

Two Degrees of Transformation

Businesses are coming together to lead on climate change. Will you join them?

January 2018



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REF 160118 - case 00039955

Scale matters in the fight for a below 2°Celsius temperature rise

Climate change will shape the way in which we do business for decades. Business has a vital role to play in curbing its effects by limiting carbon emissions, but success isn't just about action from individual companies. To create change on a level large enough to halt climate change, businesses – and whole sectors and value chains – will need to consolidate efforts.

This paper reveals what is already happening, bringing together examples from around the world of smart working, new thinking and innovation. It highlights examples that others can follow, and that will make transformation happen faster than ever before.

Hopefully these examples will inspire you to find out more about what your company can do to deliver transformational change and beat climate change.

The Alliance of CEO Climate Leaders: towards a new way of doing business

The Alliance of CEO Climate Leaders is a group of chief executive officers who believe the private sector has a responsibility to get involved in cutting greenhouse gas emissions. This includes leading the way towards a low-carbon economy, which helps people and communities stand up to the effects of climate change. This coalition, created by the World Economic Forum, aims to speed up companies' search for answers to climate change across all their work.

Nations are coming together to curb climate change

The world is uniting to fight climate change. The Paris Agreement, signed in December 2015, aims to keep a global temperature rise this century well below 2°Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°Celsius.^{1a} Alongside this, the United Nations Sustainable Development Goals for 2030 also include commitments to limit climate change.

Emissions will need to have peaked by 2020 to keep the planet on course for the below 2°Celsius target and net-zero emissions by 2050. Each country that signed the Paris Agreement has committed to its own targets, Nationally Determined Contributions (NDCs). However, these are not enough by themselves. The private sector has an important role in showing how to bridge the gap.

Climate action organizations are clear about how to step up the pace of change and curb emissions by 2020. The focus needs to be on the biggest sources of emissions. Reflecting this, it is critical that the private sector steps up to the challenge of cutting emissions across a range of areas:^{1b}

- Energy: replacing fossil fuels with renewables as the main source of power
- Infrastructure: making new infrastructure compatible with climate targets by 2050
- Transport: making zero-emission transport people's first choice
- Land use: ending large-scale deforestation
- Heavy industry: bringing iron and steel, cement production and chemicals in line with the Paris targets
- Finance: investing in low-carbon businesses and technologies and driving climate-risk reporting

From change to transformation

Many companies are cutting their own emissions. Their action matters, but it won't be enough by itself to create a low-carbon economy. That calls for change not just at the level of individual businesses, but across the economy. The biggest potential for that transformation is in five trends:

1. **Reinventing businesses** – companies shifting their mindsets and ambitions to re-invent who they are and what they offer. Only by fundamentally rethinking what kind of business they are can they thrive in a low-carbon future.²
2. **Bridging sectors** – businesses from different industries coming together to develop low-carbon products, processes and technologies.
3. **Creating sustainable value chains** – businesses engaging with governments and civil society organizations to develop new approaches to tackle challenges across their value chains.
4. **Harnessing data and connectivity** – exploring how to apply the technology and data behind the Fourth Industrial Revolution to managing natural resources in a more sustainable way.³
5. **Financing change** – finding new ways to invest more private-sector money in the low-carbon economy.

Alliance members are working in all these areas across the world to build the transformation the planet needs.

Reinventing businesses

The average lifespan of a company listed in the S&P 500 index of leading US companies has shortened by more than 50 years in the last century, from 67 years in the 1920s to just 15 today, according to Professor Richard Foster from Yale University.⁴

Leading companies need to constantly review the direction their existing markets are taking, as well as looking for opportunities for new products and services. Tackling climate change has created a wealth of opportunities for new markets. Many of them are challenging incumbent businesses to keep up with new ways of thinking. New products, services and systems are forcing them to change. The companies that don't take notice of the shifting economy and the emerging opportunities for growth are likely to be the ones disappearing from the S&P 500 Index in the next decade.

Change for good - and for growth

Royal DSM started in 1902 as Dutch State Mines, a government-owned coal mining company in the south of the Netherlands. Since then, it has completely transformed itself several times; first, into a petrochemical company and, more recently, into a global health nutrition and materials business. Employees like to say that today DSM stands for 'Doing Something Meaningful'.

Sustainability is a core value as well driving business. DSM is committed to using 50% purchased renewable electricity by 2025 and uses an internal carbon price of €50 per ton of CO₂e. It also helps customers to transform by offering solutions for the low-carbon economy. Its product Niaga®, uses circular design principles and now, for the first time, people can fully recycle carpet instead of sending millions of tons to landfill each year. Niaga® is just one example. Nearly 70% of the company's sales come from its range of Brighter Living Solutions, innovations that are better for people and the environment.

