated to NOK 3,180,000, not including VAT. Divided by an area of 210 m², this gives NOK 15,130 per m² the cost of the energy upgrade of the existing building envelope is estimated at NOK 688,000 (NOK 3,280/m²). This is a low proportion of the total costs because the difference between necessary maintenance and the energy upgrade has been taken into account. This is a rational and commendable consideration. Control calculations show energy-related costs that are more than twice as high because of the different method of estimation, but these costs are still low in comparison with corresponding energy upgrades in the other projects. This is probably because the prefabricated elements are cheaper than the usual concepts used in the control calculations. The control calculations show 6% higher total costs. A subsidy from Enova will reduce the costs.

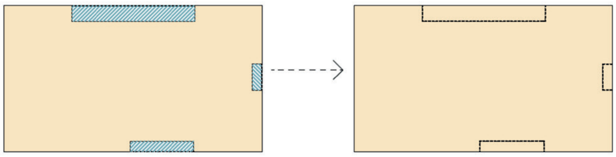
AREAL-EFFEKTIVITET



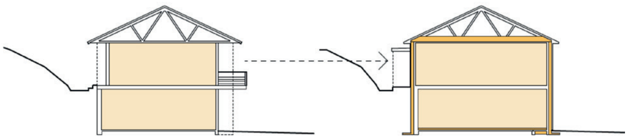
REDUSERE LUFTLEKKASJE / KULDEBRO



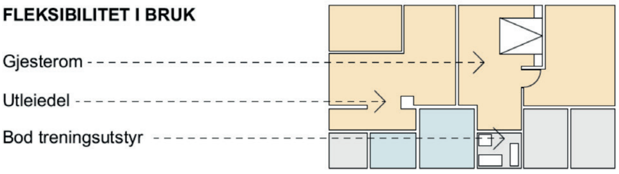
KOMPAKT BYGNINGSFORM

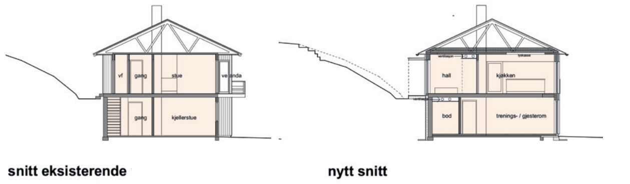


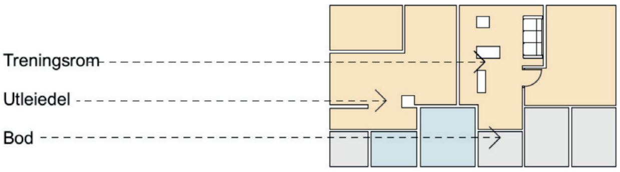
REHABILITERING / ENERGIOPPGRADERING



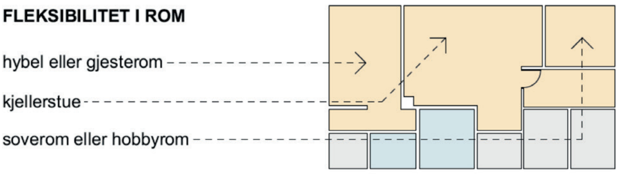
FLEKSIBILITET I BRUK







FLEKSIBILITET I ROM



Kostnader og energibesparelse pr. tiltak:

Tabell: Kostnader og lønnsomhet oppgradering pr. tiltak

Energitiltak		Levert energi	Energi spart	Kostnad			Kostnad energirelatert		
		[kWh/m²]	[kWh/m²]	[kr]	[kr/m²]	[kr/kWh]	[kr]	[kr/m²]	[kr/kWh]
0	Før tiltak	245							
1	Bygningsform	220	25	107000	507	20	86000	408	16
2	Vinduer og ytterdører	191	29	248000	1175	41	56000	265	9
3	Yttervegger*	175	16	399000	1891	118	175000	829	52
4	Grunnmur	144	31	177000	839	27	29000	137	4
5	Tak	133	11	225000	1066	97	33000	156	14
6	Kjellergulv	119	14	132000	626	45	111000	526	38
7	Balansert ventilasjon	92	27	158000	749	28	138000	654	24
8	Varme	77	15	189000	896	60	60000	284	19
Sum			**168**	**1635000**	**7749**	**46**	**688000**	**3261**	**19**

* Som en forenkling er all energibesparelse fra kuldebroer og infiltrasjon lagt til dette tiltaket.

The building envelope will be upgraded to TEK17 specification. The roof will be fitted with additional insulation in its ceiling and converted to an unventilated, unheated attic, which the jury considers a good, efficient measure. The sloping roof will be lifted by 10 cm so as to reduce the thermal bridge at the rafters. Walls in the main floor and basement will have added insulation in the prefabricated elements. A number of recesses and protrusions will be evened out to create a very efficient, compact climate screen, with a lot of windows facing south-west. An additional 100 mm of insulation will be laid in the basement floor, where there is already 50 mm in the front half of the area. Some heat losses will occur through the floor, but since there is no underfloor heating, this will be moderate. It is difficult to eliminate this loss without breaking up the floor surface. The plan is to modify location and size of many windows, which will involve a lot of additional work on the existing walls. Fitting prefabricated elements can be an effective method of insulation but will call for accurate planning and extensive use of a crane.

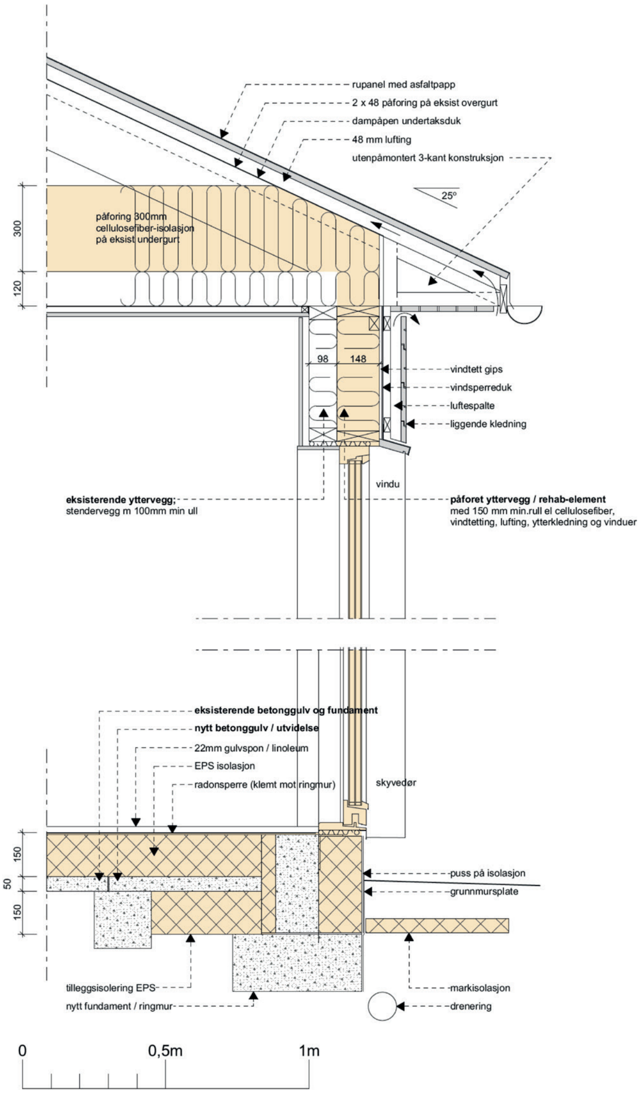
Cost-effective solutions for ventilation and energy production

Heating is based on electrical panel (or ribbed pipe) heaters, heating cables in the bathroom and laundry room, with a wood-burning stove for peak heating demand on the coldest days. Since no major modifications will be made to the floors this will probably be cost-effective but will require slightly higher delivered energy: 84 kWh/m². The plan is to install solar thermal collectors on the south-west facing sloping roof, supplying domestic hot water. This is an energy-efficient arrangement, but in economic terms it depends somewhat on the number of occupants and their hot water requirements. This is one of two projects that do not invest in hydronic heating.

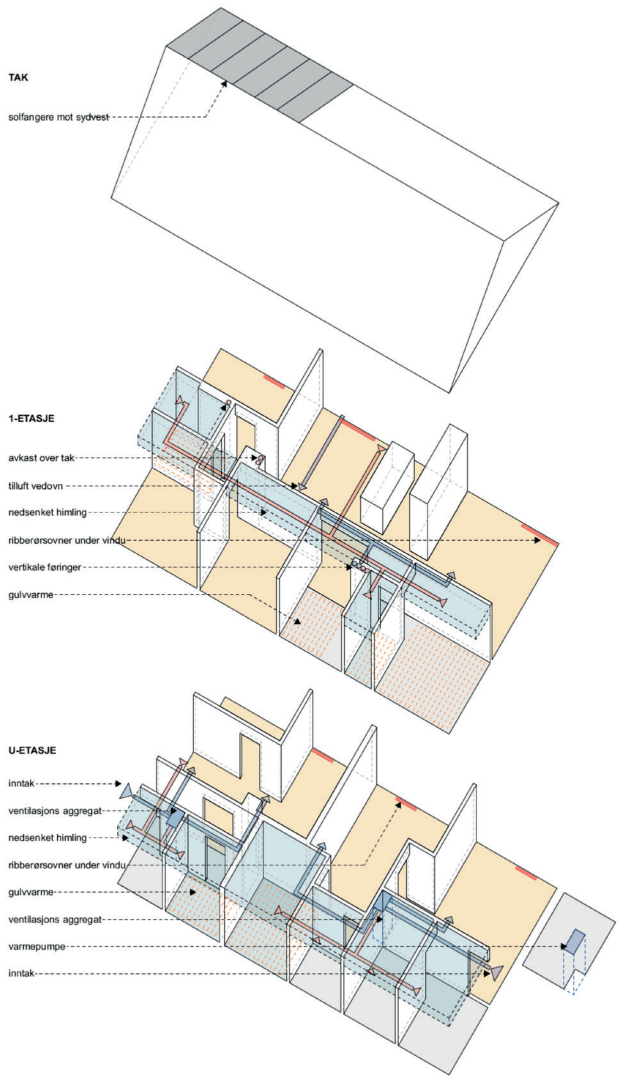
Good thermal comfort and air quality

The plan is to use balanced ventilation with heat recovery, with a simple duct installation on the warm side. The master bedroom is not included in the balanced ventilation system but relies on window ventilation. This will ensure significantly lower room temperature, as desired by the occupants. A separate unit for the rental section enables individual adjustment of supply air temperature and air flow. There are extensive window surfaces facing south-east and south-west and exterior fabric sunshades are described. Simulation demonstrates acceptable thermal conditions. None of the bedrooms receive evening sunshine.

detaljsnitt yttervegg 1:10



konseptskisse energi og ventilasjon



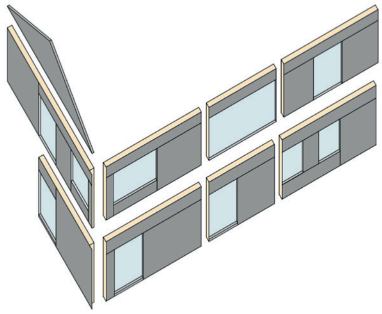
Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
Emphasis has been placed on retaining the existing appearance while improving functionality and flexibility. Retaining building elements such as roof structure, parquet floors and interior walls reduces materials consumption. The use of temperature zones results in shorter ventilation ducts and satisfies the wishes of the occupants. The overall carbon footprint is above average, but the large floor area and large number of bedrooms (6) mean that it is lower in terms of per m²*year and per bedroom.

Degree of internal and external transformation that shows appropriate solutions with minimal use of resources
The owner's wishes have been satisfied within the existing building envelope without the need for extensions, eliminating the need for resources for such work. A new, more open layout has been achieved without demolishing many of the existing interior walls. Relocating the staircase is a good initiative that provides better functionality and communication between the floors. Relocating the kitchen and creating a new, large bathroom in the basement is expensive but is considered to be correct prioritisation of investment. The same applies to the establishment of a separate living unit with new wet rooms for rental purposes in the basement.

The use of prefabricated renovation elements is an interesting contribution to the competition, as it suggests future potential for a more industrialised building process, also for renovation projects. To date this has not become normal practice in connection with the renovation of homes. The fact that the elements have different window openings than the existing façades means that widespread reconstruction of the existing studding becomes necessary.

GJENBRUK OG TRANSFORMASJON

Det er god ressursbruk å transformere boligen innenfor eksisterende fotavtrykk og hovedform. Husets bevarer sin karakter og alle primær-konstruksjoner gjenbrukes. Arkitekturen videreføres i et mer moderne uttrykk som samspiller med husets tidstypiske trekk.

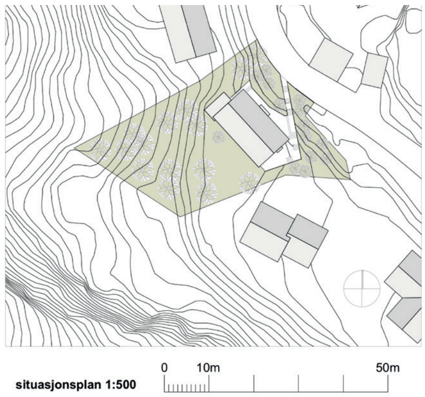


PRINSIPP REHAB-ELEMENTER (nordvest / sørvest)

Elementer leveres på byggeplass med 150mm isolasjon, vindtetting, lufting, trekledning og vinduer ferdig montert.

TERRASSE OG REDSKAPS- / SPORTSBOD

Terrassen er solrik og har fin utsikt mot sør, vest og nordvest. Den er trukket rundt hjørnet ved gavlen slik at bygningskroppen skjermer uteplassen for fremherskende vindretning.
Terrassen er bygget med redskaps- / sportsbod på bakkeplan. Dette er en uisolert, selvbærende konstruksjon utenfor husets klimasone.



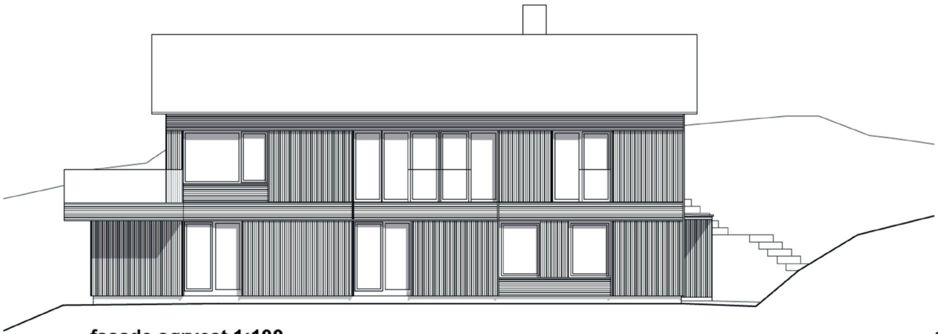
situasjonsplan 1:500

STUE MED UTGANG TIL TERRASSE

Rommet har en åpenhet mot utsikten og utgang til terrassen.
Eksisterende trapp gjenbrukes og pusses opp med et nytt visuelt uttrykk. Tilpasning mot nytt kjellergulv gjøres ved at nederste trinn formes som et bredere repos.
Rehabilitering av interiørene kan ha variasjon av ulike overflater. Det tenkes malte flater, finer eller tre-kledninger og tapet - f eks naturfarget strie. Dette kan gi kvaliteter med egenart som samspiller med husets karakter og gjør det mulig til å beholde eksisterende plate-kledninger.

