FUTURE OF SPACESHIP EARTH

The Sustainable Development Goals
Business Frontiers

I commend the Future of Spaceship Earth project for its important work. This report examines what is needed to meet the Sustainable Development Goals (SDGs), with a particular focus on the business frontiers.

The SDGs provide a holistic, universal, and ambitious roadmap for the future that we want. Achieving the goals will require action and partnership, involving stakeholders all over the world. The business sector has a crucial role to play.

This report highlights the vital contributions business can – and must – make in order to achieve the SDGs by 2030, and presents 17 inspiring examples. It is the nature of business to be innovative, to leverage technology development, and to be a vigilant driver of change. At the same time, governments have a critical responsibility to ensure a conducive business climate and level playing field for industry and enterprise. It is therefore very encouraging to read about promising public-private partnerships, and about the many actors joining forces to bring progressive development initiatives to scale.

I also commend the ability and readiness of many companies to reorganise their core activities around the SDGs. In the short term, this reprogramming of purpose and approaches will not be an easy ride. However, this report makes it clear that business leaders are ready to rise to the challenge. That is a position I applaud. In my view, the SDGs are the main track – not a side track – for addressing the root causes of poverty and building prosperous societies.

Erna Solberg
Prime Minister of Norway
Co-chair of the UN Secretary-General´s SDG Advocacy Group

THE TIME IS NOW

It is hard to believe that we are already celebrating the first anniversary of the SDGs. In a short time, the SDGs have brought together world leaders, the business community, civil society, and citizens as never before – all committed to make change happen on a massive scale. Everyone agrees that fulfilling the critical ambitions of the SDGs will take an unprecedented effort by all sectors in society – and business has to play a very important role in the process.

For business, the SDGs have provided a new "North Star" for a world in constant change. In addition to identifying where we have to be in 2030 to create a sustainable world that leaves nobody behind, the SDGs also outline new markets and opportunities for companies everywhere.

To meet the SDGs by 2030, the time to act is now. In order to succeed, we will need to invent, develop, and launch countless new ideas and solutions within a very short time. Companies need to start looking through the SDG lens right away – imagining how their operations, products, and services can support the realities of our planet and better serve markets, both today and in the future.

Many of the solutions and innovations we need are already out there. It is now a matter of finding the determination and ingenuity to bring them to life.

The good news is that businesses around the world are responding to the vision set out in the global goals. As this report shows, many companies are already taking action – for example, to reduce inequality, foster peace and stability, and protect people and the planet. They are starting to set goals based on the SDGs and plan to report on their impact. We are off to a good start.

The job ahead is to reach the thousands and thousands of companies that have yet to take up this call, or may not even be aware of the SDGs and how they can make a difference.

At the UN Global Compact, we are devoted to mobilizing a global movement of sustainable companies and stakeholders to create the world we want. We believe that businesses everywhere can play a pivotal role in improving our world, starting simply by doing business right. Our goal is to shift corporate mindsets and models everywhere in order to achieve the SDGs.

The journey to 2030 is officially underway, but our work has only just begun. We will need more pioneering corporate leaders and entrepreneurs who can build the sustainable societies of tomorrow. Equally important will be the alliances and partnerships that we build between businesses and all relevant stakeholders – both private and public – to demonstrate the huge potential of a values-driven market approach.

Working to achieve the SDGs will be the most important work of our lifetime. Actions we take today will have a lasting effect on the next generation. Let's work together to make a difference. The time is now.

Lise Kingo
Executive Director and CEO
UN Global Compact

AT THE FRONTIER

When I wrote to 17 leading companies – all of them UN Global Compact signatories – earlier this year inviting them to participate in this project, I asked myself: Could we really stop these busy people in mid-stride and ask them to dive deep into the Sustainable Development Goals (SDGs)? My question was quickly and comprehensively answered.

This publication bears testament to the fact that many businesses are in a position to give spontaneous answers about their impact on the SDGs – and they can do so because they have already engaged deeply with them.

The SDGs have become a blueprint for business. If a company says it is committed to sustainability, that needs no longer to be a vague undertaking; it means showing how you contribute to the outcomes targeted by the SDGs.

There is plenty of food for thought in the pages that follow: innovations; partnerships; technology breakthroughs; lateral thinking; sheer doggedness. These may be the actions you'd expect from business – to be the trailblazer at the frontier, coming up with concepts that catalyse new ways of doing things. There are also actions you might not expect from businesses that will catch your eye: conscious decisions to employ marginalized people; efforts to integrate small suppliers into supply chains, and to source locally; a quest to find quality and healthy products and services that serve the poor. In addition to social impact, throughout you will find a genuine determination to speak and stand up for our great silent partner, the environment.

For the most part, business has the technology, people, and processes to rock the world. The challenge, therefore, isn't the 'smarts', it's the take-up of the solutions proposed and piloted – the real scaling of these interventions. That is the primary purpose of this publication: by vividly showing what business is achieving at the frontier of environmental and social progress, we hope to educate, to inspire further leadership by thousands of other businesses, and to encourage rapid learning.

Because, let us be very clear, our forecast says that we won't achieve the goals without urgent, extraordinary action.

We in DNV GL are used to working in partnerships – indeed, that is the only way we can fulfil our role of developing global technology standards to enhance performance, safety, and environmental stewardship. But the high-level, rapid collaborations by leading companies presented here are especially noteworthy, and give a hint of what business can do on a grander scale for the SDGs.

I wish to record, on behalf of DNV GL, my deep gratitude to all the CEOs and business leaders featured in these pages; I would like to pay tribute to UN Global Compact and its Executive Director, Lise Kingo, in particular, for working with us 'at the Frontier', and, last but certainly not least, my thanks to the Prime Minister of Norway, Erna Solberg, for endorsing this publication and her message of support in her capacity as Co-Chair of the SDG Advocacy Group.
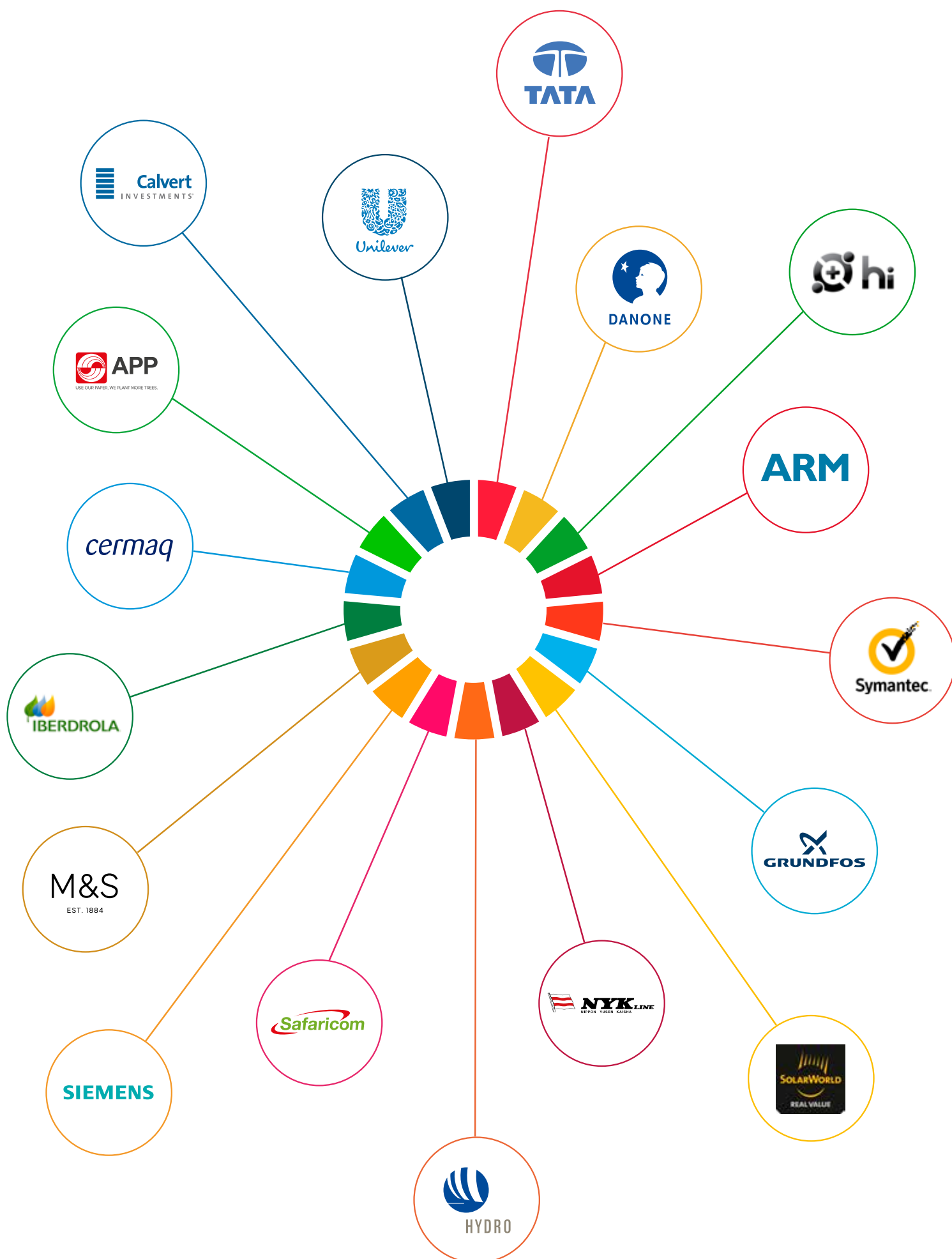
Remi Eriksen
Group President & CEO
DNV GL

17 GOALS
17 FRONTIERS

EXECUTIVE SUMMARY

In September 2015, the United Nations adopted the new Sustainable Development Goals (SDGs) for the year 2030, setting an ambition for a safe and sustainable future for everyone, and especially for the less privileged passengers aboard 'Spaceship Earth'. The 17 goals provide a global framework for action, and governments, organizations and individuals everywhere are indeed starting to act.

But even as the positive momentum builds, it is wise to take stock and consider what it will take to fulfil the goals. Are they achievable? Everywhere? What is the scale of the challenge? How can business take action? These are questions we have set out to answer.

At DNV GL we are no strangers to long-term thinking and planning. On a daily basis, our customers ask our engineers and technologists to classify, verify and assure the safety, performance and environmental impact of their assets – vessels, wind and solar farms, offshore infrastructure, pipelines, electrical grids, and so on – which are built to last for decades. We are increasingly called upon to investigate the sustainability of operations and of global supply chains. The mitigation of climate change and adaptation to its effects are topics that many of our customers wish to explore with us.

For all of these reasons, we felt it prudent to develop, as part of our strategic research and innovation programme in 2015, a 'most likely future' forecast of our world through to 2050, to guide our customers, ourselves and our stakeholders. We dubbed this our 'Spaceship Earth' forecast.

To road-test our forecast we used it to assess the likelihood of humanity achieving each of the 17 SDGs by 2030. We presented our findings in a research report issued in December 2015, which generated widespread interest. From the feedback received, it became immediately apparent that people wanted both to explore our forecast, and to compare it with their own ideas on how the SDGs can be tackled, and achieved.

This new publication therefore contains both our forecast and solutions from the private sector for attaining the SDGs. We added the 'solutions' element in dialogue with UN Global Compact, a UN initiative to encourage businesses worldwide to contribute towards a sustainable future by adopting sustainable and socially responsible policies. As we describe below, DNV GL invited 17 leading global companies, all UN Global Compact signatories, to join us on this journey.

The future we are heading towards
Our Spaceship Earth forecast predicts that the world will show significant progress in many areas. The global population will, with 8.5 billion people in 2050, be nearing its peak a decade later. On average, people will have better access to education, energy, food, clean water and sanitation as GDP per capita will continue to grow in the developing world. But the GDP growth rate will be lower and approach a standstill in the developed world; a pattern that will be repeated by developing nations as they too transition into post-industrial societies. The averages in our forecast also obscure the persistence of inequality and unwelcome phenomena like ongoing refugee crises, new forms of slavery, pockets of extreme poverty, and war and conflict.
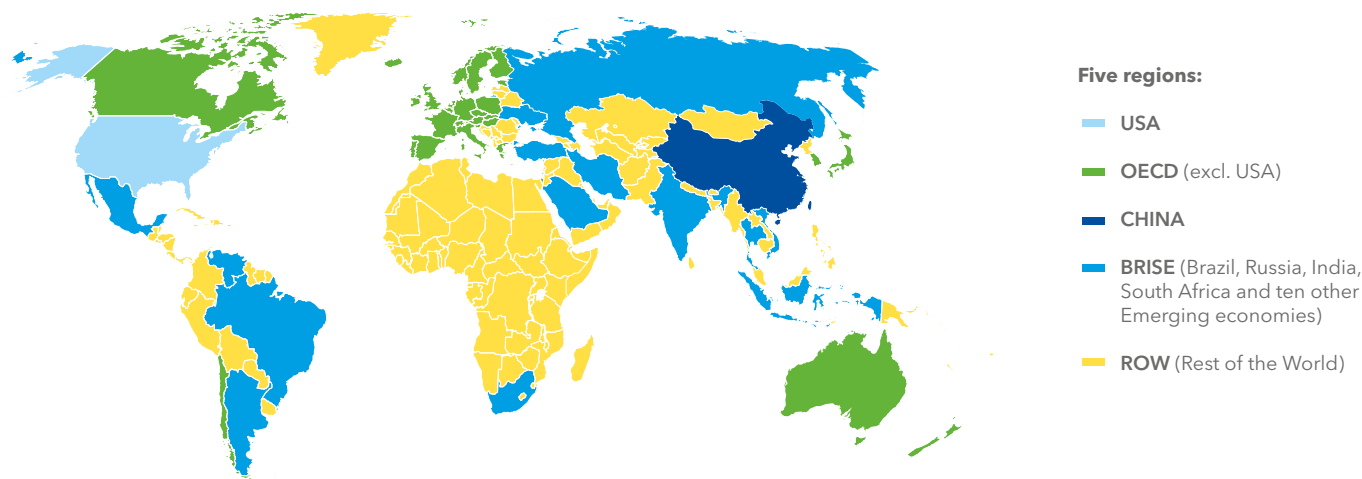
Differences between the developed world – which over time also will include China – and the still-developing world will continue, but will start to reduce over the forecast period. Whereas some emerging economies will follow the track of Japan, Korea and China and achieve fast and sustained economic development, many of the poorer nations will remain in relative poverty.

Global energy use will increase over the next 15 years, but thereafter will start to plateau as reduced energy intensity counteracts energy demand linked to GDP growth. Renewable energy will double its share after 2030 and provide half of the energy used by the world in 2050, but the world will still burn unsustainable levels of coal, oil and gas.

Likelihood of meeting the 17 Sustainable Development Goals in five world regions:

🟢 Goal likely to be reached (i.e target fulfilment of more than 95%)

🟠 Goal not likely to be reached, but more than 50% of gap between today's status and the goal is likely closed

🔴 Goal not likely to be reached, and less than 50% of gap between today's status and the goal is likely closed

		ROW	BRISE	CHINA	OECD	USA
1.	No poverty	🔴	🟠	🟠	🟠	🟠
2.	Zero hunger	🔴	🔴	🟢	🟢	🟢
3.	Good health and well-being	🟠	🟠	🟢	🟢	🟢
4.	Quality education	🔴	🟠	🟢	🟢	🟢
5.	Gender equality	🔴	🔴	🔴	🟠	🟠
6.	Clean water and sanitation	🔴	🔴	🟠	🟢	🟢
7.	Affordable and clean energy	🟠	🟠	🟢	🟠	🟠
8.	Decent work and economic growth	🟠	🟠	🟠	🔴	🔴
9.	Industry, innovation and infrastructure	🟠	🟠	🟢	🟢	🟢
10.	Reduced inequality	🔴	🔴	🔴	🔴	🔴
11.	Sustainable cities and communities	🔴	🔴	🟠	🟢	🟢
12.	Responsible consumption and production	🟢	🔴	🔴	🔴	🔴
13.	Climate action	🔴	🔴	🔴	🔴	🔴
14.	Life below water	🔴	🔴	🔴	🟠	🟠
15.	Life on land	🔴	🔴	🟠	🟠	🟠
16.	Peace, justice and strong institutions	🔴	🔴	🟠	🟠	🟠
17.	Partnerships for the goals				Not enough data to assess	

Five regions:

🟦 USA

🟩 OECD (excl. USA)

🟦 CHINA

🟦 BRISE (Brazil, Russia, India, South Africa and ten other Emerging economies)

🟨 ROW (Rest of the World)

THE SPACESHIP EARTH TERMINOLOGY

The term "Spaceship Earth" is almost as old as DNV GL and a well-used expression. The term was probably first coined by Henry George in *Progress and Poverty* in 1879, and popularized by R. Buckminster Fuller in the 1960s. The phrase has been used relatively frequently since then, for instance by the former UN Secretary-General U Thant, normally as a term describing our planet.

In DNV GL, the term was used for our 150 year anniversary in 2014 by Nina Witoszek, Head of Research at Oslo University's Centre for Development and Environment, and suggested as a project by Professor Emeritus Jorgen Randers. He suggested, teasingly, that since DNV GL was responsible for the classification of a quarter of the world's fleet and its most advanced vessels – i.e. establishing and maintaining technical rules for their construction and operation – then "… why not set up a project to class the greatest ship of them all – Spaceship Earth!"

Antarctica viewed from space. Shutterstock/NASA

As a result, by 2040, accumulated CO_2 emissions will have overshot the carbon budget – the limit that would ensure that global warming stays lower than 2°C above preindustrial levels. Inertia in the global energy system will drive global temperatures to around 2.5°C above the preindustrial levels, and many resources will continue to be used beyond the carrying capacity of the planet.

Our most likely forecast not only suggests that the rate of decarbonization of energy use will be insufficient, but also that general environmental degradation, like the loss of wild spaces, diminished biodiversity, depleted marine resources, and erosion of topsoil, will be severe.

The SDGs on climate action, life below water and life on land set the planetary boundaries for all the other SDGs. While *Homo economicus* may appear to be better off in today's financial terms in our most likely future, the quality of life is likely to remain low in the developing countries and deteriorate in developed countries. We exist on a planet – our beautiful blue spaceship hurtling through space and time – not on a financial statement. We are *Homo ecologicus*; or more plainly, Earthlings. Climate change and poverty cannot be decoupled.

Assessing the likelihood of meeting the sustainable development goals

We have used our own forecast model of five world regions to assess the likelihood of the world achieving the SDGs in 2030. Where necessary, we have used other models and data to supplement our assessment. As the illustration on page 9 shows, we conclude that **none of the 17 SDGs will be achieved in all regions.** Comparing our forecasted regional status with the SDGs, gives an indication of the gap between the future humanity wants and where Spaceship

Earth is heading. This scorecard approach is useful and provides focus, but it falls short of illuminating the strong interdependencies between the Goals. SDG 13 on Climate Action, for example, is a game changer for virtually all the other goals, as we have made clear in the discussion above.

Involving the private sector

Our forecast is of a likely future. It does not, by definition, take into account humanity's capacity to take extraordinary action.

Extraordinary action is not the exclusive domain of the private sector. But what business does best is innovate, and lead technological development that can leverage vast, global changes. The private sector delivers nearly 60% of worldwide GDP and reaching the SDGs would be inconceivable without its alignment and support. There is a growing realization that business cannot succeed sustainably in societies that fail. The corollary is also true: societies striving for sustainability open up many opportunities for the private sector. The rationale for broad engagement with the SDGs by business could not be plainer.

This kind of thinking has been advanced by UN Global Compact for more than a decade and it is therefore no accident that all 17 companies we featured in this publication are UN Global Compact signatories.

Frontier companies

Frontiers are generally exciting but uncomfortable places: remote, risky, often lawless and conflict-ridden. The frontier for the SDGs that we have in mind has all these characteristics, except that the conflict we see is the battle *against* poverty and *against* irreversible environmental degradation; it is the fight *for* dignity, *for* inclusive growth

Mafikizolo raised a flag to represent SDG 8, Decent Work and Economic Growth, at Constitution Hill in Johannesburg, South Africa. Credit: Nicki Priem, courtesy globalgoals.org

and well-being. The 17 companies that we feature in this publication are some of the pioneers on this new frontier. Clearly, they are not the only SDG pioneers in the wide world of business, but they are all signal examples of firms that have taken bold decisions to act, to feel their way forward where precedents don't exist, and to show leadership in one or several SDGs. Some of them are very large multinationals, others are sector-driven or niche-focused, and one of our pioneers is a start-up company.

All 17 goals are relevant for the private sector, but not all goals are equally relevant for all companies. We therefore asked each of the 17 signatories to reflect particularly on a single goal. The result is a far deeper discussion on the individual goals than we would have been able to present on our own.

Pioneering with the SDGs does not mean doing business and separately addressing the SDG targets. It means addressing the SDGs head-on, as an integral part of a company's business model. Thus, in this publication you will find businesses for whom the terms 'circular economy', 'zero deforestation', and 'democratizing sunshine' are not buzzwords, but a central tenet of their strategies. You will find examples of businesses that have consciously and

successfully opted to grow and service markets that work for the poor. Other firms are actively developing and recruiting from the ranks of marginalized groups in a way that makes business sense. Others again are unafraid to tackle apparent contradictions: protect the environment and provide humanity with sustainable, affordable protein – does that sound like a tall order? How about responsible investing that combines shareholder activism with investing for social and financial returns? Embark on a journey to ensure that all the products on your shelves have a sustainability story to tell? There might be enlightened self-interest in using one's own industry-leading innovation to boost education, change the nature of healthcare, or raise the productivity of micro businesses. But doing this on a wide enough scale means, as some of the firms we feature have discovered, that these engagements start to become brand-defining.

It can be lonely out on the frontier, and there are two traits that we have found our pioneering companies share strongly. The first is a yearning for camaraderie – a quest to find like-minded players in their industries to bring scale to their SDG-related activities. The second is an enthusiasm and talent for storytelling; we hope that in the limited space we have available that we have been able to do justice to these sustainability sagas.

2030 FORECAST

DNV GL has developed a model-based forecast of the most likely future for our planet through to the year 2050. For the purposes of this project we 'stop the clock' on our forecast at the year 2030, and assess the likelihood of the Sustainable Development Goals being met. The forecast model has been developed by our Strategic Research team, and focuses on key issues such as population, energy efficiency, energy use, emissions, and food availability.

How did DNV GL arrive at this forecast?

We first surveyed over a dozen forecasting models, paying special attention to the relevance of each model to all 17 SDGs. On this basis, Jørgen Randers's "2052" model (Randers, 2012), appeared to be the most suitable starting point. In dialogue with him, we refined his model and developed our independent input. We also ran sensitivity analyses with the model, and performed structural sensitivity analyses using two supplemental models: the system dynamics-based "T21" model of Millennium Institute (Pedercini and van der Voorn, 2015) and the benchmark general computable equilibrium model "RICE" (Nordhaus, 2009). "T21" does not have a regional breakdown, but covers a broader set of indicators than "2052" and "RICE" in terms of forecasted variables. Once co-calibrated with "2052", "T21" was also used for assessing SDG issues not covered by "2052".

