# EndurNýja
# Sustainable building renovation in Iceland

## Sjálfbærar endurbætur á byggingum á Íslandi

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endurnýja

eit Climate-KIC

Climate-KIC is supported by the
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Buildings are one of the largest sources of carbon emissions, responsible for over a third of total emissions in Europe. Most of the buildings that will exist by 2050 have already been constructed. Many of those buildings require restoration in order to increase their energy performance. Building renovation in Europe is just 1% a year, whereas around 3% is the optimal number in order to meet climate goals[1]. Renovation of buildings is also one of the aspects of supporting the economic recovery from COVID-19 as it is important to improve air quality and indoor environment to increase buildings´ users comfort and health.

The **Endurnýja** project focuses on collecting sustainable building renovation principles in Iceland. It tackles all aspects of sustainability: economic, social and environmental, providing a holistic view on sustainable building renovation with focus on circular economy.

## Environmental sustainability

Nowadays sustainable building renovation is gaining popularity in Iceland. Currently there are two environmental certification schemes used for renovated buildings: BREEAM and Swan. Especially Nordic Swan certification is becoming more popular in the country.

Recently the Headquarters of The Environmental Agency of Iceland became the first Nordic Swan Eco Labelled Renovation in the Nordics[2]. Next building that is planned to be renovated with the same certificate is a single house by Þingholtsstræti 35 in Reykjavik. Currently the house has undergone the first phase of the renovation with all earthworks completed. In the second phase renovating of cladding, insulation and windows is planned[3].

BREEAM®

**BREEAM Refurbishment and Fit-Out** enables to assess and mitigate sustainability-related impacts during the design and works of a refurbishment or fit-out project. Its goal is to improve building performance, which reduces operational costs. It also focuses on improved standards of living and working conditions that have positive impact on health and wellbeing of users. The standard takes into consideration changes made to the external envelope, structure, core services, local services or interior design of a building. It can be used to access the refurbishment and fit-out of most types of existing buildings[4].

**Nordic Swan Eco Labelled Renovation** is a tool to ensure that renovation projects are carried out with strict environmental requirements, good quality assurance and focus on a healthy indoor environment. It also guarantees that the building has low energy use after renovation, good indoor environment and low emissions of dangerous substances. In addition it ensures that the building has been surveyed and hazardous waste has been safely disposed of. Moreover, Nordic Swan Eco Labelled Renovation supports circular economy principles with focus on reuse of construction elements and building materials. The standard can be applied to residential housing, kindergartens, schools, holiday houses, homes for the elderly and office buildings[5].

The house by Þingholtsstræti 35 is planned to be Nordic Swan Labelled Renovation

## Financial sustainability

Currently there are two Icelandic banks: Islandsbanki and Arion bank that offer special loans for eco labelled buildings. In Arion bank no additional fees are added to the loans if the building is eco labelled[6]. Islandsbanki states in their Sustainable Financing Framework that they provide special loans for projects categorized as green buildings.

**Buildings defined as "green" by Islandsbanki are certified by following schemes:**

- LEED "Gold",
- BREEAM "Very Good" (also BREEAM in-use)
- DGNB "Gold"
- The Nordic Swan Ecolabel certification

Moreover, Islandsbanki offers green loans for renovation and refurbishment of existing buildings that improve energy efficiency by at least 30% or are certified or plan to be certified in above-mentioned certification schemes. Individual renovation measures, like installation of renewables on-site or activities dedicated to manufacturing low carbon footprint products are also taken into consideration.

Icelandic municipalities put also more focus on eco-certified buildings. Reykjavik City plans to have all new and renovated buildings BREEAM certified[7] and another municipality in Reykjavík Capital Region, Hafnarfjörður, has a policy of discounts of fees for new eco labelled houses[8].

Another institution that supports green buildings is Municipality Credit Iceland (MCI). It is a financial company supervised by the Icelandic FSA and is only allowed to lend to Icelandic municipalities[9].

**Following criteria for new and retrofitted buildings have to be met to receive green loans from MCI**:

- BREEAM rating "Very good" or higher
- Nordic Swan Ecolabel
- Other certification of similar ambitions

## Social sustainability

Sustainable building renovation focuses on using materials that do not have harmful substances, therefore providing a healthy indoor environment for the buildings' users. New workplaces and meeting spaces both for the local community and visitors are created by repurposing old structures.