ACCIONA is another business thinking long-term and implementing forward-looking business strategies. ACCIONA used to be a construction and civil engineering company focused on its domestic market. In the last decade, it has transformed into a multinational, which offers renewable energy technologies, sustainable buildings and civil infrastructure, and wastewater treatment plants and desalinization facilities. Before 2004, 94% of the business's earnings were from construction. In 2016, more than 72% came from activities related to renewable energy, water and other environmental services. ACCIONA changed its business model to promote sustainable development and lead the response to a number of connected global trends, including climate change, water stress and increasing

energy demand. It also understood, however, that these steps represent one of the biggest business opportunities of the century.

Transforming power generation

The figures are stark: burning coal, natural gas and oil for electricity and heat is the biggest single source of global greenhouse gas emissions.⁵ In 2010, these made up a quarter of CO₂e emissions. In 2014, 42% of energy-related CO₂e came from generating power.⁶ Replacing fossil fuel-based power with renewables is critical, which suggests the need for a radical transformation of the systems – and businesses – behind electricity supply.



This transformation is under way. Companies are rethinking their business models by moving away from fossil fuels and investing in innovative products, renewable energy and energy efficiency.

In 2017, Danish Oil and Natural Gas (DONG) Energy became Ørsted, completing a switch from oil and gas to renewable energy (particularly offshore wind development and battery-stored power). To achieve this transformation, Ørsted has cut coal consumption by 73% since 2006 and will phase out coal completely by 2025. Its carbon emissions have dropped by 52% since 2006, and the company aims to cut them by 96% (related to 2006 levels). It now has 25% of the global offshore wind market, providing power to 9 million people, and aims to boost this to 30 million by 2025.⁷

ENGIE is also taking up the reinvention challenge and wants to lead on clean power transformation by changing what it does. It has been advocating an ambitious climate policy, adopting an internal carbon price and calling on others to do the same. It has also supported increased disclosure of climate-related financial risks, and is now focusing on low CO₂e energy sources like natural gas and renewables, which will represent more than 90% of its earnings⁸ by

2018. ENGIE is investing in solar power generation in Brazil, India, Mexico and South Africa, reaching 700 MW of new solar capacity under construction in June 2017. Since 2016, ENGIE also cut its coal-fired capacity by 60%, by closing or selling plants in Australia, Europe, India, Indonesia and the USA.

Investors are also reducing their financial support for fossil fuels and reinvesting in clean energy alternatives. ING Group announced that by 2025 it won't finance utilities sector clients with more than 5% coal-fired power in their energy mix. It will, however, still finance non-coal energy projects for these clients.⁹ Already, it only supports new utilities clients who rely on coal for 10% of their energy or less and have a strategy to cut that to near-zero by 2025. ING Group also supports projects and clients who are combatting climate change. As of November 2017, it had backed renewable energy projects worth more than €29 billion and maintained €4 billion direct loans to renewable energy projects. This amounts to 60% of its utilities project financing.

Spanish group, Iberdrola, is also strongly committed to renewable energy. Of its currently installed 48 GW capacity, 29 GW is renewable generation, making it the world leader in wind power with an installed capacity of more than 15 GW.

Building up low-carbon construction

Cement production produces 5% of global CO₂e emissions – a proportion that is likely to rise as increasing urbanization results in more buildings and infrastructure in developing countries.¹⁰ Reflecting this, the cement industry has a role to play in promoting innovation and new ways of building.

Conscious of their climate impact, cement companies have, for many years, taken action to cut their carbon footprint. LafargeHolcim doesn't just commit to lowering carbon emissions from production, but also develops and provides solutions to limit the carbon emissions of buildings and infrastructure. By 2030, LafargeHolcim aims to reduce CO₂e emissions per ton of cement by 40% compared to 1990, and aims to avoid emissions of 10 million tons of CO₂e a year during the lifecycle of the products it sells.

In 2016, LafargeHolcim created a joint-venture called 14Trees, with UK development finance institution, CDC Group plc. It is centred on DURABRIC, an earth-based low-carbon building material. As a compressed-earth block made of local earth, sand, cement and water, it results in one-tenth of the CO₂e emissions of common bricks, while being 20% cheaper per square meter of wall. Furthermore, because it doesn't need firing, it spares the equivalent of up to 14 trees per house during the production process. DURABRIC has already been used in Malawi, Rwanda, Tanzania and Zambia. Through this joint-venture with CDC Group plc, LafargeHolcim aims to increase production in Sub-Saharan Africa.