All three models establish how issues interact, and depend on "key assumptions". As our objective was to predict the most likely future, our assumptions must also be based on well-grounded logic.

To this end, we explored historical trends in the key drivers of our assumptions and sought stable relationships in the global system. We used these key assumptions to run all three models, to ensure comparable results.

A more detailed explanation of the methodology is given in our research report (DNV GL, 2015).

A regional forecast

We divided the world into five regions, characterized by their size and economic development status. The world's two largest economic powers, USA and China, are defined as regions on their own. OECD (minus the USA) is defined as a third economic region.

Large emerging economies are assembled in another region – named BRISE after Brazil, Russia, India, South Africa, and the other ten large Emerging economies –

the common trait being that these have shown fast growth for some time, and have climbed out of widespread poverty. The final region, Rest of the World, ROW, mostly cover nations that struggle to provide their citizens with high standards of living, but additionally also represents smaller countries that would not fit in to the other categories. The regional double spread at the end of this global forecast gives the full overview of the five regions.

The global forecast is developed as the sum of the regional forecasts, and the regions are treated separately for all the input parameters and calculations. In this report, we first present the global forecast, and also include one double-page spread presenting each of the five regional forecasts.

Key assumptions

Our approach and assumptions have been empirically based wherever possible. So, for instance, in our forecast of the future energy mix, our approach was to identify energy investment trends and extrapolate from these. But as these trends obviously cannot continue indefinitely, and may create inconsistencies such as oversupply, we have made our own critical adjustments to ensure consistency between variables such as energy demand and supply.

In doing so, we drew on assumptions developed for the "sustainable scenario" developed for the Intergovernmental Panel on Climate Change (IPCC, 2010) in instances where our own analysis and model provided insufficient guidance.

Uncertainties

Although we describe our forecast as "the most likely future", other futures may also materialize. We chose to highlight factors that might possibly alter our forecast, and investigated them further. Sensitivity tests mapped out the uncertainty space. Documented in our research report (DNV GL 2015), these tests followed two paths, which we investigated separately. First we measured the implications of uncertainties in data assumptions. Then we quantified uncertainties arising from the use of different models, as they represent the global system in different ways.

Global Forecast

Our use of the "2052" model provided input to most of our assessments of the likelihood of the world achieving the SDGs. Where necessary, for some of the SDG targets we supplemented our assessments with additional, independent forecasts that were not in conflict with our model. A core issue was how each region's energy demand would develop and be supplied, and here we had to provide estimates for how productivity and population would develop and, through this, project future GDP. Additionally, we estimated each regions future energy intensity and mix, concluding with energy requirements and carbon emissions.

Calculating energy demand

We calculated global energy demand by using the first three terms of the Kaya identity (Kaya, 1990), which estimates CO_2 emissions from human sources, F, as the product of population, GDP per capita (productivity), energy intensity of economy, and emission intensity of energy use; where P is population, G is GDP, and E is energy demand.

$$F = P \times \frac{G}{P} \times \frac{E}{G} \times \frac{F}{E}$$

We followed a bottom-up strategy to estimate global energy demand. For each of the five regions, we decomposed total energy demand into three components (population, productivity, and energy intensity) and separately estimated each component and calculated energy demand as:

$$E_r = P_r \times \frac{G_r}{P_r} \times \frac{E_r}{G_r}$$

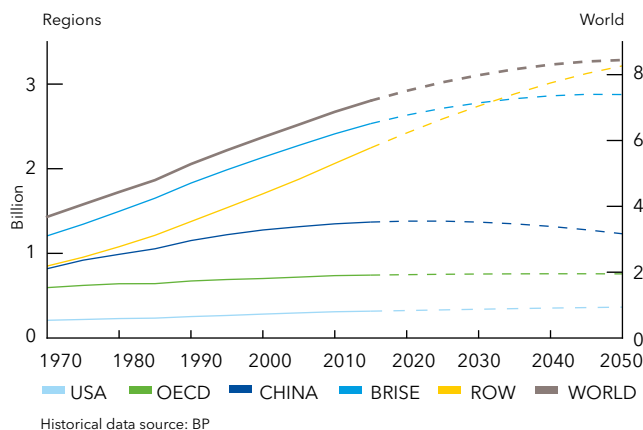where r denotes the region. We then aggregated the regions' demands to find the global demand.

Population

In this report, we have chosen to use a population forecast corresponding to the results from the 'sustainability' projections of the Wittgenstein Centre for Demography and Global Human Capital (Lutz, 2014). In line with the assumptions of this projection, we expect low mortality across the world, accompanied by increasing urbanization and high focus on female education, which drives the fertility rates down first in BRISE and later in the ROW region. The result is a significantly reduced population growth, with a flattening of the world population towards 2050, when it reaches 8.5 billion individuals (Figure 1).

Productivity

Productivity is the output provided per worker and measured in GDP per capita. As the employment fraction does not change quickly, output per capita is a very close proxy for productivity, as we verified through an initial analysis. An advanced economy's productivity growth slows down as its standard of living improves, as shown in Figure 2.

The main reason for this uneven relationship is that for poorer countries, an increase in standard of living comes first from productivity improvements in primary sectors, and then from productivity improvements deriving from industrialization, when an increased share of GDP is devoted to industrialization. In both sectors, the move from manual to industrial processes carries vast potential for productivity improvements. However, mature economies use increasing shares of their GDP for service, culture, and care (tertiary sector). This is shown in Figure 3.

We base our productivity assumption on a modified version of Figure 2, where we assume regions will converge to growth rates dictated by Figure 3, in 10 years' time.

Figure 4 shows the resulting productivity forecast. We expect productivity growth in USA and OECD to slow down, while BRISE and ROW will experience accelerating growth. China's productivity growth will also decline, but at a lower rate than in the US and OECD. Thus, Chinese productivity will exceed the world average by almost a third in 2050.
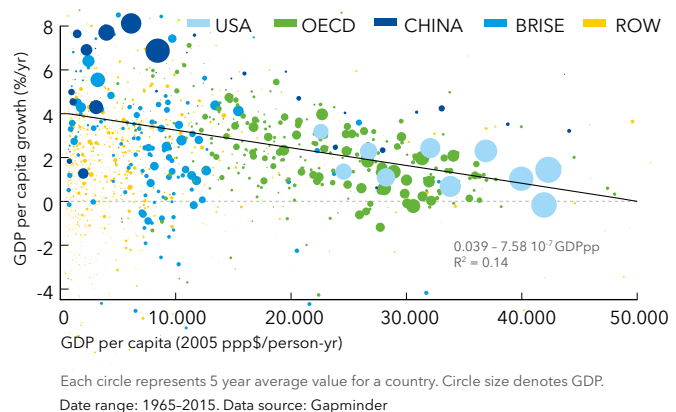

Historical data source: BP

Figure 1. Population

Each circle represents 5 year average value for a country. Circle size denotes GDP.
Date range: 1965–2015. Data source: Gapminder

Figure 2. GDP per capita growth as a function of GDP per capita

Gross Domestic Product (GDP)

Multiplying the regional population numbers from excluding under-15s and over-65s to obtain the potential labour force) with the productivity forecast numbers from Figure 4 we derived the GDP forecast in Figure 5. With strong growth in both population and productivity, the developing countries (represented here by the BRISE and ROW regions) will increase their GDP considerably over the coming 30 years, surpassing the developed world not only in growth rate but also in absolute numbers. BRISE will have the largest economy already in 2020, and ROW will rise from last to second position by 2040. As China's population growth will not continue, and productivity growth there will also slow down, the GDP growth will slow over the coming decades. While USA and OECD will maintain the size of their economic activity, their relative positions will be weakened.

Energy intensity

The energy intensity of developed world economies has been on a constant path of decline for the developed world as a result of continuous progress in energy efficient technologies and as a result of moving towards less energy consuming tertiary sector. As seen in Figure 6, the developing world has also been on a steady decline path since the 1990s. We expect this trend to continue in all regions since there still is a significant potential to improve energy intensity throughout all industries and other areas of energy use, strengthening the downwards trend throughout the forecast period. We have quantified the figures, looking at 5-year intervals of energy intensity improvements in the separate regions. The average global energy improvement will be 1.7 % in the period to 2030 and 1.4 % in the period between 2030 and 2050. With increased globalization and fast economic growth in the developing world, we expect that regional energy intensity developments will converge towards the levels in the best performing region, the OECD.

Energy demand

Multiplying the numbers in Figures 5 and 6, we derive the total energy demand in Figure 7, and our results show that the global energy use will stabilize after 2030, reaching about 16 Gtoe per year in 2050. On the one hand, countries that are already developed (USA and OECD) show steady declines in energy use, as a result of stagnating economic growth and continuous energy efficiency improvements. On the other hand, energy efficiency improvements in the developing regions are not high enough to counter their economic growth, resulting in a steady growth in energy use, and ROW and BRISE will see their total energy use increase throughout the forecast period. China's transition from a developing economy to a developed one is already ongoing, and will, over time, dramatically influence energy use, helping global energy demand to stabilize.

Energy mix

For the period between 2015 and 2030, we calculated the fuel mix, looking at historical energy investments in each region. Extrapolating these investments, and taking capital decay into consideration, we derived regional capital stocks for each of three fossil and four renewable and nuclear fuels. From 2030 to 2050, we assumed that fossil fuel investment would gradually be phased out (linearly) and disappear. We again subtracted decaying capital to determine energy capital stocks. These annual stocks for the 2015 to 2050 period were then compared with energy demand. In the cases where there was surplus energy, fossil fuels were retired from use. This happened throughout the 35-year modelling period. In the final 20 years before 2050, there were sometimes energy shortages, in which cases we regionally added renewables pro rata.

Figure 8 shows the corresponding global fuel mix by primary energy sources, and we see that the global fossil share reduces significantly through the forecast period, reaching 48 % in 2050. The fossil energy share is mainly replaced by solar and wind energy, bringing the renewable fraction to 48 % in 2050, with nuclear representing the last 4 %.

Carbon intensity

Fossil fuels emit carbon when combusted. Figure 9 shows the calculated carbon intensity of energy globally and in each region. The overall carbon intensity will reduce from 2.6 tCO_2/toe today, to 2.3 in 2030, and to 1.4 in 2050. Despite the general decline in the average global carbon intensity, the role of the various regions will change in the coming 35 years.

BRISE will surpass China in being the most carbon-intensive region by 2025, and will be the only region that will be above the world average towards the end of the forecasting period.

Carbon emissions

Given this fuel mix, we calculated regional CO_2 emissions using emission intensities of each energy source (Boden et al, 2016) and obtained the regional and global energy-related CO_2 emissions shown in Figure 10. Humanity causes considerable CO_2 emissions from other industrial emissions beyond energy, from changes in forestation and agriculture, and from other land-use changes. These emissions and changes are not directly included in our model, but have been added separately in the form of a constant non-regional addition of 6 $GtCO_2$/year added globally to account for both cement (Benhelal et al, 2013) and land-use change effects. This is a conservative approach; more optimistic scenarios would see these emission sources reduce considerably.

Figure 10 shows that global CO_2 emissions will continue to slowly increase over the next ten years, reaching a maximum at 37$GtCO_2$/yr around 2025 and thereafter slowly reduce. In 2050, global CO_2 emissions will peak 24 $GtCO_2$/yr. In our forecasts, China's emissions will peak within five years, ROW in 2035, and BRISE, representing by far the most emissions, will plateau just after 2040.

Climate consequences

Carbon emissions are the main source behind global warming. Our analysis shown above and detailed in Bakken and Özgün (2016) is more optimistic than benchmark business-as-usual approaches. In our analysis, global emissions peak around 2025, contributing to around 2.4°C warming by 2050. Notably, the carbon budget (the accumulated emissions limiting warming to 2°C) is, however, emptied before 2040, as shown in Figure 11. Thus, in our most likely forecast, the world does not manage to avoid "dangerous climate change", the common reference for global warming beyond 2°C above pre-industrial levels.
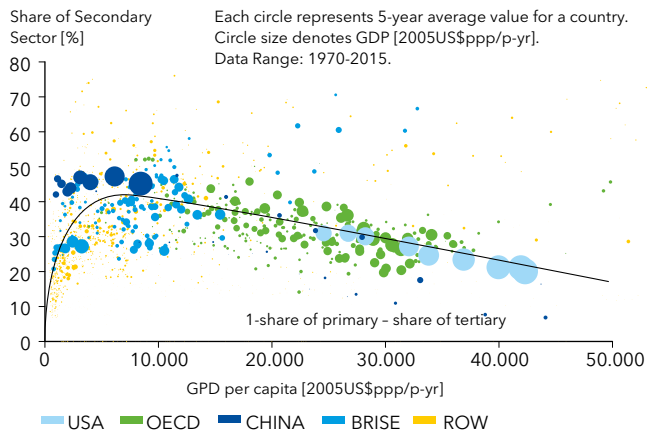
Share of Secondary Sector [%]

Each circle represents 5-year average value for a country.
Circle size denotes GDP [2005US$ppp/p-yr].
Data Range: 1970-2015.

1-share of primary – share of tertiary

GPD per capita [2005US$ppp/p-yr]

USA   OECD   CHINA   BRISE   ROW

Source: World Bank, Gapminder

Figure 3. Share of the secondary sector in GDP as a function of GDP per capita

Thousand $ / person-yr

USA   OECD   CHINA   BRISE   ROW   WORLD

Historical data source: Gapminder, UN

Figure 4. Productivity

Regions   World

T$ / yr

USA   OECD   CHINA   BRISE   ROW   WORLD

Historical data source: Gapminder, UN

Figure 5. GDP

toe / M$

USA   OECD   CHINA   BRISE   ROW   WORLD

Historical data source: BP, Gapminder
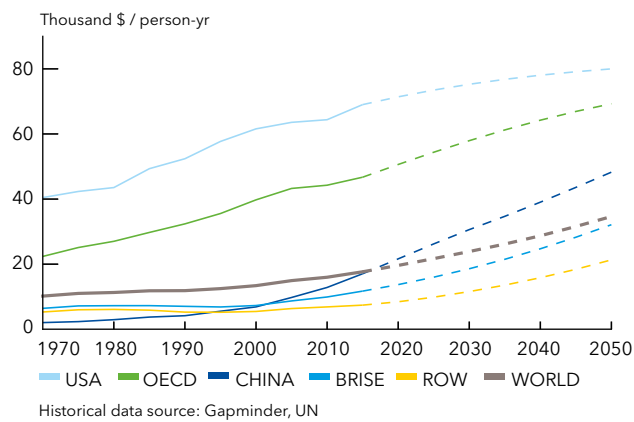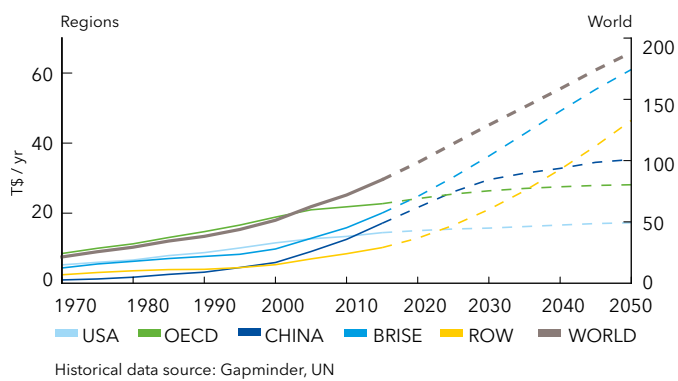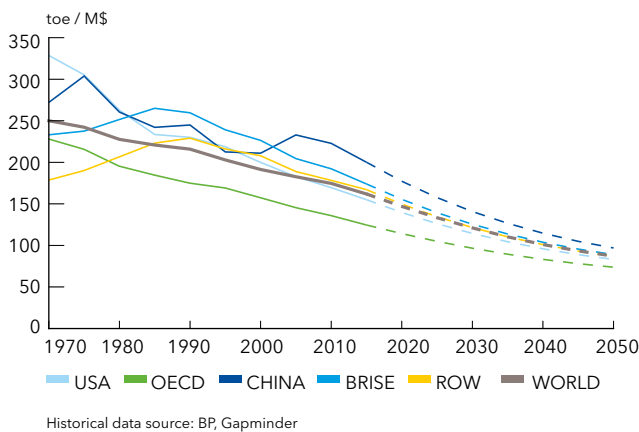
Figure 6. Energy intensity

Regions   World

Gtoe / yr

USA   OECD   CHINA   BRISE   ROW   WORLD

Historical data source: BP

Figure 7. Energy demand

Gtoe / yr

Coal   Gas   Hydro   Wind
Oil   Nuclear   Solar   Other renewables

Historical data source: BP
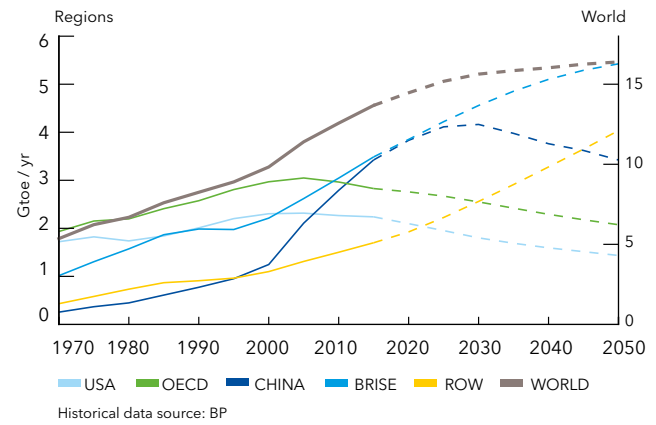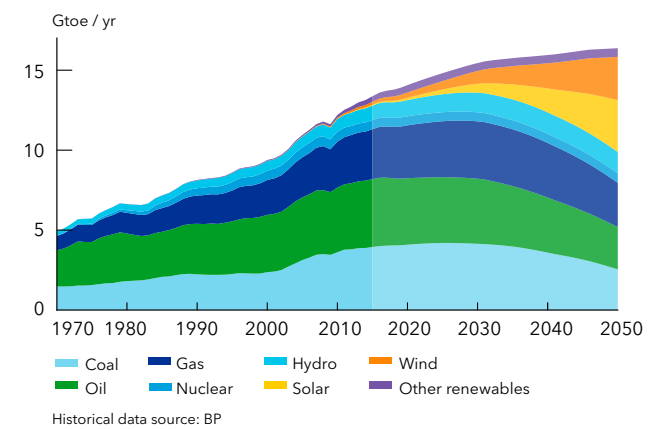
Figure 8. Global primary energy use by source

tCO_2/toe

USA   OECD   CHINA   BRISE   ROW   WORLD

Historical data source: BP, US DOE ORNL
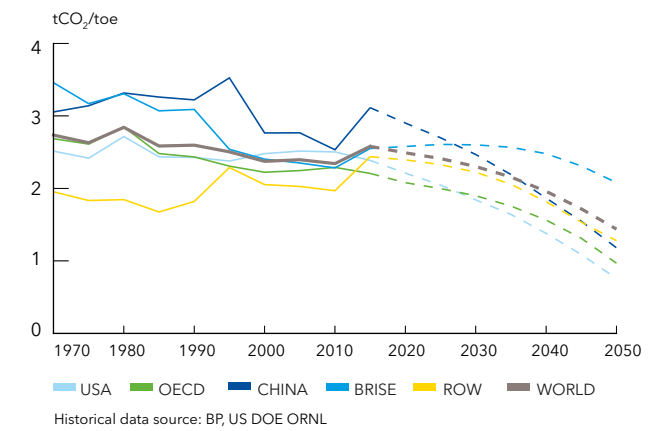
Figure 9. Carbon intensity of energy supply

Regions   World

$GtCO_2$/yr

USA   OECD   CHINA   BRISE   ROW

Historical data source: US DOE ORNL
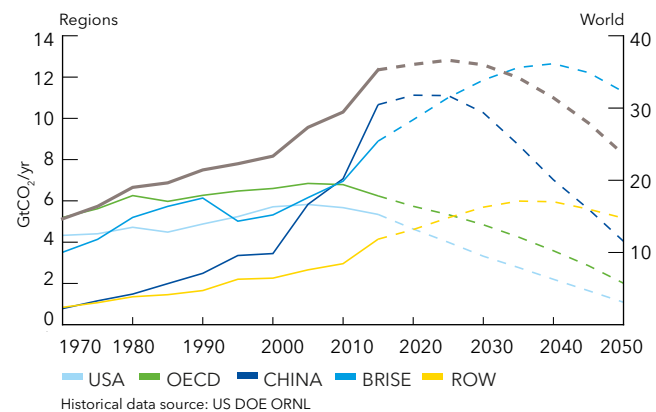
Figure 10. CO_2 emissions
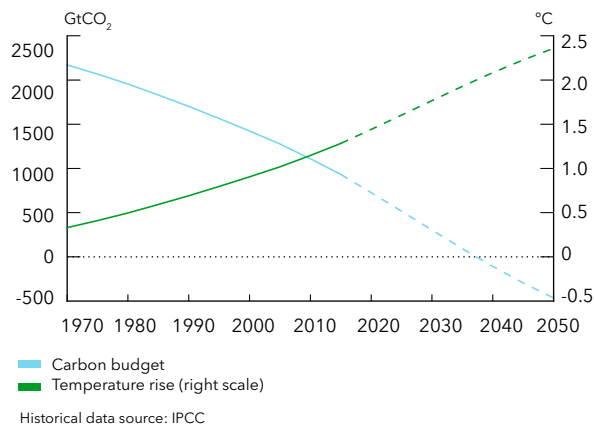
Figure 11. Carbon budget and temperature rise above pre-industrial times

Figure 12. Global food availability, non-energy footprint and unused bio-capacity

Resource use

Global food production has risen faster than population growth in recent decades owing to greater use of fertilizers, improved irrigation, and increases in crop yields as a result of genetic advancements. This means there is increasingly more food available per person, although not necessarily less hunger – because of both regional and local imbalances between food supply and demand, and because of significant food waste. In forecasting the future of food availability, we relied on the assumptions in Randers (2012).

Cultivated land will peak in around 2030 and decline by 6 % by 2050 as a result of increased urbanization, desertification, and sea-level rise (Figure 12). Compounded by the effect of increasing crop yields – which slow down as a consequence of climate change – average food availability will reach its highest point in about 2040. The decline thereafter will be driven mainly by the reduction in cultivated area.