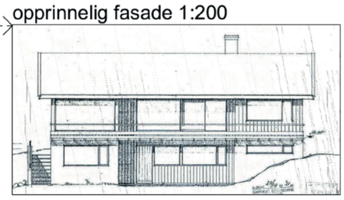
ÅPEN KJØKKENLØSNING / SPISEPLASS

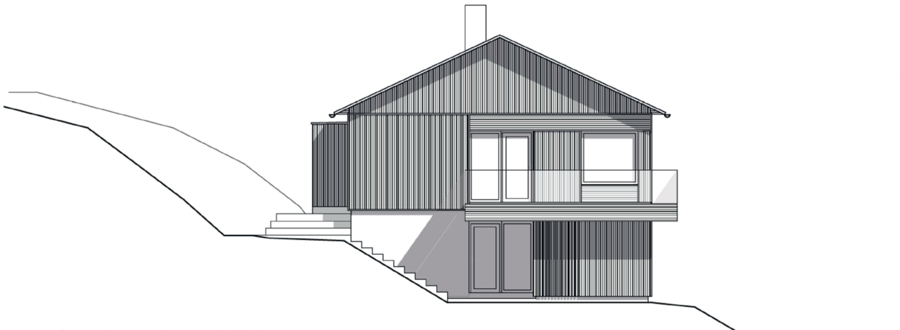
Skyvedører med fransk balkong ved spiseplass og kjøkken-øy. Veggkledning av finer eller treverk opp til overkant skyvedør og vinduer gir opplevelse av større takhøyde. Lyskasser i himling med opakt glass og dagslys-armatur gir en letthet i rommet.



fasade sørvest 1:100

opprinnelig fasade 1:200





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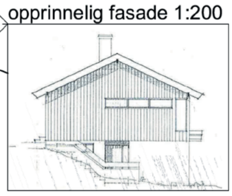
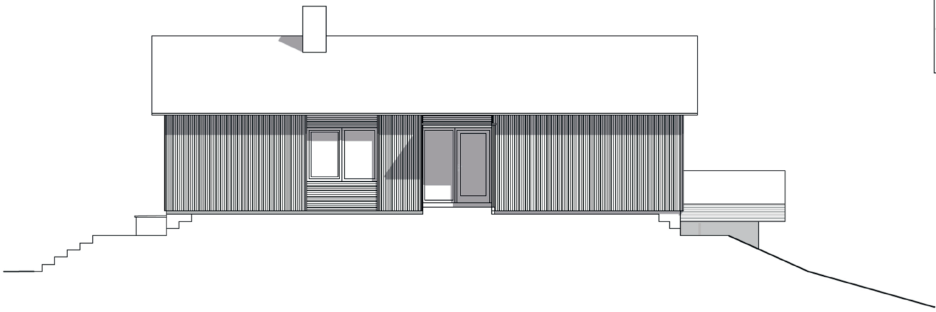
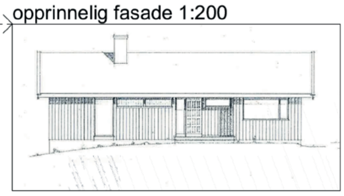
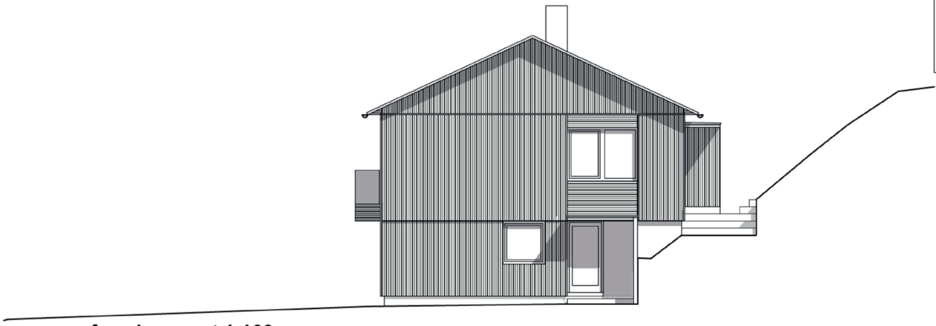




fasade nordøst 1:100

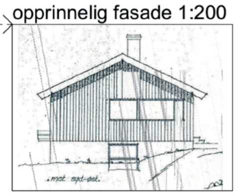
opprinnelig fasade 1:200

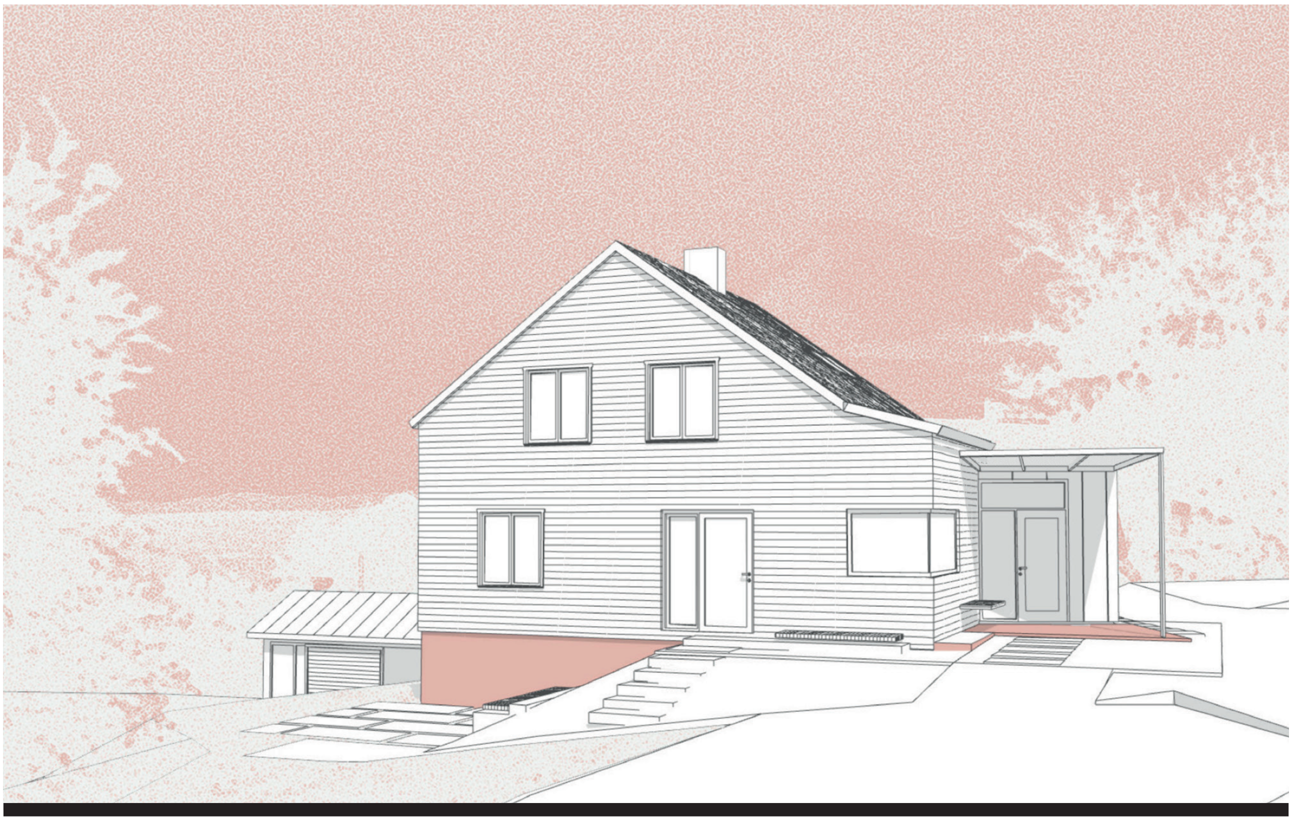




fasade sørøst 1:100

opprinnelig fasade 1:200





«HUS I HAGE» (House in a garden – version 2.0)

MALVIK 1957

TEAM:

ARKITEKTBRYGGA

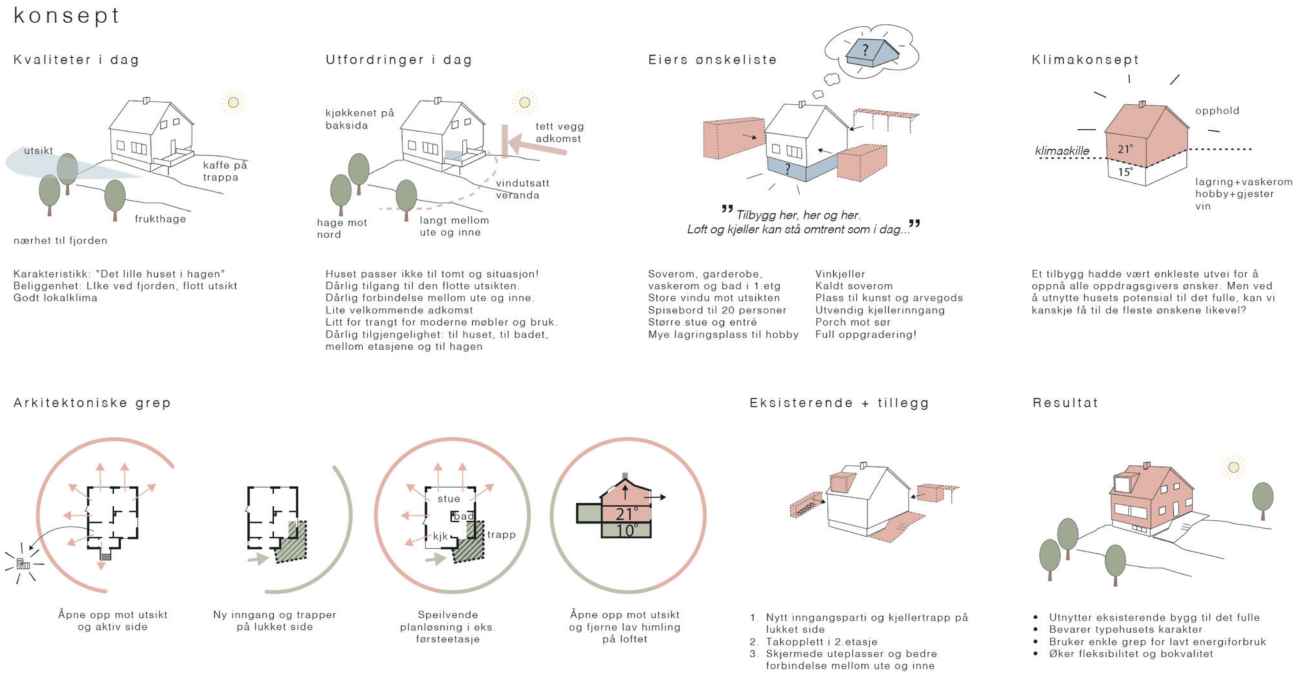
BJØRKE ARKITEKTUR AS
FASTING ARKITEKTER AS
RF ARKITEKTUR
BYGGMESTER HANS HELSETH AS
RAMBØLL TRONDHEIM

Gross Floor Area (GFA): 197 m² including basement, 62 m² and extension 24 m²
Heated area (HA): 127m² (used in energy estimates)
Delivered energy before and after upgrade: 76 kWh/m² (local climate)
Estimated net energy requirement before and after upgrade: 183 kWh/m² and 118 kWh/m²

The project takes its cue from the challenges often seen for catalogue houses in relation to its adaptation to the site. The architects take effective measures to improve the layout to correspond better with its location.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time
The project is based on Type House 5 from the Norwegian Housing Directorate's standard house drawings. It is a three-bedroomed family home with a GFA of 100 m². The design of the house is modest, with a rectangular layout and a central chimney. As is the case with most standard houses, it is not adapted to its actual situation and therefore does not make particular use of the potential and qualities of the site. The architects have produced a good analysis of the qualities of the site and revealed potential improvements for the house. The view, communication with the garden and exposure to sunlight have been influential. A new semi air-conditioned entrance hall that connects the unheated basement with the living rooms has been built at the rear of the house. An attractive raised part of the roof with windows faces the sea to enhance the quality of the first floor. Both of these exterior modifications are carried out in such a way that the original character of the house is retained. The entrance hall is designed as a contrasting feature, while the raised roof part appears to be a more natural continuation of the house's character.

High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units
The project makes considerable changes to the layout, which are adapted for a married couple with grown-up children.



The house's living room and kitchen combination is greatly improved and the decrease from three to two bedrooms provides potential for more spacious layout. The view of the sea and access to the garden and other outdoor areas are greatly improved. The staircase has been relocated and space is reserved for a possible future lifting platform. This, in combination with the very roomy porch, raise questions as to whether the layout proposals could have been more effective or whether even more elements of space and surprise could have been given priority.

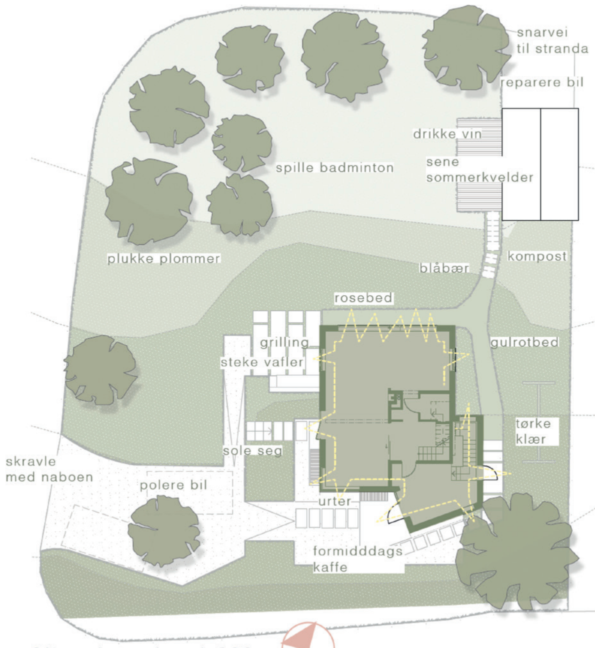
Cost-effective solutions for energy upgrading of the building envelope

The energy upgrade includes replacement of the entire roof structure, with additional insulation, added insulation of walls, new windows and added insulation of the basement.

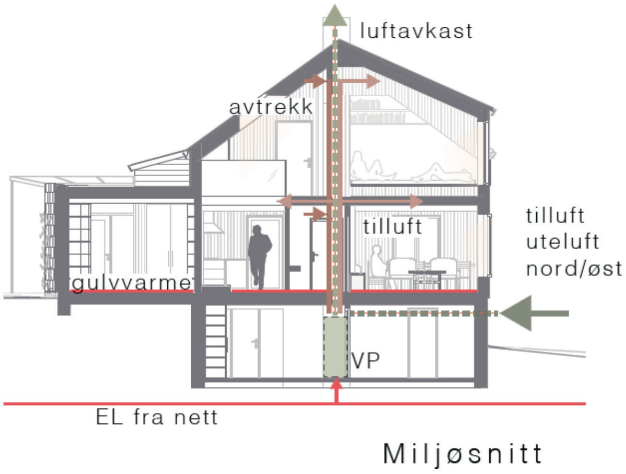
The total cost of the project is estimated to NOK 3,938,500, not including VAT. Divided by an area of 193 m², this gives a cost of NOK 20,400 /m². All three floors are included in the upgrade. The cost of the energy upgrade of the existing building envelope (169 m²) is estimated at NOK 1,396,300 (NOK 8,260 /m²) not including the technical installation work. A subsidy from Enova will reduce the cost. The control calculations of costs show approximately the same cost for the upgrade when technical installation work is included and 5% lower total cost.

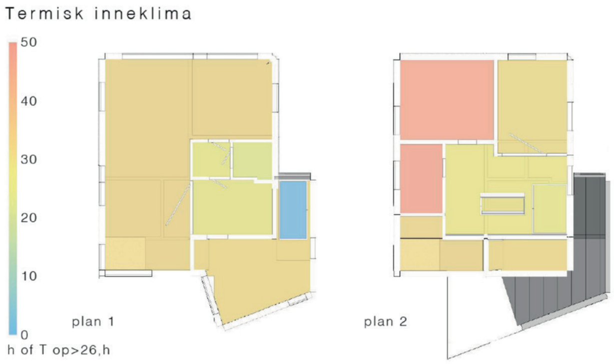
For building parts with added insulation, U-values corresponding to TEK17 level are specified. The concepts are ambitious, involving replacement of both interior and exterior surfaces. The energy estimates presuppose leakage of 0.3 at 50 Pa. The jury considers this to be unrealistic when upgrading such a small house. Using more realistic values of, for example, 1.5, the estimated energy requirement will increase by 5-10%.

