eit InnoEnergy

Co-funded by the European Union

A practical guide to decarbonising ports

Catalogue of innovative solutions

A practical guide to decarbonising ports

Ports will play a pivotal role in Europe's decarbonisation agenda. The complex cross section of industries facilitated by and operating within ports has huge potential for significantly reducing Europe's greenhouse gas (GHG) emissions and aiding the transition to clean energy. Alongside traditional port activities such as cargo, logistics and supporting the shipping industry, the larger ports, or "mini-cities" also support energy-intensive industries such as chemicals, cement, and manufacturing, and some support the energy industry itself in the form of energy generation, import and export, and energy grids. All of these industry "clusters" present a range of pathways towards decarbonisation and the transition to clean energy.

Due to the complex, multifaceted nature of ports, a coordinated strategy and a multi-pronged approach between port authorities and all stakeholders within ports will be vital to maximise the uptake of carbon-neutral technologies. Ports will need to utilise a whole range of actions across all business areas to significantly reduce their emissions. Innovative technology already exists to enable significant gains in this space, and early uptake can harness a strong competitive advantage for those forward-thinking ports.

Here, we outline a number of practical and innovative solutions to include in port decarbonisation strategies and we encourage port authorities and stakeholders to actively explore the solutions outlined in this brochure. We also highlight promising initiatives already being undertaken by European ports which demonstrate what can be achieved in this space with cutting-edge technologies.

90%
emissions reduction target in ports

40%
CO_2 reduction target in shipping

Bring shipping under the Emissions Trading System

Key drivers of decarbonisation: policy regulations and customer demand

A number of regulations and requirements directly affecting ports have been set in recent years to help tackle emissions and curb the growing climate crisis:

- The 2021 EU Green Deal set a target of **90% emissions reductions for EU port cities by 2050.**
- The International Maritime Organization (IMO) set a **CO_2 reduction target of at least 40% for international shipping by 2030,** pursuing efforts towards 70% by 2050, compared to 2008 levels.
- The **EU Emissions Trading System** (ETS) which covers power plants, industry factories and aviation, places caps on the total amount that companies can emit each year. Companies can buy and trade emissions caps as needed, but with the price of CO_2 per ton increasing (it reached EUR 63 per tonne in November 2021), it makes the purchase of emissions credits a costly business. With the larger European ports hosting power plants and heavy industry factories, there's an increased cost incentive to reduce carbon emissions. Furthermore, the EU has publicly **declared a need to bring shipping under the ETS,** although no date has been set yet.

In addition to regulatory drivers, industries, customers and other stakeholders which depend on or interact with ports are beginning to influence the demand for decarbonisation efforts. For example, cargo companies are increasingly committed to measuring and reducing their GHG emissions; manufacturers and retailers are joining consortia together with shipping companies to explore alternative shipping fuels, for example LNG, lignin, ethanol and hydrogen; and investment banks are offering performance incentive loans to shipping customers based on improvements in ESG scores to encourage more sustainable shipping operations.

These are just a few examples of increasing demand and incentives for change within ports and the shipping industry. For ports to remain competitive, the transition to decarbonisation activities and technologies is imperative.

Risk-free innovative solutions to enable decarbonisation activities

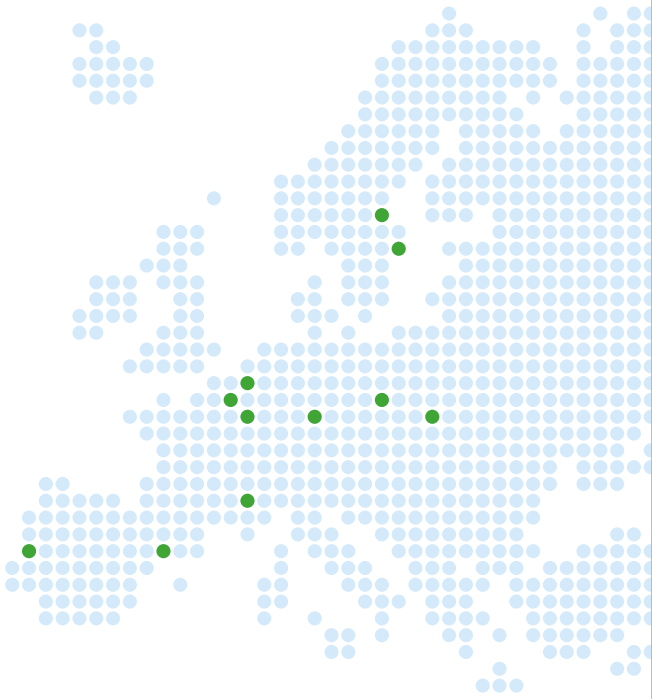
For ease of reference, the following list of solutions is categorised into seven different clusters

- Maritime industry
- Logistics
- Industry in ports
- Energy production
- Maintenance
- Clean energy for buildings
- Emissions and other impacts

Due to EIT InnoEnergy's unique overview of cutting-edge innovations across the entire energy value chain, we can suggest ready-to-implement solutions for ports, along with other promising solutions in the pipeline, which have been de-risked through EIT InnoEnergy's due diligence process.

Our trusted ecosystem of more than 500 partners across 18 countries in Europe combines vital knowledge, experience and expertise within the energy sector to enable innovative startups to scale up their technologies and reach their intended markets.

To date, we have invested over €560 million in more than 480 sustainable energy innovations, and 90% of our start-ups work with global brand names including ABB, BMW, EDF, Engie, Tata Steel and Vattenfall. We perform due diligence on all innovations prior to inclusion in our portfolio, to ensure the right expertise, financing, technology and market opportunities exist to maximise their success.