Ecological footprint is a measure of ecological disruption caused by the human race. We used Global Footprint Network's definition and data as the measure of bio-capacity and human footprint (Borucke et al 2013). Ecological footprint, as measured in global hectares, is defined as the size of land of average biological productivity needed to produce all resources that a single human consumes in a year. Energy emissions weigh more heavily than any other
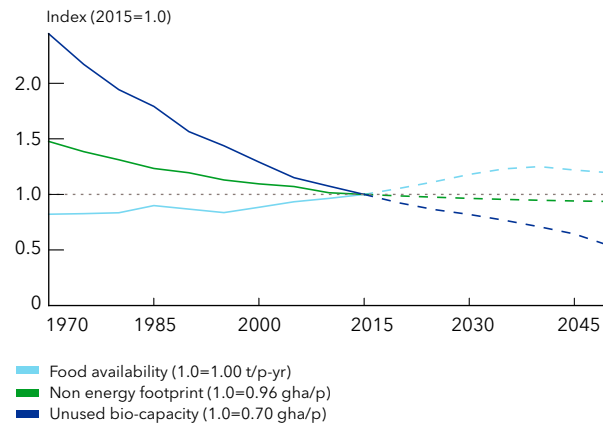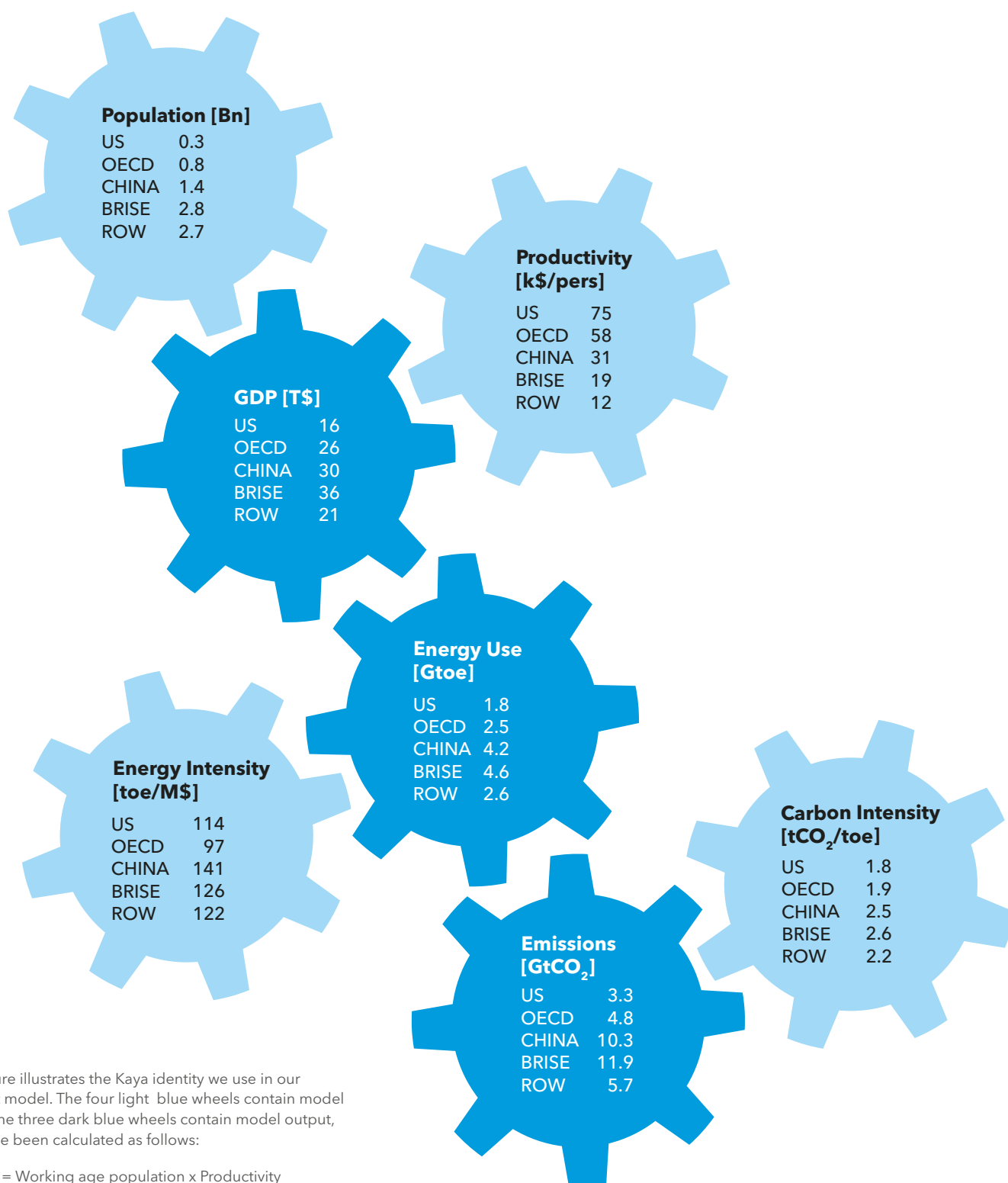
source in the ecological footprint measure, owing to the afforestation required to neutralize the effects of carbon emissions. The world's sustainability is critically dependent on the successful transition to a low carbon future. Non-energy footprint excludes energy-related footprint and focuses only on the direct uses of physical resources, such as agriculture, forestry, and fisheries. Unused bio-capacity is the total biocapacity minus non-energy footprint.

Figure 12 also presents the global averages of non-energy footprints and the corresponding unused bio-capacity per capita. Although the total non-energy footprint of the human race has been increasing, the rate of growth has been slower than that of population growth, making non-energy footprint per capita decline, largely owing to technological developments. In line with Randers (2012), we anticipate this trend to decelerate and stabilize just below current levels.

Unused bio-capacity per person has declined by over 50 % since 1970, and we expect this trend to endure as a consequence of increasing population and degradation of natural resources due to climate change, particularly after the 2040s. The individual region's performances, in terms of food and resource use and the consequences on their populations, are discussed in the Regional Forecast section below.

Forecast model

The DNV GL Spaceship Earth model provides a forecast for key future parameters from 2016 to 2050. The illustration shows the most likely 2030 figures for selected key parameters.

Population [Bn]

US	0.3
OECD	0.8
CHINA	1.4
BRISE	2.8
ROW	2.7

Productivity [k$/pers]

US	75
OECD	58
CHINA	31
BRISE	19
ROW	12

GDP [T$]

US	16
OECD	26
CHINA	30
BRISE	36
ROW	21

Energy Use [Gtoe]

US	1.8
OECD	2.5
CHINA	4.2
BRISE	4.6
ROW	2.6

Energy Intensity [toe/M$]

US	114
OECD	97
CHINA	141
BRISE	126
ROW	122

Carbon Intensity [tCO$_2$/toe]

US	1.8
OECD	1.9
CHINA	2.5
BRISE	2.6
ROW	2.2

Emissions [GtCO$_2$]

US	3.3
OECD	4.8
CHINA	10.3
BRISE	11.9
ROW	5.7

The figure illustrates the Kaya identity we use in our forecast model. The four light blue wheels contain model input. The three dark blue wheels contain model output, and have been calculated as follows:

– GDP = Working age population x Productivity
– Energy use = GDP x Energy Intensity
– Emissions = Energy Use x Carbon Intensity

FIVE REGIONS

USA

- Productivity and population growth continue to decline

- Remains world leader in GDP per person

- Decline in relative economic power continues

- Significant success in energy efficiency and energy transition

- Highest ecological and energy footprints per person and contributes heavily to resource depletion

ROW

- Population growth strong throughout, although population growth reduces as fertility falls

- Continued productivity growth, but no uniform developments, and some Less Developed Countries lag behind

- By 2050, GDP per person approaching current BRISE levels

- Rise in relative economic power continues through 2050

- Significant untapped potential in energy efficiency and transition

- Ecological footprints grow fast, although still the lowest of all the regions
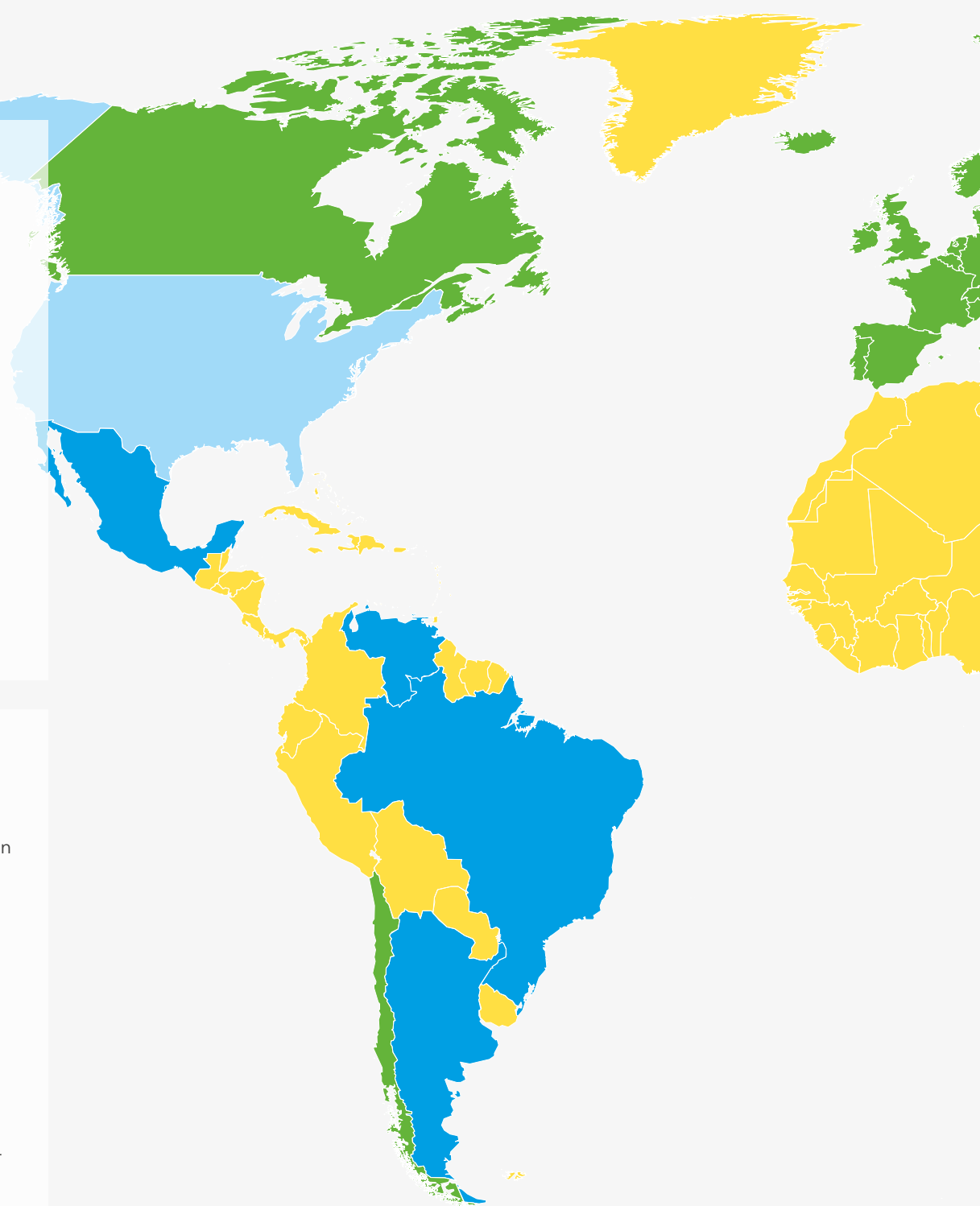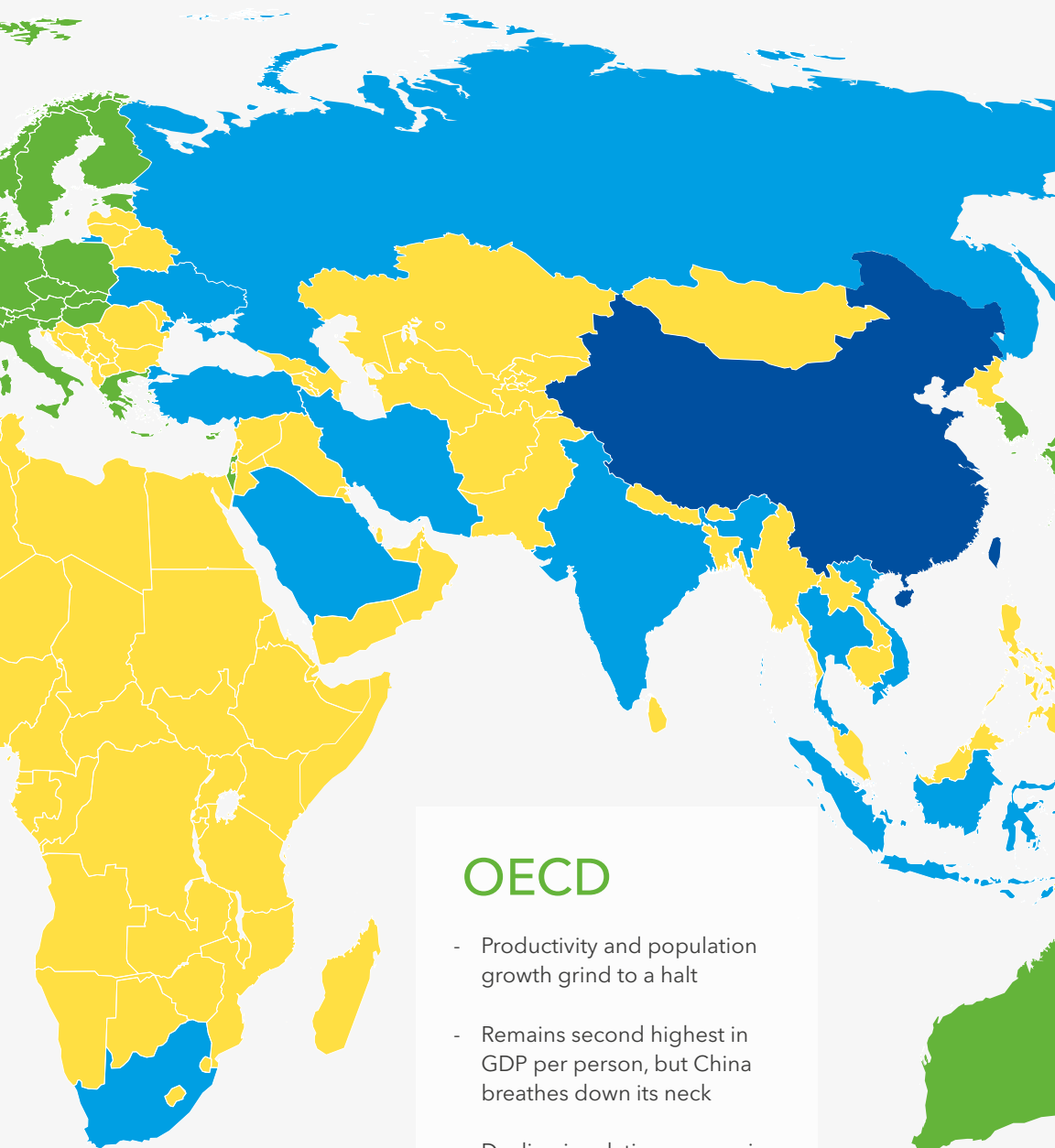
BRISE

- Population growth initially strong, but slows down

- Continued productivity growth

- By 2050, GDP per person approaching current OECD levels

- Rise in relative economic power continues through 2050

- Significant untapped potential in energy efficiency and slowest of all regions in energy transition

- Ecological footprints grow fast

CHINA

- Population starts to decline before 2030, and impressive productivity growth slows

- By 2050, surpasses many OECD countries in GDP per person

- Rise in relative economic power stops before 2030, as population declines and ages

- Significant success in energy efficiency and transition

- Footprints continue to grow, and increasingly contribute to resource depletion

OECD

- Productivity and population growth grind to a halt

- Remains second highest in GDP per person, but China breathes down its neck

- Decline in relative economic power continues

- Current leadership role in energy efficiency and successful energy transition overtaken by USA and also threatened by China

- High ecological footprints contribute to resource depletion

USA

Of our five regions, USA is clearly the most developed with the highest GDP per person. This implies that USA is furthest along the bell-shaped curve from Figure 3 earlier in the text. Its share of manufacturing in GDP has declined the most, and continues to do so. In line with Figure 2, this results in productivity growth stalling towards the end of the period. As a highly developed economy, the use of contraception and family planning in USA continue to increase, despite significant counter-pressures from some religious groups. Fertility, therefore, also declines. Population almost plateaus by 2050 at a level that is 15 % higher than today, excluding immigration. GDP growth will slacken parallel to the s in population growth. This will stagnate improvements in the standard of living that US residents has been enjoying in the past decades, which will also make USA less attractive for prospective immigrants relative to faster developing regions of the world.

Despite being one of the most developed economies, inertias in the US energy system contribute to this region being the second-most energy intensive in the world (after China). This will allow for more room for improvement, and hence a faster decline in energy intensity than in the OECD. With a future energy mix that has 2/3 less fossils than today's, and with a relatively high share of gas use compared with coal and oil, CO_2 emissions fall to only 20 % of their current levels.

Its electricity mix is already largely natural gas powered. In the future, electrification of its vehicle fleet will complement a shift in power generation from coal to renewables to ensure the most sustainable energy mix of any region by 2050. In 2030 there will be 71 % fossil fuels in the primary energy mix of USA, while in 2050, this share will have fallen to 32 %, out of which 25 % will be gas.

The USA already has the highest food availability of all regions and will retain this position through to 2050. Its non-energy footprint (how much land it would take if all resources were produced for a region's own population, measured in global hectares per person), already highest on the planet, reflects this caloric abundance and will perpetuate with little improvement, unlike, for example, the OECD. The slight decline in food per person in the USA the 2040s does not prevent unused bio-capacity from dropping to half of current levels by 2050.

In spite of substantial challenges, we forecast USA to continue to be the most developed of the five regions. The relative success of its energy transitions further underlining this conclusion, but its various footprints still grows and far surpasses the region's carrying capacity.
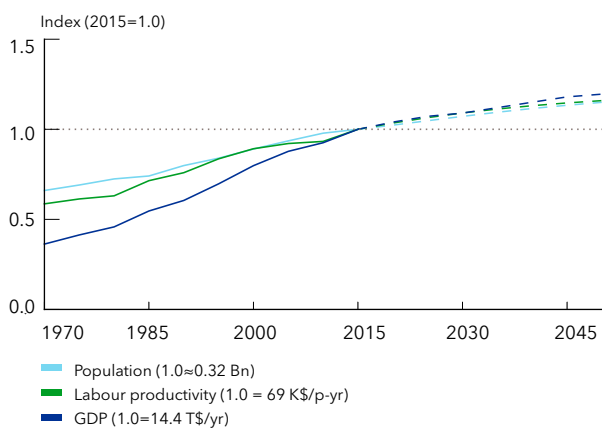

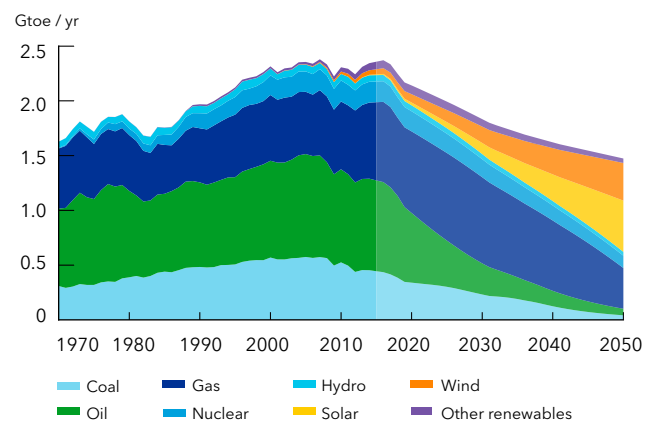Figure 13. Population, labour productivity, and GDP forecast for USA
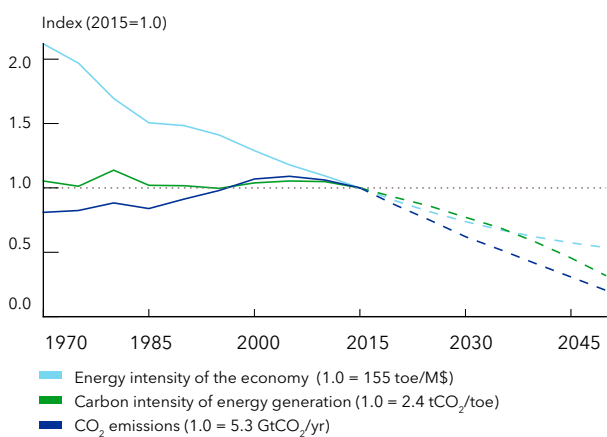

Figure 15. Energy source mix for USA

Figure 14. Energy intensity, carbon intensity, and CO_2 emissions forecast for USA
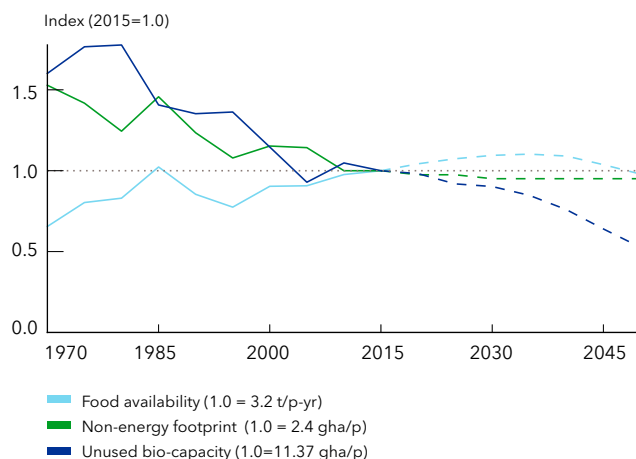

Figure 16. Food availability, non-energy footprint, and unused bio-capacity for USA

OECD

Our OECD region differs from the official members of the OECD, such that USA, Turkey, Mexico, and Latvia are excluded – the first being a separate region, Turkey and Mexico being part of the emerging economies in BRISE, and Latvia only became a new member of OECD after our analysis had been completed.

The OECD is a more diverse region than USA, with relatively large variations within the region. Broadly speaking, however, this region resembles USA, but is twice as populous and much less fecund. Its population is already stable at ¾ billion people. Because it is, on average, slightly poorer than the USA, we forecast that it will see its labour productivity grow faster. The combined effect of slower population growth and faster rise in productivity means that its GDP growth closely mimics that of the USA.

Again, compared with the USA, OECD starts off with a lower energy intensity and its improvement rate will be somewhat lower than for USA. Although its energy carbon intensity starts slightly better than the USA's, forecasting substantial coal capacity addition, we find OECD carbon intensity will fall more slowly than that of USA. Nevertheless, the emission intensity in 2050 remains lower than in USA.

In 2030, 64 % of the energy use in OECD will still be supplied from fossil energy, while in 2050, this share will fall to 33 %. Whereas the US energy supply is virtually coal-free after 2050, OECD has more than 10 % coal in its fuel mix at that time.

In the forecast period, OECD will continue to consume more food per person, but this increased food consumption will not severely degrade its non-energy footprint. Unused bio-capacity is stable for the first 24 years, but thereafter human use of pristine land and seas will tip it over sustainability limits, and degradation will take off.