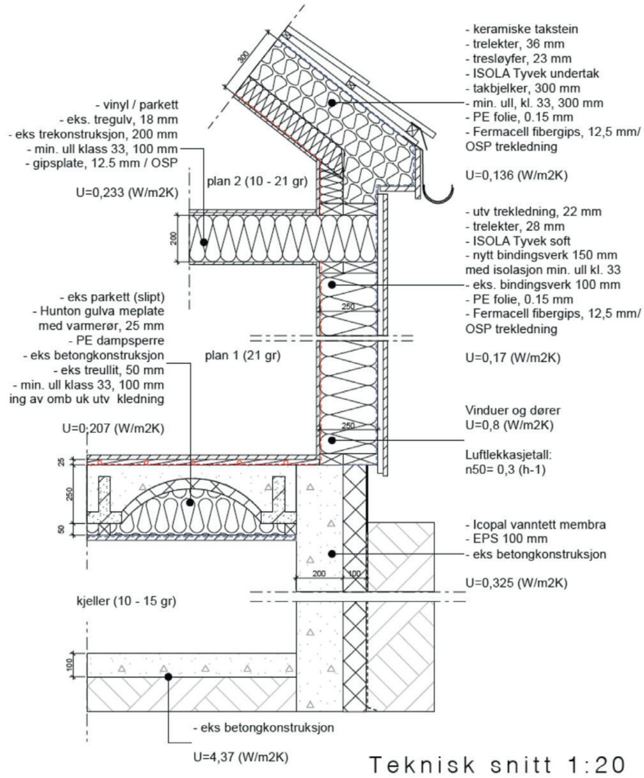
Complete rebuilding of the roof is described. When rebuilding the roof the house is vulnerable to moisture and rain damage in the period when no roof is present. A cost benefit analysis of this work might be desirable, as well as an assessment of raised room height in the upper floor. Several of the work tasks are justified by the argument that the scaffolding will already be in place. This argument may result in an expensive project.



Situasjonsplan 1:200







Cost-effective solutions for ventilation and energy production
Balanced ventilation is planned using a rotary heat recovery unit. In addition, an exhaust air heat pump' is described which will supply heat for both domestic hot water and space heating.

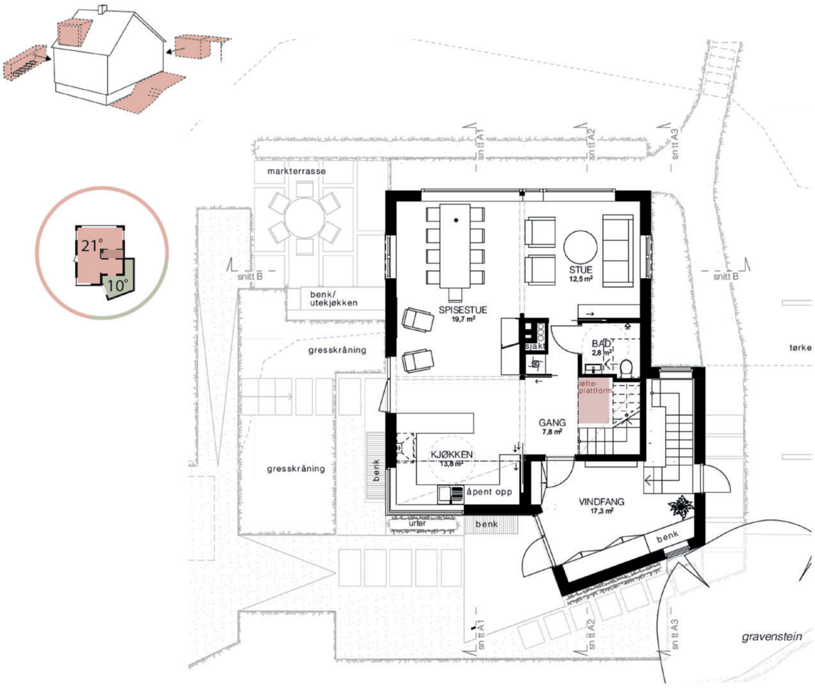
There is no documentation of on how many days per year this will satisfy the heating requirement, but fireplaces on the main floor and in the basement will be used for peak heating demand. Hydronic underfloor heating will be installed in the entrance, living room and two bathrooms, while other rooms will be heated by electric panel heaters when necessary. Ducts will be installed on the warm side of the envelope, in a vertical central shaft and within joist tiers. Details of this are somewhat unclear. The entrance and new basement staircase are defined as a separate heating zone with reduced temperature. In this case, the benefit of installing underfloor heating in the whole of this area is questionable. Solar panels were not considered to be cost-efficient, but the jury could not see that corresponding assessments had been carried out for (for example) hydronic heating or the exhaust air heat pump. In such a small house it is not obvious to invest in hydronic heating since there are fewer square metres over which to divide the cost, and parts of the cost do not increase with increase in area. If the basement is upgraded with water-based underfloor heating in a later building phase, this will of course result in improved overall economy.

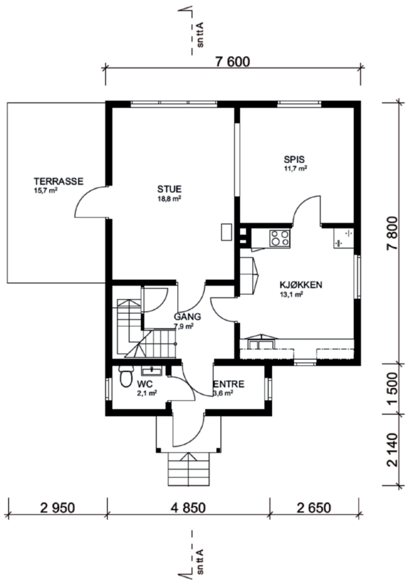
Good thermal comfort and air quality
The need for thermal comfort is effectively met, among other things by the possibility to disconnect the main bedroom from the balanced ventilation system (using a damper) and then using natural ventilation to achieve a cool room. Interior dividing walls will be fitted with additional insulation. The main bedroom receives sunlight in the afternoon and evening, but because the window area is moderate this is not considered to be problematic.

Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
Two principal measures for reducing the energy requirement are upgrading of the building envelope and the use of thermal zones. Another measure is changing the load bearing structure, which makes it possible to improve the layout and obviate the need for extensions. To reduce costs, standard concepts have been chosen for technical systems, while in the case of other materials, products with a low carbon footprint have been selected. There is a description of the potential for reuse of certain types of materials. The total carbon footprint is below average, but this is primarily due to the small size of the house. The house has two bedrooms and division into zones reduces the heated area. With only two bedrooms, the carbon footprint becomes high, both 'per bedroom' and 'per m²*year'.

Degree of internal and external transformation that shows appropriate solutions with minimal use of resources
The project adds a generous entrance which is defined as unheated or semi air-conditioned. The remainder of the home is modified quite extensively to adapt to new usage and new priorities. The project demonstrates attractive qualities and layouts, but the jury questions whether the use of resources is commensurate with what is achieved.

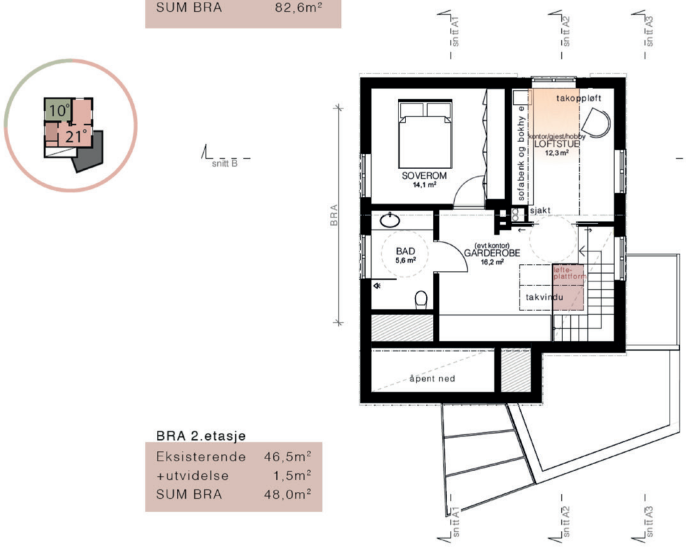
eksisterende situasjon

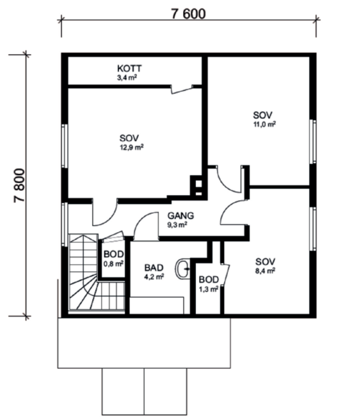




BRA 1.etasje

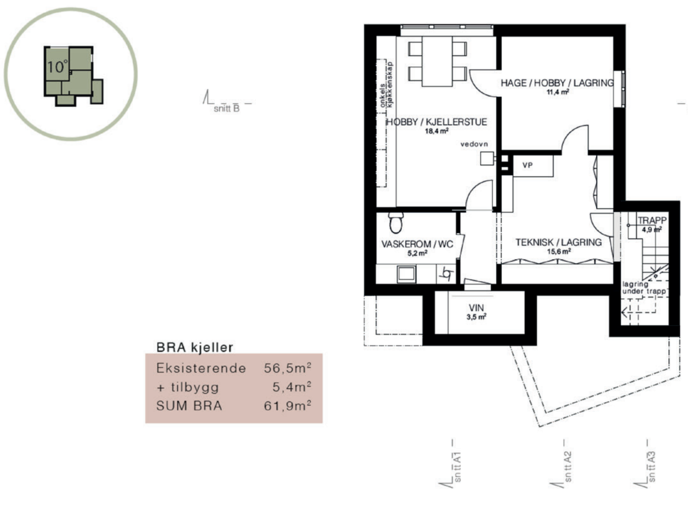
Eksisterende	60,6m²
+ tilbygg	15,0m²
+ overdekt ute	7,0m²
SUM BRA	82,6m²

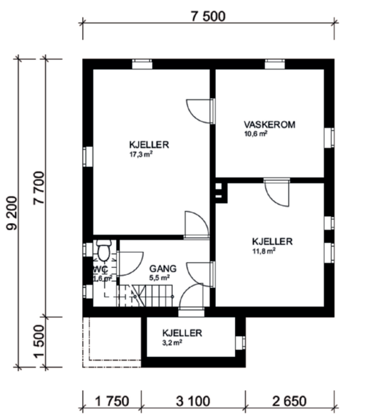




BRA 2.etasje

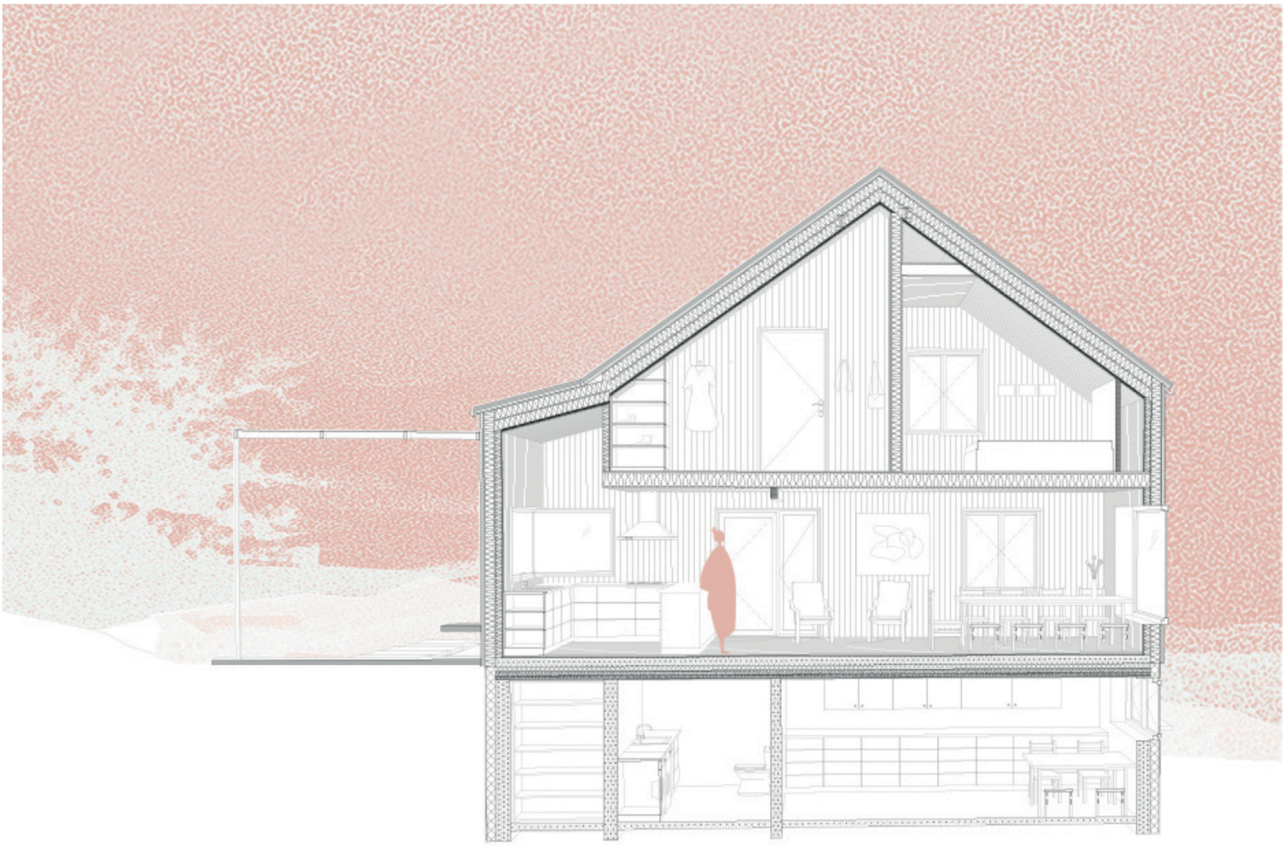
Eksisterende	46,5m²
+utvidelse	1,5m²
SUM BRA	48,0m²



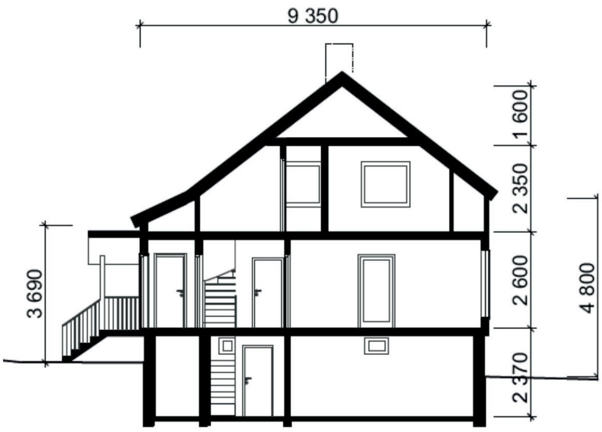


BRA kjeller

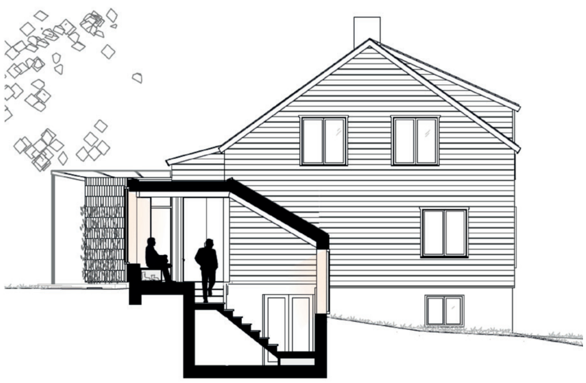
Eksisterende	56,5m²
+ tilbygg	5,4m²
SUM BRA	61,9m²



Interiørperspektiv / snitt A1 (ikke i målestokk)



Snitt A1 - eksisterende



Snitt A3

Snitt B

Snitt A2

Fasade vest

Fasadene er i hovedsak tilbakeført til estetikken i det originale typehus 5. Det gjelder også vindusformater, men hjørnevindu ved kjøkken er et moderne innslag som gir mer lys og kontakt mellom ute og inne. Verandaen fjernes - uteplasser legges mer skjermet på terreng. Hagen kommer tettere inntil huset og blir mer tilgjengelig. Inngangspartiet er mer inviterende - rettet mot adkomsten.