The chemical sector also plays a critical role in helping to reduce greenhouse gas emissions from buildings and construction. Solvay produces synthetic sodium carbonate (also called soda ash), a key raw material that cuts energy consumption in glass manufacturing. More importantly, the



chemical enables reduced emissions along the value chain of buildings. Renovating with double-glazed windows (as compared to single-glazed windows) avoids up to 3,400 kg CO₂e per metre squared over the 30-year lifetime of windows in houses in Europe. This can't be done without sodium carbonate. It is estimated that for every ton of CO₂e emitted to manufacture sodium carbonate, 90 tons of emissions can be avoided by its use in the double glazing, according to a recent joint study by Solvay and Asahi Glass Europe.

Clean computing

The rise of digitalization has transformed how many companies do business. The information and communication technology (ICT) sector contributes approximately 2% of global greenhouse gas emissions, much of which is associated with electricity usage in data centres. A more digitized and connected global economy means demand for data centres is growing.

Improving energy efficiency can help decouple growth from emissions and make data centres more sustainable. Furthermore, if data centres run on renewable power and use intelligent cooling systems, they can help create a low-carbon future.

In 2017, BT announced it would reduce carbon emissions intensity by 87% by 2030. The company is also aiming to buy 100% renewable electricity by 2020, where markets allow. Last year, it reached 82%.¹¹ BT promotes energy efficiency through products and services. By 2020, it aims to help customers cut emissions by at least three times its own total carbon impact, which includes emissions from its operations, suppliers and customers. So far it has reached 1.8 times, avoiding 10 million tonnes of emissions in 2016/17, up 32% on the previous year. In 2016, carbon-abating products and services represented £5.3bn, or 22%, of BT's revenue.

BT is also working with Ark Data Centres to develop innovative sustainable data centres that use advanced direct fresh air cooling technology. They consume less energy because the free cooling is generally available for more than 99% of the year, subject to weather conditions. This avoids having to re-circulate and artificially cool the centres' own hot air. It means Ark's data centres are the UK's most environmentally efficient. They cost £1.1m per megawatt less to run and produce 6,000 tonnes less carbon than an average data centre. The facilities also run on renewable energy.¹²

At COP23, Microsoft announced a new target to cut its carbon emissions by 75% by 2030. By investing in energy efficiency and sustainable energy projects and technologies, as well as applying an internal price on carbon, Microsoft has had carbon-neutral data centres since 2012. Also, 44% of the electricity these centres use today comes from wind, solar and hydropower sources. Microsoft aims to make that 50% by the end of 2018, and 60% in the next decade.

The Future of Internet Power (FoIP) brings together some of the world's most influential internet companies, including Hewlett Packard Enterprise, Salesforce, Adobe, Facebook, eBay and Symantec. FoIP's bold vision is an internet powered by 100% renewable energy. Data centres consumed 2% of US energy in 2014, and with more business now done in the cloud, that number has since grown. These companies identify best practices, and share challenges and thought leadership to use renewables at data centre and co-location facilities.

FoIP also co-founded the Renewable Energy Buyers' Alliance (REBA), a coalition working with more than 100 large buyers to help corporations purchase 60GW more renewable energy in the US by 2025.

Bridging sectors

Industry sectors are becoming less silo-bound as technology breaks down barriers between them. Supply chains that used to be separate are now overlapping, opening the door to new kinds of partnerships. For instance, developments like decentralized power create new possibilities to get smart about generating and using energy. The more cooperation that takes place across industries, the greater the extent of potential action against climate change.

Speeding smart transport on land...

Cross-industry partnerships spanning the energy value chain will bring new opportunities for more efficient consumption of clean energy. A digitized infrastructure, coupled with transparent and stable investment frameworks, will allow for unprecedented interactions between all actors in the energy system. For instance, Enel and Nissan launched vehicle-to-grid (V2G) projects in Denmark and the UK to turn electric cars into mobile batteries feeding power back into the grid. The aim is to make the power supply more stable, supporting renewable generation and leading to emissions reductions in the transport and energy sectors.

Partnerships in this area expand not only across different sectors (e.g. electricity and transport), but also along the value chain. For instance, in Denmark and the UK, projects have actively involved customers who own electric vehicle (EV) fleets such as Frederiksberg Forsyning (the Danish utility that operates using an EV fleet). As national regulation evolves, these new business models will be brought to new geographies. In Italy, the Enel Group foresees investments

of up to €300 million by 2022 to build up a public recharge infrastructure of 14,000 stations. Cross-sector-partnerships play a critical role in realizing this potential and Enel, which has partnerships with key companies that are investing in e-mobility (e.g. BMW, Daimler, PSA, Renault, Nissan), has signed an agreement with Volkswagen Group Italy to develop electric mobility services.

Jaguar Land Rover (part of the Tata Group) goes beyond developing low-carbon cars with clean, efficient engines and lightweight aluminium construction to understand their impact from “cradle to cradle”. The company uses sustainable and recycled materials through each car’s life. From 2020, every Jaguar and Land Rover car will be electric. Already, there are plug-in hybrids and a first fully electric vehicle. In addition, the company runs on renewable energy in the UK, and its InMotion Ventures support innovative mobility business models, products and services like lift sharing and car sharing.