Another examples of social sustainability are:

- Dialogue with local residents,
- Appropriate lighting that enhances safety in the area,
- Initiatives to increase employment or other types of special focus on socially disadvantaged or discriminated groups,
- Creating inclusive spaces for all age groups regardless of their fitness levels, for example buildings without barriers for people with disabilities

In Iceland social sustainability in renovated buildings focuses on increased interactions between buildings´ users and creating healthy indoor environment.

# Good practices of sustainable building renovation in Iceland

## Drangar Country Guesthouse

Skógarströnd, Breiðafjörður

Building year: 1981-1995 | Renovation year: 2018-2019
Owners: Jón Zimsen and Jóhanna Halldóra Sigurðardóttir
Collaborators: Studio Granda, Viðsjá, Efla, HBH / SB Trésmiði

Drangar Country Guesthouse © Estudio Gallardo

Drangar is a large estate in Skógarströnd including over 20 islands in the Breiðafjörður archipelago. The estate consists of a farmhouse, tractor shed, hay tower, cowshed and barn. Built in the 1980s, Drangar was an operating farm until 2001 and progressively deteriorated with time and weather until 2013, when the current owners acquired the property. It was decided to renovate the buildings that were in salvageable condition.


Drangar farm before renovation © Studio Granda

Drangar Country Guesthouse - renovated cow shed © Estudio Gallardo

The owners in collaboration with the architects, Studio Granda, focused on using materials requiring minimum maintenance and using principles of a circular economy by repurposing various building elements while keeping the ambience of the old farm. So far the tractor shed, cowshed and barn were renovated.

The primary structure of the tractor shed was kept; the doors and windows were replaced to resemble the original fenestration. The tractor door was replaced by a large sliding door connecting the communal area to a terrace with a view of the fjord.

Dining tables made from repurposed roof timbers and pallets © Estudio Gallardo

Steel grilles from the cowshed are now headboards in the bedrooms and external seating.© Estudio Gallardo

Communal area in the guesthouse
© Estudio Gallardo

The envelope of the building was kept, external rockwool insulation was added and the structure was clad in corrugated copper that will change its colour to green under the weather conditions. The tractor shed is now a guesthouse with four guest rooms and a common dining area.

The cowshed was more challenging to renovate as its purpose changed from housing animals and farm equipment to guest rooms and the owners' apartment. To maintain the original look of the concrete building, many of the new elements were placed inside the existing walls as independent structures.

Roofs, previously covered with corrugated tin, were reclad in corrugated copper rolled locally with the original profile. The walls were clad with the same material. Some of the new concrete elements match the old ones and share the imprecise building technique of the original. The buildings were insulated with rockwool produced in Iceland. The landscape was adjusted to the new functions with the minimum of visual intrusion. All earth works were retained on-site to enhance land drainage management.

The content of the undercroft from the cowshed was spread on the fields as a fertiliser in the owners' forestry project - around 45 thousand trees and seedlings are planted on the property and the current owners hope to plant more. The undercroft itself is now a communal kitchen and bathroom facilities, storage and technical areas. On the first floor of the building there are eight guest rooms. The original openings were kept to frame the views of the fjord. Steel grilles from the cowshed are now headboards in the bedrooms and external seating. Roof timbers from the cowshed, together with pallets remaining after the delivery of building materials, became dining tables. Corrugated tin from the original roof of the barn was reused as shuttering for new concrete walls on the second floor of the barn.

To maintain the original look of the cowshed, many of the new functions were placed inside the existing walls as independent structures © Estudio Gallardo


One of the rooms in the guesthouse © Estudio Gallardo

The height of the barn adjacent to the cowshed was increased; an additional floor was inserted to house the apartment of the owners. There is also a common area with catering facilities for the guests on the ground floor of the building. A spacious northern terrace is built partially from the concrete slats of the cowshed.

As there are no geothermal sources nearby, the owners decided to use a closed-loop heat pump that serves all heating needs and supplies domestic hot water, lowering demand for electricity. The heat pump was chosen over solar panels or wind turbines in order to have an all-year round reliable source of hot water that does not interfere with the ambience of the old farm. Cold water is supplied from an on-site borehole with a reservoir for emergency fire use.