The OCED is a developed area, but has larger regional differences, explaining that, on average, the OECD region will see a faster rise in standard of living than will be experienced by the population of USA, with labour productivity continuing to grow. Footprint-wise, OECD inhabitants will benefit from their less intensive food habits compared with citizens of the USA, but will see a slower decline in energy and carbon intensities. Even with the per person carbon emissions and non-energy footprint being lower than in USA, the emissions and footprint are far above those necessary to avoid dangerous climate change and resource use in line with the carrying capacity of the planet.
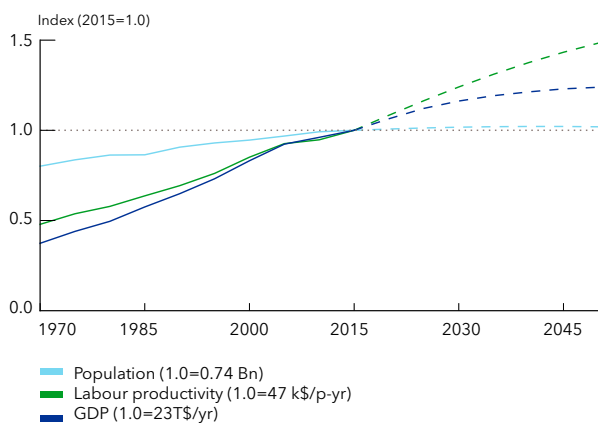

Figure 17. Population, labour productivity, and GDP forecast for OECD
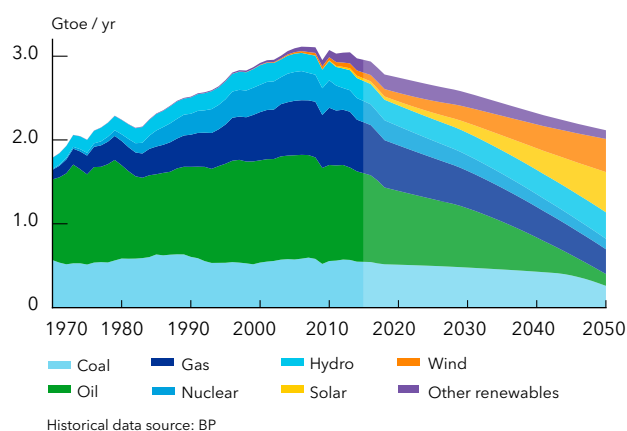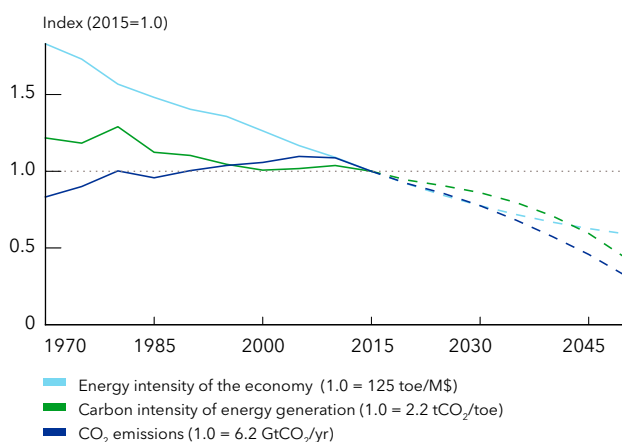

Figure 19. Energy source mix for OECD

Figure 18. Energy intensity, carbon intensity, and CO_2 emissions forecast for OECD
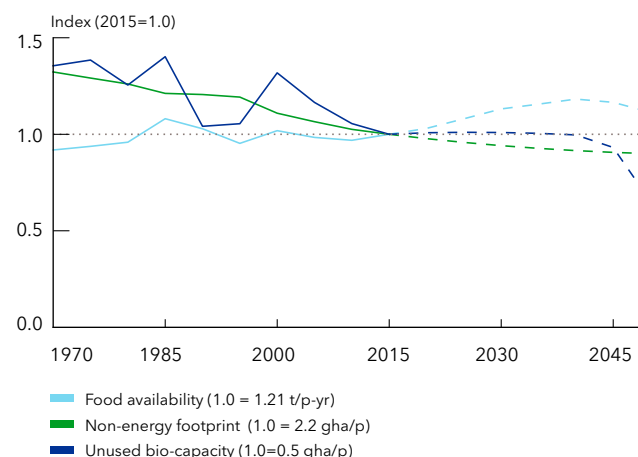

Figure 20. Food availability, non-energy footprint, and unused bio-capacity for OECD

CHINA

Already the world's most populated country, birth restriction has been applied for a long time, and China's population will peak even sooner than that of OECD. It will also fall faster, and, by 2050, be significantly lower than it is today. The population is already ageing and this trend will continue, such that the size of the working-age population will fall even faster. The labour productivity of China will continue to rise, but not at its recent historically high rates, with a tripling by 2050 forecast. No other region matches this productivity increase. The ageing population will start to show its impact on GDP after 2030, resulting in a considerable reduction in growth rate.

The energy intensity of China's economy has remained very high over the last decades, especially compared with the developed world. Referring back to Figure 2, this can be explained by the fact that China has already gone through industrialization, giving an unprecedented rise in labour productivity. This development has been largely coal powered until now, but this is already about to change. We forecast that the majority of future energy demand will be met by renewables, bringing a significant reduction in carbon intensity. The combined effects of declining energy intensity, lower GDP growth, and higher renewables share will enable China's CO_2 emissions to start declining in around five years' time.

The coal dominance of Chinese energy use will reduce considerably over the coming decades, with coal's share of total energy use being reduced from 64 % in 2015, to 46 % in 2030, and 19 % in 2050. By 2050, more than half of China's energy supply will come from non-fossil sources.

China's rapid rise in GDP has come at a high environmental cost. Twenty years ago, it had already used up all pristine land and sea areas. In practice, this is reflected by China already importing raw materials, such as coal, oil, and food. Although on a positive path, China will continue being in bio-capacity deficit until 2050. Its non-energy footprint will otherwise be sustainable and its food availability will remain high.

Well before 2050, China will become a developed region, with a GDP per person on par with that of OECD, but with an even older population. Although China will continue to struggle with being self sustainable, its food consumption will exert far less strain on the environment than that of the US or OECD populations. The inertia in China's energy system implies that carbon emissions, already way past peaking stage in the US and OECD, will peak in China within five years' time. It is worth noticing that while much of the present production in China is used for export and supplying the rest of the world with goods and products, a much higher share of future production will be consumed domestically.
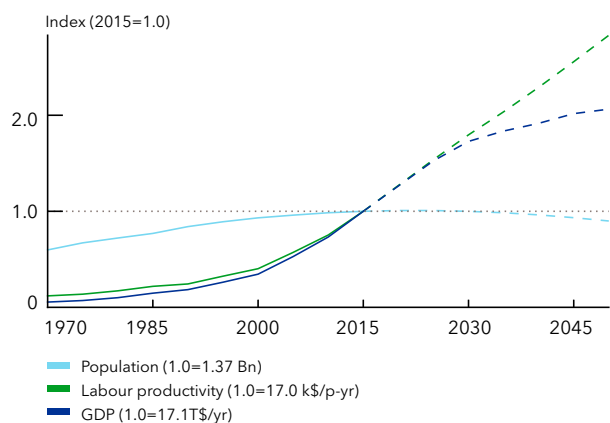

Figure 21. Population, labour productivity, and GDP forecast for China
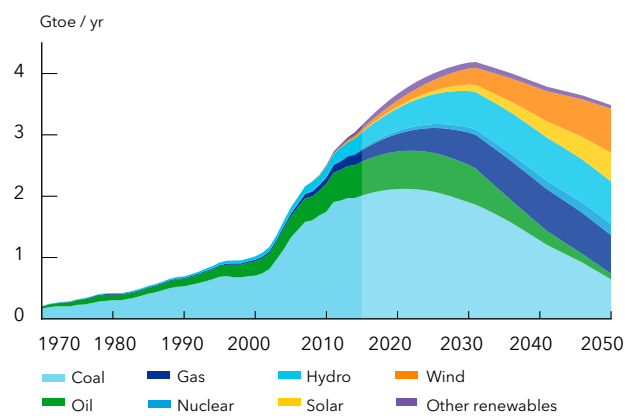

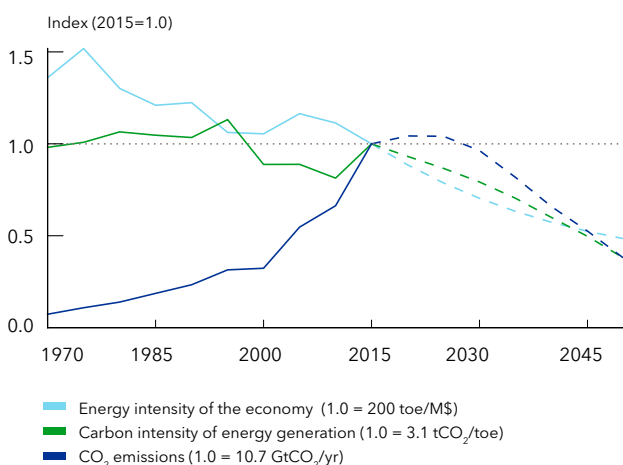Figure 23. Energy source mix for China

Figure 22. Energy intensity, carbon intensity, and CO_2 emissions forecast for China
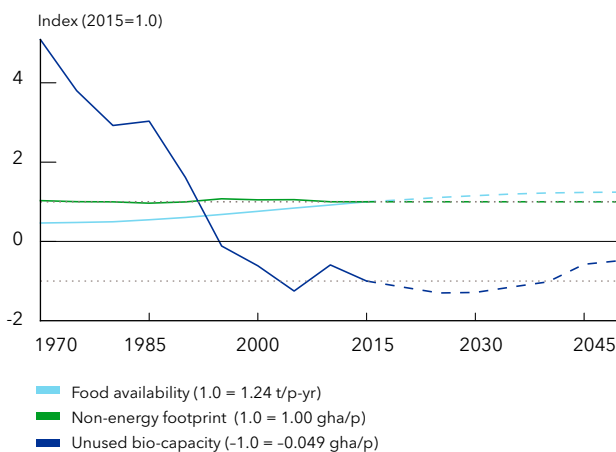

Figure 24. Food availability, non-energy footprint, and unused bio-capacity for China

BRISE

BRISE is a group of developing countries comprised of Brazil, Russia, India, South Africa, and ten other large emerging economies: Argentina, Indonesia, Iran, Mexico, Saudi Arabia, Turkey, Thailand, Ukraine, Venezuela, and Vietnam.

The population of BRISE is currently twice as high as that of China, and will increase by another ½ billion by 2050. Productivity will increase slightly more slowly than that of China. However the combined effect of a larger and younger population will result in GDP growth in BRISE to 2050 being higher than China's, and only surpassed by that of the ROW region.

Although past GDP growth in the BRISE region was less energy-intensive than in China, the larger and wealthier population in BRISE will demand steadily more energy. The forces driving the energy mix contain significantly more fossil inertia in BRISE than in China. Consequently, carbon intensity will remain flat for another 20 years, and carbon emissions will peak in around 2040, at levels almost 50 % higher than those of today.

With its strong demand for more energy, BRISE will be the prime region for fossil energy, and thus emission growth, in the coming two decades. Oil and coal use will grow significantly and fossil fuel will still represent a staggering 86 % of the energy supply by 2030, only falling to 67 % in 2050.

Food availability is, on average, significantly lower in BRISE than in China, so even if we forecast food availability to increase by almost 50 % over the next 20 years, it will not reach present-day Chinese levels, and pockets of hunger will persist throughout the BRISE region. The use of non-energy resources in BRISE will be similar to those in the developed world and will be more sustainable than China's.

Although standards of living in BRISE will continue to rise, they will not approach China's. Severe poverty and even hunger will still persist in some places. The energy mix in BRISE will remain fossil-based and emissions will continue to increase until around 2040, and still be significantly higher in 2050 than today. Collectively, the BRISE economies will constitute the strongest economic power of all our regions, by a wide margin.
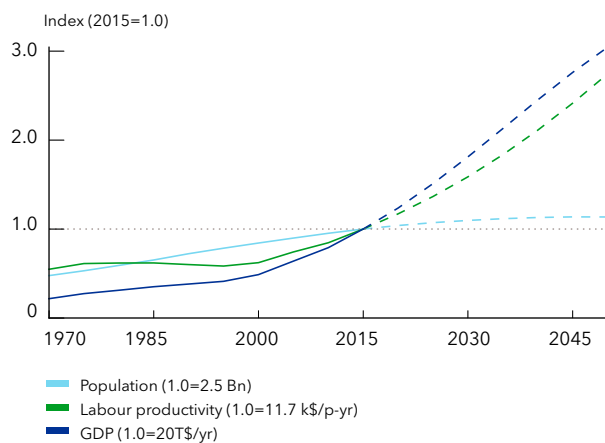
Figure 25. Population, labour productivity, and GDP forecast for BRISE

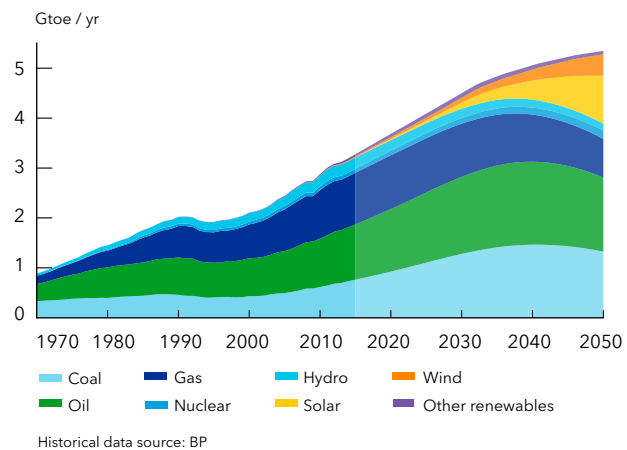

Historical data source: BP

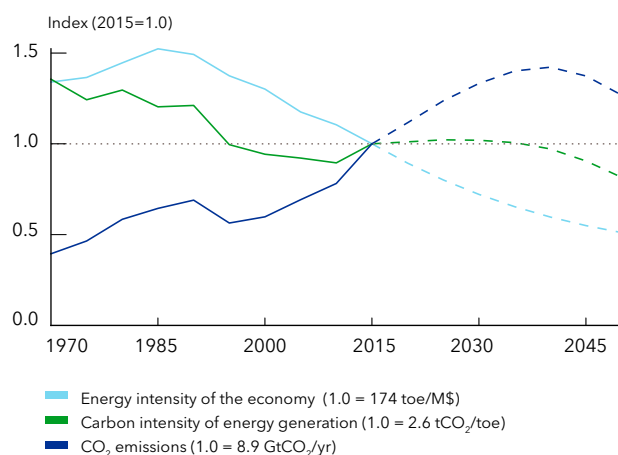Figure 27. Energy source mix for BRISE

Figure 26. Energy intensity, carbon intensity, and CO_2 emissions forecast for BRISE
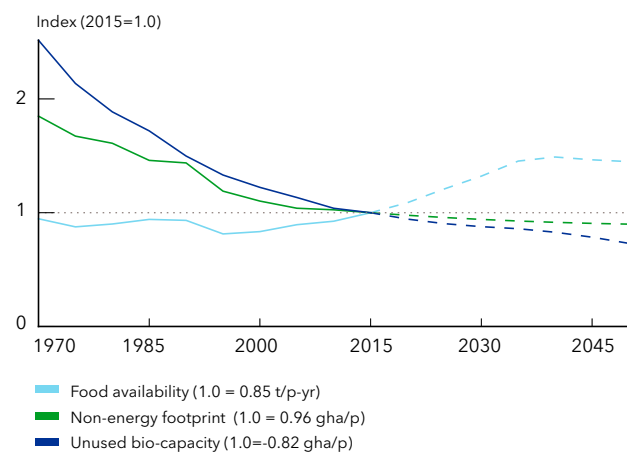

Figure 28. Food availability, non-energy footprint, and unused bio-capacity for BRISE

ROW

Rest of the World is a collection of a large number of geographically diverse countries that are not included in any of the other four regions. This group includes all of the African countries, except South Africa, many Eastern European countries, Central and South Asian countries, and many Middle Eastern, Latin American, and Pacific countries. Although dominated by many of the least developed countries, the list also includes small rich countries like Singapore and Qatar.

In terms of its 2015 population of 2.2 billion, ROW is second only to BRISE. ROW is the least developed region, and the fertility will stay higher in this region than in the others for a long time; within a decade, ROW will be the most populous region and by 2050 over 1/3 of the world's population will reside there. Although pockets of poverty will remain, both in certain least developed countries and in slum areas in other countries, its inhabitants will, on average, benefit from a high labour productivity growth similar to those in China and BRISE.
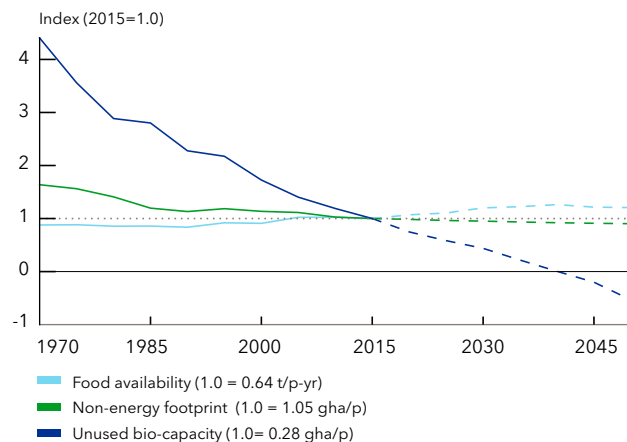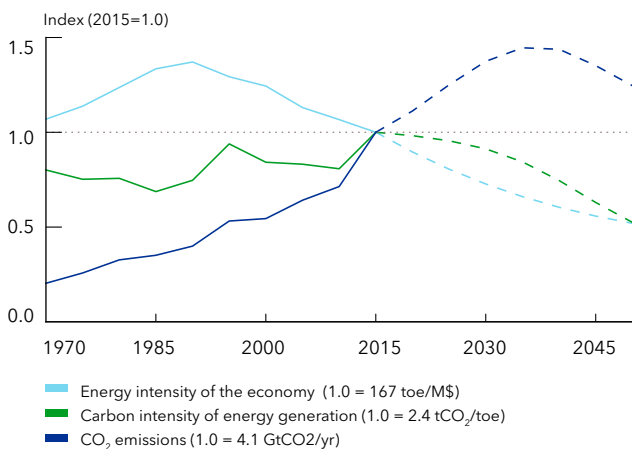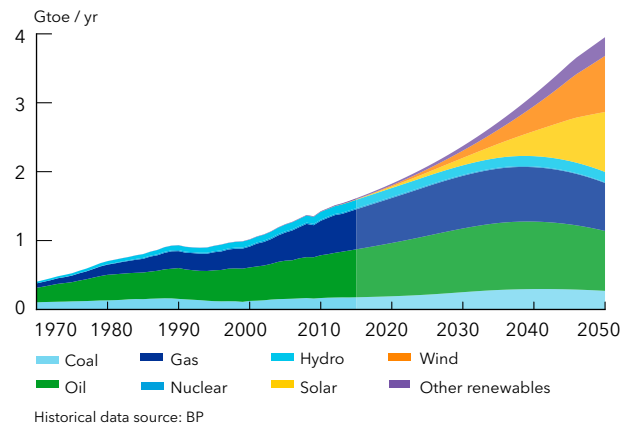
Although already showing a GDP growth fuelled similarly to that of BRISE, (i.e., less energy intensive than China's), its larger population, with better standards of living, will nonetheless require steadily more energy. The forces driving the energy mix in ROW contain significantly less fossil inertia than in BRISE, with strong opportunities for

building new energy production capacity from renewable sources. Consequently, carbon intensity will start falling within the current decade. However, the strong GDP growth implies that carbon will not peak until 2035 – similar to BRISE – and, likewise, at levels almost 50 % higher than today.

Energy use in ROW will be strongly dominated by fossil fuels until 2030, with 82 % fossil at that time. Thereafter there will be a strong increase in renewable energy, and in 2050, 47 % of the energy supply will come from fossil energy.

Food supply is currently highly problematic in certain regions of the developing world, and our forecast indicates that it will remain at a low level, with resulting under-nutrition still existing in many countries in the forecast period, albeit improving. A low growth in food consumption, indicates that non-energy footprints will remain sustainable. With a strong population increase, unused bio-capacity will continue to reduce rapidly, and pristine areas will continue to degrade and disappear after 2040, meaning that ROW must increasingly import resources from elsewhere.

ROW will continue on a positive path along many dimensions, but not fast enough to solve its many challenges. Its energy mix will remain carbon-rich, its food availability will remain low, and its fertility and population growth will reduce, but still outstrip those of all other regions.

Index (2015=1.0)

Population (1.0=2.2 Bn)
Labour productivity (1.0=7.4 k$/p-yr)
GDP (1.0=10.2T$/yr)

Figure 29. Population, labour productivity, and GDP forecast for ROW

Gtoe / yr

Coal — Gas — Hydro — Wind
Oil — Nuclear — Solar — Other renewables

Historical data source: BP

Figure 31. Energy source mix for ROW

Index (2015=1.0)

Energy intensity of the economy (1.0 = 167 toe/M$)
Carbon intensity of energy generation (1.0 = 2.4 tCO$_2$/toe)
CO$_2$ emissions (1.0 = 4.1 GtCO2/yr)

Figure 30. Energy intensity, carbon intensity, and CO$_2$ emissions forecast for ROW

Index (2015=1.0)

Food availability (1.0 = 0.64 t/p-yr)
Non-energy footprint (1.0 = 1.05 gha/p)
Unused bio-capacity (1.0= 0.28 gha/p)

Figure 32. Food availability, non-energy footprint, and unused bio-capacity for ROW

Afroreggae raised a flag to represent SDG 10, Reduced Inequalities, in Morro de Alemo in Rio de Janeiro, Brazil. Credit: Cristina Granato, courtesy globalgoals.org.

FUTURE FRONTIERS

In the coming pages, the cold hand of science (the DNV GL assessment of the likelihood of each SDG being met) meets warm-blooded business innovation. On the one hand we have a view of what the world will look like on a business-as-usual trajectory. On the other, we present 17 businesses at the frontier of efforts to change that trajectory. Presenting the probable and the possible in one 'package' may make for challenging reading, but our intention is to provoke questions and generate insights.

2030 ASSESSMENT – KEY POINTS

- We chose quantifiable indicators to assess key targets for each of the goals. The choice of indicators used is our own, and for some goals and targets, we developed our own indicators.

- Our assessment was done before the official and final list of SDG Indicators was developed.

- Some of the indicators are direct output from the forecast models, others are directly or indirectly informed by the forecast, while some goals, targets and indicators are not included or informed by our forecast.

- For rating the overall goal, we weighted the targets and indicators we targeted equally, and used the average rating.

- The assessment we present is regionalized, using the same five regions as in our forecast. Our assessment is consistent with our forecast.

- The 17 SDGs are closely interlinked. However, their interdependences are complex and not easily quantifiable, and we have therefore ranked each of the 17 SDGs individually.

THE BUSINESS FRONTIER

For each of the 17 goals we identified a UN Global Compact signatory company with business activities or markets related in some way to individual goals. In all cases, the companies' activities spanned more than one goal, but for the sake of coherence we have largely limited their input to 'their' assigned goal.

