VATTENFALL

Transform to a more Circular Business

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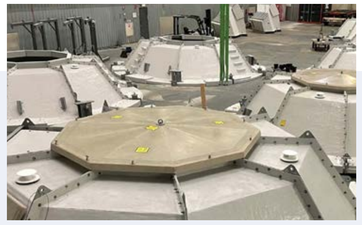
Vattenfall's purpose is to enable the fossil freedom that drives society forward.
Circularity is essential to securing future resource needs, reducing costs, and achieving our sustainability targets.

Transform to a more circular business

Circular targets in our wind business

Wind turbine blades to skis



Offshore wind turbines get reusable covers

Recyclable blades in Hollandse Kust Zuid

Wind turbine turned into compact living

From blades to buildings

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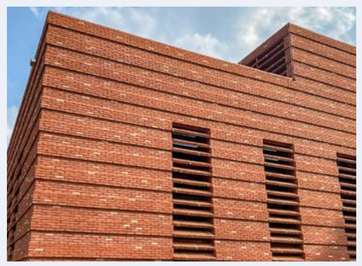

Circular design in heat transfer station

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Circular system for heat generation in Bristol

Photo: Getty images

Transform to a more circular business

Examples of circular projects across Vattenfall

To learn more about our circular ambition and action plan, please scan this QR code to visit our Vattenfall website.

Vattenfall's purpose is to enable the fossil freedom that drives society forward. Circularity is essential to securing future resource needs, reducing costs, and achieving our sustainability targets. By reducing the use of virgin materials, circularity results in less mining and processing of raw materials and the CO_2 emissions and biodiversity impact related to it.

Different circular strategies

Circularity means that we will move from a linear take-make-waste economy to a circular economy, which can be achieved in several ways. It is important to work towards material recycling (closing the loop). However, circularity goes beyond recycling, it is also about reducing the use of raw materials (narrowing the loop), and extending the lifetime of products and components through e.g., reuse and repair (slowing the loop).

This brochure provides examples of how circularity is implemented in Vattenfall's business. The projects highlight a range of R-strategies for implementing circularity, as illustrated in the figure below. We hope these examples spark new ideas and promote further progress in accelerating circularity.

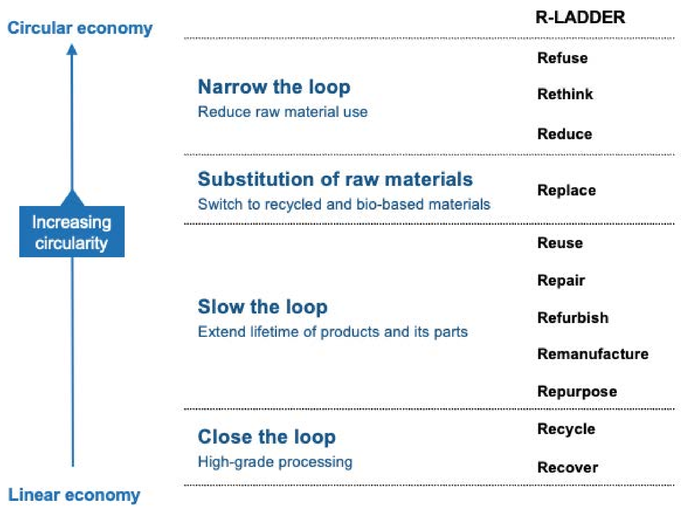


Figure. R-strategies to implement circularity

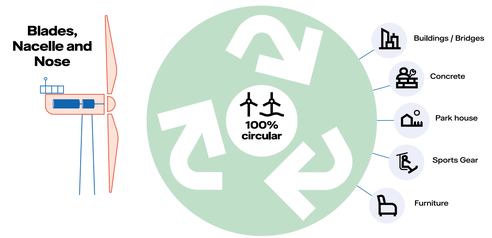
Circular targets in our wind business

Vattenfall adopted circular targets on wind turbine blades and permanent magnets.

