WASTELAND ICELAND





Lendager is a Danish-Icelandic architecture and innovation company dedicated to promoting sustainability and circularity in the

built environment.

With a long list of acknowledged and on-going building projects in Iceland, Denmark, and throughout Europe, we continue to push the sustainability agenda.



Across clients, typologies and programmes, our projects always

have one thing in common:

We make an effort to push the boundaries of what is possible in the built environment, especially when it comes to more sustainable use of materials.



When we work with materials, we use our curiosity, imagination,

experience and knowledge to explore materials with an open mind.

And we always commit ourselves to move the construction industry in a more sustainable direction.



We often link our project designs with innovation programmes, research and development, for example with industry PhDs, and relevant knowledge institutions.

It's an approach that forces us to question our current construction practices over and always implement the newest knowledge.



The most sustainable choice is always not to build.

Our goal is to find all possible ways to prevent demolition and to transform and rehabilitiate existing buildings.

Many of our projects involve mapping of buildings earmarked for change of use or demolition



Sometimes, demolishing a building is unavoidable.

In such cases, it's important to map the building materials, analyse them, and find ways to repurpose them.

Thus, the materials can have a continued life, retaining the embodied carbon and substituting the production of new materials.



We also look for recycled materials

from the local environment to save energy, limit pollution and use less resources.

After the mapping, our design process begins, guided by our core principle: Form follows availability.



In the exhibition Wasteland Iceland, we showcase projects involving large-scale material reuse and give insight into ongoing collaborations

in Iceland.

The exhibition focuses on the most significant material categories, including concrete, metal, wood, glass, and plastic, and presents selected experiments and research projects from recent years.

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CONCRETE



Concrete accounts for...

of the world's total CO2 emissions ¹



After water, concrete is the second most used material in the world.

However, its production has a significant CO2 footprint as the manufacturing of cement requires hightemperature treatment of raw materials.

Additionally, production leads to over-extraction of resources such as sand and gravel.²



In Iceland, there is a large concrete industry, and concrete is used in almost all buildings constructed in the country today.

The question is how the large amount of existing concrete

can be recycled without downcycling and crushing it for road fill, which is the typical practice.

Downcycling results in groundwater pollution and wastes the monetary as well

as embodied carbon value of the material. If concrete is recycled or upcycled, its value can be increased or retained instead.

POTENTIAL

In recent years, there have been several developments within the concrete industry.

It is now possible to directly reuse concrete from existing

buildings and demolitions instead of crushing it for road fill.

It's also possible to start early in the design process and focus on how to reduce CO2 emissions from production by minimizing

the amount of concrete in our buildings.

Over the years, Lendager has contributed to pushing this development.

CONCRETE INNOVATIONS







UPCYCLE STUDIOS

1,400 TONNES OF CONCRETE WITH RECYCLED CONCRETE WASTE AGGREGATE



KARSTADT REPARKED

CONCRETE SLABS AND BEAMS FROM MULTI-STORY CAR PARK ARE REUSED IN NEW OFFICE BUILDING



GRØNTTORVET DINING HOUSE

33,000 M3 OF HEAVILY POLLUTED CONCRETE HARVESTED FROM OLD DEMOLISHED STRUC-TURES AND REUSED IN COMMUNITY HOUSE







tonnes of metal were used in Iceland in 2019²

Metals are found everywhere in Iceland's buildings - from load-bearing structures and reinforcement to electrical wiring.

One particularly used metal is steel. This is because it is not only a strong material but also durable.

Of the 448.000 tonnes of metal

that was used in Iceland in the year 2019, 335.000 tonnes were used by the building industry.

112 tonnes became waste.²

The production of iron and steel is closely associated with the consumption of coal, and 1.5-2 kg of CO2 is emitted for every kg of steel produced.³

In Iceland, there is no natural occurrence of iron, so the

country relies on imports, making the metal production particularly energy-intensive.

Similarly, in 2019, Iceland imported 7.4 million tons of alumina to produce another metal, aluminum - and exported nearly the same amount of



A material flow equivalent to 28% of the total amount of materials coming to Iceland.⁴

POTENTIAL

Steel holds the top spot as the most recycled material in the world. Similarly, 75% of all aluminum ever produced remains in use today.⁵

Recycling 1 ton of steel

uses 75% less energy than producing new steel.

For aluminum, recycling saves a whopping 95% of energy compared to producing the metal anew.

However, recycling is still an energy-intensive process, involving sorting, cleaning, melting, and shaping the metal into a new product.

METAL INNOVATIONS



2017-2022



LISBJERG

2020-



2022-



FRAKKASTÍGUR 1





LISBJERG THE FIRST PROJECT

WHERE LOCAL PLANS INCORPORATE THE CON-CEPT OF RECYCLING, RE-QUIRING A MINIMUM OF 20% OF FACADE MATERI-AL TO BE REUSED OR RE-PURPOSED



BUILT OF UPCYCLED AND RECONFIGURED MATERIALS FROM A DEMOLISHED SCHOOL, INCLUDING STEEL FACADE PANELS FROM THE 1960S

THE SWAN

TIMBER



25-40%

of Iceland's surface used to be covered in forest⁶



At the time of human settlement almost 1150 years ago, birch forest and woodland covered 25-40% of Iceland's land area.