The owners plan in the future to renovate the old farmhouse, that is used as a private guesthouse. They also have kept windows and doors from old buildings that were not suitable for reusing in the guesthouse, with the plan of repurposing them in other projects.

## Headquaters of The Environment Agency of Iceland

Suðurlandsbraut 24, 108 Reykjavík

Building year: 1987 | Renovation year: 2020
Owner: Reitir Real Estate Company
Collaborators: THG Architects, Visthús, Multiconsult, Mannvit


Suðurlandsbraut 24 © Reitir

The building has 5 stories. About half of the building belongs to The Environmental Agency of Iceland and this part of the building was renovated. On the 3rd floor there is reception and offices, the 4th floor consists of office spaces and on the 5th floor there is a canteen and conference rooms. Renovated area is about 2000 $m^2$. Mainly the interior was renovated, with the exception of a large window area in the stairwell.

Criteria for the renovation were introduced in 2017. Minimum 25% of the building had to be renovated.

**Key elements of the renovation** were:

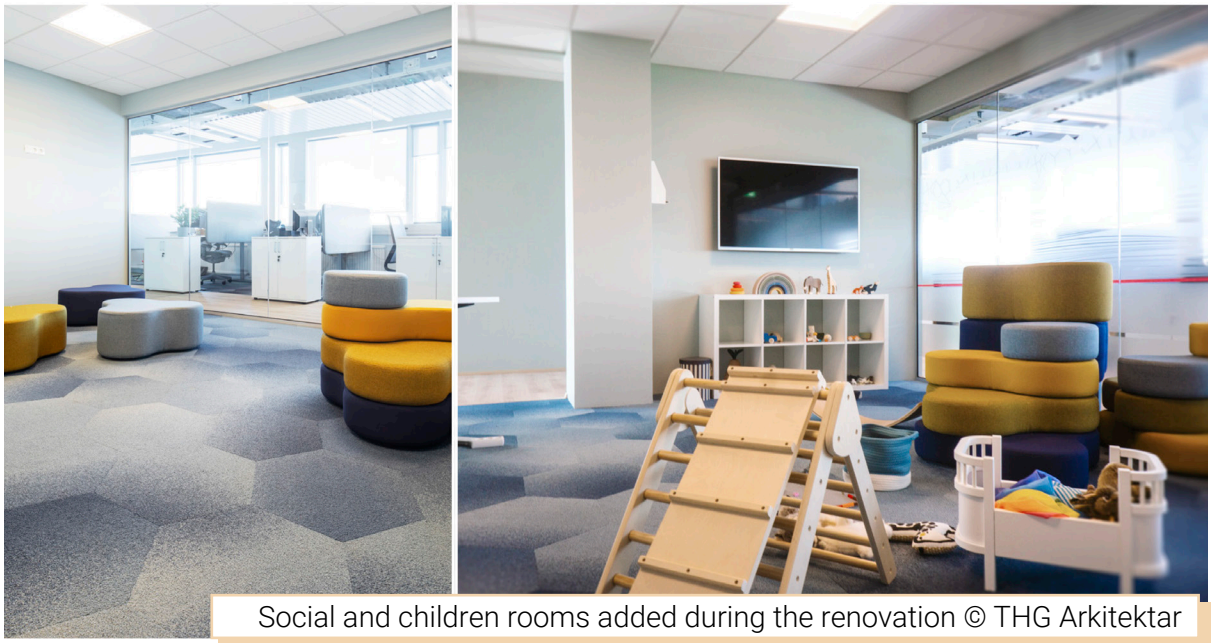
- Reduced energy consumption
- Improved floor plan and air quality
- Chemical products and building materials meet strict requirements
- Encouraged recycling of building materials

The office before the renovation © THG Arkitektar

Before the renovation, there were many enclosed and differently sized spaces. There were limited meeting facilities, acoustics were poor, there was no ventilation and lack of daylight. Some elements of the interior were up to 40 years old.

Main objectives of the renovation were to design modern work facilities with focus on materials and health aspects. Air quality and acoustics were improved. New workspaces are bright and have various meeting facilities. Meeting rooms and private spaces were increased and diversified. Thanks to creating more open spaces, there are now more opportunities for social interactions between employees. Social responsibility part of the project included also implementing a children room in the new floor plan. There is also dedicated space for employees to take breaks, thus enhancing social contact.