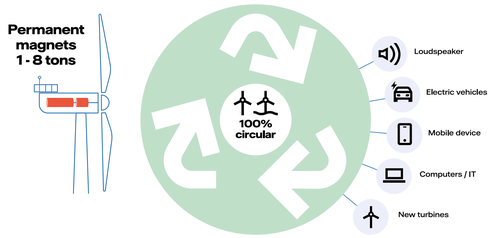
Photo: Jennie Lind

Vattenfall is committed to expanding its renewable energy portfolio to achieve its Net Zero emissions target in 2040. Circularity is a key enabler to reduce environmental impacts from building new assets. By reducing the use of raw materials, circularity results in less mining and processing of raw materials leading to energy savings and lower impact on biodiversity in our supply chain. Today, 85 - 90% of the total mass of a wind turbine can already be recycled. However, recycling solutions for **turbine blades** and **permanent magnets** are still under development, presenting opportunities for further innovation in circular practices.

In 2021, Vattenfall committed to a landfill ban on decommissioned wind turbine blades from owned windfarms, a 50% circular outflow of wind turbine blades by 2025 and 100% circular outflow by 2030. A circular outflow means that blades are reused, refurbished, repurposed, or recycled. In 2024, these targets have been extended to all composite waste from wind turbines including nacelle canopies and nose cones.



In 2024, Vattenfall committed to achieving a 100% circular outflow of permanent magnets from our decommissioned wind farms, from 2030 onwards. Vattenfall is dedicated to developing circular solutions to reuse, refurbish, repurpose, or recycle permanent magnets.



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R-strategy: Reuse, refurbish, repurpose and recycle

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Photo: Martin Fryklund

Wind turbine blades to skis

We are working with partners to produce skis with recycled materials from wind turbine blades which have reached the end of their operational life.

Blades are difficult to recycle because of the material composition and available recycling technologies. Blades are made of resin, glass or carbon fibre, balsa wood, PVC or PET foam, other polymers, and metals. Separating these components presents a significant challenge, complicating the recycling process and limiting the potential for recovering residual value. Moreover, technologies for recycling composite materials exist, but vary in maturity.

As part of our commitment to a 100% circular outflow of composite materials from wind turbines by 2030, we have explored various blade recycling technologies. In collaboration with innovative Norwegian recycling company Gjenkraft, blade material was recycled into skis in 2024. Gjenkraft recycled the carbon fibre from the blades to high quality carbon fibres, which were then used by EVI to produce alpine skis that meet industry standards while significantly reducing environmental impact. The use of recycled materials results in less mining and processing of primary raw materials and the CO_2 emissions and biodiversity impact related to it.

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Photo: CCM B.V.

Offshore wind turbines get reusable covers

Reusable covers for foundations used during installation of offshore windfarm Hollandse Kust Zuid.

A monopile cover is a necessary stopgap in the stage between the foundations and the tower of a wind turbine being installed. It offers protection against seawater, rain and bird droppings. In the past, these covers were typically discarded after a single use.

Vattenfall challenged its suppliers to come up with a sustainable cover for Dutch offshore windfarm Hollandse Kust Zuid. CCM B.V., a start-up, designed a monopile cover made of fibre-reinforced polyester panels strengthened with steel beams and bolts. The design features not only material that can be reused over time, but also a cover that can be used several times over in the construction of other offshore wind farms. It is expected that individual covers can have a lifespan of 10 to 15 years.

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Recyclable blades in Hollandse Kust Zuid

Photo: Matthias Ibeler

Offshore windfarm Hollandse Kust Zuid in the Netherlands uses Siemens Gamesa‘s RecyclableBlades which are designed for recycling.

Wind turbine blades are difficult to recycle due to the resin used in their construction, which requires high temperatures and pressures to break down. This process is energy-intensive and degrades the material properties, complicating recycling efforts.