Fasade sør

Nytt tilbygg utformes slik at man får et overdekket uteareal mot sør og sol. Her har det alltid vært et samlingssted i Sjøvegen. Nå er det bedre kontakt og forbindelser mellom ulike ute- og innerom. Vinduet i tilbygget sørger for siktlinje fra boligen til det prisbelønnede Gravenstein-treet.

Hagestue:

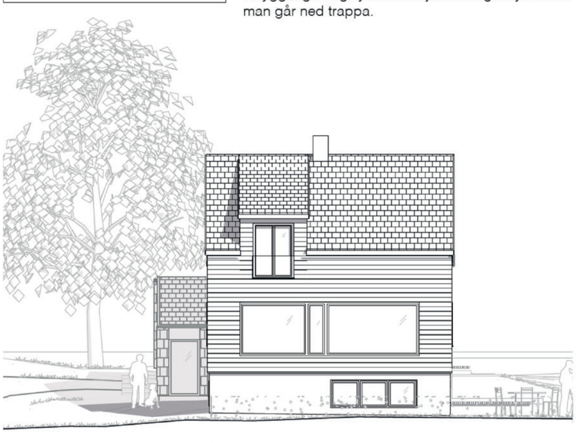
Garasje om vinteren - Sosialt rom om sommeren. Eksisterende stort stuevindu og rester av trekledning blir til skyveporter slik at langsiden kan åpnes. Eksisterende verandagulv flyttes ned hit.

Fasade nord

Hovedfokus for huseierne er utsikten over hagen, fjæra og fjorden, og det store vindusfeltet blir en dramatisk kontrast til de små formatene i huset forøvrig. Vindusfeltet samler fasaden og fungerer som "vektstang" for takopplettet og åpningen til større vindu i kjellerstua. Slik får alle etasjene tak i denne viktige utsikten. Vinduet på nordveggen av tilbygget gir dagslys ned til kjelleren og utsyn mens man går ned trappa.

Fasade øst

Tilbygget er utformet etter innvendig kjellertrapp og følger terrenget. Døra inn til vindfanget gir maksimal fleksibiltiet og tilgjengelighet når turutstyr skal transporteres ut og inn, og blir en kjærkommen snarvei når man skal ut til tørkestativet, grønnsakshage, kompost, garasjen og stranda.



«ÅPENT HUS - TETTE VEGGER» (Open house - sealed walls)

HAMAR 1963

TEAM:

WHITE ARKITEKTER

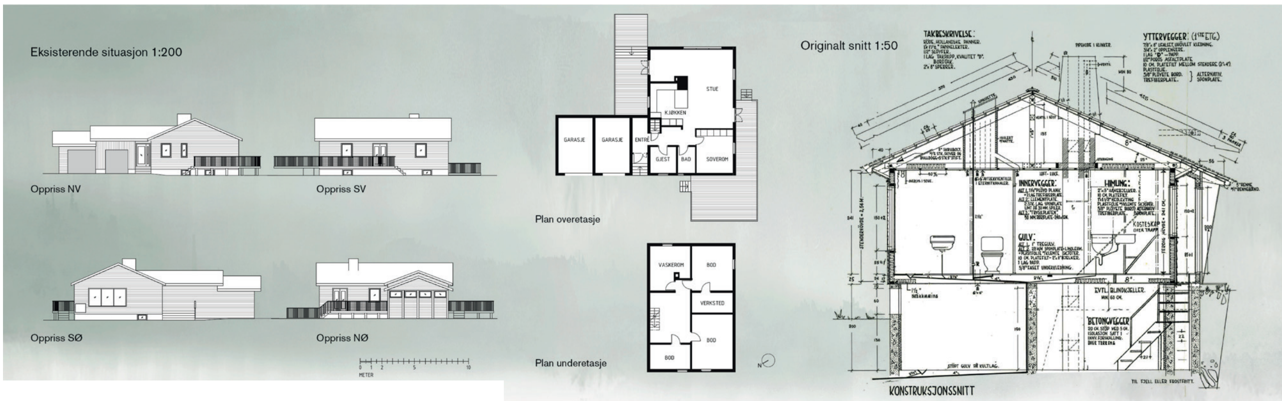
WHITE ARKITEKTER, OSLO
CIT ENERGY MANAGEMENT, GØTEBORG
BYGG1OSLO
NORSK GJENVINNING

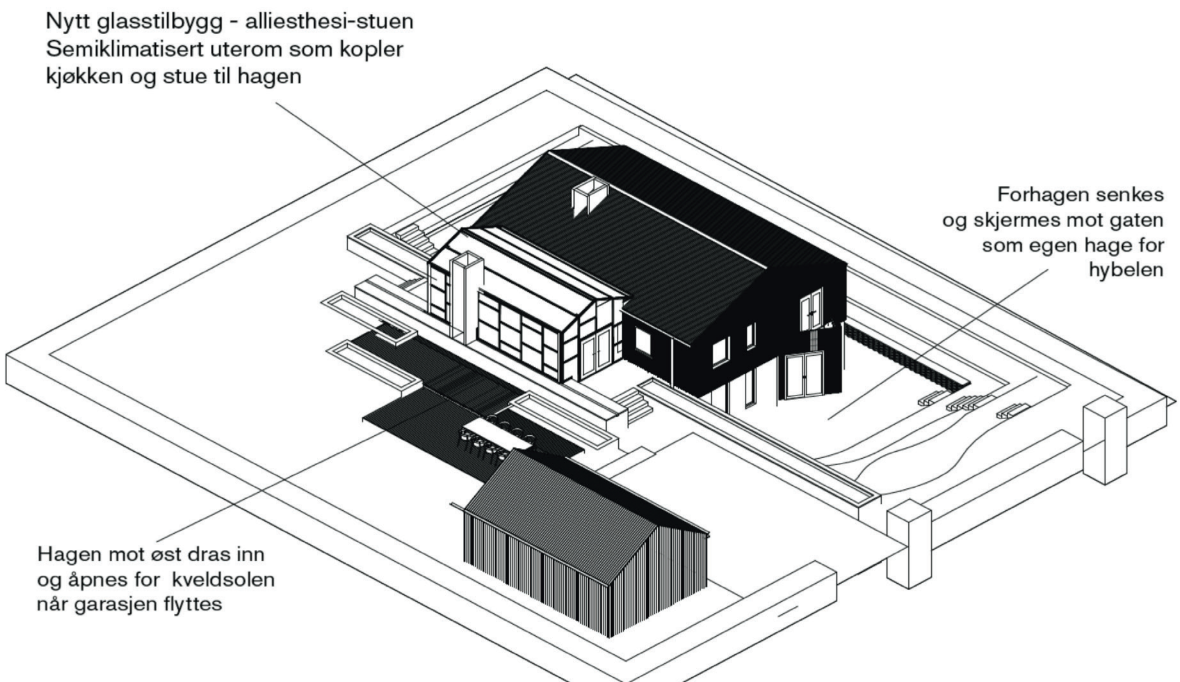
Gross Floor Area (GFA): 176.5 m² (not including the glass structure)
Heated area (HA): 175m² (used in energy estimates)
Delivered energy before and after upgrade: 156 kWh/m² (measured) and 16 kWh/m² (local climate)
Estimated net energy requirement before and after upgrade: 356 kWh/m² and 88 kWh/m²

A common challenge presented by owners requiring further improvements to a house that has already been renovated. The architects have improved the house by adding a room connecting the house with the garden. The new entrance hall will provide new qualities and experiences throughout the year.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time
The project is based on a typical situation: new owners have renovated the building internally, only to discover that it doesn't satisfy their needs. 'Åpent hus – tette vegger' caters to the need for more area by making use of the whole basement as living space, including a rental unit. The rental unit is located on the west side, towards the road. With the exception of the rendered surfaces in the basement, little is left to remind one of the house's characteristics typical of its time. The house appears to be new, and the solution adopted to make use of the basement is to lower the ground surface on three sides of the building. This provides a 'lower' and an 'upper' garden.

The garage is moved to a better location on the site and a glazed extension is added which functions as an entrance hall, and as living space when the climate permits this use. The proportions of the house, the glazed extension and the garage are well harmonised. In combination they create a sheltered outdoor area for the main part of the home. The glazed extension forms a transition between being indoors and outdoors and becomes an effective new feature.





Ny situasjon aksonometri

The jury would have liked to have seen a more varied treatment of the terrain in which the mass balance of the property could have been developed as a theme. A sunken garden, as proposed by the architects, will entail both aesthetic and technical challenges. This will also be an arrangement that may present conflicts with local building regulations if we view the project in a wider context.

High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units

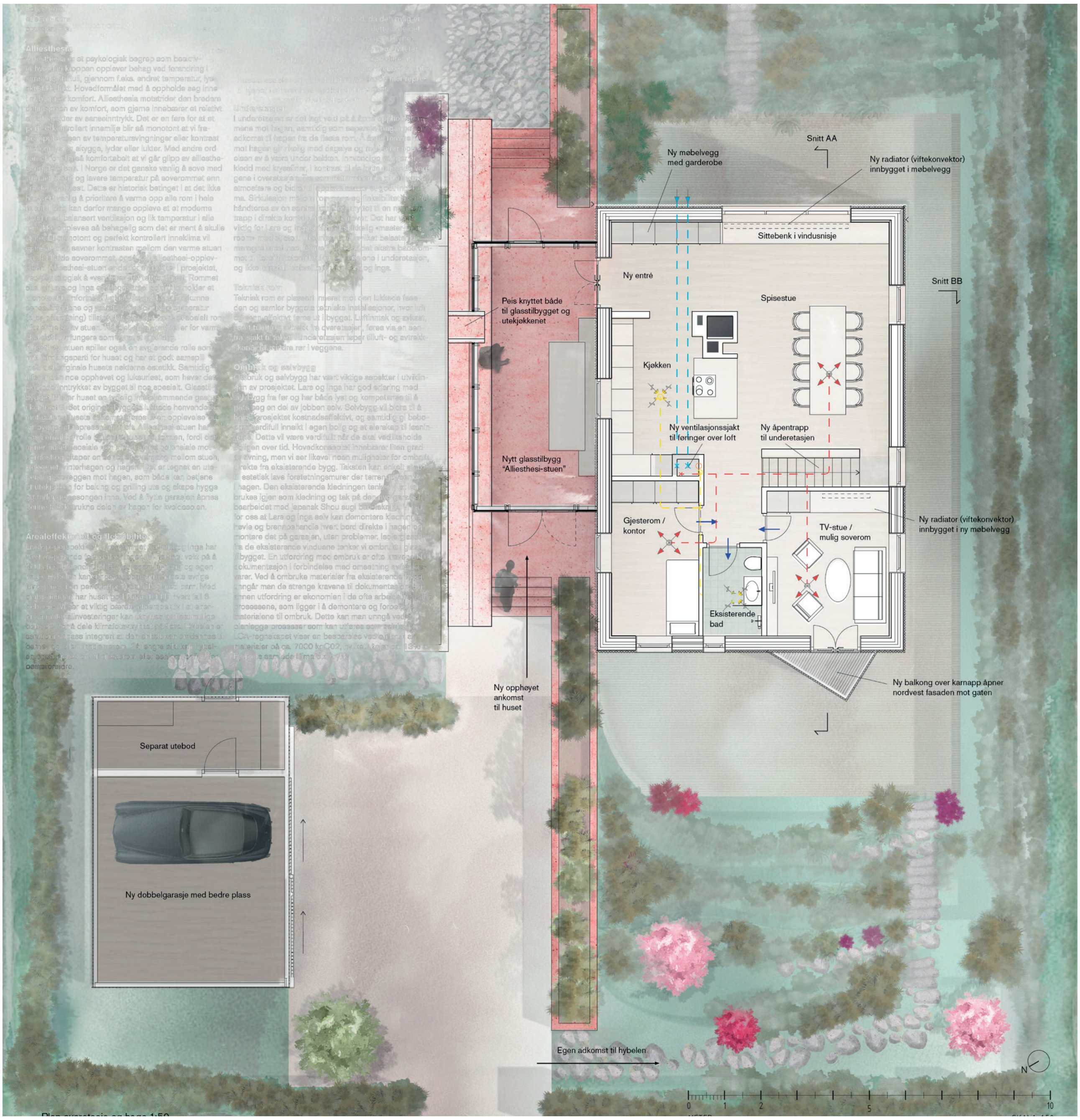
The most significant feature – the division of the outdoor areas – is clearly defined and will provide sheltered, private areas for both residential units. A low wall with associated vegetation leads from the street to the stairs and the entrance hall. The fact that the glass structure (conservatory) is the entrance hall becomes obvious mainly as a result of the treatment of the outdoor areas. The glass structure functions as a transition zone between the house and the garden while also serving to separate the garden behind the house from the road. This is a very effective concept. The fireplace in the glass structure also faces the garden to the north.

The ground floor layout has been as far as possible left unchanged, so as to avoid unnecessary costs, since this section has already been renovated by the owners. The living room in the existing house is towards the east, while the bedroom and TV room face west toward the afternoon sun. This does not seem entirely successful, and the jury feels that the architects ought to have addressed this better.

In the basement the main bedroom faces east, which is more appropriate. The rental unit is small, and its windows face south and west. More variation in the distribution of daylight in this house would have improved the project. This area will receive a lot heat from the sun during the summer and the jury questions the resulting living quality for any of these concepts. The sunken garden will also result in less circulation of the outdoor air.

Cost-effective solutions for energy upgrading of the building envelope

The energy upgrade consists of added insulation of the unheated loft, added insulation of existing walls and new windows on the main floor, and added insulation and new windows in the basement. The basement floor will be excavated to increase ceiling height and add insulation in the floor.

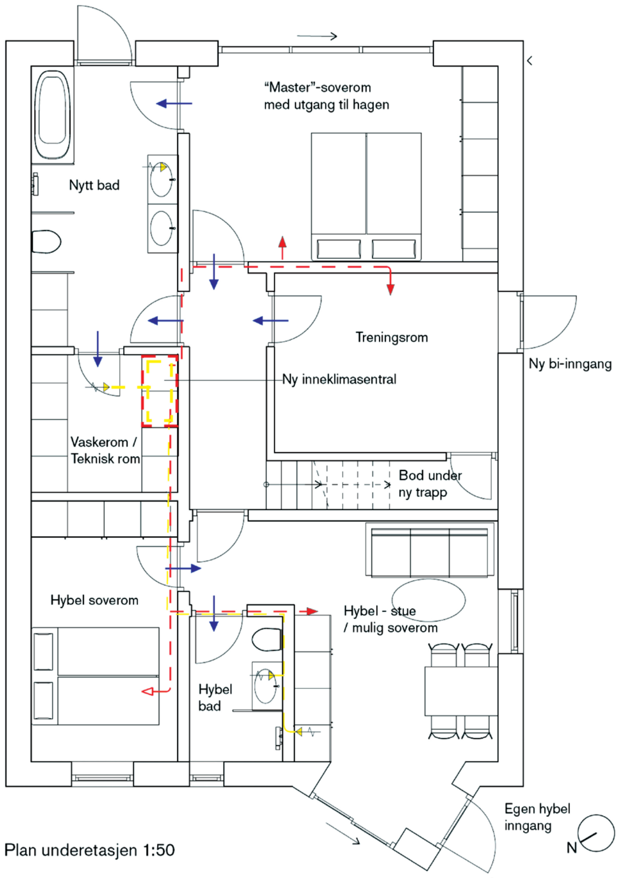


The total cost of the project is estimated to NOK 5,095,000, not including VAT. Divided by an area of 175 m², this gives a cost of NOK 29,100 per m². This is expensive, but the cost includes the glass structure whose area is not included in the calculation. The cost of the energy upgrade of the existing building envelope is calculated as NOK 2,455,000 (NOK 14,000/m²). A subsidy from Enova is estimated to NOK 185,000, which will reduce the cost of the energy upgrade by NOK 1,060 per m². Control calculations show 4% lower total costs and 26% lower costs for the energy upgrade. They also show that the cost of the energy upgrade amounts to less than 50% of the total cost.