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Decarbonising the **maritime industry**

With global transport responsible for approximately 24% of all CO_2 emissions and shipping accounting for 10% of total transport emissions, it will be imperative for ports to help facilitate the transition of shipping vessels to clean energy. Electrification and the use of green hydrogen and bioenergy will be key in fostering the transition, and ports will play a key role in providing charging/refuelling stations for the newly-powered vessels. Hybridisation of shipping vessels can also play an important role in reducing emissions in the transition phase. Hybrid vessels have a conventional diesel engine and an electric motor – and when the motor is in use, no diesel is burned, therefore no GHGs released.

Electrification of ships

Volterion. A portable energy storage solution supply which, due to laser welding rather than the use of gaskets for its battery stacks, is compact, lightweight, safe, and leak-proof – essential components for use on shipping vessels. These stacks can be used to ensure an uninterruptible power supply, acting as an independent power source on board vessels.

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Wattalps. A long-life modular battery system which can be tailored to power small and medium marine transport, and is able to operate at a vast range of temperatures (-20 to +45 degrees Celsius) due to integrated thermal control technology.

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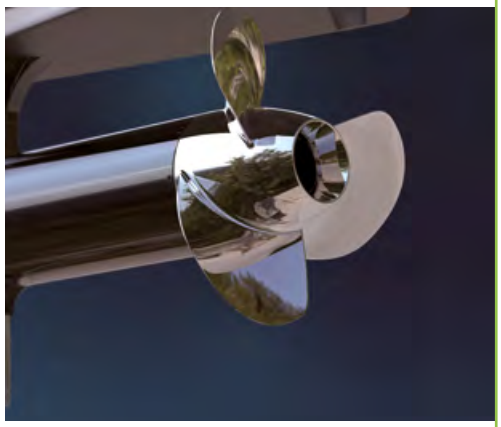
Zparq (still in pilot phase). A high power, high efficiency submerged electric motor system for propeller-driven watercraft. A passive cooling system allows the motor to be up to 10 times smaller in volume than motors with equal power, thereby minimising underwater drag and noise.



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Skeleton Technologies. Ultracapacitors which can be used to store energy during heave-up movements, and then discharge the energy when needed. This helps reduce the peak energy load on ships' main power systems and increases efficiency of the system. They are also lighter than batteries, and can assist with engine start/stop, energy recovery, and back-up power bridging.

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Green fuels to power vessel

To make large industrial hydrogen projects financially viable, new business models are being developed whereby the maritime company becomes an active stakeholder in developing the product and market for green fuels to power vessels. Shipping companies are currently exploring a number of potential green fuels, including biodiesel, e-methanol, bio-methanol, and ammonia. Other potential fuels include hydrogen, liquified natural gas (LNG), and nuclear.

Through its work spearheading the **European Green Hydrogen Acceleration Center** (EGHAC), EIT InnoEnergy is helping to advance the exploration and development of green hydrogen and ammonia as potential low/zero carbon fuels for the maritime industry. See page 30 for more details.

HYSILABS
HYDROGEN CARRIER

HySiLabs. Hydrogen is expected to be a key player in the future low carbon economy but current storage and delivery of hydrogen in its gaseous state is challenging and hazardous. HySiLabs has developed an emission-free liquid carrier (HydroSil) which allows transport of hydrogen safely by ships and road transport. In addition to transporting hydrogen, there are high hopes for its use as a shipping fuel. A benefit of using hydrogen compared to other alternative shipping fuels is the relative ease of retrofitting existing ships with hydrogen fuel cells.

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2 Decarbonising **logistics** in ports

Ports are responsible for a variety of direct and indirect carbon emissions within logistic activities, such as diesel-powered shore-side infrastructure (for moving containers, cranes etc.), non-renewable electricity consumption used to power buildings, lighting and various machinery, and other indirect emissions from the vehicles that use the ports to deliver and load cargo, and their associated warehouses. All of these activities present opportunities for decarbonising, using a mixture of electrification (with renewable energy sources), greater energy efficiency, smart technologies to aid transportation and delivery, and providing shore-side electricity for docked ships.

Optimising delivery and logistics

Compta Emerging Business. The company's Cargo e-Business solutions provide real-time information for processes such as container control, ship planning, terminal management, berth planning etc. enabling greater efficiency and reducing operational costs of cargo logistics operations.

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Enappgy. A network of sensors that enable remote monitoring of machinery to prevent costly malfunctions, prepare more efficient schedules to optimise delivery routes and save energy by clustering spaces that are in use (for example in port warehouses), and identification of costly energy leaks.

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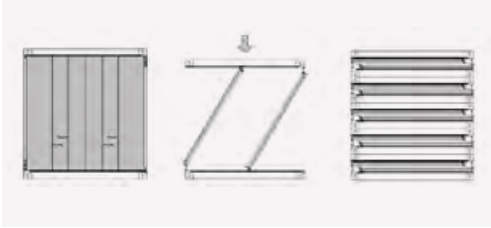
Navlandis. Foldable shipping containers that occupy 75% less space than traditional containers, lowering transport costs for empty containers (more can be stored and transported compared to traditional containers) and ultimately reducing carbon emissions.



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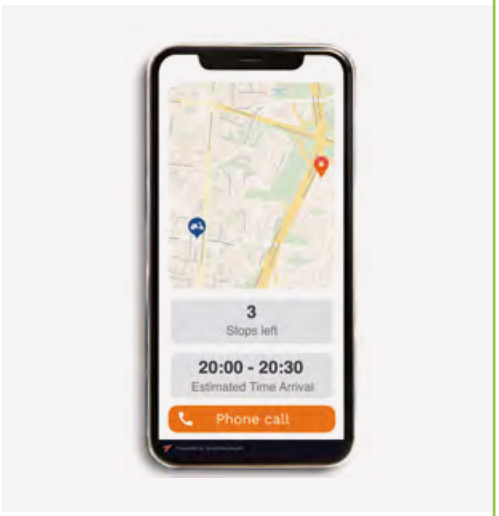
SmartMonkey. A route optimisation platform which can be used by delivery companies operating out of ports to reduce the carbon footprint of their journeys by up to 30%.