Vattenfall used three sets of Siemens Gamesa‘s RecyclableBlades in windfarm Hollandse Kust Zuid, which was the maximum available amount at that time (2022). RecyclableBlades are designed to facilitate recycling, by using a resin type that dissolves in a low-temperature, mildly acidic solution. This separates the resin from the other components in the blade: fiberglass, carbon fibre, plastic, wood, and metal without significantly impacting their properties. As a result, these materials can be efficiently recycled into new products afterwards.

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Photo: Jorrit Lousberg

Wind turbine turned into compact living

Wind turbine nacelle turned into a tiny house, showcasing innovative reuse of materials during the Dutch Design Week 2024.

The nacelle is the housing of the machinery of a wind turbine, like the rotor and generator. It is made of glass-fibre reinforced plastics, a water-tight and lightweight material. The tiny house was conceived and designed by Superuse and executed by Blade-Made and Woodwave.
The liveable space of 35 m^2 retains the recognizable exterior of a wind turbine nacelle, while the interior has been redesigned to include living spaces. It is equipped with sustainable features such as a heat pump and solar panels and furnished with second-hand furniture and materials.

This project showcases the potential for repurposing wind turbine components and reducing the need for energy-intensive recycling processes. The tiny house was prominently displayed at Dutch Design Week in October 2024.

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From blades to buildings

Illustration: Lloyd arkitektkontor

In a new high-tech neighbourhood in Lund in southern Sweden, turbine blades from a decommissioned wind farm will become a very visible part of the facade of an eco-friendly multistorey car park.

When Danish onshore windfarm, Nørre Økse Sø, was decommissioned in 2023, Vattenfall explored opportunities to repurpose or recycle the blades. This led to the idea of incorporating part of the blades into the facade of a car park.

The blades will be used to create curtain walls, non-structural walls designed to remain open for safety reasons. The architect, Jonas Lloyd, aimed to achieve what is called “visible sustainability“. The aim was to construct a building where it is apparent to people that wind turbine blades were used in the facade

The turbine blades are currently in storage and will be integrated in the Swedish car park, which is expected to be completed in 2025.

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Photo: Elisabeth Redlig

Circularity in our heat operations

Vattenfall's heat operations are commonly located near urban areas, enabling the recovery of excess heat even from smaller companies.

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Primary energy use from companies and industries is characterised by large amounts of energy losses in the form of waste heat. While recovering this excess heat presents challenges e.g., heat generated in locations where there is no nearby demand, it also offers valuable opportunities, like energy recovery.

Vattenfall developed SamEnergi, which is Vattenfall's business for purchasing excess heat from companies, such as data centres, bakeries and smelters. Recovering excess heat from ,businesses and supplying it to the district heating network is far from new as such, but it has mainly been an option for heavy industry. With SamEnergi, we now have a standardised agreement format that makes it easier for smaller sized companies to sell their excess heat. The solution means that Vattenfall offers to purchase excess heat, transport it and reuse it where it is needed, for example heating up nearby residential and commercial buildings by making use of energy that otherwise would not be used.

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Watching eye encourages plastics recycling

Photo: Stock footage

Vattenfall‘s FossilEye technology uses digital cameras to improve plastic waste sorting and recycling, which is an important way to reduce fossil carbon dioxide emissions from waste incineration.

Plastic in waste streams used for energy recovery is an unnecessary source of fossil carbon dioxide emissions. To address this, Vattenfall, in collaboration with Tekniska Verken in Linköping and Umeå Energi, has initiated the development of a smart, portable facility designed to identify and measure the plastic content in waste prior to incineration.

Using a digital eye in the form of a camera, the tool quickly determines what is plastic and what type of plastic it is, hence the name FossilEye. The technology has been developed by the company RoboWaste and was tested at the three companies’ waste incineration facilities during 2023-2024. Diverting plastic from the waste stream provides the possibility to increase recycling of plastics.