The project represents an ambitious upgrade of the building envelope, somewhat exceeding TEK17 specifications. A somewhat unusual solution has been chosen for the outer walls, with partially continuous insulation in a double-wall construction. Other methods would probably be more efficient. The existing solution with a ventilated attic is retained. A more advantageous solution wouldhave been to convert this to an unventilated attic with a vapour open underlayer roof. This would result in a compact building envelope with low heat loss.

No mention is made of measures to be carried out in connection with the terrain modification close to the house in order to prevent water penetration in case of heavy rainfall. The terrain modification is substantial and calls for effective measures to deal with surface water and snow.

The unheated glass structure will to a varying degree maintain a higher temperature than ambient temperature and will function as a thermal buffer. This is most of the time a nice quality that will provide a longer 'outdoor season' in the cold climate typical of Hamar. With only sporadic use of the wood stove, the room is a positive energy contributor, but if it were to be kept continuously heated this would significantly increase the energy consumption. The glazed structure is located on the north side of the house and a study of the solar radiation would have provided more information about the benefits of building this structure: specifically, the number of days with sufficient sunshine to provide a comfortable temperature, and any days with excessive temperature. The selected concept, with the roof of the glass structure extending half a metre into the main roof, may entail additional costs and technical complications.



Plan underetasjen 1:50

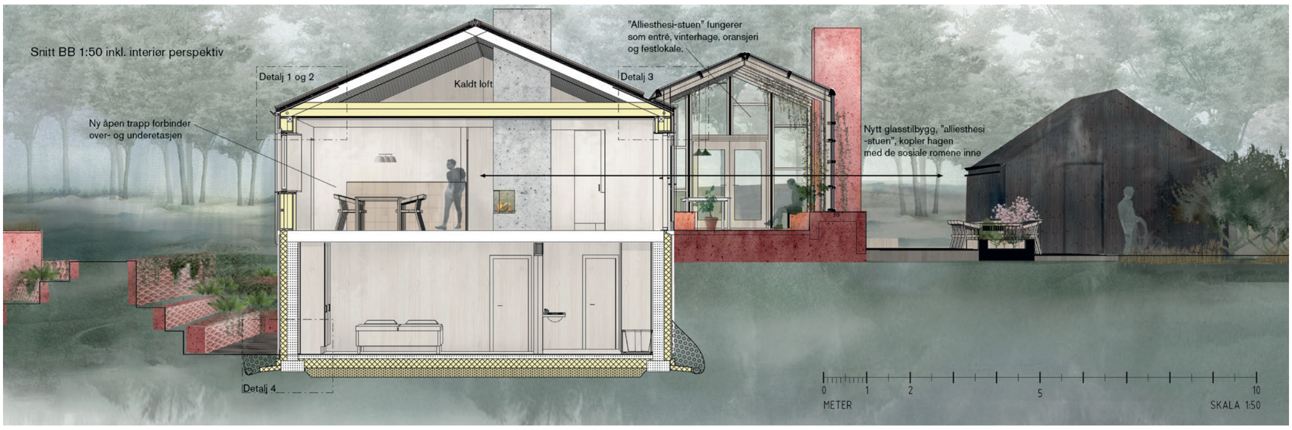
Cost-effective solutions for ventilation and energy production
The concept includes a compact heat pump unit, containing balanced ventilation with heat recovery, as well as an exhaust air heat pump, such as Flexit Econordic WH4. The planned duct installation with a central shaft and ducts in the unheated attic looks reasonable. The exhaust air heat pump in the exhaust air (utilising additional outside air if necessary) provides heat for tap water and space heating. Heat distribution is provided by two fan convectors (in the upstairs living room and TV room), which are shown built into the furniture. In addition, hydronic underfloor heating is fitted in the basement. The estimated delivered energy consumption without solar panels is as low as 61 kWh/m². This is partly the result of investment in hydronic heating and an efficient heat pump. When including 40 m² of solar panels mounted on the sloping roof facing south-southeast, the estimated supplied energy becomes as low as 15.1 kWh/m².

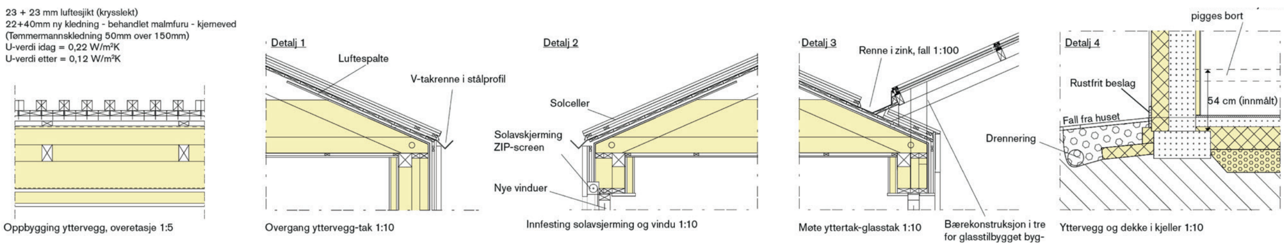
Good thermal comfort and air quality
The proposal includes a description of different temperature zones, but these are only to a limited extent achieved in practice: the one-zone balanced cascade ventilation system transfers heat from the warmest rooms to the coldest. Neither is there a separate air handling unit serving the rental section that permits separate adjustment. If one were to pursue a strategy based on different temperature zones, the underfloor heating in the bedrooms could be omitted. Two bedrooms are exposed to afternoon and evening sunshine, but since the window areas are moderate, excessive temperature is unlikely to be a problem.

Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
The principal modification involves using the existing volume in combination with a glazed extension. The use of existing volume will result in reduced materials consumption but lowering the floor in the basement will involve energy consumption at the building site. This is not included in the carbon footprint as calculated in the OPPTRE project. The glazed extension amounts to about one fifth of the carbon footprint, but the intended reuse of glass may reduce this figure. However, there are no actual sketches or descriptions to substantiate this. The same applies to the reuse of concrete roof tiles in garden walls and terraces. The home is flexible in use, with the possibility of increasing the number of bedrooms in the main house by making use of the rental flat. The carbon footprint is not among the highest or lowest, though in terms of m²*year it is relatively high. This is, among other things, because the area of the glazed extension is not heated. Solar panels have also been incorporated to produce renewable energy. Both financially and for the carbon footprint, these provide gains. It should be mentioned that the improvement of the carbon footprint will take 52 years to be realised, since OPPTRE has chosen to use the Norwegian CO2 factor for electricity, which results in a long payback period).

Degree of internal and external transformation that shows appropriate solutions with minimal use of resources
The glazed extension introduces a supplementary space which will give the impression of living in a house with new qualities. Instead of changing the previously renovated ground floor, the architects have added a room that represents something different. A place that is neither indoors nor outdoors. The act of adding a new quality without changing the already renovated areas on the ground floor seems sensible. Glass is a resource-demanding material but seen in relation to the reduced need for modifications of the existing floor, the jury feels that its use can be justified.

The jury is sceptical regarding the large-scale excavations proposed to achieve step-free access from the basement level to the outdoor area. Clearly it is positive for the project to make use of these areas as living space, but the relationship with the garden and outdoor areas would have benefited from a more cautious approach. Demolishing and moving the garage is considered a very sensible step.





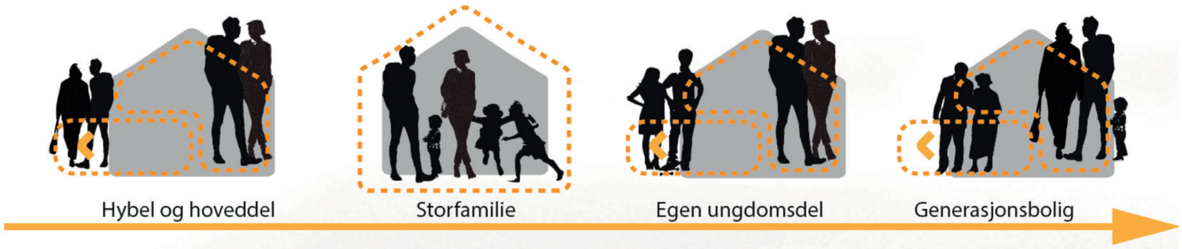
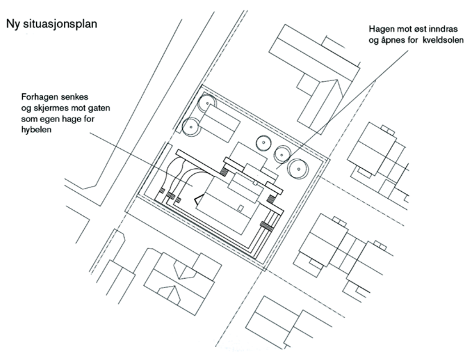
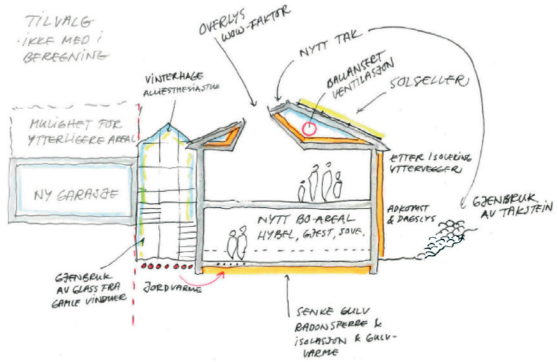
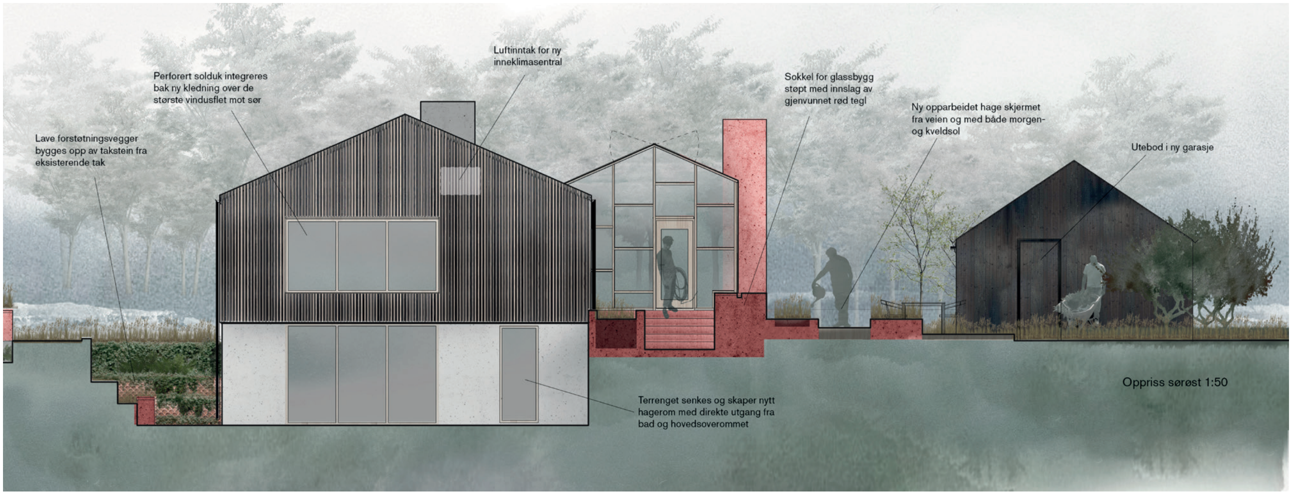


Diagram - fleksibilitet i et livsløpsperspektiv






Luftinntak for ny
inneklimasentral
Perforert solduk integreres
bak ny kledning over de
største vindusflet mot sør
Sokkel for glassbygg
støpt med innslag av
gjenvunnet rød tegl
Ny opparbeidet hage skjermet
fra veien og med både morgen-
og kveldsol
Lave forstøtningsvegger
bygges opp av takstein fra
eksisterende tak
Utebod i ny garasje
Terrenget senkes og skaper nytt
hagerom med direkte utgang fra
bad og hovedsoverommet
Oppriss sørøst 1:50


Nytt glasstilbygg - alliesthesi-stuen
Semiklimatisert uterom som kobler
kjøkken og stue til hagen
Ny peis og utekjøkken
Ny vindusåpning i
fasaden
Sokkel for glassbygg, støpt
med innslag av gjenvunnet
rød tegl
Adkomsten formaliseres og gjøres
til en opplevelse gjennom det nye
glasstilbygget
Oppriss nordøst 1:50


Ny hovedadkomst gjennom
det nye glasstilbygget
Ny garasje og utebod
plassert mot gaten, for
å åpne for kveldssol i hagen
Kledning av gjenvunnet
panel fra eksisternde bygg.
Shou sugi ban - brent
overflatebehandling
Ny karnapp med balkong
markerer inngangen til hybelen
i underetasjen og gir utsikt over
den nærliggende
fotballbanen
Egen inngang til hybelen
Oppriss nordvest 1:50
Terrenget senkes og
skaper nytt hagerom for
hybelleiligheten


Eksisterende terrassedør
erstattes av et vindu
Veggåpningen tilpasses.
Ny bi-inngang i
underetasjen
Eksisterende vindusåpnin-
ger bevares generelt.
Vinduene utskiftes
Ny plasering av garasje
gir god orientering for
ekstra solceller på tak
Oppriss sørvest 1:50

«MALVIK 2020»

MALVIK 1989

TEAM:

PIR II

PIR II AS TRONDHEIM
TØMRER OLA RAVN HASSEL
VILL VED

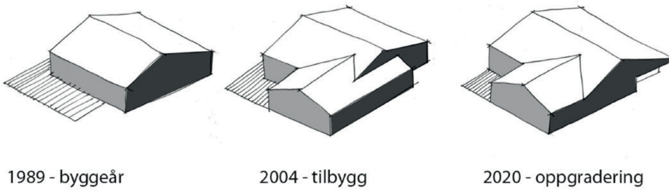
Gross Floor Area (GFA): 287 m²
Heated area (HA): 278 m² (used in energy estimates)
Delivered energy before and after upgrade: 115 kWh/m² (measured) and 120 kWh/m² (local climate)
Estimated net energy requirement before and after upgrade: 202 kWh/m² and 143 kWh/m²

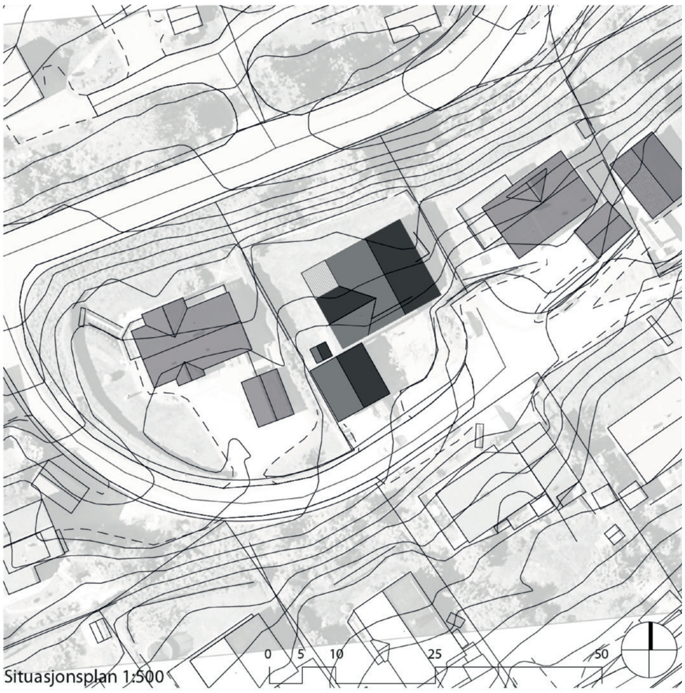
An integrated upgrade that provides good living quality and a simple and harmonious appearance.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time
The house in Malvik is a standard house designed by Selbu Byggtre AS, often referred to as a 'Tyrolean-style house' (Tyrolerhus). The house is located in a north-facing slope, with the gable end and characteristic full-width balconies facing the fjord. A later extension to the south has given the house a slightly more complex form.