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Electrification and energy efficiency

Skeleton Technologies. In addition to its use on vessels, this ultracapacitor energy storage technology can be utilised for port-based cranes, whereby energy is recovered during lowering and braking operations and can be re-supplied for lifting. This helps in reducing diesel engine size as peak power requirements are taken over by the ultracapacitors. The ultracapacitors can also provide almost instant charging of automated guided vehicles (AGVs) and shuttles in automated warehousing. This allows for energy savings of around 30% in addition to reducing CO_2 emissions.

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Terminals to connect docked ships with shore power

Elestor. Low-cost electricity storage systems with an extensive lifespan, based on hydrogen bromine flow battery technology. Originally developed by NASA, the bromine flow battery technology has been further engineered by Elestor to enable its use in a wide variety of grid and industrial applications, including the storage and supply of electricity for docked ships.

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3 Decarbonising **industry** in ports

The type of industries contained within ports varies depending on port size and infrastructure, but can include ship building, chemical, food, construction, petroleum, electrical power, steel, fish processing, and automotive industries. The carbon tax, specifically for energy intensive industries like steel and chemicals poses a large incentive for these industries to look for lower emission production methods.

Routes to decarbonisation of industries within ports include using renewable heat to run industrial processes, improving energy efficiency within existing processes, electrification of processes, using green hydrogen as a feedstock, employing circular production models, and utilising waste heat.

Powering industrial processes with renewable energy sources

HELIAC

Heliac. Solar fields based on low-cost, high-efficiency lenses that focus the sun's energy like a magnifying glass, and are capable of producing heat of up to 400 degrees Celsius. This heat can power numerous processes in industrial plants that operate within ports (15% of global energy is consumed by industrial processes below 400 °C). Steam generated with the Heliac panels can also drive turbines to generate electricity.

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MEVA ENERGY

MEVA. Using a wood-based feedstock or agricultural residue, MEVA technology converts these waste products into renewable biogas which can provide fuel (heat or energy) suitable for industrial processes, for example to power chemical plants located within ports.

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NAŌDEN
Cogenerating another form of energy

Naoden. Based on gasification, Naoden produces modular, micro power plants that turn wood-based feedstock, green waste and fruit stones and shells into heat and electricity, capable of powering some industrial processes.

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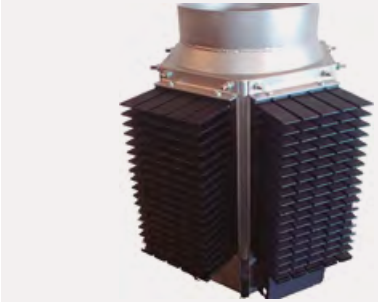
Improving energy efficiency and utilising waste heat

AEInnova. Smart heat and vibration monitoring technology that can help avoid or minimise unplanned downtime of machinery in industrial plants (unplanned downtime costs industrial manufacturers an estimated $50 billion each year). The technology is powered by waste heat so no battery maintenance or ongoing operational costs are required.



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Eco-tech Ceram. Heavy industries such as those typically located in ports lose more than 20% of the energy they consume in waste heat. Eco-tech Ceram has developed a storage system which turns waste heat into electricity, cold air, or steam.

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Energiency. Software powered by artificial intelligence to minimise energy consumption across manufacturing processes while maximising production yields. The software uses pre-existing industrial data to help industrial operators centralise and share their energy performance analyses and monitoring in factories, in accordance with ISO 50001.

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Electrification of industrial processes

Cascade Drives. A "plug-and-play" replacement for most hydraulic actuators, enabling electrification of heavy industrial equipment and significantly improving productivity and efficiency. The technology includes linear actuators as high-pressure pump drives for water-jet cutting, high pressure processing (HPP) for food and beverage, and hot isostatic pressing of 3D-printed metal parts. Powerful actuators can be used for heavy lifting applications such as container handling trucks, forklifts and excavator booms.

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Skeleton Technologies. Skeleton's supercapacitors can be utilised for industrial applications which require lightweight, cost-effective, leak-proof, and powerful energy stacks. Specifically, they can replace the need for lead acid batteries in cold-starting diesel engines in industrial machinery.

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Green hydrogen for industrial processes

HySiLabs. A potential revolution in the hydrogen delivery market, this solution facilitates the safe, efficient transportation of green hydrogen by utilising an emission-free liquid hydrogen-carrier. Furthermore, the Hydrogen on-demand process enables the release of hydrogen from HydroSil on demand, on site (within the port) and without any energy input.

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Making industries 100% circular

Enosis. A biomethanation solution which uses microorganisms to convert H_2, CO and CO_2 from non-reusable waste like sludge, end-of-life wood, plastics and solid recovered fuels into methane that can then be injected into the gas grid and used to power industries.

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C-Green Technology. With hundreds of millions of tons of wet biowaste (sludge) produced each year, C-Green has developed a solution for drying the wet biowaste in an energy-efficient way with pressure and heat, rendering it a clean and odourless biofuel and biogas that can replace fossil fuels. **Pulp and paper plants and water treatment plants** (which can operate within ports) can make use of this new solution for managing their biowaste.

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POLY POLY

PolytoPoly.com. An online platform that sources and analyses recycled polymers and connects plastic recyclers and plastic converters, boosting the circular economy of polymers and generating energy savings for chemical production plants.