The views and examples which follow are the result of one or more interviews with DNV GL, where the respective business leaders shared their thoughts on:

- The feasibility of the SDG, and the accuracy of DNV GL's assessment

- The particular contribution – technologies and approaches – that their business could bring to the SDG

- The role that business generally can play to help meet the SDG's targets

In each instance we have included a specific case example to bring the impact each company is having on the SDG in question to life.

Traffic-lighting the SDGs

This system of 'scoring' the likelihood or otherwise of SDGs being met is DNV GL's own, and not the result of any other (e.g. UN) process. The three colours indicate the following:
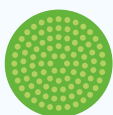
Goal/target likely to be reached (i.e target fulfilment of more than 95%).
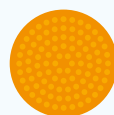
Goal/target not likely to be reached, but more than 50% of gap between today's status and the goal/target is likely closed.
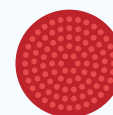
Goal/target not likely to be reached, and less than 50% of gap between today's status and the goal/target is likely closed.

1 NO POVERTY

ROW BRISE CHINA OECD USA
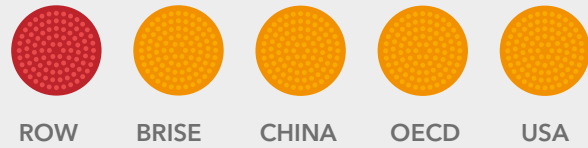
SDG1 on ending poverty sits at the heart of the SDGs. This is the main yardstick by which the successes and failures of the SDGs are likely to be measured, and the principle of leaving no one behind is clearly rooted in this goal. Poverty, in all its forms, includes extreme poverty and relative poverty that differs between the nations, and also has the multi-dimensional poverty aspect.

Model input

Our main model does not give poverty numbers. Economic poverty is correlated with GDP, and the GDP growth/person is forecast to continue, with relatively high figures in the three developing regions. However, growth for China is considerably slower than the last 15 years (see SDG8 for exact figures). The T21 model, shown in Figure 1.1, forecasts a 25 % reduction in absolute numbers and 33 % in share of population living in extreme poverty. These are nowhere near the target of eradicating extreme poverty.

Regional considerations

Extreme poverty is mainly an issue for developing countries. The regions in our assessment do not give a sufficient breakdown for a good illustration of the challenge, as both BRISE and ROW, in particular, have huge individual and geographical differences – in their past and in their likely future success of meeting the target on eradication of extreme poverty.

Conclusion

High extreme and relative poverty in ROW ensure a red score. OECD and USA have low extreme poverty, but do not succeed in reducing relative poverty, and so score yellow. BRISE and China improve on both relative and extreme poverty, but not enough to have a green overall score. The score is based on assessing economic poverty, as we have little input for scoring multi-dimensional poverty.

Billion people SSP1 Scenario V4-B Data
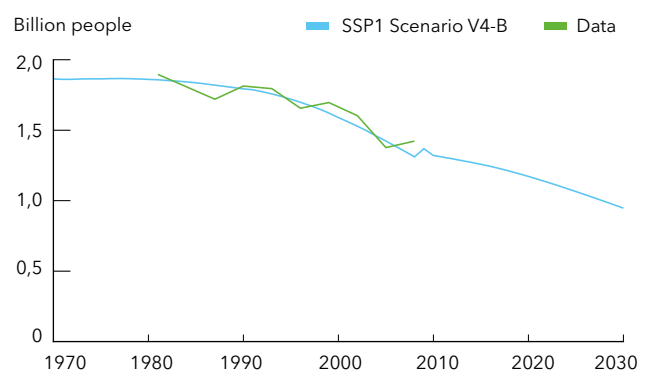
Figure 1.1. Number of people in extreme poverty

% of population OECD CHINA BRISE ROW
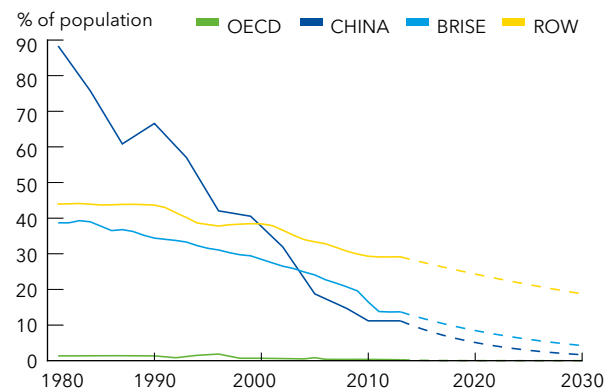
Historical data source: World Bank, Development Research Group.

Figure 1.2. Poverty headcount at $1.90 a day

% of population OECD CHINA BRISE ROW
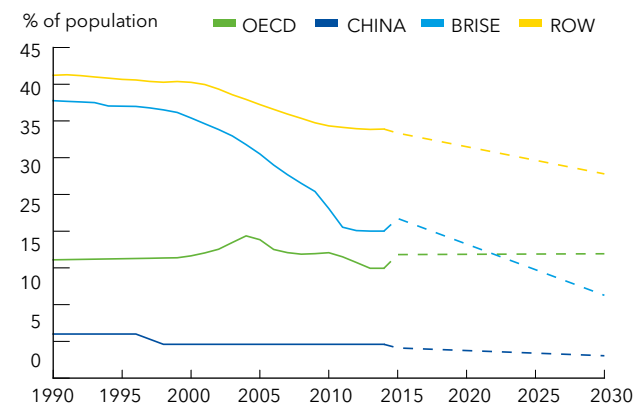
Historical data source: UN

Figure 1.3. Population below national poverty line

END POVERTY IN ALL ITS FORMS EVERYWHERE

Assessment details

We have chosen to rate the two targets that are quantifiable, with target 1.1 representing extreme or absolute poverty, and target 1.2 representing national or relative poverty.

TARGET 1.1

By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day. *Indicator chosen: Percentage of population living on less than $1.25 (PPP) per day.*

| ROW | BRISE | CHINA | OECD | USA |
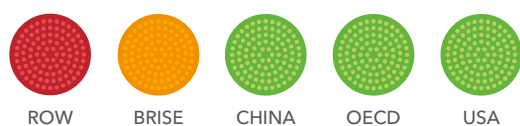
Eradicate poverty has been the most visible of the MDGs, with the goal being to half the number of people living on $1.25 PPP/person-day between 1990 and 2015. The goal was met five years ahead of the 2015 deadline, mainly driven by welfare increases in China, resulting from its strong economic growth.

The goal for the next 15 years is to end extreme poverty for the remaining 800 million people, and is likely to be much harder. Several international studies, including those from the World Bank, have projections of between 3 and 8 % of the people remaining in extreme poverty in 2030, with the vast majority in Sub-Saharan Africa. The threshold for extreme poverty was changed in 2015 from $1.25, 2005 PPP to $1.90, 2011 PPP. The number of poor people remained unchanged using the new definitions (World Bank, 2015), so this does not influence our assessment.

TARGET 1.2

By 2030, reduce at least by half the proportion of men, women, and children of all ages living in poverty, in all its dimensions according to national definitions. *Indicator chosen: Percentage of population living below national poverty line.*

| ROW | BRISE | CHINA | OECD | USA |
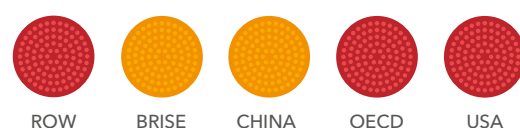
Many developing countries, including large countries like Nigeria, still have over 50 % extreme poverty, and, in some Sub-Saharan countries, like Madagascar and Zambia, the trend is heading in the wrong direction. As shown in Figure 1.2, in ROW the goal is not likely to be met, mainly due to the challenges in Sub-Saharan Africa. The progress in most BRISE countries has been considerable and the region is likely to close more than half of the gap from the current 14 %. India is key to meeting the target in BRISE. In China, the rapid progress is expected to continue, and it is likely to meet the target with less than 5 % share in 2030. However, it should be remembered that the last share is hardest. Absolute poverty is rare in OECD and the USA.

Poverty, in all its dimensions, goes beyond economic poverty. However, for this target, we consider the indicator of percentage of population living below the national poverty lines.

Unlike extreme poverty, relative poverty is also an important issue for the developed countries. In OECD countries, national poverty rates of around 10 % are common, and statistics for OECD show little improvements over the last 10 years, as illustrated in Figure 1.3. USA figures are not included in the World Bank data, but data from the US Census Bureau (2015) show flat or increasing relative poverty in US over the last decades. With increased (USA) and stable (OECD) inequalities shown by the Palma ratio (see SDG10), neither the USA nor OECD will meet the target. China's national poverty line of 2300 yuan/person-year is just above the absolute poverty line from the World Bank (Jiao, 2015). We forecast China to have a yearly economic average growth of 3.7 %/person to 2030; this is significantly lower than in the previous 15 years. With the last share of the population more difficult to reach, we assess that China is likely to reduce the share of population below the national poverty line, but not by 50 %, hence a yellow rating. For ROW and BRISE, reductions in relative poverty are expected to follow the reductions in absolute poverty.
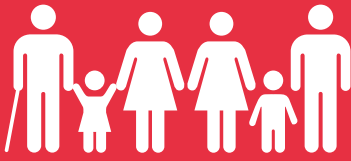
THE TATA GROUP

THE POWER TO ACT

The World Bank estimates that despite solid development gains in tackling extreme poverty, some 800 million people were still below the poverty line of $1.90 day in 2015.

The world's poor are now concentrated in Sub-Saharan Africa and parts of South Asia; in other areas where progress has been made, the benefits of prosperity have been shared very unequally and significant non-income related disparities remain. In India, for example, social factors play a large role in determining access to quality education and health services that enable people to move out of, and not fall back into, poverty.

Aggregate private sector investment in the least developed countries exceeds foreign aid by a clear margin, and there is growing recognition of the role that the private sector plays in addressing poverty by driving innovation, pursuing efficiency, creating employment, and fuelling growth. With this in mind, the interface between one of the largest and more forward-thinking companies in India and the public provides insights into the potential for business to tackle what is arguably the first among equals of the SDGs. We spoke to Shankar Venkateswaran, Chief - Tata Sustainability Group.

Assessment

Citing the multi-dimensionality of poverty, Tata Sustainability Group's Shankar Venkateswaran is wary of using income indicators as the main measure of this SDG. "The understanding of poverty that we have in our region is that it is highly dependent on other factors and the other SDGs," he says. "None of them is isolated and independent." This holds true globally too, he says, where the effects of climate change and the ongoing refugee crisis will place increasing strains on the provision of basic services, and hamper the world's ability to achieve SDG 1.

As far as the Indian sub-continent is concerned, progress on SDG 5 and SDG 10 (Gender Equality and Reduced Inequality) in particular is crucial to what happens to poverty. Since both of these are rated red in the DNV GL report (correctly so, in his opinion), Venkateswaran feels it is inconsistent for BRISE not to also be overall red for SDG 1.

One thing is certain: progress on SDG 1 will not be achieved through business as usual. Several international studies, including those from the World Bank, have projections of between 3 and 8 % of the people remaining in extreme poverty in 2030. As far as targets go, the Tata Sustainability Group (TSG) thinks performance on the overall Target 1.2 is fine.

However, despite national governments being committed to poverty alleviation through a slew of welfare measures and conditional cash transfer schemes to halve the percentage of people living below the

SHANKAR VENKATESWARAN
Chief – Tata Sustainability Group

The Tata group is a global enterprise, headquartered in Mumbai, India, comprising over 100 independent operating companies across many sectors including steel, automotive, consulting, power, chemical, food & beverage, telecoms, and hospitality. Tata's mission is to improve the quality of life of the communities they serve globally through long-term stakeholder value creation based on leadership with trust. The group operates in more than 100 countries across six continents, and generated annual revenues of $109 billion in 2014-15, with Tata companies collectively employing over 600,000 people.

«Social factors like gender and identity have a huge impact on poverty… they can prevent access to services, even if those services are available.»

«We work with a chamber of commerce of citizens and entrepreneurs from the 'lowest' caste to consciously include their members into our supply chains.»

national poverty line, they believe it is unlikely for BRISE to partially meet this goal. This despite the fact that progress in most BRISE countries has been considerable, and the region is likely to close more than half of the gap from the current 14 % levels.

India will remain key to meeting this target in BRISE. We at TSG don't think the targets of SDG 1 are unreasonable or not doable, we're just not sure whether the critical changes needed to achieve these will in fact be undertaken in, for example, India and South Asia," says Venkateswaran.

There are vested interests closely linked to gender equity and inequality. "In India, whether on issues of gender equity or caste, you are asking the powerful to give up power. It requires considerable enlightenment for that to happen." Provisioning resources is one thing – you may have enough schools, for example – but gender will determine what or whether you will be taught at those schools.

Social factors deny access to services even if they are available. "Thus you can just look at this SDG from the supply side, but also from an uptake side – and that is determined by social factors."

Tata Solutions
The Tata Group approaches its stated mission – 'To improve the quality of life of the communities we serve globally, through long-term stakeholder value creation based on Leadership with Trust' – in three ways.

The first relates directly to Tata's role as a producer of goods and services. "You can make a significant difference in poverty if the kinds of goods and services you produce are the kinds that also serve the poor," Venkateswaran says. "It's about a larger market place; thinking of not just profit margins to be made per unit of dollar, but how you run businesses, and the role that you have producing goods and services that serve a large and growing number of people."

The second is to create employment, both directly within its companies and in the supply chain around them. "It's about businesses being conscious and asking, how can we also positively impact those who are left out of these processes?" Business can create employment opportunities for women and other socially disadvantaged groups in its own operations and through the value chain. Outsourcing is one area that has seen significant changes in the last 20 years, going from a cost-cutting measure to one that brings positive changes, both in better quality and better working conditions.

"We work with a chamber of commerce of citizens and entrepreneurs from the 'lowest' caste to consciously include their members into our supply chains." Training and finance schemes, some of them with additional input from government, also help facilitate these (see case study).

The third aspect is Tata's involvement in communities, which Venkateswaran describes as moving beyond philanthropic CSR to more strategic efforts to create value for people at the base of the pyramid. For example, Tata Consultancy Services developed mKrishi, an application that uses mobile phones to bring personalized advice to farmers. Besides giving them access to information like weather, practical advice, and pricing, it also gave them access to new markets. Before this kind of 'disruptive innovation' a farmer would have been at the mercy of the middleman. "Now," says Venkateswaran, "they are in a better position to play the market."

Working over so many sectors, from manufacturing to IT and hospitality services, gives the Tata Group a unique breadth and robustness when it comes to weathering economic cycles and providing employment opportunities. "But at the end of the day, factories are the ones that create the greatest number of jobs and allow people with the lowest level of education to enter the workforce."

Business Contributions
"Business and manufacturing have dual role in reducing poverty; they serve the poor by producing affordable goods and services for the poor and they create employment opportunities since many of the goods and services are produced by the poor," says Venkateswaran.

There are an estimated 4.5 billion people in the world at "the bottom of the pyramid" (who live on $5 per day or less). They represent a $15 trillion economy, poised to expand as they join global markets as consumers and producers. Businesses should view these people as producers and consumers of products, rather than as mere beneficiaries of charity.

Businesses should ensure that they meet their responsibility to respect human rights, including the rights of the most impoverished, and use their influence on public policies and public finance for good, beyond simply lobbying for cases and policy that suit them. "Businesses are powerful, and national governments and global institutions take them very seriously." Venkateswaran believes business should advocate around and lobby for changes that will address framework conditions of poverty, for example, by engaging in policy dialogue for the provision of basic goods and services where they operate. "Businesses are very powerful; government needs business perhaps more than vice versa. Private firms are goal-orientated, and look to solutions rather than talk". Businesses have a foot in the door when it comes to influencing policy – how they use that influence is another thing. ∎

Tata affirmative action programme

Despite India's record of rapid economic growth and poverty reduction over recent decades, rising inequality is a subject of concern. Poverty and social exclusion has its roots in historical divisions along lines of caste, tribe, and gender. Culturally rooted systems perpetuate inequality, and prevent disadvantaged groups from taking advantage of economic opportunities.

Champa Devi, a landless agricultural worker from Haidagajjar village in the state of Uttarakhand, was one of those disenfranchised. After her husband died, Devi, struggled to feed her family of seven. In September 2015, Devi was selected as part of the Tata Affirmative Action Programme (TAAP) to be trained in backyard poultry operations.

Some 300 million Indians belong to the Scheduled Caste and Scheduled Tribe (SC / ST). After the Indian economy opened up in 1991, the private sector agreed to partner with the government in making India a more inclusive society, through initiatives under the "Affirmative Action (AA) for the SC/ST communities". The Confederation of Indian Industry (CII) committed to taking time-bound, concrete steps in AA under the umbrellas of four Es: Employment, Employability, Entrepreneurship, and Education.

TAAP encourages Tata companies to exercise positive discrimination in employment or in creating business partners, without sacrificing merit, quality, or cost. It also requires Tata companies to initiate, or build, on existing projects for SC / ST youth in education and vocational training. The partnership of Tata Motors Pantnagar with SUVIDHA, an NGO that provides training to landless farmers in the Nainital district, was one such programme.

Champa Devi received one week's training in poultry rearing, at the end of which Tata Motors financed her purchase of 20 chickens. The Company also linked her with the Government of Uttarakhand's 'Backyard Poultry Development Scheme' under which SC/ST beneficiaries received20 chickens from the government.

Within two months of implementation of this training programme, beneficiaries reported to have an increase in monthly income of between Rs 3000 to Rs 4000. It certainly changed Champa Devi's life. The self-reliant approach of this training programme, she says, improvied both the economic and the nutritional status of her family.

TAAP continues to use the four Es to address inequity and social exclusion. There has been an increase in incremental employment of SC / STs in the Tata group; over 200 % growth in number of SC / ST youth trained under various Skills Development Programmes to bolster employability over four years (50 % of those trained have found employment); TAAP has covered over 80,000 students in 2015 through scholarship programmes, improving educational infrastructure and working towards bettering the quality of education for the SC / STs; and 15 Tata group companies associated themselves with 350 vendors from SC/ST communities to support entrepreneurs, promote supply chain diversity, and extend business worth USD 17.6 million in 2015.

2 ZERO HUNGER

ROW   BRISE   CHINA   OECD   USA
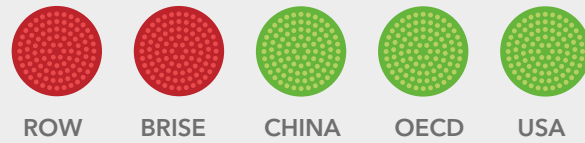
SDG2 is, first and foremost, about ending hunger. Food security, nutrition, and agriculture are other key aspects of the goal. Unlike most other goals, we have chosen to rate the achievement of this goal based on only one indicator, representing whether we succeed in ending hunger.

Model input
The forecast gives relevant input to this SDG. Key parameters like food production and cultivated land are included in our model. The model also gives forecasts for GDP/person, which is correlated with hunger. The T21 model, but not our main model, forecasts the number of people living on less than $1.25/day (illustrated under SDG1 in Figure 1.1), which is strongly correlated with hunger.

Regional considerations
If we had chosen a wider perspective on this goal than just ending hunger, the developed countries would also have challenges, because nutrition, including obesity, and sustainable agriculture are areas with significant challenges globally. With the focus only on ending hunger, this is mainly an issue for developing countries.

Conclusion
With one indicator only, the conclusion on the goal equals the conclusion on target 2.1. Thus, ROW and BRISE get a red rating, and China, OECD, and USA a green rating. The uncertainty is highest for BRISE, which could succeed in reducing hunger sufficiently to get a yellow or green rating.

«From a sustainability perspective, I find it difficult not to take environmental and social welfare into account. I realize that environmental and social welfare are much more difficult to assess than hunger and therefore, hunger is the only dimension that can be evaluated at this point in time. However, hunger is the outcome of dynamic feedback relationships with food system activities and food system drivers.»

Birgit Kopainsky, UiBergen

% of population
OECD   CHINA   BRISE   ROW
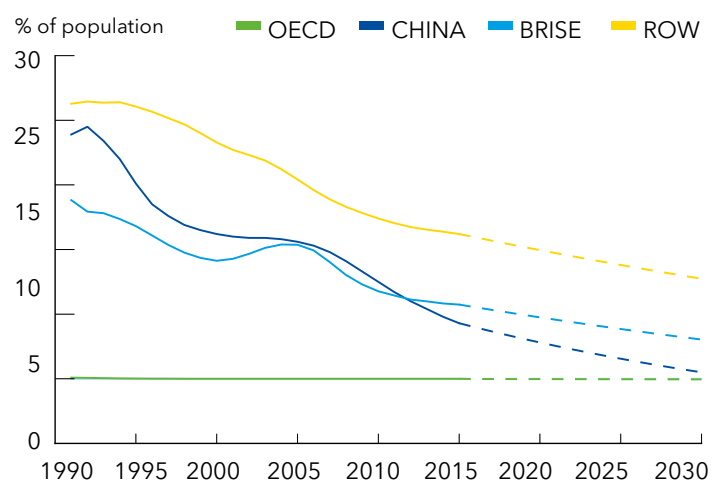
Historical data source: FAO Food Security Data

Figure 2.1. Proportion of population below minimum level of dietary energy consumption

END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

Assessment details

To achieve our overall assessment for this SDG, we rate only one target, that being 2.1 on ending hunger. The most reliable parameter for ending hunger is to measure whether everyone has enough to eat, and the best indicator for this is the Proportion of population below minimum level of dietary energy consumption. This is also a continuation of an MDG indicator, for which historical data are easily available. Target 2.1 covers more than minimum level of dietary energy consumption, but in our opinion this indicator gives a good proxy for measuring the success of SDG2.

TARGET 2.1.

By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round. *Indicator chosen: Proportion of population below minimum level of dietary energy consumption*

ROW   BRISE   CHINA   OECD   USA

Our model forecasts an 18 % increase in food/person over the coming 15 years. Even more relevant is the prediction of a 32 % increase in BRISE and a 20 % increase in R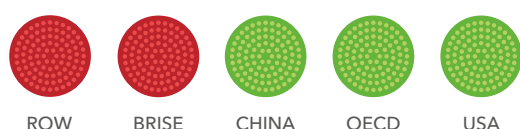OW, which are where the majority of hungry people live. Table 2.1 illustrates historical figures and our forecast. The food produced does not say anything of distribution and import/export, and thus only provides input to the indicator. However, both India (in BRISE) and the most populous ROW countries that have

most people below the minimum level of dietary energy consumption are net food importers. Hence, increased food production is likely to result in fewer people hungry.

The model also gives figures for GDP, and, over the next 15 years, we expect an annual GDP growth/person of 3.6 % in ROW and 3.4 % in BRISE. For ROW this is significantly higher than the 2.5 % experienced in the last 15 years. We can expect that the increased output – given a relatively flat expectation on income distribution (addressed in SDG10) for the poorest people – will ensure more food. Based on the above, we assume a downward trend that is 1.5 times faster (in percentage change per year) than in the previous 15-year period, mainly based on the increasing food production forecasts.