... and in the air

The global aviation industry produces around 2% of all man-made CO₂e emissions.¹³ Projections expect aviation emissions to quadruple in coming years, and potentially account for 22% of global emissions by 2050. The Paris climate change agreement doesn’t cover international aviation and shipping, but the sector is creating its own rules, which will help to make air transport more efficient and less reliant on fossil fuels. This calls for significant investment in technologies that don’t exist today.



Siemens has teamed up with Airbus and Rolls-Royce to research and develop a hybrid-electric technology flight demonstrator. It will be a significant step forward in hybrid-electric propulsion for commercial aircraft.¹⁴ The team plans to fly the 2 megawatt E-Fan X demonstrator in 2020 after ground testing. The E-Fan X will help realize the goal of making electric flight a reality in the foreseeable future.

Suntory has a different approach to reducing emissions from aviation. It shares transport containers with other companies to cut the impact of importing goods. By using space to the full and making sure containers are filled both ways to and from airports, the company is cutting the number of journeys and making sure containers do not fly back empty. Suntory has worked with Kirin, Toyobo Logistics and Toshiba to cut CO₂e emissions by a combined 286 tons a year.¹⁵

Connecting cities

Cities are home to more than one-half of the world's population (by 2050 that could be 66%) and they generate 80% of its GDP. At the same time, they use 75% of its natural resources and produce more than 70% of CO₂e emissions.¹⁶ New ways are emerging in which to limit this impact, not least smart grids, electric transport and low-carbon (though still affordable) housing.

The Indian government announced its Smart Cities Mission¹⁷ in 2016 with a focus on sustainable, inclusive development for better quality of life. India also wants to switch to electric vehicles by 2030. Partnerships are bringing both of these visions a step closer.

Tata Motors is supplying 25 hybrid diesel-electric buses (the single biggest order for hybrid technology) to the Mumbai Metropolitan Region Development Authority. The bus is expected to cut diesel consumption and emissions by 25%.¹⁸ Tata is also developing fuel cell buses, which will completely eliminate fossil fuel and exhaust emissions¹⁹ in cities where hydrogen infrastructure is available.

If e-rickshaws took over from all of India's 250,000 petrol rickshaws, they could cut more than 2 million tonnes of emissions a day.²⁰ ABB is working with the central Indian city of Jabalpur to create a network of solar-powered charging points for e-rickshaws. Currently, 5,000 petrol rickshaws operate in Jabalpur, burning 20,000 litres of fuel a day and producing 46 tonnes of CO₂e. E-rickshaws would limit this impact, but have been slow to catch on because owners have to charge them overnight at home by plugging into the grid. That's costly, and the power comes from coal-fired sources. ABB is supplying solar inverters for new charging stations. A full charge will take seven to eight hours, powering the rickshaw for 100-150km at a lower cost than charging from the grid.

Connecting buildings

Buildings produce 40% of global emissions. Danfoss is seeking to lower that figure by collaborating across sectors to develop connected buildings that produce energy instead of just consuming it. For example, in Aarhus, Denmark, managing waste water smartly and efficiently makes the water cycle energy-neutral. Furthermore, it produces heat for

neighbouring buildings as well as energy to sell back to the grid.

Danfoss also works on transforming supermarkets so they enable energy transition. To use energy in an efficient way, heat recovered from their refrigerators' cooling process warms up homes in the local community. Also, by connecting unused cooling compressor capacity back to the energy grid, supermarkets help to balance out energy supply from fluctuating renewable sources. Recent pilots show that, on average, supermarkets can achieve a return on investment within 18 months.

Accenture has combined data integration and analytics to help clients save money and cut emissions by forecasting maintenance issues. A client from the hospitality industry wanted to reduce the energy consumption of one of its flagship hotels. Accenture's tools gathered data from heating and air conditioning to help staff spot potential problems early and before faults occurred. Accenture's programme highlighted action the company could take, then tracked the equipment's performance so staff could see the impact. In 18 months, Accenture helped its client save 2 million kWh of electricity and more than 135,500m³ of natural gas. In a year, the client saved \$250,000 and used 9.4% less energy – equivalent to 188,850 gallons of gasoline or 3,900 barrels of oil.²¹

Let there be (more efficient) light

Lighting produces nearly 6% of CO₂e emissions. LEDs use 40% less power than conventional bulbs, and a global switch to LEDs could save more than 1.4 million tonnes of emissions. It would also avoid building 1,250 power stations,²² and make solar powered lighting possible in areas without electricity. It promises to be one of the most significant short-term ways to cut greenhouse gas emissions.