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SURF CLEANER

SurfCleaner. Products that eliminate and separate all types of pollution, for example oil, from water surfaces, powered by solar cells, batteries or via grid connection. Typically, industries and wastewater facilities can only separate around 50% of the oil from their wastewater. Surfcleaner products allow for almost 100% oil/water separations rates, meaning more recovered oil can be reused or resold.

14 LIFE BELOW WATER

Customer case. **Treatment of oil-contaminated storm water at the Port of Stockholm.**
The Port of Stockholm needed more effective control over cleaning of oil-contaminated storm water in Loudden energy port. The capability to record and document the process was required as well as safer operation complying with the requirements and stipulation of the authorities.

"SurfCleaner has exceeded our expectations, both in terms of capacity and maintenance. It has made our daily work easier. In the past we made rounds of the facility measuring and manually recording the levels in the tanks. Now the plant looks after itself and sends an alarm if there is a problem.
The solution performs so well that the results are below the environmental requirement of 3 ppm hydrocarbons in the cleaned water. Another factor is that SurfCleaner reduces the amount of water in the oil, therefore our costs for disposal of the separated oil are lower".

Niklas Lundkvist, *Head of Energy* Port Loudden, Stockholm

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Decarbonising **energy production** in ports

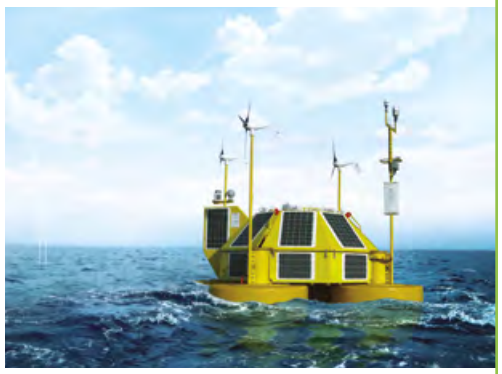
As mentioned earlier, ports can become important producers and providers of clean energy solutions and heat for the economy. Ports already have strong grid networks and connect large electricity consumers, and since they provide ideal landing points for the huge planned capacity of offshore wind, they will be vital for the development of this renewable energy source. Ports also have great potential to house the development of large-scale electricity storage which will be needed for balancing fluctuating supply and demand, and for facilitating the transportation of green hydrogen.

Renewable sources of electricity production

Offshore wind

Ports will be important enablers of the transition to renewable energy with some ports operating as energy hubs, specifically for offshore and onshore wind generation. EIT InnoEnergy has a number of products in its portfolio that can be relevant for these ports.

Eolos. A low cost and accurate offshore wind data source which can help to pinpoint the best location for new offshore wind farms by reliably estimating the wind energy potential through a floating LiDAR buoy which can be deployed completely autonomously in any offshore location.



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Principle Power. Their WindFloat® technology is a semi-submersible, three-column floating platform compatible with any standard offshore wind turbine, allowing wind farms to be optimally located, independent of depth and seabed conditions, enabling access previously untapped sites with higher quality wind resources and minimum impact to stakeholders and the environment.

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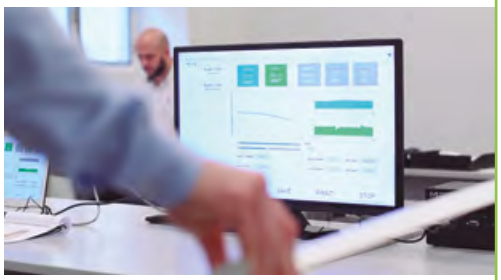
Fibersail. A shape-sensing system for wind farms based on fibre optic technology which can measure the deformation of wind turbine blades during operations, enabling the turbine to prevent excessive loads through the control system, thus reducing unexpected failures, enabling the most efficient performance mode and allowing for continuous condition assessment.



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Onshore wind

ACT Blade. ACT Blade has developed tensioned textile-covered wind turbine blades which are 24% lighter than conventional blades, and can be extended longer than conventional blades, facilitating a 9% increase in energy generated.

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Aerones. Robotic technology to carry out maintenance, inspections and repairs to wind turbine generator blades. The technology can save costs, reducing downtime and increase energy production, without exposing personnel to risks of physical inspections.

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Nabrawind. Development of advanced wind technologies for wind turbine components, which include a self-erecting tower to provide the height needed for optimum wind collection without the need for cranes during construction, and a modular blade system, applicable to any wind turbine blade that allows manufacturing blades in two or more parts that are transported separately and assembled on site, thus enabling a new generation of XXL blades.

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Large-scale electricity storage to balance supply and demand

Beeplanet. Repurposing lithium-ion second life batteries from electric vehicles to create energy storage systems. Their Power ESS technology is available in capacities from 42kWh to 1MWh and is designed for the commercial and industrial, primary, and construction sectors, suitable for photovoltaic and wind plants.

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Elestor. Electricity storage systems based on hydrogen bromine flow battery technology. Elestor's low-cost, long-life electricity storage systems are based on hydrogen bromine flow battery technology. Originally developed by NASA, the bromine flow battery technology has been further engineered by Elestor to enable its use in a wide variety of grid and industrial applications.

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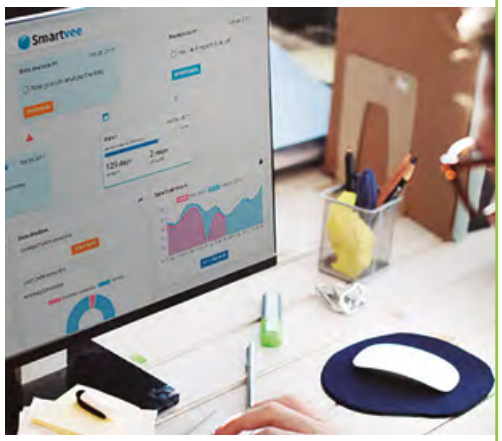
Developing district heating networks for utilities

ConnectPoint. Providing IT solutions for utilities, for example digitalisation and optimisation of the heat production process, data management of infrastructure and meter data and optimisation of substations in the network.