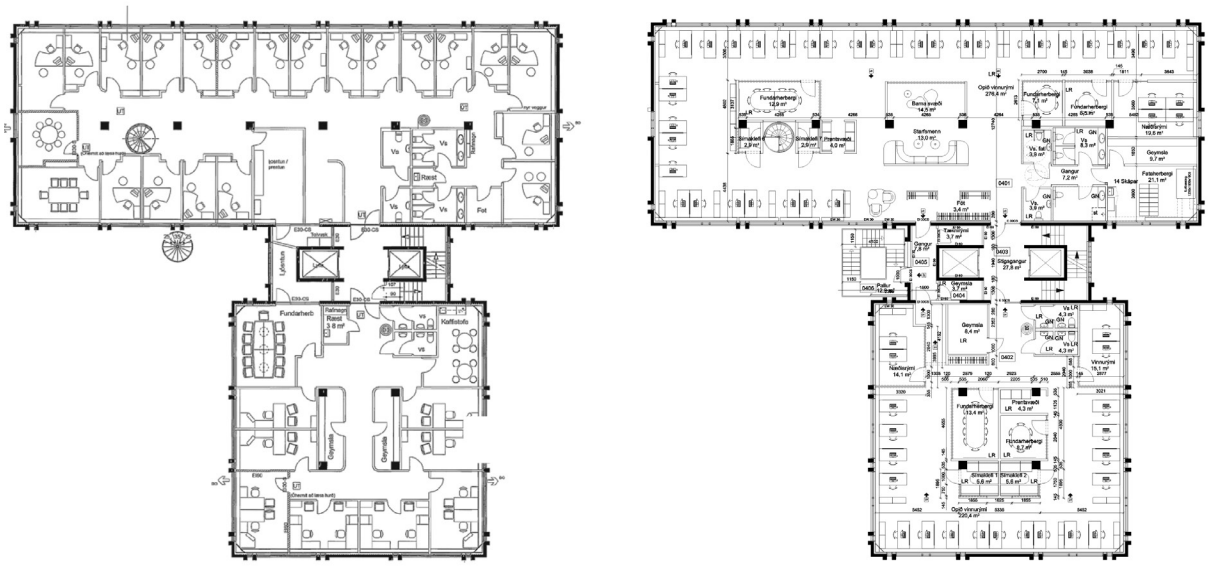
The office before the renovation © THG Arkitektar



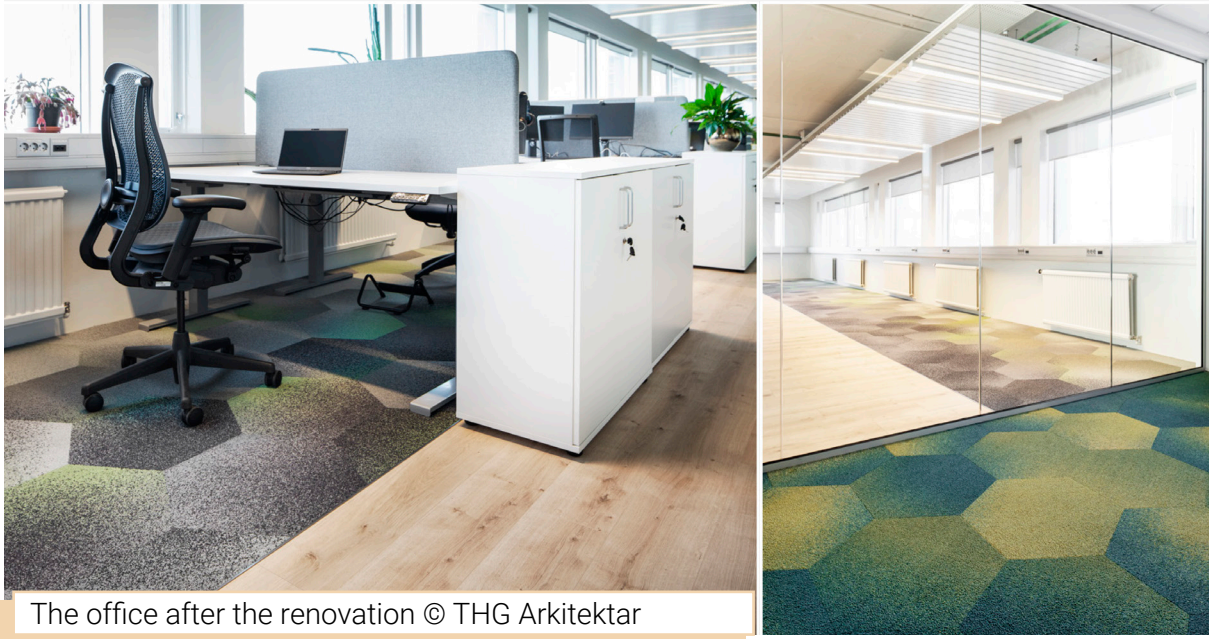
Social and children rooms added during the renovation © THG Arkitektar