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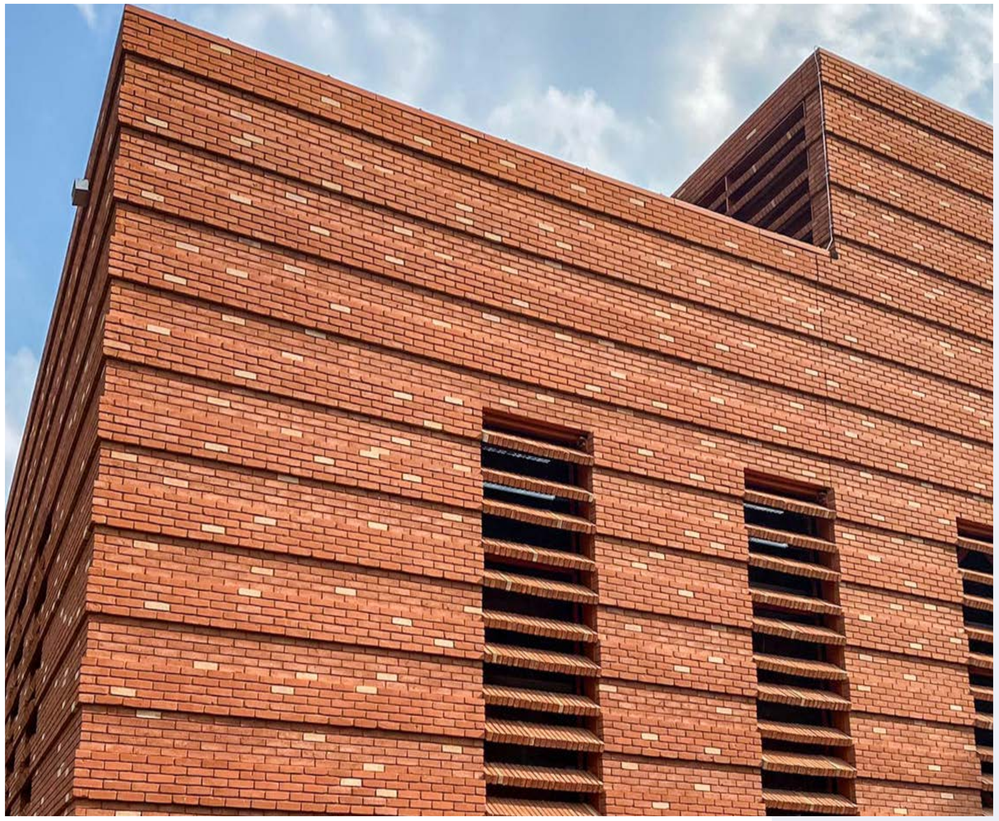

Photo: FRONT

Circular design in heat transfer station

Recycled bricks used in Vattenfall‘s heat transfer station in Amsterdam

The Hakfort Heat Transfer Station is part of the district heating network of the city of Amsterdam. The heat distribution station has been constructed as circular as possible with reusable steel construction and reusable wooden beams. The roof of the building is covered with grasses.

Construction waste has also been processed in the bricks themselves. FRONT, former StoneCycling, supplied bricks and brick strips. In the sliced bricks the construction waste can be seen in the form of light speckles. The combination of different textures and layers, presented in a lively orange facade, resulted not only in a functional and circular design, but also in an aesthetically pleasing building. Waste upcycled with this project is 104.656 kg.

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Photo: Jennie Lind

Circularity in hydropower

Vattenfall has developed a climate-smart hydropower concrete with reduced cement content, lowering CO_2 emissions by around a quarter.

Greenhouse gas emissions from hydropower mostly derive from the production of steel and concrete. As Vattenfall's hydropower plants were constructed in the first half of 1900, the current impact comes from reinvestments and maintenance work, often using a significant amount of concrete.