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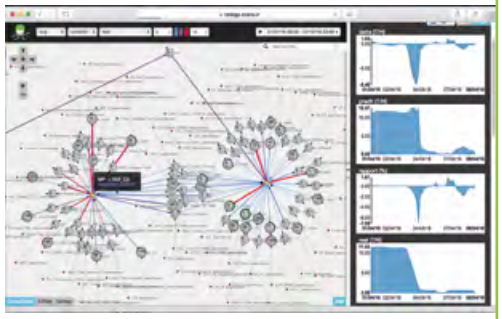
DCBrain. An AI-powered SaaS decision support tool to optimise, forecast and make reliable flows to obtain operational recommendations in real time for smart heating grids (can also be applied to gas, electricity and water grids).



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Heliac. Solar fields based on low-cost, high-efficiency lenses that focus the sun's energy like a magnifying glass, and are capable of producing heat of up to 400 degrees Celsius. The heat generated can be used for local and district heating (and cooling when combined with absorption heat pumps).

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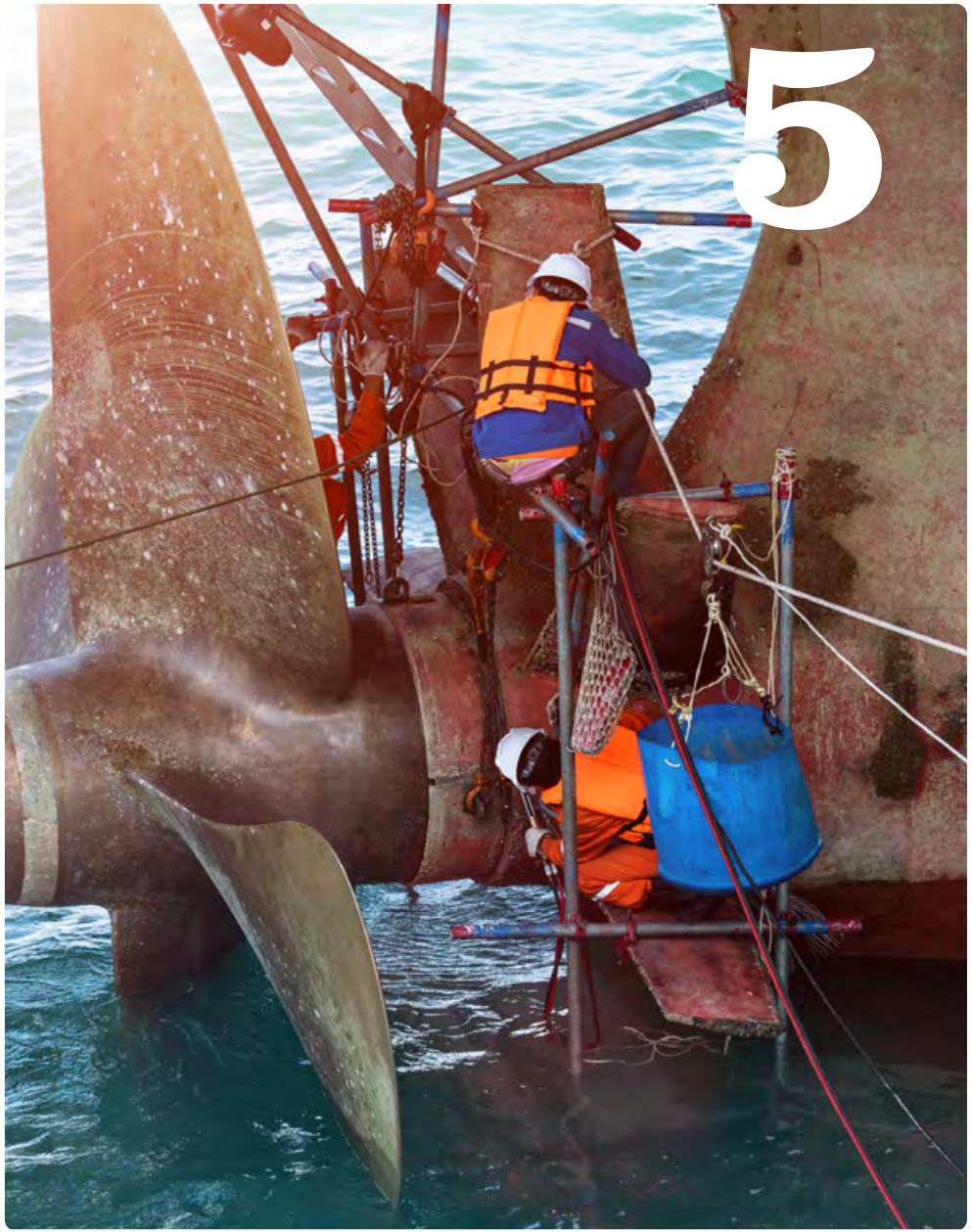

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Decarbonising the **maintenance** of ports

Maintenance activities and construction works in ports provide further opportunities to decarbonise, utilising renewable energy, off-grid storage to power tools and switching from diesel-powered machinery to electrified options. Dredging companies will need to modify their vessels and switch to either carbon-neutral fuels, electrify or hybridise their vessels and equipment.

Decarbonising construction works

Instagrid. A portable power supply that emits no toxic fumes and provides full mains power (3600W), eliminating the need for generators on construction sites within ports.