Figure 2.1 shows the historical figures for proportion of population below minimum level of dietary energy consumption for the last 25 years, and the forecast for the next 15. For this indicator, UN data are presented as "5" when the value is 5 or less, hence the graph looks somewhat strange with a lower cap on 5. Our estimate is that towards 2030, China will continue its strong downward trend, and achieve the goal of having less than 5 % of its population living below the minimum level of dietary consumption in 2030. BRISE will continue its downward trend, and we forecast a decrease from 11 to 8 %, and ROW will also continue its trend, with a forecast reduction from 16 % to 13 %.

With this, neither BRISE nor ROW will achieve the goal, nor will they close 50 % of the initial gap; hence they get a red rating despite their forecast progress.

Region	1990	1995	2000	2005	2010	e2015	f2020	f2025	f2030
USA	2.7	2.5	2.9	2.9	3.1	3.2	3.3	3.4	3.5
OECD	1.3	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.4
China	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.4
BRISE	0.8	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.1
ROW	0.5	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.8

Table 2.1: Food produced [tonnes/person-year]

DANONE

HEALTHIER FOOD, HEALTHIER PLANET

The UN's Food and Agriculture Organization estimates that some 2 billion people do not have enough to eat. According to *The Economist*, food production will need to double by 2050 to accommodate the world's rising population. This needs to be achieved on a planet that has lost half its topsoil in the last 150 years, and where climate change is exacerbating environmental degradation, food insecurity, and poverty.

Danone's mission is to "bring health through food to as many people as possible". As part of this commitment, the company has taken the strategic decision to build a health-driven products portfolio, focusing only on healthy categories. Some 88% of Danone's total sales in 2015 were generated in healthy categories based on official public health recommendations. The company calls its core business 'Alimentation': expressing the belief that nourishment goes beyond foods and beverages and should be considered in its broadest sense, including nutrition, taste, social and cultural dimensions.

Danone has a long tradition of reconciling business growth with social responsibility: in1972, its CEO Antoine Riboud gave a speech that marked the birth of Danone's dual commitment to business success and social progress. More recently, in 2015, Danone published its "Manifesto", bringing its mission to the next level, committing to leading an alimentation revolution by helping reconnect communites to their health and that of the planet. Danone's CEO, Emmanuel Faber, shares his views.

Assessment
"The 17 targets are closely interlinked, and achieving one goal will often require – and contribute towards – success within other goals. Furthermore, looking at SDG 2, it is our belief that it cannot be sustainably achieved if it does not go beyond hunger: among others, we need to address all forms of malnutrition, ensure sustainable production cycles and regain biodiversity," says Emmanuel Faber.

EMMANUEL FABER
CEO, Danone

Danone is a leading global food company founded almost 100 years ago. With its headquarters in Paris, today the company employs close to 100,000 people in over 130 countries. Its principal business lines are Fresh Dairy Products, Early Life Nutrition, Waters and Advanced Medical Nutrition. In 2015 Danone generated sales of €22.4 billion, more than half of this in emerging countries. Danone's mission is to bring health through food to as many people as possible.

«The challenges of world hunger can be met only if we are able to develop radically different approaches, combining economic, environmental and social objectives.»

Danone Solutions

Danone believes that food is an essential asset to reinforce healthy living and meet some worldwide health challenges, from contributing to the healthy development of children, to nurturing and protecting overall health at key moments throughout the human lifespan. Danone's recent partnership with B Lab is a modern illustration of its ambition to pioneer a new business approach.

Danone invests in research to understand local public health challenges and local eating practices. These research programs enable Danone to promote healthier choices that are relevant to the communities' habits. One example of this "local community" approach is Danone's enriched cereals for infants, Phosphatine. In Africa, anemia is a critical concern; the lack of awareness and reliance on ineffective treatments represents real obstacles to many children's health. To help solve the problem, Danone conducted two studies among mothers in Cameroon and Ivory Coast. As a result, in 2014 Danone reformulated its Phosphatine range in these two countries: the product now provides 70 % of iron needs of children and is also 30 % cheaper.

Danone's vision of alimentation goes beyond food: through education programs, Danone promotes healthier drinking and eating habits and healthier lifestyles to children, parents, patients and caregivers. In 2015, over 530 million people were reached through the 155 consumer programs deployed by Danone.

Healthy food begins with a healthy planet. Opting for a healthier and more sustainable diet goes hand-in-hand with resilient farms that work in harmony with nature and generate economic and social value. "The challenges of world hunger can be met only if we are able to develop radically different approaches, combining economic, environmental and social objectives", says Faber.

Acknowledging the climate footprint of the food supply, Danone has an ambitious climate policy targeting zero net carbon emissions by 2050. It applies to Danone's full scope of responsibility, including not only areas under its direct responsibility (manufacturing, packaging, logistics, end-of-life), but also areas where the company shares responsibility, especially in agriculture (milk). "Our activities are directly linked to nature and agriculture. The risks of global warming are high and they affect both the natural cycles on which we depend and people's living conditions, starting with family farmers and livestock breeders. With this climate policy, we are adopting another decisive step for a resilient growth model."

Beyond farming and production, supplying food involves products packaging, refrigeration, distribution and disposal. We aim to source packaging raw materials sustainably and give a second life to all plastics we use. We will continue to optimize packaging weight ratio for minimum material and maximum quality and food safety and seek to encourage our consumers to sort and recycle," says Faber.

Finally, healthy food means a healthy ecosystem. Following on its dual economic and social project, Danone has a number of funds and programs in place to empower farmers, suppliers and communities around its full value chain: danone.communities was created in 2007 to finance social business on nutrition and water access; the Danone Ecosystem Fund was created in 2009 to provide support to Danone partners (small farmers, subcontractors, and vendors); Livelihoods was created in 2011 to structure environment-related projects such as family farming, mangrove reforestation, agroforestry, rural energy in emerging countries, and in return provide investors with carbon credits with strong social intensity.

Business Contributions

Fighting for healthy nutrition is a global objective, and business has a critical role to play in it. "A great deal can be achieved in the next decade-and-a-half with the right approaches, and, crucially, the right kind of partnerships between companies, governments, NGOs and with the support of the UN," says Faber. "Not only do we need vision, we should also couple it with innovative investment partnerships."

Danone funds structures act as catalysts, mobilizing the energies, knowledge and investments of different stakeholders, and drastically increasing the striking force of their projects. The Livelihoods initiative, for example, has enabled the plantation of 130 million trees, sequestering 10 million tons of CO_2, thanks to the complementary expertise and power of over 10 major companies as partner investors and as many NGOs, all building on mutual capacity and knowledge sharing. The €100 million Danone Ecosystem fund operates 63 projects in 28 countries, conducted hand-in-hand with 51 NGO partners. Danone believes that success will come from integrated partnerships; hybrid models where companies, philanthropy, communities and governments all play a role in shaping the future of agriculture, both in cities and in rural areas. "I believe that if we want to reach SDG 2, we need to scale up to another level of partnerships, and innovate with output-based financing instruments, such as social or development impact bonds."

Danone is in the process of developing new goals for the company involving all 17 SDGs as organizing principles for its business.

"We are designing new goals for the company that will go further than just delivering growth and profit," says Faber. "We are fully aware that we won't be able to reach these company goals by ourselves and need to do it with friends and partners. We have a very powerful tool with our Manifesto that gathers all the Danone people around a global vision. This vision is open to anybody who is interested in joining us to build an alimentation revolution." ∎
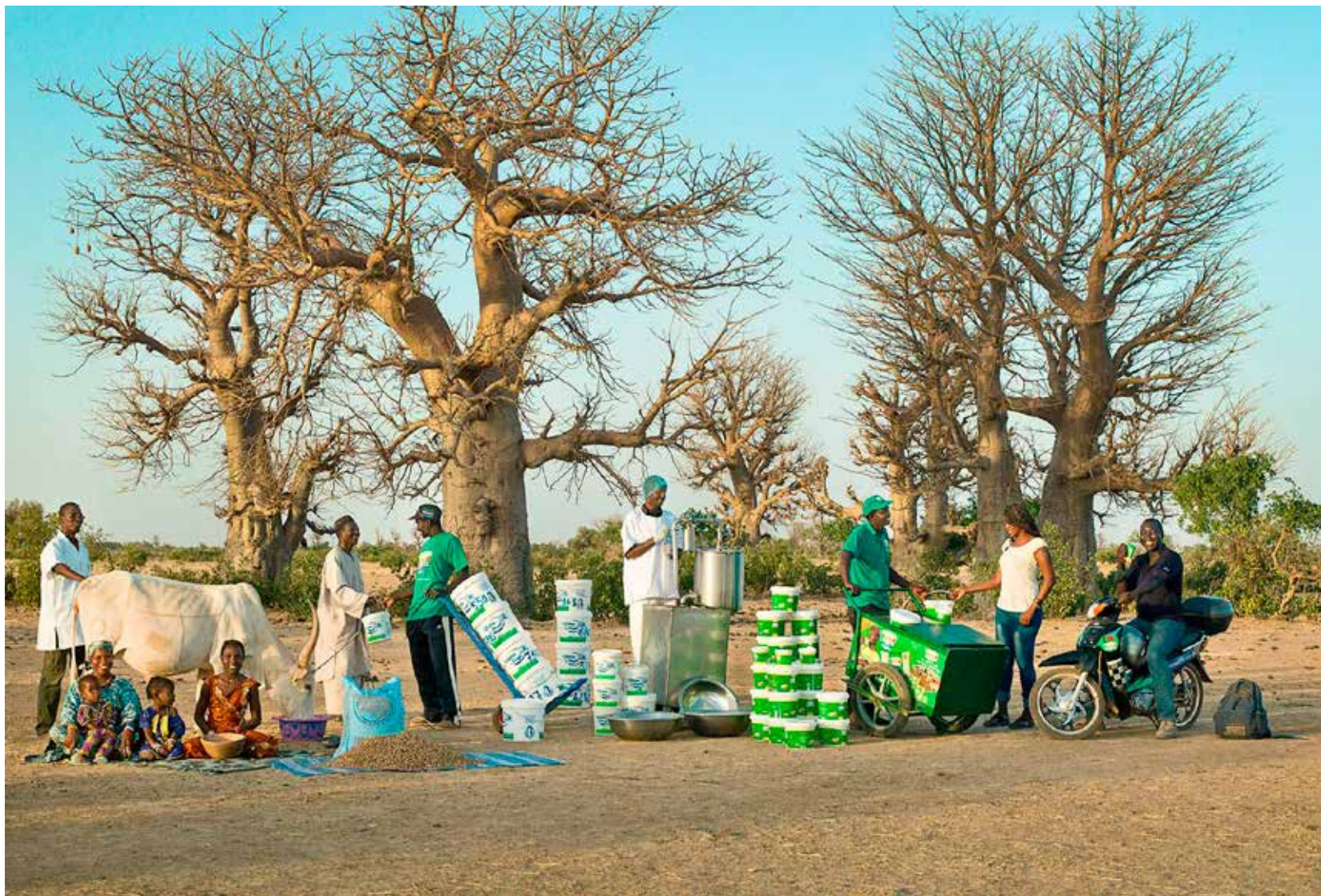
Laiterie du Berger

In 2005, more than 90% of Senegal's milk was imported in powder form - this in a country where 30% of people live only on livestock. "That was an aberration," says Bagoré Bathily, the Senegalese Veterinarian living in the Sahel region on the border with Mauritania.

Bagoré recognized that producing and selling locally collected milk could improve the lives of the nearly 4 million Peuls, or traditional livestock herders, in his area, and started La Laiterie du Berger as a family business. He set up a network to collect fresh milk twice a day, enabling 600 family farmers within a radius of 50 km to live exclusively on production. By 2011, the factory had grown from a production of 500 to 4,000 kg of finished products per day, and was supplying a range of yogurts (Dolima which means "Give me more") and cream to approximately 4,000 clients. The ability to sell their milk at a fixed price provided a secure income that benefitted over 7,000 people.

Bagoré also provides cattle feed for the farmers during times of lean grazing, as well as veterinary assistance and training to improve their productivity.

For many of these initiatives, Bagoré drew on the danone.communities network for support and technical advice on connecting family farmers to local, national and international markets, increasing the use of new technologies for family farming, and innovative financing models to enable projects to be scaled up.

"La Laiterie du Berger epitomizes what we are trying to do in danone.communities' projects," says Emmanuel Faber. "It connects sustainable agriculture with healthy eating and drinking practices, makes available affordable products, and improves the lives of local communities through a viable business that Danone, beyond providing capital, may improve even further through distribution and marketing assistance."

3 GOOD HEALTH AND WELL-BEING

ROW   BRISE   CHINA   OECD   USA

After the creation of the MDGs, there has been tremendous progress in reducing child mortality, improving maternal health, and tackling HIV/AIDS, tuberculosis, malaria, and other diseases. This ambition continues with SDG3, which aspires to promote the best possible health and wellbeing for all. Four targets were selected for assessment of the third SDG, as these have the most comprehensive datasets. These targets addressed a reduction in the global maternity mortality ratio; an end to preventable deaths of newborns and children under 5-years of age; an end to the AIDS epidemic; and a one third reduction of premature mortality from non-communicable diseases.

Model input
The forecast gives relevant input to this SDG. Key parameters include under 5-years of age mortality rate per 1,000 live births. The T21 model forecasts the under-5 years mortality to decrease substantially; however, the world as a whole will not reach the target of under-5 mortality of 25 or lower per 1,000 live births by 2030, as illustrated in Figure 3.1.

Regional considerations
Despite great achievements in the field, AIDS is still the leading cause of death among adolescents in Sub-Saharan Africa and 22 million people living with HIV do not have access to life-saving antiretroviral therapy (UN, 2015). On a global scale, non-communicable diseases (NCDs), mainly cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes represent 63 % of all deaths. In all developing regions, the maternal mortality ratio has been nearly halved in the past 25 years. However, only 51 % of countries supply data on causes of maternal death (UN, 2015).

Conclusion
The forecasts for USA and OECD are rated green for all targets. With the exception of premature mortality from NCD, China is also rated green for overall goal achievement. The forecast for BRISE is green, yellow, and red for the four targets, and ROW has been rated yellow and red. Both regions get a yellow rating in total, with ROW close to a red rating. There are significant uncertainties in our assessments.
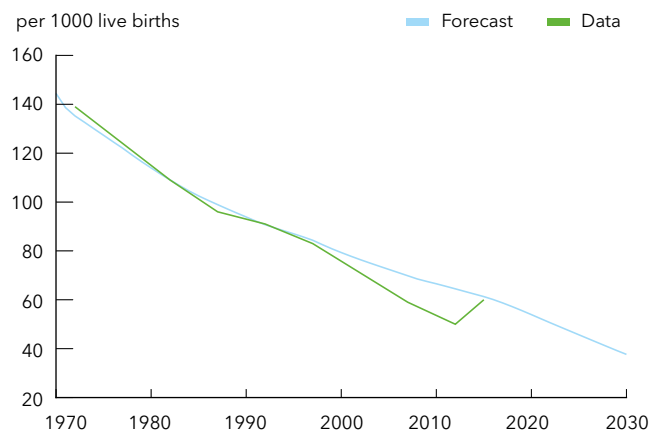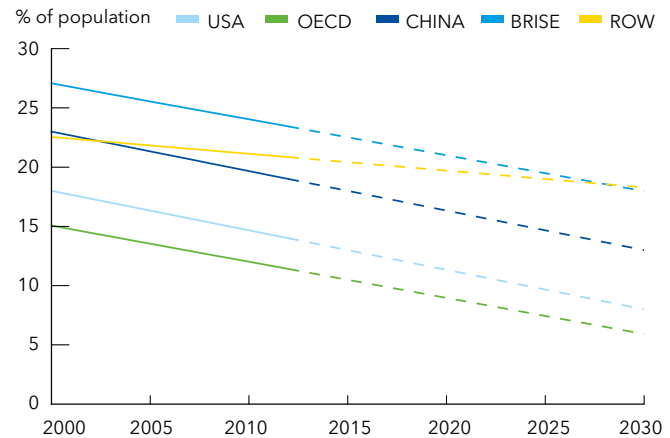

Figure 3.1. Forecasted under 5-years mortality

Historical data source: WHO

Figure 3.2. Probability of dying between 30 and 70 years from non-communicable diseases.

# ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES

Assessment details

We assess maternal and under-5 mortality, the population living with HIV, and the probability of dying from NCD for SDG3.
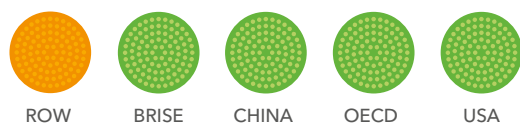
TARGET 3.1

By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births**.** *Indicator chosen: Maternal mortality ratio per 100,000 per live births*

ROW	BRISE	CHINA	OECD	USA
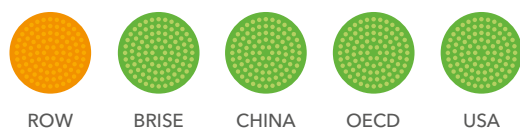
Maternal mortality rates indirectly reflect the status of healthcare for all. Despite longstanding international commitments to reducing maternal mortality, it remains substantial in BRISE and ROW. New technological developments, such as mobile health, that enables access to healthcare in remote and poor areas, contribute to our assessment that BRISE will succeed in reaching the target, while ROW will close more than 50 % of the initial gap. OECD, USA, and China are already at the target today.

TARGET 3.2

By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births. *Indicator chosen: Infant mortality ratio per 100,000 per live births.*

ROW	BRISE	CHINA	OECD	USA

Child mortality is closely linked to target 3.1 on improving maternal health. Most countries have come a long way in reducing child mortality and our forecast shows that all, except ROW, will achieve the target of under-5 mortality to below 25 per 1,000 live births. ROW is likely to close 50 % of the gap, and is therefore rated as yellow.

After the MDGs, there was a great push towards curtailing AIDS in developing countries. The latest available data show that the overall trend of HIV infection is generally decreasing, but also that there are many newly infected, as well as many undetected, cases. This means that many still die from AIDS-related causes. This is particularly true in sub-Saharan Africa and in various populations at high risk of HIV (Piot et. al. 2015). «End epidemics» are difficult to quantify, but we use a threshold of 0.5 % of the population as a quantifiable threshold here. Although the numbers are decreasing, ROW and BRISE are unlikely to close 50 % of the gap to where they should be in 2030. Some literature shows an increase in HIV/AIDS infections in OECD countries due to the financial crisis. However this will not affect the overall rating, which remains green.

TARGET 3.3

By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases. *Indicator chosen: People living with HIV, aged 15-49 years, percentage.*

ROW	BRISE	CHINA	OECD	USA
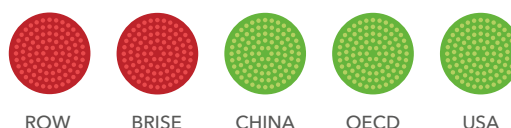
All age groups and regions are affected by NCDs. Today, of the premature deaths, 82 % occurred in low- and middle-income countries. In our assessment, reducing the number of premature deaths by 1/6 will give a yellow rating. Thus, ROW will be red, China and BRISE are on track for a yellow rating, while OECD and USA are likely to meet the target. This is illustrated in Figure 3.2.

TARGET 3.4

By 2030, reduce by one third premature mortality from non-communicable diseases (NCD) through prevention and treatment and promote mental health and well-being. *Indicator chosen: The probability of dying between ages 30 and 70 years from the 4 main NCDs - cancer, diabetes mellitus, cardiovascular disease, chronic respiratory disease.*

ROW	BRISE	CHINA	OECD	USA
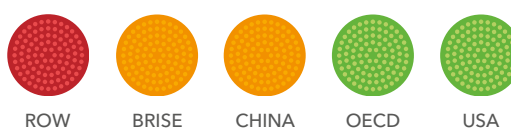
==== **HI TECHNOLOGIES**

SAVING LIVES TODAY WITH TOMORROW'S TECHNOLOGY

Healthcare faces deepening threats to its ability to meet the needs of humanity. Inequitable access, ageing populations, spiralling costs, the rise of non-communicable diseases (NCDs), the declining efficacy of antibiotics … all mean that continued deployment of traditional healthcare methods is not sustainable.

At a time when new solutions are desperately needed in healthcare, developments in another industry sector – ICT – may provide many of the breakthroughs. Hi Technologies is a small company with big ideas, and even bigger ambitions: to reinvent and humanize medical technology. The company's CEO, Marcus Figueredo, shared some insights.

Assessment
"We should not be seeing children dying because of problems that were solved by medicine a long time ago," says Figueredo. "We already have the technology, the processes, and the healthcare professionals. The problem is one of politics, about investing in access." Get this right, he says, and we'll meet the first two targets in SDG 3. "So I think the DNV GL report's indicators are right for these first two."

The deeper challenges for the third target on communicable diseases, Figueredo says, are also policy-related. His country is currently battling an outbreak of the Zika virus, while also dealing with dengue fever, HIV, and tuberculosis. "All of these are preventable; the problem is that we are not applying the solutions we have at hand fast enough." For this reason, he agrees that BRISE countries are unlikely to meet the target by 2030.

The biggest challenge to developed countries is posed by the fourth target, dealing with prevention and treatment of NCDs like heart disease, stroke, cancer, diabetes, and chronic respiratory disease. BRISE, China, and ROW have much work to do here too. The increasing global crisis in NCDs is now widely seen as a barrier to development goals, including poverty reduction, health equity, economic stability, and human security. It also happens to be the area in which Hi Technology's offering can make the greatest difference.

MARCUS FIGUEREDO,
CEO Hi Technologies

Hi Technologies multi-award-winning technology enables health professionals to connect with patients though telemedicine. The company was founded in 2004 with the mission to reinvent and humanize the medical technology. This year, Brazilian IT company Positivo bought 50 % of the company. Hi Technologies employs 27 people at its headquarters in Brazil.

«We are creating ways to analyze not only individual vital signs or clinical labs exams, but also triangulating our data with geography and social media to see how diseases spread. Chronic diseases are not spread by infection, but relate to behavioural changes and changes in lifestyle.»

«We believe that the biggest challenge in healthcare is empowering patients».

While Figuredo agrees that USA and OECD should be green, he warns that the cost of chronic diseases "has the ability to destroy health care systems," but will at the very least impede so-called modern health services from making better progress on target 3.4.

Hi Technologies Solutions

In 2015, DNV GL published a position paper, Healthcare in 2050, which stated that future healthcare will be characterized by '4 P's': prediction, prevention, personalization, and participation. Technology will play a central role in enabling a transition from the current, unsustainable and costly centralized "repair shop" model of healthcare to a highly distributed version where much of preventative and chronic care is delivered in the home or other convenient location through telemedicine.

Our 2050 view includes futuristic technology such as advanced genomics; pervasive subcutaneous sensors linked to personal (possibly robotic) health coaches; the creation of digital selves though data collection and analytics enabled by the Internet of People; the use of additive manufacturing (3D printing) and so on.

Excitingly, some of that technology-enabled future is already here. The launch product from Hi Technologies was software to monitor the vital signs of hospital patients remotely via the Internet. The results were so encouraging that the company embarked on a hardware route. Their new generation vital signs monitor, known as 'OpenVida' was adopted by hospitals in 22 Brazilian states and is now used in 15 countries. Other products followed: the Milli pulse oximetre, a sleep apnea detector, a tele-ECG, a childbirth monitor and the Milli Screening for babies born with a critical congenital heart defect (CCHD). (See case study.)