To reduce cement usage and limit heat development during construction, a common approach is to incorporate by-products that react with cement. Vattenfall has combined this method with insights gained from its major expansion phases in the 1950s and '60s to create a modern, climate-smart concrete concept.

The first major application of this climate-smart concrete was at the Lilla Edet power station on the Göta älv in 2021. During the work to replace parts of the existing dam, extensive tests have been carried out to ensure that the concrete is suitable for construction works and, above all, meets the requirements for dam safety and durability for over 100 years from now.

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Creating demand for near-zero cement

Photo: Adobe Stock

Vattenfall and CemVision have partnered to develop and supply near-zero emission cement, potentially reducing CO_2 emissions by 95% compared to traditional cement by 2030.

Vattenfall and CemVision entered an agreement (LOI) in 2024 for the development and future supply of near-zero emission cement. This innovative cement has the potential to reduce CO_2 emissions by up to 95% compared to traditional cement, significantly lowering the carbon footprint of construction projects.

Cemvision develops cement made from recycled residual materials from industries, including mining and steel industries, manufacturing in a process where Cemvision's kilns are fuelled by fossil-free energy. In today's demo production, carbon emissions are reduced by 80%, and as processes and supply chain are optimised, the reduction will be up to 95% by 2030.

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Vattenfall and SSAB in new fossil-free steel collaboration

Photo: Åsa Bäcklin

Vattenfall and SSAB have signed a letter of intent regarding deliveries of fossil-free steel produced with HYBRIT technology.

Building on the existing HYBRIT initiative launched in 2016, which aims to revolutionize the steel industry by replacing coal with fossil-free hydrogen, the two companies expanded their collaboration in 2023 to include deliveries of fossil-free steel. SSAB will supply Vattenfall with fossil-free steel produced at the HYBRIT pilot plant in Luleå, to be used in Vattenfall's operations. Deliveries of fossil free steel will come from:

- SSAB Zero™ which is made of recycled steel and produced with fossil-free electricity and biogas
- SSAB Fossil-free™ steel which is produced by using HYBRIT® technology, with direct reduction of iron ore using fossil-free hydrogen – emitting water instead of CO_2.

The collaboration also involves working with subcontractors to ensure at least 10% of the steel Vattenfall purchases annually is fossil-free by 2030. This initiative supports Vattenfall's goal of achieving net zero emissions by 2040 and aligns with the First Movers Coalition's objectives.

More informations about:

Our climate targets

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Photo: Jimmy Eriksson (Agency: NORD ID/NORD DDB)

Circular IT and reuse of equipment

Vattenfall has a long-term partnership with IT recycling companies Inrego and AFB to optimize reuse and recycling of IT equipment.

Increasing the reuse and recycling of IT equipment has been a key focus for many years. Today, all mobile phones and all our laptops and desktops are collected for reuse and refurbishment. Some of our laptops that are used in highly sensitive environments are yet not available to send to reuse and refurbishment, but an initiative is ongoing for the process to start.

Since 2020 Vattenfall has collaborated with Inrego to optimize the reuse of IT equipment. During 2024, 6 200 products have been sent to the partner for reuse from our offices in Sweden, Poland, Denmark and the UK. This has generated CO_2 saving of approximately 720 tonnes calculated by the research center IVL, the Swedish Environmental Institute, using their science-based model. In Germany, AFB is the partner taking back the IT equipment and reusing it. In 2024, 4 850 IT and mobile equipment were processed resulting in a saving of 725 tonnes $CO_{2.}$ The CO_2 savings were calculated by TU Berlin, myclimate and Star Cooperation.

Reusing IT products reduces the need to extract primary natural resources. After thorough data destruction, hardware testing, spare parts procurement, repairs, upgrades, and cleaning, in 2024, AFB successfully reused 85% and Inrego 79 % of the equipment. Any remaining items were professionally recycled to ensure sustainable resource management.