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Wattsun. Another portable off-grid power supply consisting of a 2000W battery system that can be charged with renewable energy and used to power construction equipment silently while producing zero emissions.

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Dredging

Cascade Drives. Dredging equipment used for port maintenance is either mechanical, hydraulic or hydrodynamic. Cascade Drives "plug-and-play" solutions can help to electrify the dredging equipment used within ports so that it no longer relies on fossil fuels for power.

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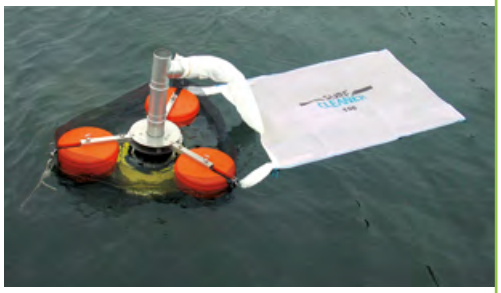
Oil removal, water cleaning

SurfCleaner. Products that eliminate and separate all types of pollution, for example oil, diesel and sludge from water surfaces, powered by solar cells, batteries or via grid connection. The SurfCleaner technology can separate up to 8,000 litres of oil per hour keeping the water surface completely free from oil and bacterial growth, and can be used for separation and cleaning in oil refineries, treating oil-contaminated storm water, separating oil from industrial wastewater and for treating oil spills.



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Clean energy for **company facility buildings**

Company buildings within ports will also play a role in cutting emissions by transitioning to cleaner energy sources and will be expected to harness renewable energy wherever possible. Smart software solutions will help to enable the most efficient use of energy, and digital heat management will also be incorporated into the solutions.

Cloud energy optimiser. A cloud-based add-on to building energy management systems which predicts the energy needs of the various zones based on the weather forecast and adjusts accordingly, thereby reducing energy waste.

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Compta Emerging Business. Another cloud-based IoT energy management software for energy efficiency control in buildings. The technology can be used to monitor items such as lighting circuits, power plugs, air-conditioning, chillers, water, gas and electricity meters.

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Enappgy. A software platform and associated technology to enable smart lighting and energy use in buildings. Its smart lighting systems combine LED lighting and smart sensors, offering energy savings of up to 90%. It's smart energy systems provide full oversight of all the energy consumption points in a building, such as electricity, airconditioning, gas, CO_2, water, and machinery.

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Lyv. An energy supply system for monitoring, storing and optimising energy that provides up-to-date consumption information and insights to reduce costs; increases the use of green energy; incorporates a peak shaving battery system that maintains reliability and operates for hours without external power; and includes smart modules such as custom AI-driven optimisers automated to maximise energy efficiency.

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Modio. Technology to monitor and manage energy systems remotely and share data, regardless of the existing hardware, enabling big data and AI to be used in existing buildings and systems.

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Sylfen. Smart energy hubs to optimise generation and storage of renewable energy for buildings. Sylfen's reversible electrolyzer works to store excess electricity in the form of hydrogen, and works as a fuel cell to produce electricity and heat from that same hydrogen, or alternatively from (bio)gas.

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Thinnect. A building monitoring and control solution consisting of sensors and cloud software that can be used to collect condition information from the building and control building systems optimally for energy efficiency.

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Vilisto. Smart, self-learning radiator thermostats for digital heat management within commercial and public buildings.

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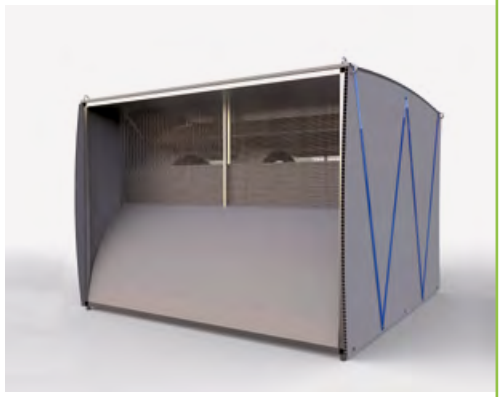
Wind my Roof. Generating renewable energy for buildings by combining wind and solar power, with the turbines and panels adapted to the size of the roof available.



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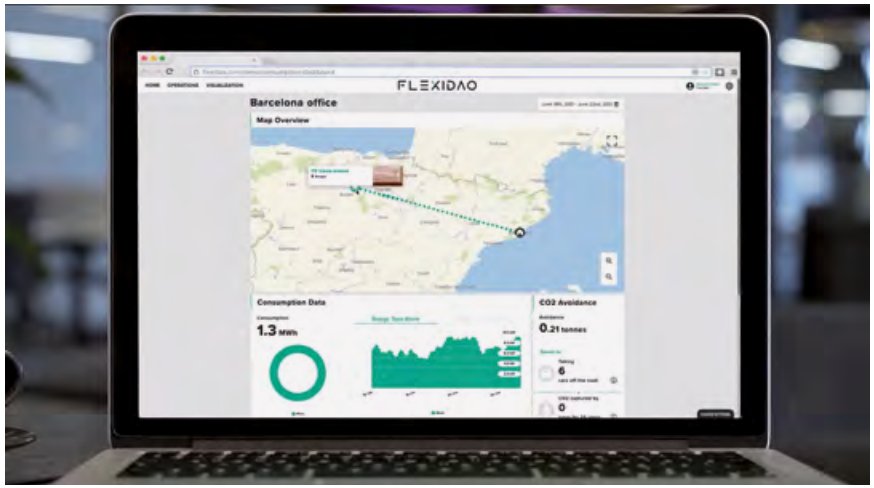
Monitor, measure and disclose **emissions and other impacts**

A final activity tying all of these clusters and decarbonisation efforts together is sustainability reporting, to measure, manage and communicate efforts to cut emissions. In the EU is it currently mandatory for all companies with over 500 employees to report on their non-financial impacts (which include emissions) and increasing numbers of smaller companies are also voluntarily reporting their impacts. Vast amounts of data are involved in measuring and managing an organisation's sustainability impacts and some exciting new technologies have been developed to manage such quantities of data.