Managing LEDs remotely through the internet of things (IoT), whether it's for street lights or road maintenance, can further save power. If homes, businesses and cities were combined, an estimated 80% of emissions could be saved.²³

Los Angeles is the first city to adopt connected lighting, and is now integrating wireless technology into the street lighting pole produced by Philips Lighting and Ericsson. This is part of Philips' wider commitment to LEDs. At COP23, the company announced it was the first global lighting company to break through the 1 billion LEDs-sold milestone for the Global Lighting Challenge, a clean energy ministerial campaign aimed at reaching global LED sales of 10 billion lamps. Philips aims to deliver 2 billion by 2020.

People inside buildings receive less than 40% of the daylight available to them, which results in high costs in terms of energy and human health. BASF has developed a system that captures up to 95% of daylight using a non-powered technology and conducts it deep into a building's interior without using windows. The system can be used to bring daylight into the inner areas of office and residential buildings, factories, schools, hospitals as well as ships and aircraft. Aside from saving energy, the use of daylight has a positive effect on productivity, well-being and patient recovery.

Creating sustainable value chains

Emissions from the value chain often represent the largest source of greenhouse gas emissions for consumer products companies. In some cases they account for up to 90% of the total carbon impact.²⁴ Companies can make great strides, not least by setting an example and showing what is possible, but to tackle the problem fully, they need connections with governments and civil society groups. This joint action boosts the scale and pace of change.

Tackling deforestation

Land use, including forestry and agriculture, accounts for about 11 Gigatonnes CO₂e, or 20% of global emissions. Making better land use choices holds the potential to remove more than 23 Gigatonnes CO₂e per year and 37% of the needed mitigation to 2020.²⁵ Ending deforestation in tropical regions represents a crucial component of nature-based solutions, which are essential to achieving the Paris Agreement targets.

Clearing forests has long been the route to provide the agriculture land needed to meet a growing demand for food and consumer goods. Beef, soy, palm oil and paper are among the commodities whose recent expansion has often

come at the expense of forests. Meeting emission reduction targets means ensuring that consumers' demand in these supply chains is met without further deforestation.

The Tropical Forest Alliance 2020 (TFA 2020) is a global public-private partnership working to support the shift towards deforestation-free supply chains. It includes companies like Unilever, Marks & Spencer, Nestlé, PepsiCo, HSBC and Wilmar, alongside civil society, government and "jurisdictions", with the aim of ending commodity-driven deforestation by 2020. The TFA 2020 is a good example of how corporate leadership can ignite and support transformational and systemic change. By making voluntary commitments to reduce or eliminate deforestation in their supply chains, businesses create the confidence for governments to advance ambitious policy leadership. For example, in November 2016, the governments of seven African palm oil producing countries, representing more than 70% of Africa's tropical forest, signed the TFA 2020 Marrakesh Declaration for the Sustainable Development of the Oil Palm Sector in Africa. This has ensured putting sustainability, human rights and collaboration with industry, indigenous peoples and civil society groups at the heart of the expanding palm oil industry in Africa.



The Marrakech Declaration builds on a growing global movement that has seen more than 470 leading businesses make voluntary commitments to reduce or eliminate deforestation in their supply chains, and more than 190 government, non-governmental and corporate entities committing to the elimination of all deforestation driven by agricultural commodities by 2020 through their signature of the New York Declaration on Forests in 2014.

Yet, this movement must intensify its efforts, if it is to meet its goals. Irrespective of its strong momentum, independent assessments indicate that the international community will miss its target of eliminating commodity-driven deforestation by 2020 if efforts are not increased and accelerated.^{26,27} This is why the TFA 2020 launched its Forest and Commodities Agenda 2020, in which it identified 10 priority areas for action to accelerate progress against deforestation.²⁸

Curbing agriculture's emissions

Cutting emissions from agriculture is an important part of tackling climate change. Currently, the sector produces 14% of global CO₂e. A rising world population needs agriculture all the more, but rising temperatures alongside less predictable – and sometimes extreme – weather poses a bigger problem than ever. The challenge becomes to cut emissions and make farmers less vulnerable to risk while not undermining their income.

Syngenta works with farmers to make them more resilient to changing weather by:

- Producing more with less: growing more crops from existing farmland avoids converting other land for agriculture. One example is increasing rice yields in Bangladesh, China and Indonesia by combining better tools, practices and agronomic advice.
- Increasing farmers' knowledge: showing farmers how real-time data helps them make better decisions about what to plant, where and when, and which technologies to use on plants and soil. Syngenta also partners with food companies and processors to help growers capture farm data and report sustainability metrics on land use, soil conservation, soil carbon, water quality, and CO₂e emissions, making supply chains more transparent.
- Making the food chain more resilient: helping farmers use different techniques in extremely dry areas to cut their impact on the environment and stay productive. For instance, in the dry regions of Hungary, Mexico and Russia, Syngenta is working with local organizations and universities to encourage farmers to adopt sustainable soil management practices, like conservation agriculture. This maintains more moisture in the soil, keeping it productive even in dry conditions.