The challenges in the renovation project were taking into consideration of environmental properties of building materials. Nordic Swan eco labelling requirements partially directed and restricted material selection. However, the choice of materials increased as the time went on.

Moisture inspection of the whole building was conducted and leakage with windows and in the roof was detected. There was also water collection on the roof terrace and moisture damage in the basement. Moisture problems were solved and therefore the lifetime of the building was prolonged.



Plan of the 4th floor before and after renovation © THG Arkitektar



The office after the renovation © THG Arkitektar

User-controlled energy-saving air-conditioning was installed in the building. The system has also heat recovery with efficiency of 80%. Air-conditioning unit start cost is 4 million ISK higher compared to conventional system, however it is estimated to lower operating costs by 1,5 million ISK per year and is therefore expected to pay off after 2,5 years.

LED energy-saving light was installed in the renovated building. It is demand-controlled, has motion sensors and automatically switches off. New LED lights save 80% of energy compared to old lighting system and it will save approximately 2 million ISK per year.

The office after the renovation © THG Arkitektar

The building waste was marked according to Nordic Swan renovation requirements and categorized as hazardous or ordinary waste. Waste from the construction site was 76,2 tons, of which **94,4% was recyclable building waste**. It was sorted and recycled, therefore lowering costs of construction waste disposal. 5,6% of the waste was classified as dangerous or non-recyclable and therefore ended up as a landfill. Iceland currently lacks facilities where it is possible to burn hazardous building waste, therefore alternative solution had to be used. Some materials and building elements, including interior doors, were reused. Cork tiles from offices and traffic areas on the 3rd and 4th floor were used as underlayer for new floor coverings and aluminum bars from the ceiling were reused in Kringlan shopping center eating area.

The cost of the renovation was about **40% of real estate value**, but it also **increased the value of the building by about 60%**[10]. The cost of the renovation is estimated to be 3-5% higher than ordinary renovation cost due to Swan certification and associated with it various additional inspections, like moisture analysis. However, used sustainable technologies, like energy-saving lighting and air-conditioning are expected to pay back in a few years and lower operating costs of the building in the long term.

## Office building Hofðabakki 9

Hofðabakki 9, 112 Reykjavík

Building year: 1969 - 1980| Renovation year: 2013
Owner: Reitir Real Estate Company
Collaborators: EFLA Consulting Engineers, VA Architects, Landslag