FLEXIDAO

Flexidao. Software that uses blockchain to match energy production data and energy consumption to help companies trace where their electricity comes from and its true CO_2, every hour of the day. This data can then be easily and securely shared with auditors and other stakeholders, and enables companies to create energy certificates to prove the credibility of their procured energy emissions (known as Scope 2 emissions).



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Key alliances as an additional support for industrial-scale decarbonisation projects

Converting to new technologies takes time and investment and, in some cases, requires entirely new infrastructures and business models. Support and collaboration throughout the entire value chain is vital in order to share knowledge, resources and costs. EIT InnoEnergy spearheads three key industrial alliances in Europe to help accelerate the transition to green energy.

EUROPEAN BATTERY ALLIANCE EBA250

The European Battery Alliance,

formed in October 2017, addresses the ever-increasing demand for efficient batteries. Establishing a complete domestic battery value chain in Europe is seen as imperative for a clean energy transition and a competitive industry, and more than 700 stakeholders along the battery value chain have joined the alliance as of November 2021.

More info

The European Green Hydrogen Acceleration Center (EGHAC),

established in 2020, aims to build a €100 billion a year green hydrogen economy in Europe by 2025. Green hydrogen shows great potential within ports as a feedstock for industrial processes and as an alternative shipping fuel. By taking an ecosystem approach, which, for the maritime industry involves contribution from ports, public authorities, engine OEMs, shippers and fuel suppliers, the EGHAC can help orchestrate the collaboration and investment needed in new technology and infrastructure to help decarbonise the industry.

More info

European Solar Initiative

The European Solar Initiative,

established in 2020, aims to scale up the solar PV industrial ecosystem in Europe, with a target of reaching 20GW annual production capacity by 2025. The biggest challenge is storing the energy generated by solar PV to balance out peaks and troughs in supply and demand, and ports are expected to play a key role in managing this aspect of solar power generation in the future.

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These three alliances combine the knowledge, expertise and financing from a range of stakeholders to support large industrial projects and drive innovation. EIT InnoEnergy's central position within these alliances enables us to guide individual companies in finding the right technical or financial support, or partnerships needed to assist with the transition.

Innovation in action at European ports


Port of Amsterdam


Port of Rotterdam

A number of European ports are already making headway with their decarbonisation efforts. Here are a few examples demonstrating how existing technologies and cutting-edge innovations are being explored and utilised to reduce carbon emissions.

H2Gate. Importing and storing hydrogen on an industrial scale

The Port of Amsterdam, together with tank storage company Evos and three other specialised hydrogen companies are investigating the technical and commercial feasibility of importing and storing hydrogen on an industrial scale. The parties are jointly working on a blueprint for an import, storage, distribution and trading hub, consisting of facilities with a total throughput capacity of 1 million tonnes of hydrogen per year. *Learn more about the project here.*

Utilising sea water to create hydrogen bromine flow batteries

Elestor and Vopak are jointly developing a hydrogen bromine flow battery with the aim of scaling up electricity storage capacity of these flow batteries from 200kWh to 3000kWh by 2023. From there, they intend to develop the batteries to an industrial scale. Hydrogen and bromine are used because of their low cost and abundance globally, eliminating the need for expensive metals such as lithium, cobalt and vanadium. As bromine is found in seawater, ports could play a vital role in the production of these batteries. *Read more about the project here.*

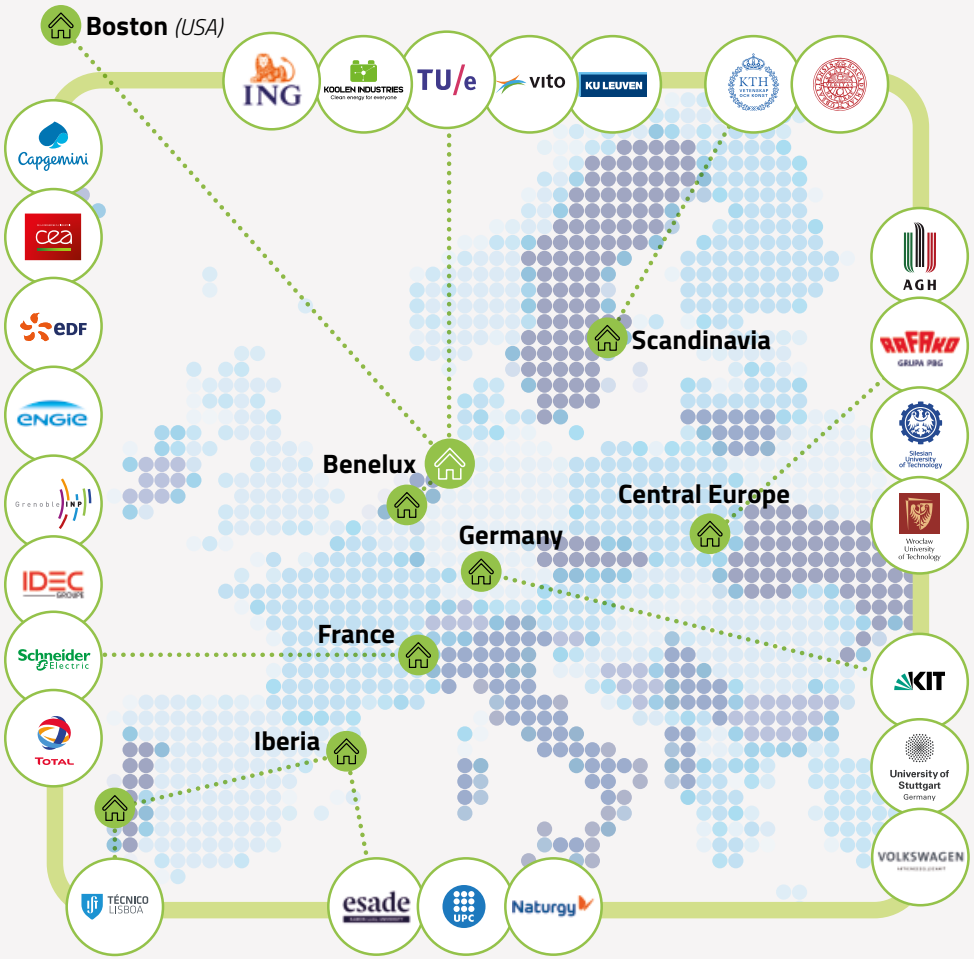
Electrification of cranes in the port of Amsterdam