Battery power fit for the future

Battery power is similarly vital to the low-carbon revolution. Batteries are the key to the success of electric cars and storing renewable energy. Battery capacity needs to grow 12-fold to meet expected consumer demand; the market will be worth an estimated \$100 billion by 2025, while batteries

in homes and businesses will account for 57% of the world's energy storage capacity by 2040.²⁹ There is, however, a human and environmental cost. Mining the cobalt needed to produce batteries often relies on child labour, and battery production also requires high-polluting materials like lithium, nickel, manganese and graphite.³⁰

The Global Battery Alliance, launched in September 2017, is a public-private partnership dedicated to building an inclusive and sustainable battery value chain. Businesses including BASF, Enel, Johnson Controls, Royal DSM, Solvay and Veolia are working with other companies from the automotive and mining industry and with traders to end child labour, cut pollution and promote recycling.

Harnessing data and connectivity

Data is routinely described as “the new oil”, and for many controlling, understanding and exploiting it is the new route to competitiveness. Not for nothing are the IoT and analytics now seen as the Fourth Industrial Revolution. This technology also holds the potential to help curb energy use, grasp industry’s impact on the planet and come up with new ways to limit it. For this reason, action from the technology sector has transformational potential. It could enable a 20% drop in global CO₂e emissions by 2030, holding emissions at 2015 levels.³¹

Technology for the Earth

This year, Microsoft announced Artificial Intelligence for the Earth, a new programme to put the power of artificial intelligence (AI) and data insights into more sustainable management of issues around water, agriculture, biodiversity and climate change. In the next year, the \$50 million (over five years) project aims to improve access to AI and education about its role in innovation that will advance sustainability. Existing applications include land cover mapping to aid precision conservation, smart agriculture through sensors, drones, data and broadband connectivity, and testing the viability of using smart mosquito traps to remotely track and monitor species’ health.³²

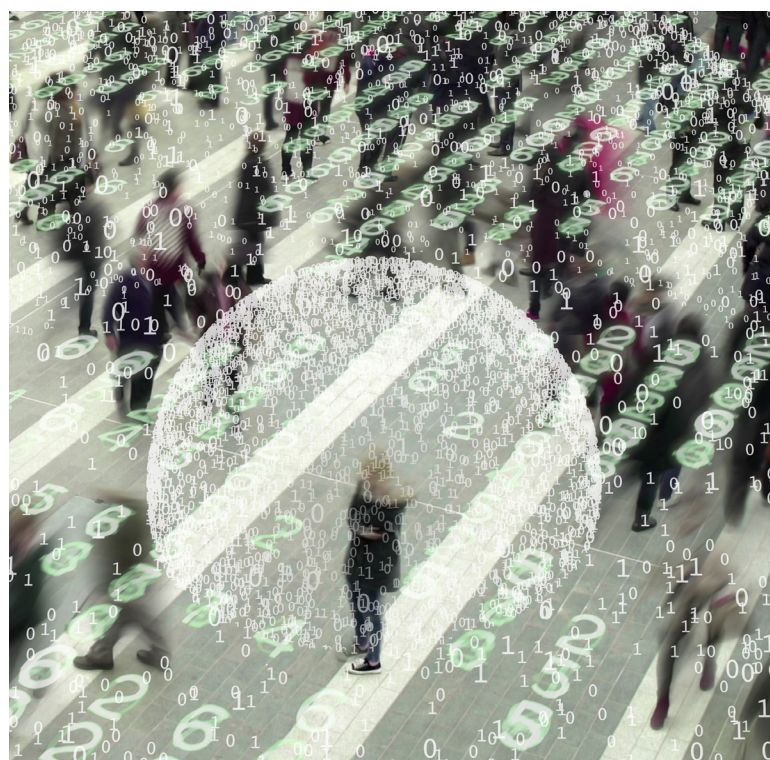
Ericsson is working with technology partners and NGOs to find an efficient way to restore Malaysian mangrove forests. Approximately one-half of Malaysia’s mangroves have been destroyed by development, fire, deforestation or pollution, leaving coasts unprotected from risks like flooding and tsunamis. Recent scientific studies have shown that coastal wetland, especially mangroves, can act as carbon sinks, which limit climate change by storing carbon in plants and in the soil below. Connected sensors monitor the environment, with cloud-based software providing real-time information on ambient temperature, soil, humidity, water, salinization and more. This helps communities take prompt action when conditions change and gives them warning of floods, fires and tsunamis. The same technology could also tell farmers when it’s best to plant, water and fertilize crops, and how best to boost yields by studying how crops behave under different conditions.³³

Ericsson has used a similar solution on an islet in the Philippines, which is a proposed critical nature habitat and ecotourism area. Aside from the sensors, near real-time images from cameras will also help the local government look out for intruders and keep the area safe for migratory birds and other wildlife.