Hi Technologies is now concentrating its efforts on disease prevention, with technologies that enable people to detect and manage diseases at home. A unit about the size of an espresso machine can detect HIV, dengue fever, syphilis and Zika with just a drop of blood or saliva, and also monitor cholesterol, diabetes and a lot of other conditions.

Figueredo estimates that there are 12 million people living with diabetes in Brazil, but half of them either don't know it, or are in denial and do not engage with treatment. "We believe the same thing happens with a lot of other diseases. For us the challenge is to get the patient to be involved in their treatment." He believes the key is to give them more power over their treatment regimes.

Hi Technologies' machines are designed to be affordable enough to have in every household. This is important because family members are a key part of ensuring compliance. Many people feel more comfortable sharing their information with a machine, and "respond when a machine tells them they have high cholesterol but not when a doctor does." Figueredo likens it to the person who will share things on Facebook or social media, but not face to face in real time. "It's very strange, but it's all about how people relate to technology."

Empowering patients will also empower physicians and healthcare professionals, freeing them up to take care of more people, more effectively and remotely.

This kind of distributed healthcare will become increasingly necessary as the lack of trained healthcare professionals soars across the globe; 2020 predictions estimate a nurse shortfall of close to 1 million in the US alone.

Business Contributions

The knock-on development effects of healthcare crises are nowhere better illustrated than through the contemporary example of devastation wrought by the Ebola virus – the epidemic has been declared 'over', but it has left 23 000 children orphaned in Liberia, Sierra Leone, and Guinea. In addition to being a cause of poverty, health is impacted by poverty and strongly connected to other aspects of sustainable development, including water and sanitation, gender equality, climate change, and peace and stability.

Businesses have a responsibility to address these issues wherever possible. It starts with the most basic, such as Danone's commitment to making healthy foods and clean water accessible and affordable to all. As Danone CEO, Emmanuel Faber, says, "New ways can and will be found to better serve this generation and the next, and to bring healthy, affordable food and safe water to the greatest number of people." At the other end of the technological scale are innovations like ARM's commitment to bringing wearables to the world, partnering with the likes of UNICEF so that they can create what ARM's Head of Sustainability and Corporate Responsibility, Dominic Vergine, calls "the next generation of health, education, and agricultural technologies."

Hi Technologies also sees a role in business servicing the wider healthcare community with population information statistics using artificial intelligence. "We are creating ways to analyze not only individual vital signs or clinical labs exams, but also triangulating our data with geography and social media to see how diseases spread. Chronic diseases are not spread by infection, but relate to behavioural changes and changes in lifestyle."

These examples from Hi Technologies are a foretaste of the potential that digitalization holds for distributed, lower-cost and patient-centred care. There are obstacles to overcome, not least behavioural changes from both the providers and receivers of care, along with security and privacy issues, but a new day for healthier longer lives is dawning. ■

Giving tiny hearts a chance to grow

One in every 100 children is born with a congenital heart defect (CDH). Roughly one in every four of these children has a critical CHD (CCHD). CCHD is life threatening and requires intervention in infancy. However, CCHD is not always detected prenatally, and on first examination babies can appear normal. Some infants with CCHD are discharged from the nursery to home, only to have their condition deteriorate once they get there.

Routine in-hospital screening of newborns is already widely recommended, however due to cost and accessibility still not implemented in most counties. Hi Technologies developed the "Milli Newborn Screening for CCHD", a portable device that provides a simple, painless and non-invasive way to monitor the levels of oxygen in a baby's blood. (Oxygen saturation levels of under 95 % indicate a possible heart defect.)

The device performs the complete CCHD protocol, minimizing errors and reducing the time of testing. It matches each baby with a photo as well as identifying details, and can store up to 10 000 patient exams at a time. These can be shared over the Internet for easy access to doctors, specialists or other key health care professionals.

The team took ten years to develop and test the device before rolling it out for use in hospitals. The team estimates that, to date, the technology has screened more that 170 000 newborns in Brazil. Although routine testing for CCHD it is not yet compulsory in Brazil, in the neonatal unit in the Curitiba hospital where it was first introduced the device has already saved many lives.

4 QUALITY EDUCATION

ROW   BRISE   CHINA   OECD   USA
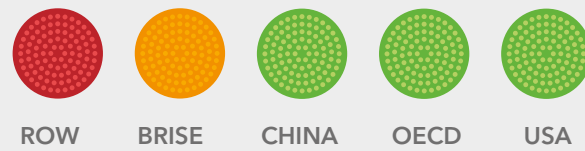
SDG4 is key to preparing the global population for the modern world. The most crucial part of it is to ensure education, and the key principle of leaving no one behind, is kept in focus through the inclusive and equitable principles. Continued lifelong learning opportunities are another part of the goal, going beyond basic education.

Model input
Continued high focus on education is a primary assumption behind our model's fertility and thus population forecasts. The T21 model run with our assumptions gives quantitative results on global literacy rates, forecast to increase from 88 % today to 92 % in 2030. This is illustrated in Figure 4.1, and the data are not regionalized.

Regional considerations
The quality dimension of education is very hard to measure, but inclusive and equitable education is generally in place in the developed world, and also mostly in place in China by 2030. Hence, the main challenge towards 2030 is in BRISE and ROW.

Conclusion
China, OECD, and USA score green on all three indicators. BRISE scores red, yellow, and green on the three indicators, and gets a yellow score, in total. ROW has two red and one yellow score and gets a red score in total.

% of adult population   Forecast   Data
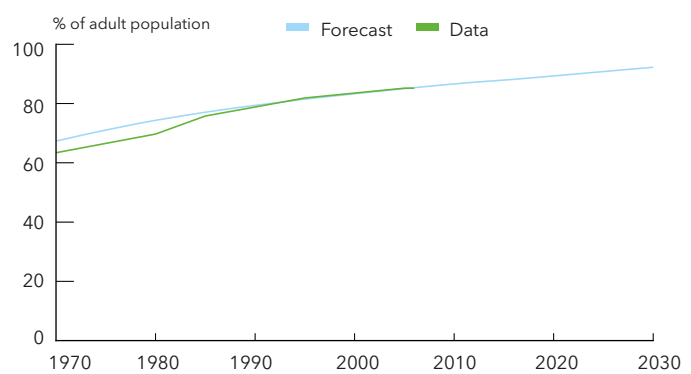
Figure 4.1. Global literacy rates

% of relevant age group

USA   OECD   CHINA   BRISE   ROW

Historical data source: UNESCO Institure for Statistics
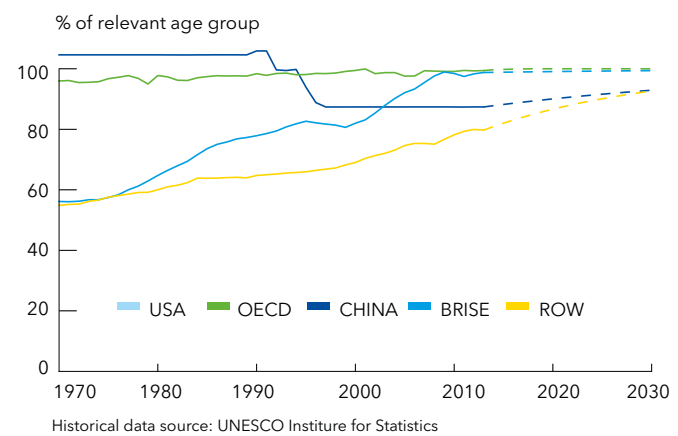
Figure 4.2. Primary school completion rates

Ratio of women to men

USA   OECD   CHINA   BRISE   ROW

Historical data source: FAO Food Security Data
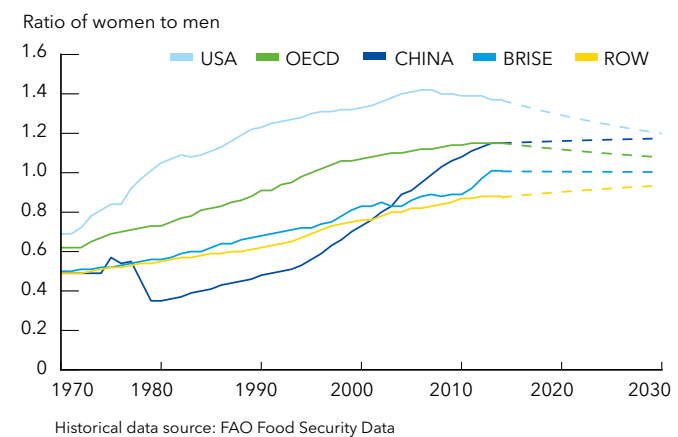
Figure 4.3. Gender parity index for tertiary school

# ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL

Assessment details

We included three targets in our assessment; basic education; equal access to higher education; and literacy.

TARGET 4.1

By 2030, ensure that all girls and boys complete free, equitable, and quality primary and secondary education, leading to relevant and effective learning outcomes. *Indicators chosen: Primary completion rate. Lower secondary completion rate.*

ROW	BRISE	CHINA	OECD	USA
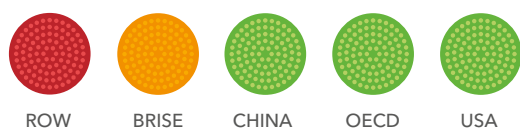
Completing primary education will ensure basic literacy and numeracy, while seconda ry education will be a step towards ensuring lifelong learning opportunities. USA, OECD, and China have high completion rates, although data quality is a key challenge for this indicator, both in developing and developed countries. Data for primary completion are illustrated in Figure 4.2. There is universal progress on both primary and secondary completion rates, with BRISE having 91 % and 76 % respectively, to date, and ROW 73 % and 46 %. With the expected improvements, ROW cannot fill the gap, and BRISE is likely to meet the target for primary education only.

TARGET 4.3

By 2030, ensure equal access for all women and men to affordable and quality technical, vocational, and tertiary education, including university. *Indicator chosen: Gender Parity Index in tertiary level enrolment*

ROW	BRISE	CHINA	OECD	USA
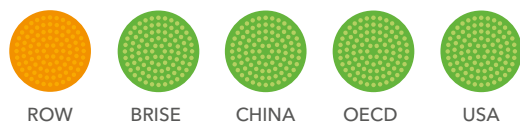
The main issue addressed by this indicator is that women do not have the same opportunities as men. Hence, more women being enrolled than men is rarely an issue of access. There are significant country variations in ROW, but the average trend is good, with the ratio of females increasing from 69 % to 81% over the last 15 years, as illustrated in Figure 4.3. This is expected to continue to above 90 %, but not fast enough to meet the target. For BRISE, the ratio today is at 93 % and increasing, while the other three regions are above 100 %. We give those four regions green rating.

TARGET 4.6

By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy. *Indicator chosen: Literacy rate at 15-24 years*

ROW	BRISE	CHINA	OECD	USA
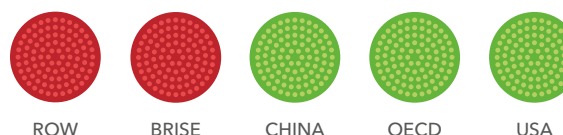
Literacy rates for youth will, over time, ensure full literacy for the entire population, and is a key indicator. Literacy rate is close to 100 % in USA, OECD, and China and will continue to be so. Literacy in BRISE has stabilized at around 90 % in recent years, with India having lower figures and pulling the average down. Literacy in ROW has improved slowly, from 74 % to 78 %, over the last 15 years, and many LDCs still have literacy rates below 50 %. Some countries, mostly in ROW, but notably also India, have poorer literacy rates in women than men.

ARM

SMARTER LEARNING

As creators of the "architecture for the digital world", ARM is literally everywhere. Its technology is used in 95 % of smart phones, 80 % of digital cameras, and 35 % of all electronic devices.

ARM touches and influences the lives of billions of people, and its direct business activities and corporate responsibility programmes contribute across almost all of the SDGs. For the purposes of this publication, ARM limited its thoughts to SDG4, with Dominic Vergine, ARM's Head of Sustainability and Corporate Responsibility, having a great deal to say on the subject of inclusive and equitable quality education.

Assessment
ARM is in broad agreement with DNV GL's model-based assessment of SDG 4, which draws largely on UNESCO data. While the forecast data reveals that many of the world's LDCs will not meet most of the targets, Dominic believes there is cause for optimism in the onward march of information and communication technologies.

As worldwide access to mobile technology burgeons, the percentage of the world's population that remains unconnected is now very small; even in the least connected area, Sub-Saharan Africa, more than 60 % of the population has access to a mobile – and devices are becoming increasingly affordable.

"Access is not ownership," cautions Dominic, "but typically the next step from access to a shared, basic mobile, is access to a smartphone. When you are looking in lesser developed countries, there is a great opportunity to provide quality services – healthcare, education, agriculture, job-related – that can really transform people's lives. I think you'll see more of those services coming to the fore on very affordable smartphones. Remote service provision deepens with the introduction of the Internet of Things (IoT), which includes wearables, sensors around the home, and so on."

One of the key challenges is access to truly affordable computing. Until the cost of smartphones and the associated data connectivity reduces, the desktop PC still plays a role in some countries. Dominic cites the example of the Endless Mini, arguably the world's most affordable computer. Running on an ARM processor, this US $79 computer has a bespoke operating system that allows people with little or no PC experience and with little or no access to the Internet to introduce a computer into their homes, preloaded with more than 100 applications including an encyclopedia from Wikipedia, word processing, educational lectures, health tips, and business advice.

DOMINIC VERGINE
Head of Sustainability and Corporate Responsibility, ARM

ARM is a British multinational semiconductor and software design company. It's primary business is in the design of CPUs, software development tools and processors for mobile phones. Headquartered in Cambridge, England, it employs 4000 people and recorded revenues of £968 million in 2015. ARMs goal is to work together to shape a sustainable and connected world.

«A lot more students get switched on when you make STEM education about improving the world. Bringing in healthcare or environmental issues, for example, makes engineering a lot more appealing to girls.»

«Some of the most exciting solutions to solve the hardest problems facing the poorest communities around the world are not coming from Silicon Valley or London, but from places like Accra, Jakarta, and Wuhan.»

Erica Kochi, co-founder of UNICEF Innovation

ARM solutions

STEM (science, technology, engineering, and mathematics) education is a key funding area for ARM, in part to secure a future pipeline of talent for itself and its ecosystem of partner companies, but also because, increasingly, technology is fundamentally embedded into innovative solutions for developmental challenges.

In the UK, ARM supports the 2020 STEM Scholars Programme, which targets schools from areas of high deprivation and specifically encourages participation in STEM subjects by girls and by those from disadvantaged backgrounds. In 2016, ARM was a key participant in the Junior Academy of the New York Academy of Sciences – a programme for exceptionally talented young (13–19 year-old) international STEM students to work on cutting-edge projects. The two winning teams sponsored by ARM in 2016 were made up of virtually networked students from 8 different countries, including Macedonia, Honduras, and Kenya. One of the projects is titled "Improve Infant Health through Wearables and Data"; the other project provides underserved people with access to clean water, using lightweight portable containers that feature, inter alia, sensors to detect residual contaminants.

"The key with these projects is that they bring a social focus to a STEM challenge," says Dominic. "A lot more students get switched on when you make it about improving the world. Bringing in healthcare or environmental issue, for example, makes STEM a lot more appealing to girls, who tend to drop out of STEM subjects much earlier and more frequently than boys. Encouraging new generations of girls across the world to use the power of engineering to tackle social problems - and not just build bridges and roads – is a major opportunity for the whole of humankind."

In 2015, ARM people provided mentoring support as part of the 1,000 Girls, 1,000 Futures programme run by the Global STEM Alliance (GSA), of which ARM is a founding partner. The GSA has a goal of reaching a total of one million students in 100 countries by 2020.

ARM was also the first major donor behind the Code Club in the UK, which runs over 3,500 volunteer-led after-school coding clubs. Many ARM employees have volunteered their time and expertise to these clubs in the UK, and more will do so as ARM helps the Code Club expand internationally.

ARM is also a funding and hardware-design partner of the micro:bit project led by the BBC, which has provided every Year 7 school pupil in the UK with a pocket-sized codeable computer with motion detection, a built-in compass, and Bluetooth technology. "The scale and potential of this programme is amazing," says Dominic. "We're working with other international partners on this like Microsoft and Samsung, and I think all of us are inspired by the potential for this scaling."

Business contributions

Given its presence in so many aspects of peoples' daily lives, ARM impacts a broader range of SDGs than most companies. Indeed, their CR 2015 annual report lists corporate responsibility examples for all 17 of the goals. They intend to take this a lot further. In August 2017, ARM will host the "Global Goals Technology Summit" together with UN Global Compact and the University of Cambridge.

This event will specifically target technology-intensive multinational companies. "But the idea is not for technologists to speak to technologists as such," says Dominic. "We will line up specialists on each of the SDGs – people that our industry is not familiar with – to speak about what different social sectors are looking for in terms of technology." ∎

Innovating with UNICEF

In 2015, ARM and the UNICEF Innovation Unit entered into a unique partnership aimed at transforming the lives of tens of millions of children through economically-sustainable technology solutions.

ARM not only injects its own expertise and funds into this joint effort, but can mobilize its extensive partner base (the huge global ecosystem of tech firms that use ARM's processor IP) to deliver innovative solutions for the international development agenda. "We are excited by the prospect of seeing mainstream corporations perceiving social investment opportunities as core business investments – and then acting on that perception," says Dominic.

The first fruits of the partnership with UNICEF was a "Wearables for Good" Design Challenge – a competition calling upon individuals to design a wearable device offering a cost-effective, efficient, and sustainable solution to pressing maternal or child health problems. The competition quickly developed into one of the most inclusive global design challenges yet seen, attracting 2,000 registrants from 65

countries that resulted in 250 design submissions. The winners received financial backing and a structured incubation process with a range of ARM's industry partners.

Literacy Bridge, an NGO working in Ghana, has been able to dramatically scale its operations in partnership with UNICEF Innovation, ARM, and government ministries. The programme has made "Talking Books" available to over 200,000 people living in extreme poverty in Northern Ghana. Through songs, dramas, and interviews, the books provide education on health and agriculture to reduce maternal and child mortality, hunger and chronic malnutrition, and help people to reconsider gender roles.

Commenting on the partnership with ARM, Erica Kochi, the co-founder of UNICEF Innovation, says that the combination of ARM's extensive partner ecosystem and UNICEF's global presence means that, "Some of the most exciting solutions to solve the hardest problems facing the poorest communities around the world are not coming from Silicon Valley or London, but from places like Accra, Jakarta, and Wuhan."

5 GENDER EQUALITY

ROW   BRISE   CHINA   OECD   USA
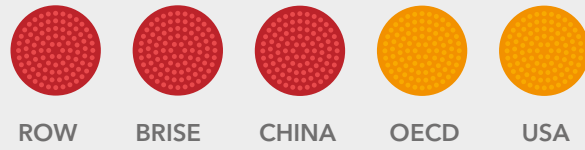
This SDG covers a wide number of targets for gender equality, including education, labour participation, and ending harmful practices

Model input

The DNV GL model does not provide input for assessing SDG5 directly. Nevertheless, our model links gender equality, education, and reduced population growth

Regional considerations

Basic education is an essential platform for gender equality and the gender equality indicator for this is high or improving around the world. The assessment on equality measures in working life is less rosy, and improvements on these are really slow. Gender wage gaps are actually increasing, even where education goals are achieved, like in China.

Equality in working life settings is weak in all regions. ROW and BRISE have considerable challenges with early marriage.

Conclusion

Gender equality will continue to be a challenge across the world, also in 2030. USA and OECD do not achieve the goal, despite equality having been on the agenda for a long time, as the main challenges remain in gender parity within working life. ROW, BRISE, and China get red ratings as they are failing to meet most indicators.

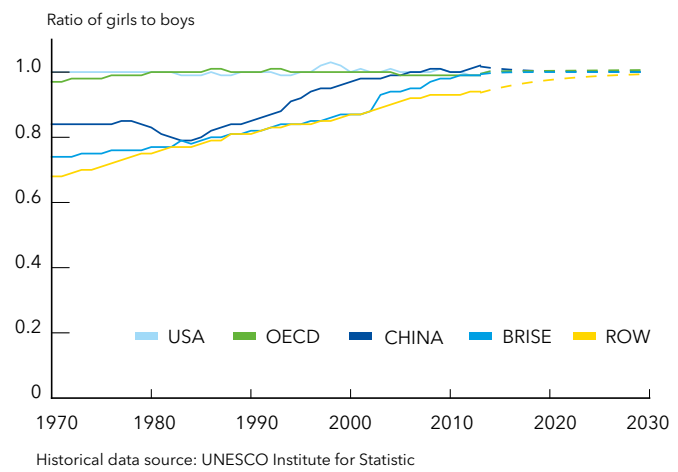Ratio of girls to boys

Historical data source: UNESCO Institute for Statistic

Figure 5.1. Gender parity index for school enrollment

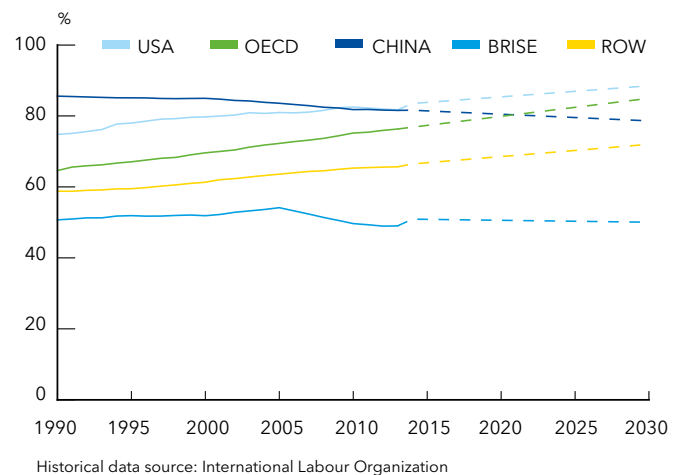Historical data source: International Labour Organization

Figure 5.2. Ratio of female to male labour participation rate

# ACHIEVE GENDER EQUALITY AND EMPOWER ALL WOMEN AND GIRLS

Assessment details

For SDG5 we assess gender differences in primary and secondary school completion, women aged 18-24 years that were married or in a union, ratio of women to men in labour force participation, and the gender gap in wages.

TARGET 5.1

End all forms of discrimination against women and girls everywhere. *Indicator chosen: Primary school completion rates for girls and boys. Secondary school completion rates for girls and boys.*

| ROW | BRISE | CHINA | OECD | USA |
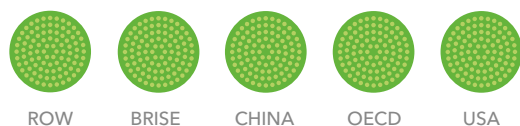
The ratio of girls versus boys that have access to education is a good indicator for measuring gender equality. However, this says nothing about total school enrolment (see SDG4). For China, USA, and OECD the goal for this indicator is already achieved. BRISE countries are on track and should also close the gap by 2030, and the same goes for ROW.