The Port of Amsterdam uses Skeleton Technologies to partially electrify their diesel-powered cranes. Full electrification or retrofitting the cranes would be too costly at this point in time, so instead they use technology which captures energy during lowering of freight and then redistributes the energy to power the lifting of freight. With the addition of a storage bank, a DCDC converter and a simple controller, the energy can be efficiently stored and reused. Using this technology generates more than 25% savings in fuel consumption and carbon tax for the port.

Reducing CO_2 emissions of sludge management by 80% at the Port of Rotterdam

C-Green, a start-up of the EIT InnoEnergy portfolio, and REYM, the leading Dutch industrial cleaning and waste management company, are launching a unique collaboration to increase the circularity of industrial wet waste - so-called sludge. REYM and C-Green will build a C-Green OxyPower HTC™ plant for converting sludge into biofuel at REYM's facility in the port of Rotterdam. C-Green's process transforms sludge into a dry, sterile, biobased, carbon-enriched product that can be used as biofuel or as soil improvement. Compared with today's sludge management, as much as 80% of greenhouse gas emissions can be avoided using C-Green's technology.

The power of the network
Building global connections



About EIT InnoEnergy

Catalysing and accelerating the energy transition

EIT InnoEnergy brings people and resources together, catalysing and accelerating the energy transition. New ideas, products and solutions that make a real difference, and new businesses and people to deliver them to market. Operating at the centre of the energy transition, we build connections worldwide, bringing together innovators and industry, entrepreneurs and investors, graduates and employers.

Our impact

In just 11 years, we have built the largest sustainable energy innovation ecosystem in the world:

- €560 million has been invested into more than 480 sustainable energy innovations, all on track to generate €16 billion in commercial revenues by 2026.
- 90% of our start-ups already work with global brand names including ABB, BMW, EDF, Engie, Tata Steel and Vattenfall.

Decarbonising Europe

We are also spearheading the way to a decarbonised Europe by 2050 through the leadership of three industrial alliances: battery storage, green hydrogen and solar photovoltaics. These alliances bring together the knowledge and experience required to support large industrial projects. Ultimately, these actions play a fundamental role in realising our goal of a carbon neutral Europe by 2050.

Our ecosystem

All this is made possible thanks to our rich network of more than 500 key players from 18 different countries. Together we act as a key vehicle for the European Green Deal and make up the ingredients needed to bring a constant pipeline of sustainable energy innovation to market. Established in 2010 and supported by the European Institute of Innovation and Technology (EIT), we have offices and hubs across Europe and in Boston, US.

Doing good and making a profit in climate deep tech is possible...

At EIT InnoEnergy we follow the **Environmental Social and Governance** (ESG) principles for responsible investments. Moreover, the **European Green Deal** is at the core of our strategy. In this context, one important related element is the contribution we make to the **Sustainable Development Goals** (SDGs) established by the **United Nations**.

As part of EIT InnoEnergy's commitment to making a positive impact on the energy sector, on the environment, the economy and on society, we assess the contribution the companies in our portfolio make to SDGs.

Up to 95% of these companies contribute to SDGs 7, 8, 9, 11, 12 and 13, given that SDG 7 and 13 are those with a direct link to EIT InnoEnergy strategic goals of the reduction of CO_2 emissions, an increase in the security of energy supply, and the lowering of costs along the value chain.

DGs are at the core of our investment process and provide a means to measure impact, because making good and making a profit may be two sides of the same coin; because making good and making a profit may be two sides of the same coin.

SUSTAINABLE DEVELOPMENT GOALS

No poverty. Economic growth must be inclusive to provide sustainable jobs and promote equality.

Zero hunger. The food and agriculture sector offers key solutions for development, and is central for hunger and poverty eradication.

Good health and well-being. Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

Quality education. Obtaining a quality education is the foundation to improving people's lives and sustainable development.

Gender equality. Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

Clean water and sanitation. Clean, accessible water for all is an essential part of the world we want to live in.

Affordable and clean energy. Energy is central to nearly every major challenge and opportunity.

Decent work and economic growth. Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs.

Industry, innovation, and infrastructure. Investments in infrastructure are crucial to achieving sustainable development.

Reduced inequalities. To reduce inequalities, policies should be universal in principle, paying attention to the needs of disadvantaged and marginalized populations.

Sustainable cities and communities. There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more.

Responsible consumption and production. Responsible Production and Consumption.

Climate action. Climate change is a global challenge that affects everyone, everywhere.

Life below water. Careful management of this essential global resource is a key feature of a sustainable future.

Life on land. Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

Peace, justice and strong institutions. Access to justice for all, and building effective, accountable institutions at all levels.

Partnerships. Revitalize the global partnership for sustainable development.

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