Kokusai Kogyo analyses satellite or drone images for plant protein content, dryness and more, sending the information to smartphones. This helps Japanese farmers stay on top of unpredictable weather and use their resources in the best way possible to cut error and waste, and boost productivity. This becomes more valuable at a time when surprise weather means farmers cannot trust their experience as much as they used to. Furthermore, it helps to retain and attract new workers to an industry that is rapidly shrinking because of its labour-intensive nature.

The indicators help farmers decide when to harvest or fertilize their crops, improve drainage or reseed. Among other things, it’s allowed family-run wheat farms, who communally own post-harvest equipment like drying machines, to bring their crops to the same ‘setting’. That cuts fossil fuel use and post-harvest time and labour, as well as improving the quality and quantity of the harvest. Dairy farmers who used to routinely reseed their fields of hay after a set number of years can now identify and reseed only the fields with the most weeds, without unnecessarily reseeding the better-performing fields.

Precision farming that maximizes output and reduces energy and raw material use grew out of necessity in resource-strapped Japan. It can, however, be useful for other countries facing food shortages and sustainability issues. The Japanese government exports practices like these to developing countries.



Financing change

Shifting to a low-carbon economy requires action on a global scale to get the planet in step with the Paris Agreement target. New ideas, strong will and smart thinking all matter, but it will take investment to make transformation happen.

The world will invest an estimated \$90 trillion in infrastructure over the next 15 years. That will mean increasing today's \$3.4 trillion-a-year spending to \$6 trillion.³⁴ China's \$5 trillion Belt and Road initiative offers a significant opportunity for sustainable investment. It will connect more than 60 countries across Asia, the Middle East, Europe and Africa with roads, railways, airports, power plants, oil and gas pipelines and refineries, and financial infrastructure.³⁵ Private-sector finance must, however, play its part in low-carbon investment. That means making it easier to invest in ideas, businesses and technologies that cut emissions.

Putting portfolios on a 2 degree path

The UBS Climate Aware Fund gives investors a portfolio that supports the Paris Agreement's target to stop temperatures rising more than 2° Celsius. The portfolio chooses companies based on their commitment to cut their carbon footprint. It looks at their reporting on emissions, objectives and how they're turning policies into action. It also analyses how their carbon footprint changes over time. If they have coal, oil or gas reserves or use electricity from coal-fired sources, they get less investment weighting than other companies in the portfolio.³⁶

Green financing products

Green bonds (or climate bonds) are a financial instrument, which can help make low-carbon investment possible. A 2017 report shows "climate aligned bonds" worth around \$895 billion financing low-carbon assets or projects, or initiatives helping the planet cope with climate change. Overall, this is \$201 billion up on the figures from 2016.³⁷ The bonds commonly help finance energy efficiency, renewable energy and sustainable infrastructure projects.

In September 2017, after the launch of its third green bond, ENGIE became the world's largest issuer, with €5.25 billion in green bonds to reinforce financing of energy transition projects.³⁸

In 2014, Iberdrola was the first Spanish company to issue a green bond, and in 2016 it was the world's largest private issuer. To date, the company has issued €6.7 billion in green bonds and €500 million in green bank loans. Proceeds help finance and refinance renewable and grid projects both in Europe and the US. The Wikingen offshore wind farm in Germany, a flagship project for Iberdrola, is one such project

to benefit. It generates enough power for 350,000 homes, avoiding 600,000 tonnes of CO₂e emissions in the process.

HSBC has played an important part in establishing the green bond market, continuing to be a leading underwriter of green, social and sustainability bonds. In 2016, HSBC was sole green structuring adviser and one of the Joint Lead Managers on the first ever green bond to finance an airport (in Mexico City). At the time, that was the biggest ever Latin American green bond issued. The trust behind the airport issued bonds worth \$2 billion to build low-carbon buildings including control towers and terminals, on-site solar power, and waste and water management facilities. The airport will handle 50 million passengers a year, yet aims to be carbon neutral, using 40% less energy than international standards and running on 100% clean energy.³⁹

With help from the International Finance Corporation (IFC) – a sister organization of the World Bank and member of the World Bank Group – Fiji has issued a \$50 million sovereign green bond, which is likely to be one of the first of its kind offered by a developing world country. The bond will raise funds for projects with environmental and social benefits, including energy efficiency, renewable energy and clean transport, as well as initiatives to cut pollution and



greenhouse gas emissions, and manage water supply in a sustainable way. The projects also aim to make Fiji less vulnerable to the effects of climate change.