As the vikings used timber as the main source for energy and building, Iceland experienced a massive deforestation.

Today, only 2% of Iceland's surface is covered with woodland.⁷



Still, Icelanders use the same amount of forest products per

capita as other nations, but they are almost all imported due to Iceland's very small forest resource.



If the country rebuilt its timber resource, it could meet society's current needs, reclaim biological productivity, enhance ecosystem resilience, and decrease dependence on imports.

And as we focus more on sustainable construction, the

demand for timber increases in the future.

However, transitioning to timber construction at scale will cause pressures on wood availability and forest ecosystems to reach their



limit.

Thus, it is important to investigate how waste timber can be reclaimed and utilized in our buildings.

Wood production leads to significant waste volumes as it is often discarded due to rigid requirements.

The waste is often downcycled,

ends up as biofuel, or is used in the production of chipboard.



This not only wastes available local resources but is also costly. There are expenses associated with burning the wood and lost revenue opportunities for society.

POTENTIAL

One way to reuse wood is through the cascade principle. Here, the wood is circulated to have the highest value for as long as possible, delaying the release of embedded CO2 from the building.

This is used in Lendager's other projects, such as TRÆ, Lendager's flagship timber building.

TRÆ includes 13,013 m2 of floors, 3,711 m2 of timber walls, and 345 timber ceilings made from discarded reclaimed wood.

TIMBER INNOVATIONS







TR/Æ

80 METRE HIGH-RISE WITH CLT FLOOR PAN-ELS, TIMBER COLUMNS, TIMBER FACADE BUILD-UP AND REUSED TIMBER FOR FLOORS, WALLS AND CEILINGS



HÁTEIGSVEGUR

APARTMENT BUILDING

USING REUSED MATERI-ALS AND CLADDING OF WASTE WOOD, CUTTING CARBON EMISSIONS BY 30% COMPARED TO A CONVENTIONAL HOUSE

GLASS



1400-1560°

is needed to recycle glass



Steel and glass constitute 35% of CO2 emissions in construction in Iceland today.

Windows usually have a lifespan of 30-50 years.⁸



1:1 recycling of windows is difficult, as the technical properties of windows quickly become obsolete due to new energy requirements.



This results in large amounts of glass waste from the demolition and renovation of buildings every year.



The fate of discarded glass in Iceland is typically to be downcycled into road fill, building foundations or landfill alongside other waste.

POTENTIAL

It's crucial to keep windows in circulation rather than downcycling them.

Therefore, exploring recycling options for discarded window panes, particularly from buildings undergoing window replacements, is significant.

In this exhibition we

demonstrate how new windows can be created from discarded double-glazed panes sourced from the Smáratorg 1 building.

GLASS INNOVATIONS

2015-2018

 $\boldsymbol{\sigma}$



2019-



2022





UPCYCLE

STUDIOS

TRÆ



2020-



2023-







UPCYCLE STUDIOS

75% OF THE WINDOWS **IN THIS PROJECT ARE REUSED AND SOURCED** FROM ENERGY RENO-VATION PROJECTS



SMÁRATORG REUSE OF GLASS FROM SMÁRATORG,

CREATING A LIGHT INTERIOR WALL AND A NOVEL INNOVATION, WHERE TWO GLASS PANES ARE REASSEMBLED.

PLASTIC

Two-thirds of the plastic consists of short-lived products such as packaging and single-use plastics, which quickly become waste.

This is a problem because 99% of plastic is made from fossil fuels such as oil, natural gas, and coal.¹²

Since Iceland does not have its own production of plastic, the country depends on importing

plastic products.

When the plastic becomes waste, it is exported to other countries for recycling. Although plastic is largely nonbiodegradable, it often ends up in nature, where it creates significant problems for wildlife and humans.

Since Iceland does not have its own production of plastic, the country depends on import of plastic products.

When the plastic becomes waste, it is exported to other countries for recycling.

POTENTIAL

The possibilities for recycling plastic are increasing.

It's about reinventing the positive qualities of plastic – long durability, flexibility, low production costs, versatility – all of which, unfortunately, have become a curse today.

One of the potentials is to recycle equipment from the fishing industry, which Iceland's economy has depended on for centuries.

This is used in Lendager's green chair, Upcycle Chair, that is made of both recycled ocean plastic and recycled industrial plastic from the brewery industry.

PLASTIC INNOVATIONS

COPENHAGEN TOWERS

SUSPENDED CEILING MADE OUT OF FELT FROM 100% RECYCLED PET-BOTTLES.

NOVO NORDISK FACTORY

INSULIN PENS ARE RECYCLED AND TRANSFORMED INTO FURNISHING AND FUR-NITURE

This exhibition is a collaborative effort with a variety of important actors in Iceland.

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