The architect has deliberately not tried to preserve the standard house's typical characteristics and what has been described as the 'liberation' of the 1980s and 1990s, and wishes to portray a cleaner expression, removing the eaves and balconies and simplifying the main form. Several excellent interventions have been made to achieve the desired characteristics. The existing north-facing balconies are rarely used and reduce the amount of daylight entering the main living space of the house. Larger window surfaces facing the view and the terrace to the west provide new qualities such as better daylight conditions. Simplification of the main shape provides a new roof-covered entrance area to the south. This expensive modification should have been more effective in providing new qualities to the interior rooms.

Stripping the gable façade and extending the wall panel to the ground changes the character of the house. The original division of the façade by the balconies is lost in favour of the larger north-facing surface. The jury feels that there are good arguments for this choice,





but that it would still have been possible to introduce some elements, such as smaller balconies providing airy sitting areas outside bedrooms, so as to retain an interesting façade. The illustrated variation in panel colours could become less distinct or be painted over in time.

High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units

Moving the existing kitchen is a good measure to define the living zones and create better functionality and flexibility in use. This is an effective response to the houseowner's expressed wishes. Larger window surfaces facing the view and the terrace towards the west improves the living quality significantly in the most important area of the house.

More space for wardrobe and storage area in the entrance hall has been prioritised in response to the needs of the family. The layout could have been optimised by combining the kitchen and the laundry room, which would have improved movement on the main floor. A door between the kitchen and laundry room would be functional and practical. The proposed modification of the bathroom layout should be reconsidered so as to avoid entry directly from the living room. The new access to the bedroom through the living room leads to increased traffic in this area. The extension of the attic over the entrance area provides an additional bedroom, but the area is relatively dark and has limited ceiling height.

The basement is almost unchanged and retains its own spacious living unit. A possible division of the main floor into two units has been illustrated to show how the large house might in the future provide space for more people. Integrated storage furniture as shown in the reference illustrations is an interesting idea that could be developed later in the project. The interior perspective clearly indicates how upgrading interior surfaces in combination with other measures will lead to major improvements in living quality.

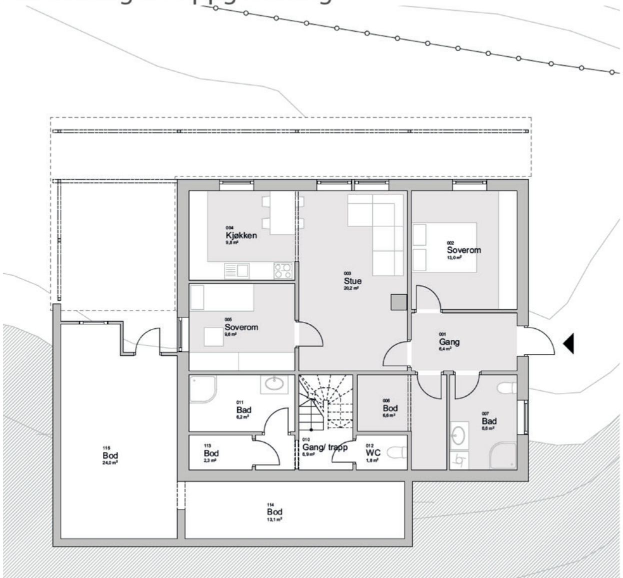
Cost-effective solutions for energy upgrading of the building envelope

The energy upgrade includes added insulation of the outer walls both internally and externally, internal added insulation of the roof and external added insulation of the foundation walls.

The total cost of the project is estimated to NOK 3,375,000, not including VAT. Divided by an area of 278 m², this gives NOK 12,140 per m². The cost of the energy upgrade of the existing building envelope is calculated to NOK 1,128,700 (NOK 4,060/m²). Control calculations show somewhat higher costs: 7% higher total costs and 2% higher for the energy upgrade of the building envelope. A subsidy from Enova will red**uce the cost.**

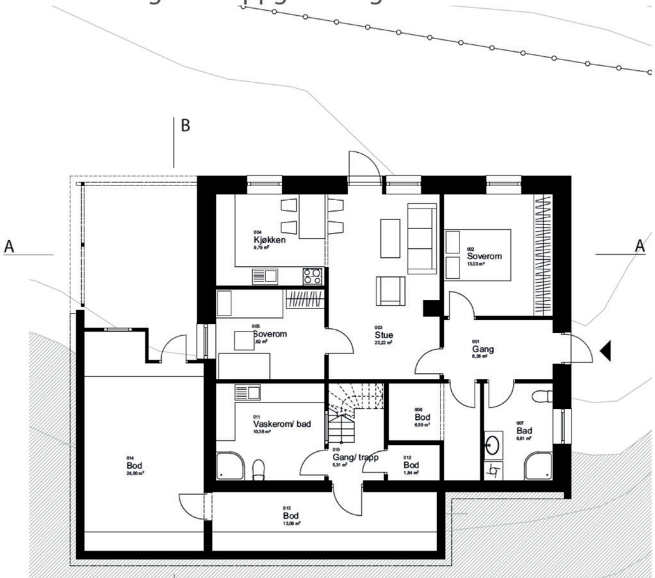
The building envelope will be upgraded close to TEK17 level. Low air infiltration and supplementary insulation of a relatively compact building envelope will result in low heat loss. Improved floor insulation in the habitable basement is not mentioned, and without this, significant heat loss would occur when using electric floor heating. Air change rate of 2.5 h-1 is used for the energy calculations, which may be unnecessarily unambitious. Modifying this to 1.5 will result in a 6-7 per cent increase in estimated energy consumption.

Planløsning før oppgradering



Plan sokkel - før oppgradering
1:100

Planløsning etter oppgradering



Plan sokkel - etter oppgradering
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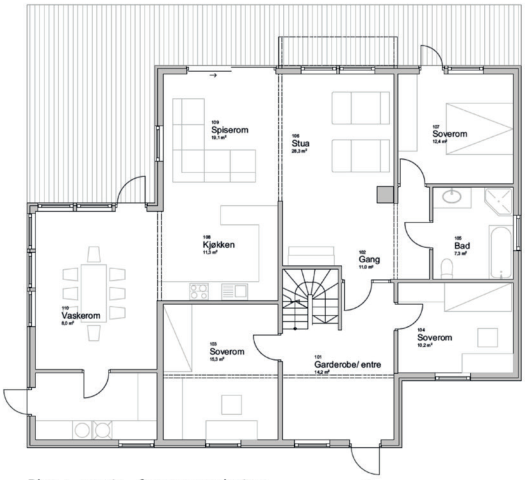
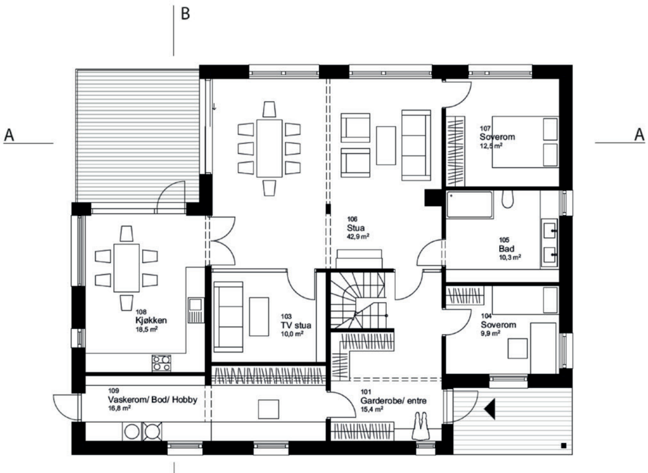
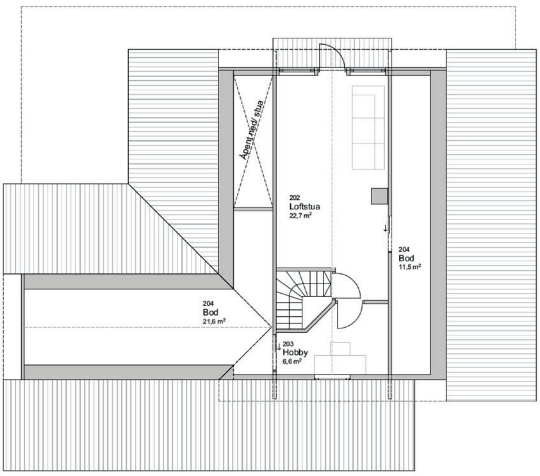


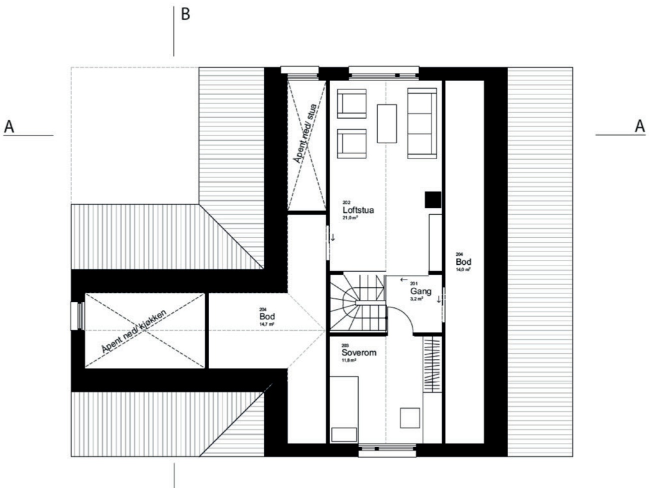
Plan 1. etasje - før oppgradering
1:100



Plan 1. etasje - etter oppgradering
1:100



Plan loft - før oppgradering



Plan loft - etter oppgradering

Adding of insulation both on the interior and exterior side of the construction is an expensive method of improving energy efficiency, and it also results in a lot of replacement of materials, compared with added insulation on the outside alone. The jury assumes that the purpose of adding new battens on the inside of the walls is to accommodate piping for technical installations. As a pure energy-saving measure it would be more cost-effective to increase the amount of insulation on the outside by the same amount and leave the inner walls untouched. Installation of a new vapour barrier shown in detailed plans of the attic crawl-space would seem to be difficult to achieve in practice. Moreover, the ventilation of the roof structure is unclear (there are small, if any, openings in the rafters).

The windows was replaced when the house was upgraded in 2004. . It is questionable whether it is cost-effective to replace them again. In an ideal world the upgrade would take place at the point at which the windows, cladding and heating installation reach the end of their technical lifespan and need to be replaced anyway. The problem is that these events rarely coincide, and sometimes the solution is to make the replacements in several stages (with carefully planned boundaries between different stages).

Cost-effective solutions for ventilation and energy production

Balanced ventilation with efficient heat recovery will be installed throughout the house. Ducts will be laid on the warm side of the envelope and appear to be well organised and efficient. The existing air-to-air heat pump, with an estimated contribution of 25%, will be retained. The project specifies that the existing electric underfloor heating cables will be replaced. In this respect a renewal is affected but the existing technical configuration will be retained, and the house will continue to be rely on direct electric heating. As the under-floor is being replaced and significant modifications are being carried out in the floors, one might have considered installing hydronic heating. At the same time the floor insulation in the habitable basement could have been improved. This would have provided opportunities for using different heat sources. For example, the house could have been equipped with a heat pump providing good distribution of heat throughout the house, which would have been economically beneficial in a house of this size. With an efficient heat pump connected to a water-based heating system (and hot water supply), the delivered energy could have been reduced from 120 kWh/m² to 70-90 kWh/m².

Good thermal comfort and air quality

Electric floor heating provides good thermal comfort. Installation of a ventilation system provides high air quality and a separate unit for the rental section permits individual adjustment of the air supply temperature.

Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)

Carbon and energy issues have been dominant in the design selection from the outset, the principal considerations being to find measures that provide significant effect with the least possible disturbance and to optimise the layout.

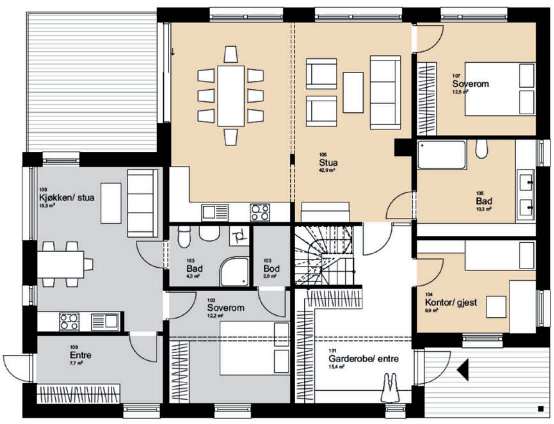
The focus is on low carbon footprint, both during modification work and through the selection of materials. An exception is the windows, where the plan is to replace the ones installed in 2004. These have a significant residual lifetime and early replacement will lead to a somewhat increased carbon footprint. Solar panels were considered but were rejected, partly because of the location and orientation of the house, and partly because the CO_2 factor for electricity supply results in a long payback time. Even with a strong focus on the carbon footprint in the analysis, it is on the high side, both in total, and per bedroom.

Degree of internal and external transformation that shows appropriate solutions with minimal use of resources

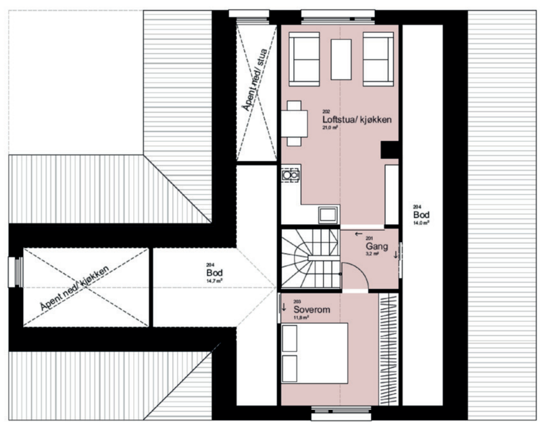
The goal of the project is ‘to achieve a lot with little’, and to create the best possible living quality with minimal and creative use of resources. Rearrangement of the main floor by moving the kitchen and increasing window area to improve the view are simple and effective measures that provide a lot of functionality, flexibility, daylight and room quality in those areas of the house that are used most.

The jury would have liked to have seen more interior spatial qualities created by ‘repairing’ the main concept for the house related to the kitchen and entrance, although a simple, compact shape is beneficial in terms of energy efficiency. The architectural expression is changed consciously and relatively simply from a familiar standard house type with large gable-end balconies and eaves to a volume without balconies and what the architect claims is a modern appearance, without eaves. The jury questions the necessity of removing all the balconies and relief from the façades, and whether the building becomes less dominant on the site as desired.