ING Group has issued 18 sustainability bonds worth more than €15 billion to fund clients' social, green and water projects. Furthermore, it has developed a financing structure that has led to approximately 10 transactions linking the interest rate to a company's sustainability performance and rating.

Securing vulnerable crops

Cotton is Burkina Faso's most important cash crop, with Sofitex accounting for 80% of production though 2 million smallholders. The crop is, however, vulnerable to drought. The IFC is supporting Sofitex with investment that allows farmers to warehouse their crops, and in doing so, reduce their losses. They are also getting training to store water in fields for when it's in short supply, and advice on combatting erosion. This ensures that farmers don't have to exploit groundwater, while their cotton crop could increase by around 40% and their maize by 30%.

IFC has backed Sofitex with three tranches of investment, together worth €230 million, under the Global Warehouse Finance Program (GWFP). The backing supports measures that are part of Burkina Faso's NDC under the Paris climate change agreement. The funds have come from the public and private sector. The Canadian, Dutch, Japanese, UK and US governments have donated under the Global Agriculture and Food Security Program (GWFP). Private sector supporters include Société Générale and BNP Paribas. The GWFP lets the IFC invest in more innovative and risky projects that have a strong potential to boost food security and cut poverty.

Speeding up green investment

The IFC has highlighted that the Paris climate change agreement is helping to open up nearly \$23 trillion in opportunities for climate-smart investments in emerging markets between now and 2030.⁴⁰ Finding ways to speed and scale-up opportunities for the private sector to work with governments on country-specific opportunities is critical to realizing the green investment opportunity.

PwC's Climate Finance Accelerator (CFA) matches government, finance and capital market players from selected countries with project and green finance experts. They work together to develop outline financing propositions for priority NDC projects. The first CFA paired Colombia, Mexico and Nigeria with HSBC, Deutsche Asset Management and BNP Paribas, alongside impact investment adviser, Enclude, with Vietnam participating as an observer. Projects the group prioritized represented more than \$5bn of financing and mitigated 100,000 tonnes of CO₂e.

The Sustainable Development Investment Partnership (SDIP) aims to mobilize public and private money for \$100 billion of sustainable infrastructure projects in developing countries. Brought together by the Forum with the backing of the Organisation for Economic Co-operation and Development (OECD), members include Allianz, HSBC, the IFC and PensionDanmark. SDIP works in different regions to help local institutions develop projects and raise capital.⁴¹



Make change happen

From finance and energy, to transport and construction, what you've read here shows that change is happening, but we need more of it. Climate action faces a critical year in 2018. Companies, sectors, states and regions will need to step up their ambitions in the race to make sure 2020 is the year of peak emissions. By joining the Alliance of CEO Climate Leaders, you can help to make that difference.

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Acknowledgements

The World Economic Forum would like to acknowledge the valuable contributions of the following companies in the development of this document:

ABB Ltd; Accenture; Acciona; Allianz; BASF; BT Group; Danfoss A/S; Enel Spa; ENGIE Group; Ericsson; Hewlett Packard Enterprise; HSBC Holdings; Iberdrola; ING Group; International Finance Corporation (IFC); Johnson Controls; Kokusai Kogyo Co. Ltd.; LafargeHolcim; Marks & Spencer; Microsoft; Nestlé; Ørsted; PensionDanmark; PepsiCo; Philips Lighting; PwC; Royal DSM; Siemens; Solvay SA; Suntory; Syngenta International; Tata Group; UBS Group; Unilever; Veolia; Wilmar International.

As well as The Writer for their support in the writing of this paper.

Project Team

Emily Farnworth
Caterina Cilfone
Noam Boussidan

Contact

For questions about the Alliance of CEO Climate Leaders and the World Economic Forum Climate Initiative please contact:

Emily Farnworth, Head of Climate Initiatives,
emily.farnworth@weforum.org

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About the World Economic Forum Climate Initiative

The Paris Agreement, despite the US federal government's stated intention to withdraw, has generated irreversible momentum on climate action. Many cities, states, businesses and investors understand the risks associated with climate change and are seeing the benefits of taking action. However, the scale and pace of change needs to rapidly increase. The next two years are crucial for delivering progress in line with the science if the world is to avoid the worst effects of climate change. A requirement of the agreement is that countries raise their ambition on climate action ahead of 2020. In practice, this means implementing smart policies and incentives that can drive the low-carbon transition.

The World Economic Forum's Climate Initiative will use its global platform and convening power to help raise ambition and spur greater and faster climate action. Specifically, it will bolster the efforts of relevant public and private stakeholders to address policy challenges, shift the investment landscape, and develop new business models and technologies to accelerate the transition. It will also leverage the growing opportunities provided by the Fourth Industrial Revolution to help realize the full potential of these technologies.

Endnotes

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World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744

contact@weforum.org
www.weforum.org