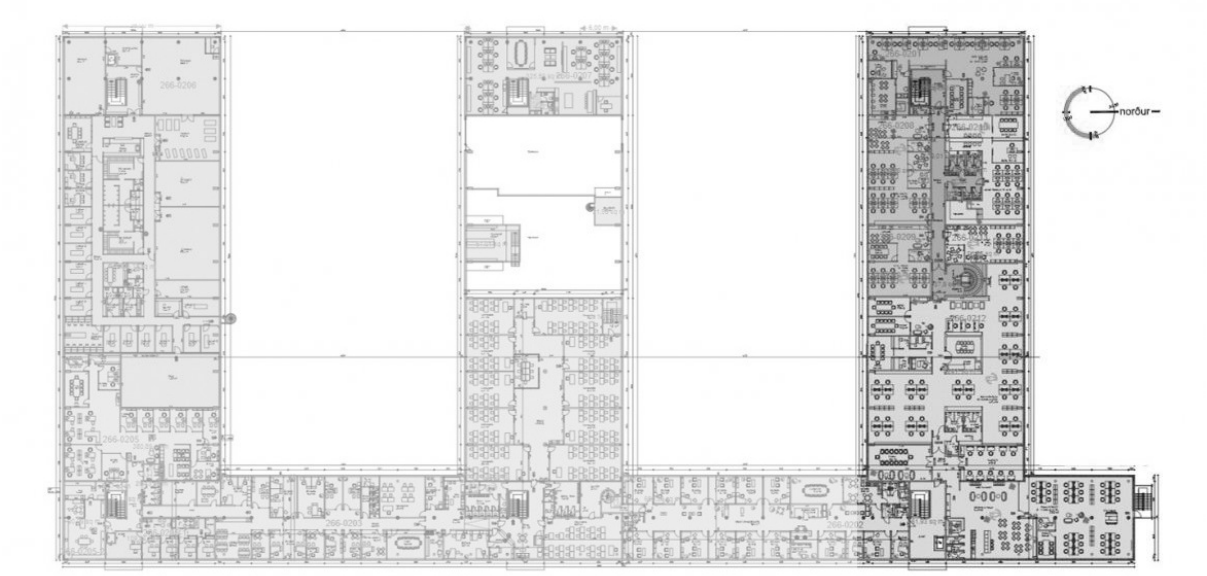
Renovated office building by Hofðabakki 9

The building by Hofðabakki 9 is E-shaped and one of its segments was renovated according to the BREEAM Refurbishment standard. Renewed segment is 3-storey office building with approximate floor area of 3700 m².

During the construction period waste was measured, sorted and reused. Waste management took place on the site. Dust pollution was minimized.

Renovated segment of the building © EFLA

Indoor air quality was improved by installing efficient mechanical ventilation. Air intakes were located far from sources of outdoor pollution. Interior building materials like flooring adhesives, wood and linoleum flooring, carpets and furnishing do not include VOCs[11].




Plan of the 2nd floor of the building © Reitir

The acoustics were improved by reducing revibration time and improving sound insulation. In order to improve acoustics, carpets were placed on floors and tiles with good acoustic performance were installed on the ceiling. Moreover, sound insulation of the walls was improved and sound from equipment minimized.

Lighting was diversified in different zones and it is controlled by occupancy sensors in order to reduce energy use. Fluorescent lamps fitted with high frequency bulbs were installed to minimize health problem risks associated with flicker. Lamps covers were installed in order to reduce the risk of glare.

Office building by Höfðabakki 9 © Reitir

Daylight calculations were performed. Curtains were installed to reduce glare and minimize strain on eyes due to contrasts in light.

Electricity use of lighting, computers, large electronic devices and ventilation system was measured and collected in a database. Energy efficient lamps were placed indoors and outdoors. Moreover, daylighting control was installed together with outdoor lighting.

Metering system that measures sanitary cold water use and cooling water for ventilation and computer systems was installed. Water taps and toilets were chosen based on low water use. A metering system of hot water was also installed. It measures use of water in radiators, ventilation system, snow melting and sanitary hot water. Measurements from both systems are collected in a database.

The number of parking spaces was reduced by 59 and more vegetation was added to the outdoor area. Space for pedestrians and cyclists also increased. Vegetation belts were placed between parking spaces in order to collect run-off surface water.

Outdoor space after renovation © Reitir

## Summary

There is increased interest in sustainable building renovation in Iceland. Especially BREEAM, Nordic Swan Label and using principles of circular economy are gaining popularity. Authorities and private institutions are also interested in sustainable restoration of structures with many green loans available on the market. Hopefully this trend will continue and there will be more examples of good practices of sustainable renovation in Iceland in the future. This would be in line with the Renovation Wave, which is a part of the European Green Deal.

Endnotes


1 https://eeglobalalliance.org/news/why-is-building-renovation-the-cinderella-of-eu-green-deal
2 https://www.facebook.com/%C3%9Eingholtsstr%C3%A-6ti-35-109380067625050
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7 Dagur B. Eggertsson „Grænni byggingar hjá borginni“
8 https://www.hafnarfjordur.is/stjornsysla/frettir/hafnarfjordur-tekur-forys-tu-og-hvetur-til-vistvaenna-framkvaemda
9 https://www.lanasjodur.is/media/graen-skuldabref/MCI-Green-Bond-Frame-work.pdf
10 Information from property´s owner - Reitir
11 Volatile organic compound


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