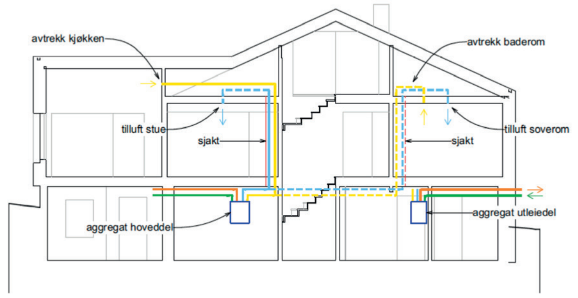
Scenario 2035

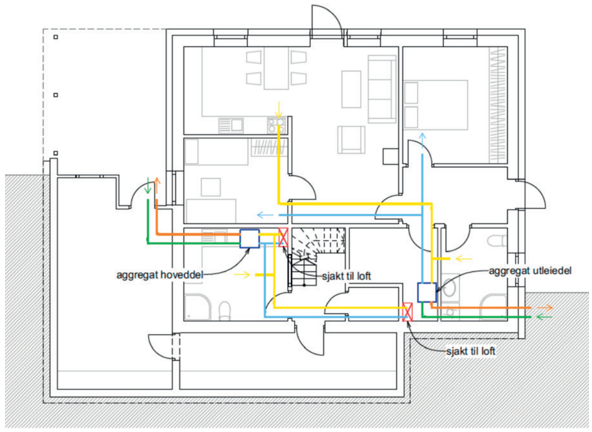


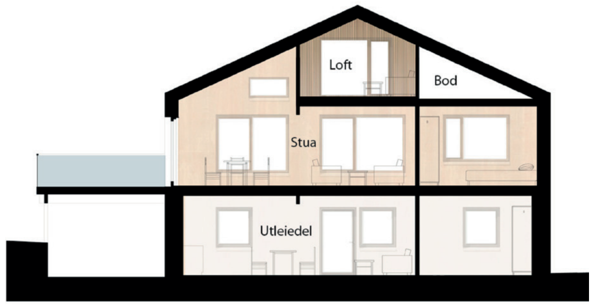
Plan 1. etasje - med en ny utleieenhet og hovedleilighet på ett plan
(Plan sokkel som for 2020)



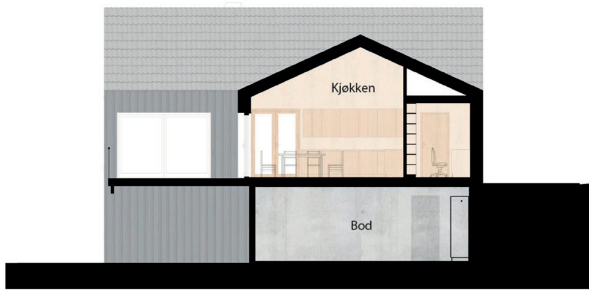
Plan loft - med gjesteleilighet (f.eks til barn), med felles bad i kjeller





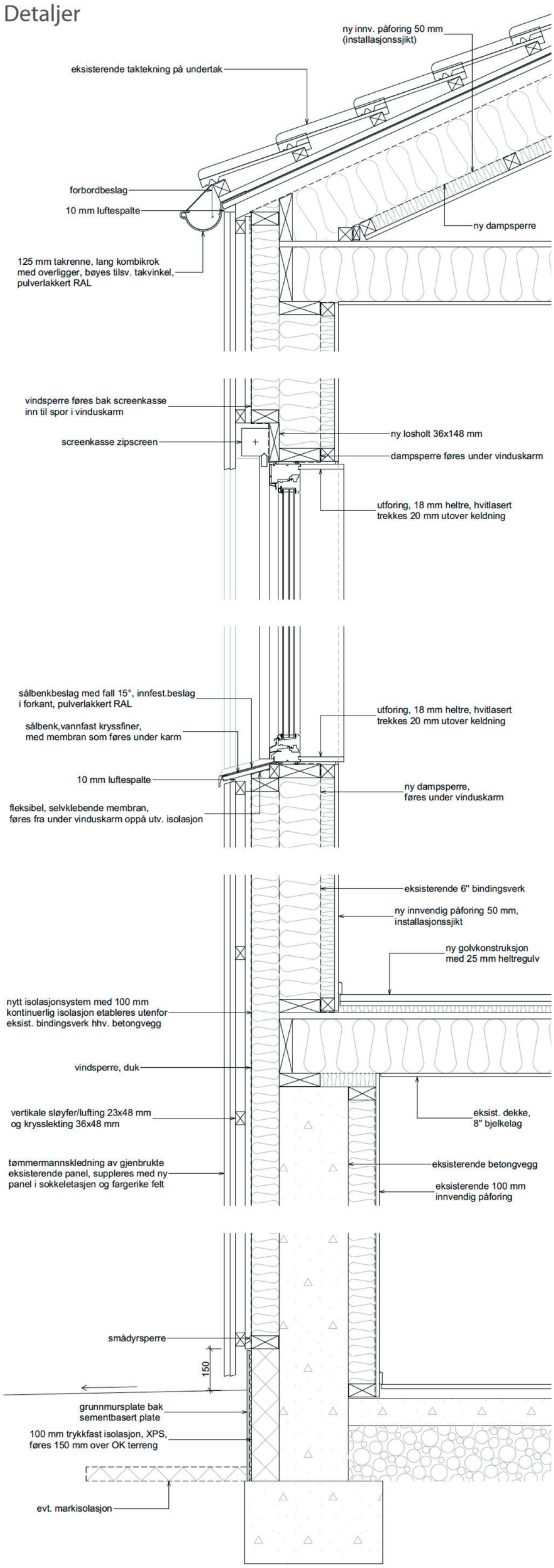


Snitt A-A - etter oppgradering



Snitt B-B - etter oppgradering

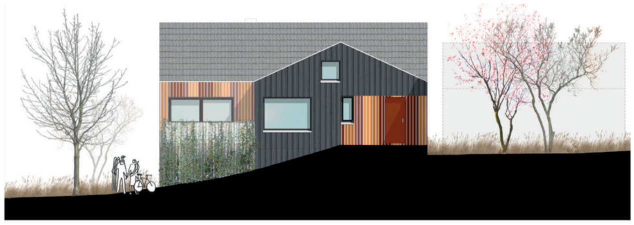
Detaljer



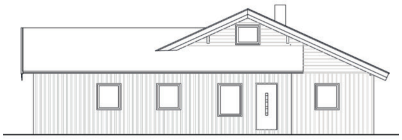
Fasade mot nord - før oppgradering
1:100

Fasade mot nord - etter oppgradering
1:100

Fasade mot vest - før oppgradering
1:100

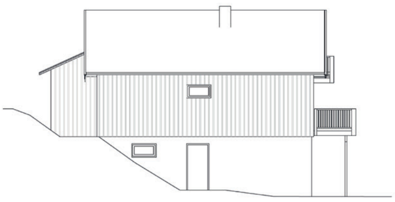


Fasade mot vest - etter oppgradering
1:100



Fasade mot sør - før oppgradering
1:100

Fasade mot sør - etter oppgradering
1:100



Fasade mot øst - før oppgradering
1:100

Fasade mot øst - etter oppgradering
1:100

«HUSET I SANDEFJORD» (The house in Sandefjord)

SANDEFJORD 1972

TEAM:

HANS HUS ARKITEKTER

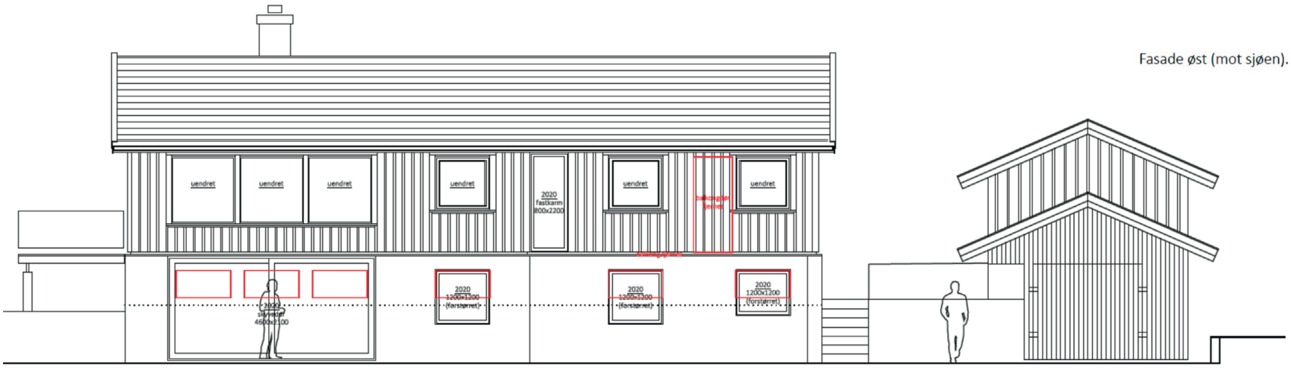
HANS HUS ARKITEKTER
TØMRERMESTER OLE THORSTENSEN
ASPLAN VIAK

Gross Floor Area (GFA): 192 m²
Heated area (HA): 192m² (used in energy estimates)
Delivered energy before and after upgrade: 131 kWh/m² (measured) and 68 kWh/m² (local climate)
Estimated net energy requirement before and after upgrade: 216 kWh/m² and 110 kWh/m²

A respectful development of a typical 1970s house using an analysis of carbon emissions throughout the building's lifetime as an important tool.

High architectural quality combined with respect for the characteristics of the existing house that are typical for its time
The house is a common 1970s standard house in which the habitable basement is partially below ground. The approach includes an excellent assessment of the important issue of whether the reduction of carbon emissions from use after renovation compensates for the emissions from the actual renovation. In the light of this, the architects conclude that it is important to preserve what is good enough, respect the value of what exists and adapt new features. There is no need to modify the building envelope, but rather to reinforce and develop it. The owner’s rather low budget is also incorporated in this basic philosophy. The building appears in the illustrations following upgrading as a straightforward, easily recognisable and attractive 1970s house.

The project also presents a plan for stepwise energy upgrading, which is necessary because of the financial challenges that affect integrated, effective concepts. Added insulation of the outside of the basement walls before the floor above presents aesthetic and technical challenges but can be accepted as Phase 1 of an integrated plan, as discussed in the project documentation. The jury feels that the idea of a low-cost, stepwise upgrading could have been followed more consistently, among other things by reducing interior added insulation in Phase 1 and instead increasing insulation outside in Phase 2. Large amounts of interior insulation take up a lot of living space.



Fasade øst (mot sjøen).

The balcony outside the bedroom could well have been retained instead of constructing a built-up roof surface in the recess with no function. Relocating the main entrance to the basement affects the home's character to some extent, but the interior concept is such that the jury does not consider it essential that this modification be affected. The project shows that the main entrance could also easily be retained as it is.
The jury feels that the lowering of the terrain facing the sea could have been limited to a shorter length of the façade without the basement suffering loss of natural light.

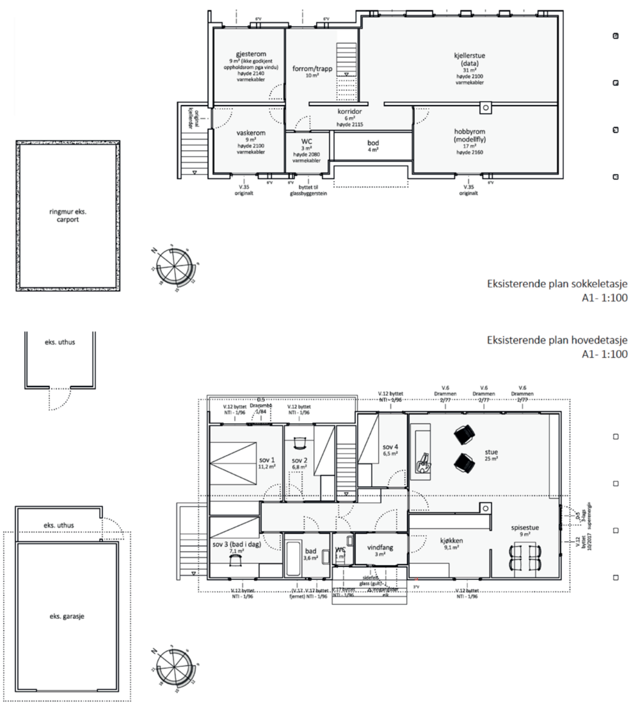
High housing quality with innovative, functional, and space-efficient solutions for different life phases and if possible, with rental units
The jury acknowledges an inventive and surprising division of living units in which the main home is located in a basement adapted to the owner's lifestyle and desire for contact with the garden and the sea, while the rental unit is on the ground floor. A rental unit is prioritised that enjoys a fine view of the sea and plenty of daylight, in contrast with many such units, while the lowered main living unit attains other qualities, albeit with daylight only from the north-east.

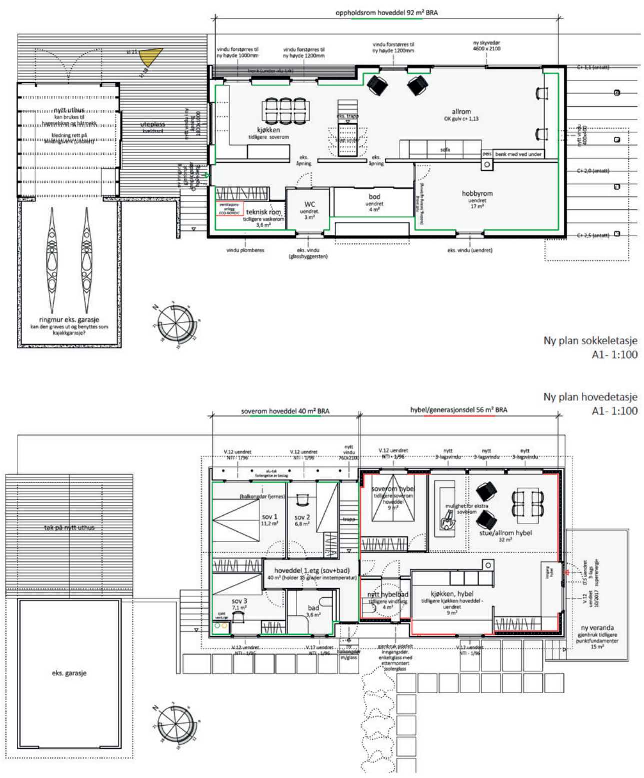
However, the ceiling height in the basement is low. One should either open up more space in the staircase connected with the upstairs entrance to improve local ceiling height or lower the floor in part or all of the basement if the fundamental concept of locating the main living unit in the basement is to be acceptable.

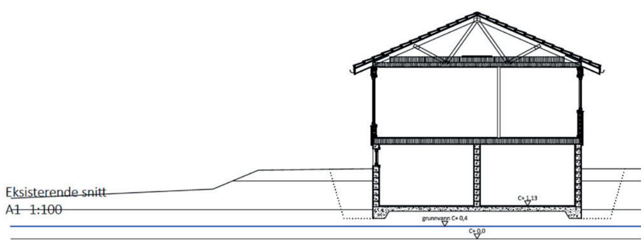
Lowering the floor is not technically impossible but will be costly. By opening up more around the staircase the living unit could have acquired a high area in communication with a more generous entrance situation upstairs. Bedroom number 2 would then need to be removed or relocated in the basement.
Communication with the surrounding terrain through sliding doors is an attractive concept, but the jury feels that the length of the lowered terrain facing the sea could have been reduced.

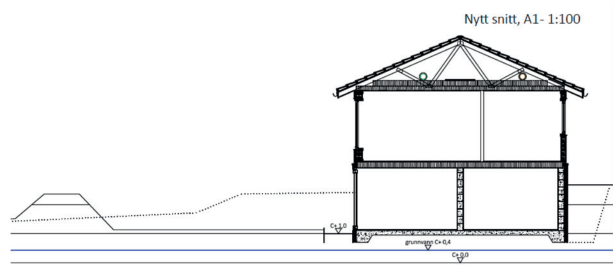
Cost-effective solutions for energy upgrading of the building envelope
The project proposes stepwise upgrading. Added insulation of the basement walls and interior added insulation of some walls in the main floor will be carried out in the first stage. The ceiling below the unheated attic is already well insulated.

The total cost of the project is estimated to NOK 1,721,500, not including VAT. Divided by an area of 192 m², this gives NOK 8,810 per m². The cost of the energy upgrade of the existing building envelope is estimated to NOK 806,000 (NOK 4,200/m²). Control calculations show 7% lower total costs and 3% lower costs for the energy upgrade. A subsidy from Enova is estimated at NOK 30,000, which will reduce the cost of the energy upgrade by NOK 160 per m².









15 cm of additional internal insulation of the wall is described in the flat on the main floor. This does not seem adequate and results in thermal bridges and little improvement in wind-proofing. It might have been more sensible to add 5 cm of internal insulation (plus the 10 cm already present) in the first instance and then in the next building phase an additional 5-10 cm of external insulation and thorough wind-proofing. A air change rate of 2.04 h-1 is used in the energy estimates. This is probably somewhat optimistic in view of the fact that internal insulation and sealing is only carried out on the main floor, and only in slightly more than half the area. The basement floor exhibits relatively high heat loss, but because of the 2.1-metre ceiling height it is difficult to do anything about this without breaking up the floor. Another challenge is that the basement floor is almost at the same level as the groundwater/sea level. The floor construction and lower part of the wall should be of a solid nature and designed to tolerate flooding.