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Refurbish and Recycle Vattenfall IT

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Reused bricks in new substation

Photo: Pontus Bergman

Using reused bricks for substation buildings reduced the carbon footprint by over 90%, enhancing sustainability in power grid project.

To meet the demands of an increasingly electrified Solna, located just outside Stockholm, the power grid has been strengthened with a new regional grid station, completed in 2024, along with new underground cables offering higher capacity than before. This infrastructure will provide greater power and stability to large parts of Solna, supporting the municipality's growth and development.

By using reused bricks for the buildings, the carbon footprint was reduced by over 90 percent compared to using newly manufactured bricks. Additionally, a green area has been designed with trees for noise reduction, a more pleasant environment for nearby residents, and the potential collection of stormwater and rainfall of up to 600 cubic meters. Various species of trees and plants have been planted to increase biodiversity and create variation in the green experience throughout the year. Finally, solar panels on the roof support the station's internal operations and reduce the load on the municipal power grid.

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Photo: Simon Wennberg

Pilot project: reusing secondary substation buildings

As part of our efforts to reduce environmental impact, Vattenfall Eldistribution will test circular construction and reuse of existing secondary substation buildings.

Vattenfall Eldistribution owns thousands of secondary substations and constantly reinvests to ensure stable electricity delivery. However, new constructions have a significant climate and environmental impact.

Reusing and upgrading existing buildings instead of constructing new secondary substations is a more complex process. It requires experience, collaboration, problem-solving skills, and proper documentation. Additionally, a clear strategy is missing for reuse when planning new secondary substations.

To address these issues, a pilot project was launched in early 2024 to explore the reuse of secondary substation buildings. The project involves seven secondary substations and focuses on gathering insights into environmental, economic, and organizational factors. Continuous evaluation will help develop guidelines and criteria to support future circular construction initiatives.

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Photo: Mark Seelen

Vattenfall‘s circular approach for office renovations

Vattenfall maximized the reuse of existing materials when renovating the Arnhem office in 2023

During the 2023 renovation of Vattenfall’s Arnhem office, most products, including doors, furniture, and IT equipment, were reused, promoting sustainability and reducing environmental impact by avoiding the use of virgin materials.

Offices periodically require refurbishing and renovation to maintain functionality and aesthetics. The challenge lies in the significant resource use and environmental impact associated with traditional renovation and refurbishment processes.

To address this, Vattenfall focused on circularity during the renovation, by maximizing the reuse of existing materials. As a result, the Arnhem office reused approximately 85 % of the partition walls, glass cassettes, and doors, 90% of the furniture, and all IT equipment. This approach minimised waste and made the office renovation more sustainable.

R-strategy: Reuse

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Circular system for heat generation in Bristol

Photo: Jon Craig

By harnessing the latent heat from Bristol's historic floating harbour, Vattenfall is expanding the Bristol heat network and replacing the need for individual carbon intensive boiler systems.

Vattenfall Heat UK is committed to removing all new, permanent fossil fuel assets from operations and phasing out all existing gas-fired assets by 2030 in Bristol. As part of this commitment, Vattenfall operates England's largest harbour-based water source heat pump at Castle Park Energy Centre.

Since 2022, this energy centre has been generating 3MW of low carbon heat and was awarded, Heat Pump City of the Year' by the European Heat Pump Association in its first year. It provides heating and hot water to 2,500 homes on the Old Market heat network in Bristol City Centre. The water source heat pump serves various buildings, including new sustainable offices and residential properties.

The energy centre operates in three stages: extraction, energy generation, and distribution. Water is taken from the harbour, filtered to remove debris, including eggs from invasive mussels, and then used in a heat pump. The heat is transferred into a separate water - the Bristol heat network, and the harbour water is returned just 3 to 4 degrees cooler than when it was extracted. Finally, the hot water is stored and transported to homes and businesses through underground pipes, with Vattenfall installing substations to exchange heat between the network and buildings.

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