Cost-effective solutions for ventilation and energy production

The plan is to install a compact heat pump unit, containing balanced ventilation with heat recovery, as well as an exhaust air heat pump (Flexit Econordic WH4) This will provide domestic hot water and space heating. Radiators will be installed in all living rooms and hydronic underfloor heating in the new bathroom upstairs. This type of radiator takes up a certain amount of space, something which should have been indicated on the plans. When the assertion is that this is a fairly inexpensive concept, it may not be logical to invest in water-based heating. Following the next building phase (external insulation and wind-proofing of the main floor), the heating demand will be lower, and parts of the heating system will then be over-dimensioned.

The compact heat pump unit is envisaged as being installed in one corner of the basement. A vertical main shaft passes up through a bedroom and into the unheated attic. This does not seem a good arrangement since space is limited and getting the pipes into a corner of the attic will be complicated. It is also difficult to avoid noise in the bedroom. Further duct installation as shown in an unheated attic already insulated with 35 cm of mineral wool also seems impractical.


Kjøkken sett mot trapp og allrom


Trapperom
Mot gårdsplass


Trapperom
Mot sjøen


Perspektiv - trapperom

If the basement is to be satisfactory, the ceiling height must be increased, and the floor insulated. This means that the floor must be broken up and lowered, which would be expensive but could possibly be done in the next building phase. In that case one should not put too much money into this at this stage: in other words, one could avoid investing in pipes and radiators, but instead stay with the existing under-floor electric heating cables for the time being.

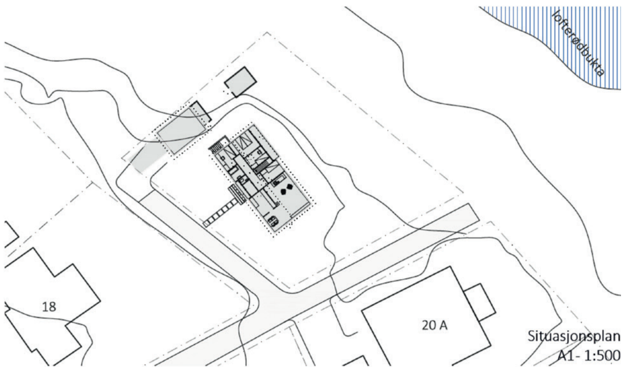
Good thermal comfort and air quality
Insulation of bedrooms has been postponed to building Phase 2. This is unlikely to present problems as regards thermal comfort. The living rooms in the basement is fitted with heating cables and only 3-5 cm of insulation, and there are no plans to change this. With so little floor insulation the electric floor heating should be kept slightly warm to avoid a cold floor. This will increase energy consumption. There is no separate air handling unit allowing individual adjustment of the supply air in the rental section. Several bedrooms are exposed to evening sunlight, but the window areas are so small that comfort will probably be acceptable.

Low carbon footprint in a life cycle perspective (materials, demolition, replacement, and reuse)
A simple upgrade is proposed with potential for a stepwise approach. An important strategy is to select modifications that provide carbon footprint reductions in the course of the next few years. Although this will not have an effect on the carbon footprint as calculated in the OPPTRE project, it is nevertheless a sound strategy. In addition, emphasis is placed on materials that have a low carbon footprint and long lifetime. Solar panels have not been considered, which harmonises with the wish to select measures that have the greatest possible effect in the short term. The house has the lowest carbon footprint, both in terms of per bedroom and of m²*year, despite being one of the largest buildings. As a result, the total carbon footprint is among the lowest.

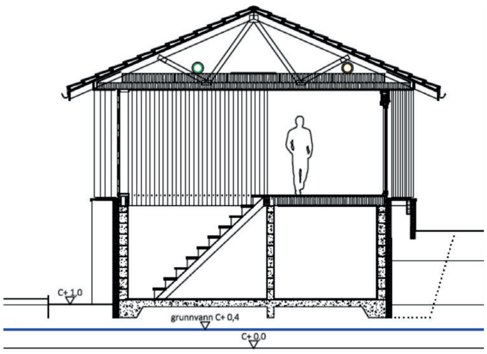
Degree of internal and external transformation that shows appropriate solutions with minimal use of resources
A commendable attempt has been made to produce an unconventional division into a main living unit and a rental unit, and the configurations take into account and are justified on the basis of carbon footprint accounting and budget, in addition to the homeowner's special needs and interests. The interior transformation is limited to the upgrading of the basement, in addition to a new bathroom on the ground floor.

However, the jury feels that the concept, which involves inadequate ceiling height in the basement, is not realistic as shown, and resources should be used to carry out improvements such as breaking up and lowering the basement floor to make the main idea acceptable.

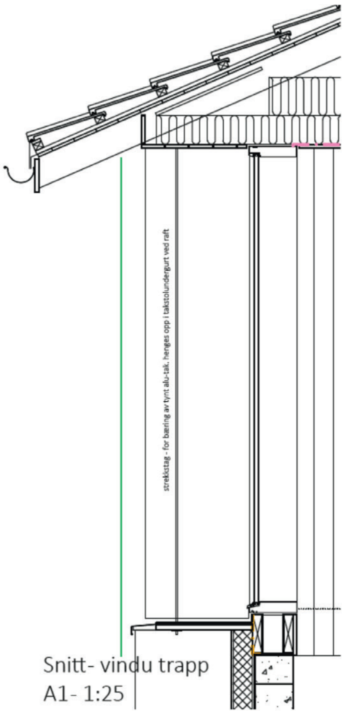
With the carbon footprint accounting in mind, it is desirable to retain those parts of the original building that are of value, as well as to not modify the exterior appearance more than necessary. At the same time the project shows that thinking in terms of stepwise upgrading presents challenges and that it may be better to accept compromises. The jury feels that the length of the terrain modifications towards the sea could have been reduced.

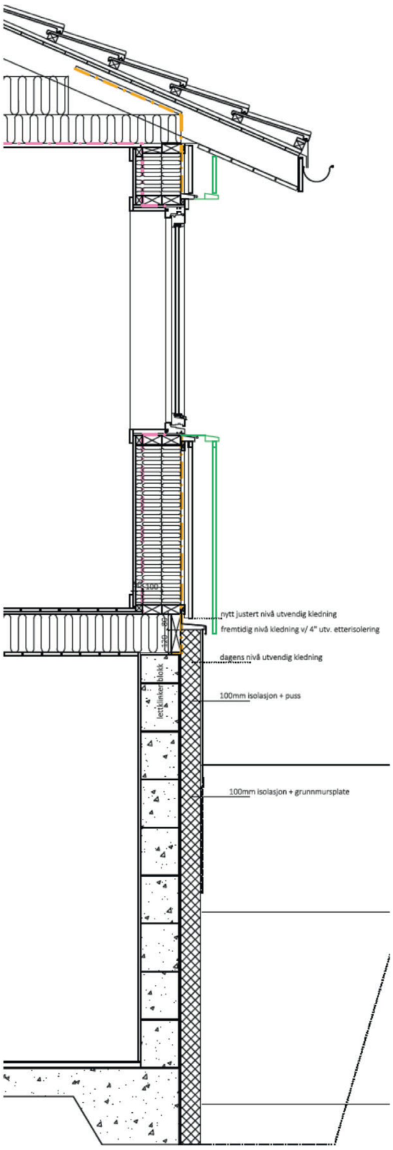


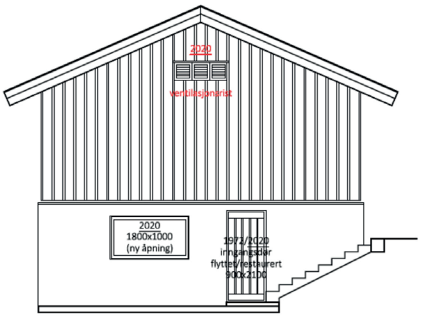
Situasjonsplan
A1- 1:500



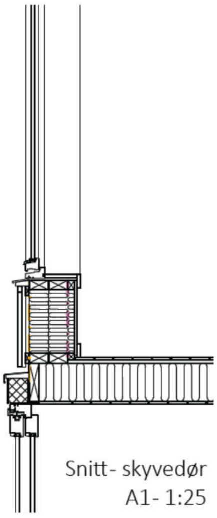
Nytt snitt gjennom trapp, A1- 1:100


Snitt- vindu trapp
A1- 1:25





Ny fasade nord, inngang hoveddel A1- 1:100


Snitt- skyvedør
A1- 1:25

Snitt- generell detalj
A1- 1:25

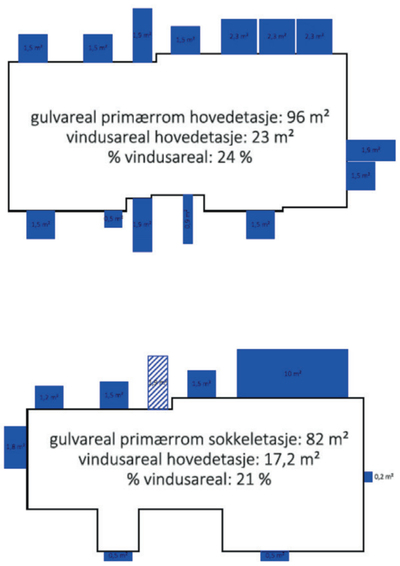
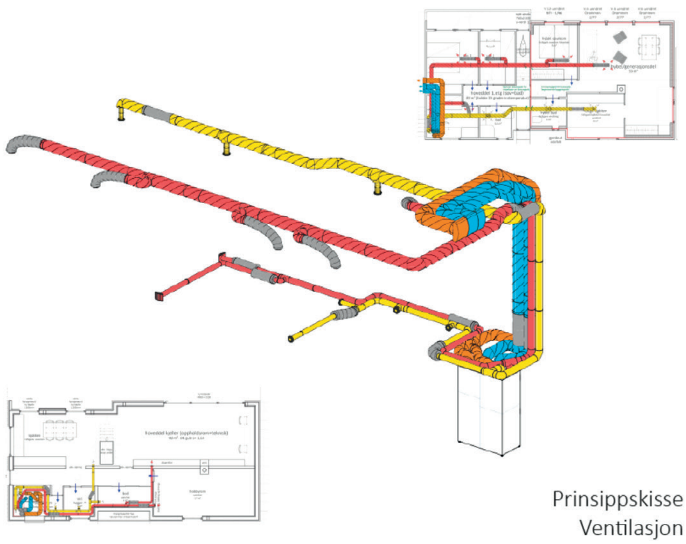


Diagram- vindusandel

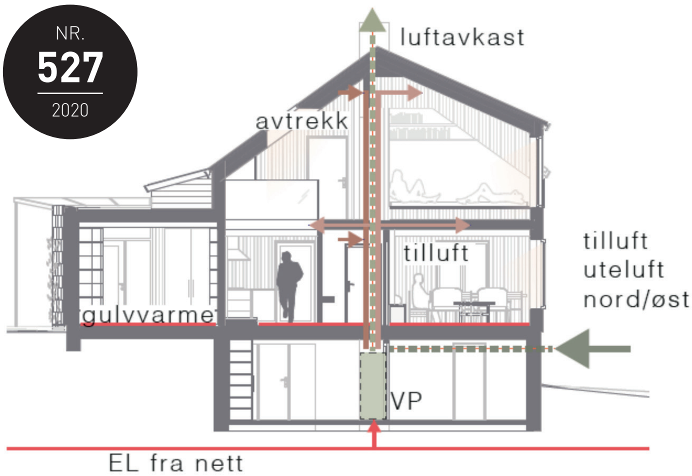

Prinsippskisse
Ventilasjon

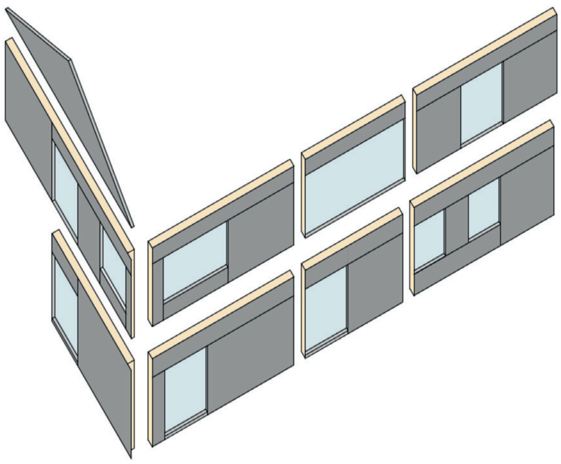

Perspektiv skyvedør

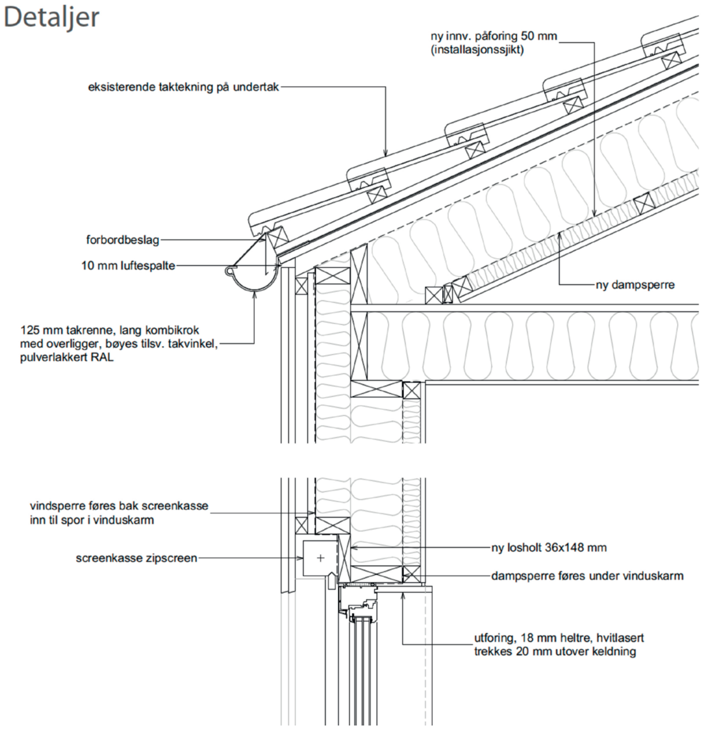

Oppbygning hus
1972

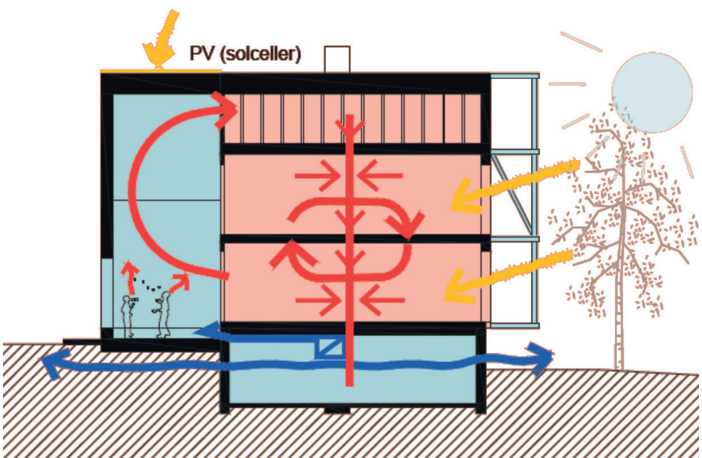

Perspektiv

NR.
527
2020









Norske arkitekters landsforbund (NAL)

Norske arkitekters landsforbund (NAL) er en fagideell medlemsorganisasjon for over 4300 arkitekter i Norge. Vi arbeider for å fremme god arkitektur og stedsutvikling, og utvikler forbildeprosjekter innen miljø og bærekraft med våre samarbeidspartnere. Vårt mål er å øke miljøkompetansen og tverrfagligheten blant arkitekter, planleggere og øvrige aktører i byggesektoren.

arkitektur.no

Norske Arkitektkonkurranser (NAK)

Norske Arkitektkonkurranser (NAK) er den eneste publikasjon i sitt slag, der arkitektkonkurransene dokumenteres på en systematisk og profesjonell måte. Her presenteres både vinnerprosjektet og de øvrige premierte, innkjøpte og hedrede utkastene, samt de sentrale deler av juryens kritikk. NAK oppleves av oppdragsgiver som et nyttig redskap i det videre arbeid med gjennomføring av byggesaken, samt at det gir god «markedsføring» for oppdragsgiveren og for prosjektet som skal realiseres.

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