TARGET 5.3

Eliminate all harmful practices, such as child-, early- and forced-marriage and female genital mutilations. *Indicator chosen: Percentage of women aged 20-24 who were married or in a union before age 18 years.*

| ROW | BRISE | CHINA | OECD | USA |

OECD and USA have an insignificant share of marriages before 18 years and this means a green rating. Data are not available for China. BRISE and ROW have a long way to go. The issue is heavily linked to cultural practices and we cannot foresee that half the gap will be covered by 2030. For ROW and BRISE there are also strong challenges with other harmful practices, e.g., female infanticide in certain countries. Many changes will be needed before all harmful practices are eliminated.

TARGET 5.5

Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life. *Indicators chosen: 1. Ratio of female to male labour force participation rate. 2. Gender gap in wages by sector of economic activity.*

| ROW | BRISE | CHINA | OECD | USA |
| ROW | BRISE | CHINA | OECD | USA |
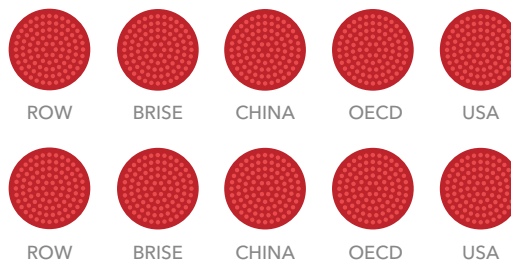
Labour force participation: To have full participation, the goal is 100 %, with 95 % as the lower limit for green. China has a relatively high ratio today, but this may reduce towards 2030. Also BRISE is on a downward trend, driven by Russia and India. USA, OECD, and ROW are all moving in the right direction, but none of them are on a trend to close half the gap. Hence, they all get a red rating.

Gender gap in wages: To have equal opportunities, the goal is 0 % difference, with 5 % difference as the lower limit for green. Statistics show that USA and OECD are improving, but are not on a trend to close half of today's gap by 2030. We have data for selected ROW and BRISE countries that indicate no improvement, and we chose to use that as representative for the regions. China's gender gap in wages has increased over the last decades, and no trend indicates a drastic reduction to 2030 (Chi and Li, 2014).

SYMANTEC

HOLDING UP HALF THE WORLD

Women hold up half the world, but traditionally they've not had equal access to its riches. Gender issues are often embedded in cultural norms, which can be resistant to change.

Access to healthcare, childcare, and education for women, as well as universal suffrage and safety from harm and harassment, are not only cornerstones of gender equality, they are also key to fighting poverty around the world, and interwoven in many of the SDGs.

Basic education is an essential platform for gender equality, and the gender equality indicator for this is high or improving globally. But there is still much work to be done, and when it comes to public life, there are still way too few women in key positions, from heads of state to company boards.

Employment equity is one area that business influences directly – having half the population underrepresented in one's business is not a smart move. The Female FTSE Board Report 2016 commended the fact that the 25 % female representation in FTSE 100 boardrooms by 2015 was exceeded; the new target is 33 % by 2020 on FTSE 350 boards.

Over the past decade the percentage of women on top boards has increased in every country across Europe. The numbers were lower for countries outside Europe, with the exception of Australia and the USA.

Promoting a diverse and inclusive workplace is not just part of Symantec's commitment to ethical operation; gender-diversity is emerging as a brand-defining aspect of Symantec's operation. We spoke with Cecily Joseph, Vice President of Corporate Responsibility and Chief Diversity Officer.

Assessment
Although the Spaceship Earth Assessment predicts that Gender Equality will still be a challenge across the world in 2030, Symantec's Cecily Joseph has a refreshingly positive outlook.

"I've never felt as positive as I do right now," she says. "I feel very optimistic because there is so much focus and attention on issues like women's empowerment, equal pay, getting more women into technology and into leadership roles, and more girls into STEM (Science Technology Engineering and Maths) education than ever."

While Joseph admits that her personal perspective is tech-focussed, in 23 years working in the industry, she sees more urgency and energy around this topic than ever before. "So I feel that the future of this conversation is very bright and very positive."

SDG 5

CECILY JOSEPH
Vice President of Corporate Responsibility and Chief Diversity Officer for Symantec Corporation

Symantec is a global cyber security company based in California with over 11 000 employees in 35 countries. In 2015 it recorded revenues of $6.5Bn. Symantec's corporate citizenship is directly linked to its mission to help businesses harness the power of their information and to make the digital world safer.

«Women make up half the population of the world, and they should be equally represented in the workforce.»

«We set clear goals and have been intentional about changing the culture around gender. These things don't happen by accident. I think companies have to own that.»

Symantec solutions

Gender equity is arguably one of the most global of all the SDGs for our workforce. "Gender issues translate - the goals that we set are global goals," says Joseph. "Our employees and our customers are very global and our workforce needs to emulate that. Women make up half the population of the world, and they should be equally represented in the workforce."

A proactive intention, backed by Symantec's executive leadership, resulted in a shift over just two years from 10 % to 30 % representation on the Board of Directors. The company also set goals around the percentage of women in leadership (at director level and above), launching projects to develop females inside the company.

Not only did the Symantec board recruit for women, it deliberately looked outside its usual channels and traditional networks to draw from a broader and more diverse pool of skills and talent. Joseph points to two recent female board appointments, a retired Air Force General, and an Irish corporate banker, as examples of the kind of breadth and diversity that make a corporation more robust, as well as more representative. In an unusual move, Symantec didn't insist that possible directors already had served on a public company board. This common requirement – of prior board service – is one reason that boards have appointed so few female directors," says Joseph. "In this way we contribute to expanding the number of women in leadership globally."

The area of cyber security presents a serious global threat – as well as significant opportunities for bringing more women into the field. "In every country we do business there is a shortage of cyber security professionals and talent that understands the cyber security landscape. Within that talent pool there are even worse numbers when it comes to gender. If you look at technology there are probably 18 % of women in tech as a whole, but in cyber security there are probably around 10 %."

Symantec launched a programme of rapid education to increase the numbers of women and people of colour within the cyber security space, bringing them to internships and jobs at entry-level positions within a one-year period. After launching the programme in the US, they recently expanded it to India.

Business contributions

A scarcity of women in top positions isn't limited to the tech industry. A study released in 2015 by McKinsey & Co. and non-profit LeanIn.Org showed that even though women and men are almost equally represented in entry-level positions,

fewer women get promoted to each higher level. By the time women reach senior vice president, they represent just 23 % of the positions, the study said. C-suite representation is even less at just 17 %, according to the study's data, which tracked 118 companies, including 26 in technology. "We've lost women every step of the way," said Lareina Yee, a partner at McKinsey & Co.

As Danone's CEO, Emanuel Faber, reported to the French Ministry of International Affairs, "Women's empowerment is crucial to achieving fair development. They are, in many cases, subject to such severe discrimination that it is necessary to focus on their empowerment as a matter of priority, without which development can be neither fair nor sustainable."

Joseph suggests that more businesses should adopt the women's empowerment principles from the UN Global Compact. "It's an incredible framework for moving the needle on gender equity, not just in one dimension, but across the whole company. It points to how you can have an impact and embed gender equity into everything,from talent management to your customer facing areas, how you invest in your community, and how you constitute your board and establish governance. I think that more companies should not just sign on but truly adopt them and integrate them."

Joseph would like to see collective action and public commitment from her industry. "Companies should collectively adopt goals. For example, in tech we could set a collective target for higher representation of women, and adopt certain practices that will help us all move there."

Besides Symantec's commitment to STEM education, Joseph points to innovative opportunities to encourage more women to switch to technological fields. Business should explore more creative ways to bring women into technology – especially if they've been deterred from pursuing technology at some earlier point in their education cycle. "We often get caught up in this debate about the small pipeline of women coming out of schools with technology backgrounds. But there are many supporting jobs in technology companies, especially the larger ones, which are not tech jobs. You are hiring people in marketing, in human resources, in legal, in finance, in sales. You can reach some gender equity goals by looking more broadly at bringing in a more diverse population."

There is still a long way to go, but the journey starts with setting clear goals and being intentional about changing the culture around gender. "These things don't happen by accident. I think companies have to own that." ∎

Building cyber security skills

Cyber security threats are a global issue and are on the rise. The global IT Security market was estimated to be $77 billion in 2015 and growing at over 8 % annually. By 2019, the demand for cyber security professionals is expected to rise to 6 million, but a gap in skills will leave a projected 1.5 million of those positions unfilled.

In 2014, Symantec launched its Cyber Career Connection (SC3) to attract and train young adults, especially women, in the field of cyber security.

"The cyber security industry is facing a workforce crisis – the global shortage of cyber security professionals is expected to reach a shocking 1.5 million by 2020. We saw an opportunity to address this issue impacting our industry while also undertaking another key problem – the lack of women and people of colour in cyber security roles," says Cecily Joseph.

In the US, SC3 involves collaboration with several non-profit partners including NPower and Year Up in a programme designed to train and certify underserved young adults and veterans for careers in cyber security. Since its inception, SC3 students have successfully launched their cyber security careers

with internships and full-time employment at major companies, including CBS Interactive, Conde Nast, eBay, GAP, KPMG, SAP and more. Of the graduates, 72 % are black or Hispanic, and 24 % are female, fuelling a more diverse pipeline.

In 2015, SC3 partnered with Indian IT association NASSCOM (National Association of Software and Services Companies) to build a cadre of world-class, certified cyber security professionals in India.

The initiative was in line with Prime Minister Narendra Modi's "Digital India" initiative to develop skills and leadership in cyber security, with a particular gender focus on women in the profession. Symantec sponsored 1 000 scholarships for women candidates, as well as supporting the creation of courseware for five job roles and teacher training.

"India has ambitions to be global leaders in this area, and we saw a huge opportunity to uplift and empower women in India through this very rapidly growing industry. So we partnered with the NASSCOM foundation to bring scholarships to women in India who are pursuing cyber security fields."

6 CLEAN WATER AND SANITATION

ROW   BRISE   CHINA   OECD   USA
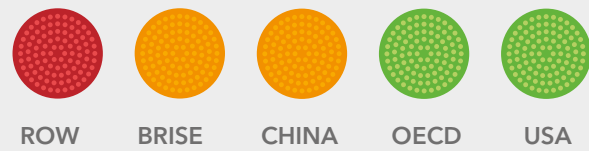
«My feeling is that we can be more optimistic. Technology (desalination, storage) holds some promises, and investment in some poor geographical areas is increasing.»

Harald Siem, Norwegian Institute of Public Health

SDG6 is about access to, and quality of, water and sanitation, and also the sustainability aspects of how we use water and manage water quality. While access is mainly an issue for developing countries, the sustainability aspects are key for all.

Model input
The model forecast informing this SDG is limited. There is a strong correlation between GDP and availability of safe water and sanitation, and we expect the strongest GDP growth for ROW, indicating further improvement. We also know that climate effect, increasing due to GHG emissions, will impact water scarcity. However, the effect is not quantified in our model.

Regional considerations
The main challenge for access remains in the poorer developing countries, particularly in rural areas. Within the first target that aims for universal and equitable access to safe and affordable drinking water to all, significant gaps remain. Sanitation is less developed than drinking water, and the same geographical pattern is seen as for safe water scarcity. The situation is likely to improve, but not disappear, over the next 15 years. Water sustainability is an issue in large parts of the world, correlated with precipitation patterns, but not well associated with normal developing-developed country status.

Conclusion
ROW gets a red rating, with significant challenges in both water and sanitation. BRISE and China both get yellow ratings, but with China on the borderline to achieving a green rating. USA and OECD score green.

% of population

Historical data source: WHO/UNICEF Joint Monitoring Programme (JMP) for water Supply and Sanitation
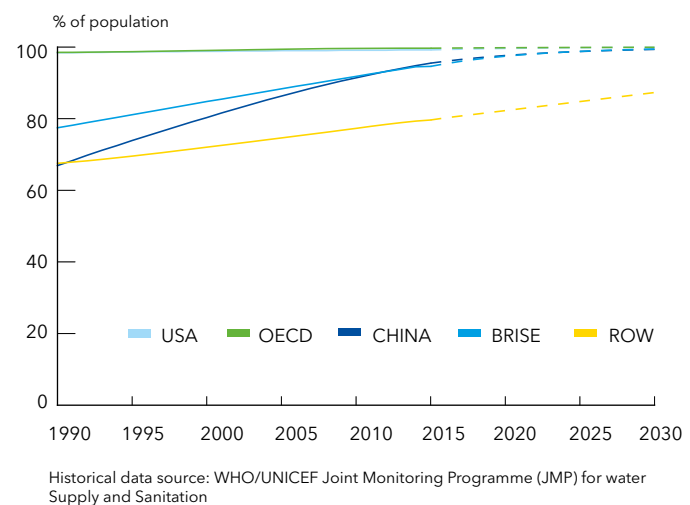
Figure 6.1. Percentage of population using safely managed water services

% of population

Historical data source: WHO/UNICEF Joint Monitoring Programme (JMP) for water Supply and Sanitation
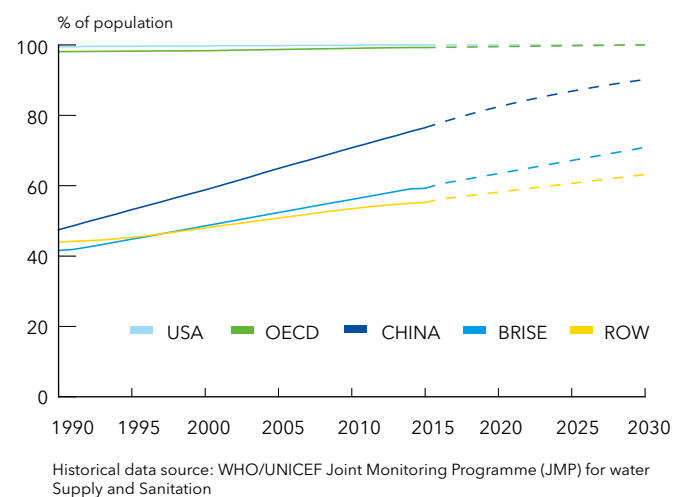
Figure 6.2. Percentage of population using safely managed sanitation services

ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

Assessment details

To achieve our overall assessment, we quantified and rated three of the SDG targets, two of them concerned with water, the third on sanitation. Target 6.3 on pollution is highly relevant, but hard to quantify and provide trends.
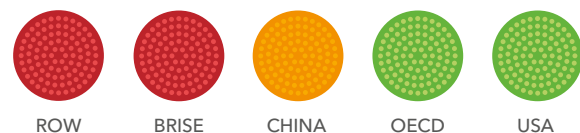
TARGET 6.1

By 2030, achieve universal and equitable access to safe and affordable drinking water for all. *Indicator chosen: Percentage of population using safely managed water services, by urban/rural.*

ROW   BRISE   CHINA   OECD   USA
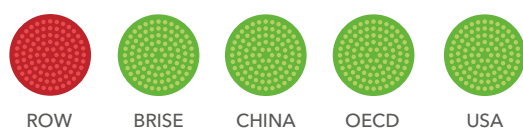
There has been significant progress on this indicator in recent decades, and also several of the least developed countries report good results. BRISE and China have 93 % and 95 % achievement today and should reach the target, while ROW is currently at 75 % (68 % in rural areas and 85 % in urban areas). Although ROW is improving, it is, as illustrated on Figure 6.1, not likely to be fast enough to achieve the goal. The urbanization trend seen in recent decades will continue and influence this indicator, as access to safe water is generally easier in urban areas than rural areas. Progress is also expected on storage and, in some areas, desalination, but increasing amounts of flooding can worsen the situation, at least temporarily.

TARGET 6.2

By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations. *Indicator chosen: Percentage of population using safely managed sanitation services, by urban/rural.*

ROW   BRISE   CHINA   OECD   USA

Access to sanitation is generally lower than access to water services all over the developing world. Although progress is seen almost globally, the progress is far too slow to meet the target in many developing countries. The urban population generally has better access than the rural population, but slum areas in cities remain a major challenge (ref. also SDG11). As can be seen in Figure 6.2, the current achievements and progress in ROW and BRISE are not sufficient to meet the goal, and, in rural areas in these two regions, less than half the population currently meets the target. China is not likely to meet the target, but should close half the gap from today to 2030. New technologies in treatment, e.g. photocells and light, and recycling sewage for profit, give a potential upside in our forecast.

TARGET 6.4

By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. I*ndicator chosen: Proportion of total water resources used.*

ROW   BRISE   CHINA   OECD   USA
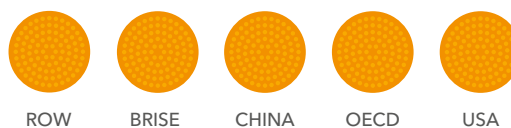
Measuring water withdrawal is complicated, but is included to reflect that SDG6 is not only about access, but also about sustainable water use. The indicator on proportion of water resources used illustrates where there is abundant water and where water is scarce. The challenges with use of water resources are not well correlated with GDP, but are obviously closely connected to climate zones and normal rain patterns. These are however, already influenced by climate change. Colour-coding therefore reflects that all regions face challenges in some parts of the region.

━━━━━━━━ **GRUNDFOS**

WATER EVERYWHERE, INTELLIGENTLY

Access to clean water and sanitation for all in 2030 is a joint, global target that takes focused efforts from public, private, and the civil spheres in collaboration.

MADS NIPPER
CEO, Grundfos

Grundfos is a global leader in advanced pump solutions and a trendsetter in water technology. The company contributes to global sustainability by pioneering technologies that improve quality of life for people and care for the planet. As such, its core activity aligns closely with the sustainability aspects of how we use water and manage water quality. Grundfos recorded revenues of DKK 24,800 million in 2015 and has over 18 000 employees around the world.

Water affects 15 of the 17 SDGs. It is figuratively everywhere in the sustainability conversation, but physically it remains tragically unevenly distributed. Access to clean water is a daily struggle, if not crisis, for many millions, without accounting for the difficulties that global warming can and will bring. Each year, millions of people, most of them children, perish from largely preventable diseases caused by a lack of access to clean water and proper sanitation.

There is a well-spring of hope however: a great deal can be done to make our use of water vastly more efficient. The solutions are partly technological, and for a perspective on the art of the possible, we spoke to Mads Nipper, President and CEO of Grundfos.

Assessment

In line with DNV GL's assessment, Grundfos sees huge challenges ahead to meet the targets of Sustainable Development Goal 6, clean water and sanitation, particularly in the developing countries. Access to water and sanitation is a basic human right and constitutes a critical sustainable development challenge. This challenge is becoming more urgent, and exacerbated by the effects of climate change, which puts more pressure on water quality and availability.

"The need for water and sanitation on a global scale is evident - and the lack of equal access to both is one of the world's greatest risks in the future," says Mads Nipper.

Water is the single most important necessity for life - it simply is irreplaceable. However, more than 663 million people lack access to it. That's a staggering figure. Another eye-opener is that 2.4 billion are without basic sanitation. UN figures tell us that roughly one third of the world's population risk losing their lives to waterborne diseases.

"The SDG target year, 2030, is not far away, and these are very ambitious targets. In order to reach them, we all need to join forces and push for genuine change. Without substantial action from the private sector, the targets cannot be reached. We need to take action fast, together, and in the right ways," says Nipper.

«Without substantial interaction from the private sector, the targets cannot be reached. We need to take action fast, together, and in the right ways.»

Grundfos solutions

Grundfos contributes to meeting the challenges of water sustainability and management with innovative water technology, which can move water to where it should be in an energy-efficient manner.

"We have been refining our pumping and related expertise for decades, and I feel confident that our knowledge and products can make a difference," says Mads Nipper. "We aim to create cleaner technologies and solutions, which improve efficiency, enable consumers to reduce their water and energy consumption, and increase the reuse of resources."

To secure sustainability, he stresses the importance of looking at the entire water cycle, from source to end, and not only treating both potable and waste water, but ensuring that the distribution network is efficient to reduce wastage of this scarce resource.

"Technology is crucial. We need to supply intelligent solutions to integrated water resource management." This includes protecting the water sources, using less energy during extraction and fewer chemicals in treatment, and reducing water loss through the distribution cycle.

"On groundwater we have a long tradition of providing submersible pumps and focusing on energy efficiency. One of the sustainable innovation paths we have pioneered is a solar-powered pumping station."

Grundfos is the largest supplier of solar water pumps in India, and received the United Nations "Momentum for Change" Award during COP21 in Paris, for its approach to sustainable water supply in Kenya and Uganda.

The company is also looking at wastewater as a potential resource – 80 % of human wastewater is dumped into rivers and seas without any treatment. Wastewater treatment brings water back to life so that it can be reused.

Tackling leaks is another urgent and surprisingly effective intervention. The World Bank estimates that 45 million cubic litres of drinking water are lost daily through distribution channels – enough to serve 200 million people.

"We designed an intelligent water distribution system that we call Demand Driven Distribution," explains Nipper. Here, pumps, intelligent components and system surveillance are packaged to build unique pressure management solutions that minimise water losses, reduce energy consumption, and minimise operational costs for leaks and pipe maintenance.

Water provision is a long-term investment, so it is important to have a life-cycle cost perspective that covers both the equipment and the energy used in producing water. Part of that involves improving ability to collect revenues to ensure the financial viability of water operations.

Business contributions

Water stewardship, according to the SDG Compass project, is a strategy that addresses the economic, environmental, and social dimensions of water. By adopting stewardship, companies are able to make a positive contribution to improved water and sanitation management and governance that addresses their risks while contributing to sustainable development.

On a global scale, finance is available, but according to a UN report, in 77 % of countries the finance is still insufficient to reach targets 6.1 and 6.2.

Cooperation and public-private partnerships, through groups such as the 2030 Water Resources Group, a public-private-civil society cooperation with its roots in the World Economic Forum, can help address access to finance, capacity building, and infrastructure.

Throwing money at the problem is not, in itself, the issue. In the water and sanitation sector, quick fixes inevitably fail quickly. Solutions need to be both technically robust and, if not self-sustaining, then should at least come with long-term service solutions that make sense in challenging social contexts.

As Mads Nipper told the Global Compact Leader's Summit in New York, "The water and climate challenges pose very real risks to businesses and societies worldwide. Therefore, we must come up with self-sustaining solutions. We need to make sure that resources put into solving these problems will not be one-time donations, but rather investments, which can pay off and turn into reinvestments. We need commercial drivers in order to have a chance of fulfilling the ambitious and necessary goals we have set out to achieve together. We need to cooperate across NGOs, governments and businesses to succeed."

Grundfos collaborates with a number of NGOs and UN organizations to speed up the engagement, for instance in some of the largest refugee camps in the world. The aim is to raise awareness among other global companies, NGOs and governments around the world. ∎

Lifelink for a better life

In 2008, Grundfos founded a subsidiary called Lifelink, an organisation that offers sustainable water solutions to developing countries. Lifelink systems are scalable, and can be installed in large or small water schemes in both urban and rural settings.

"This is about designing smart, sustainable, reliable and durable solutions that can improve the quality of life for people in the developing world," says CEO Mads Nipper.

In urban areas, the systems can be connected to the water network or a water storage tank. In off-grid rural areas, they can take the form of communal water points and mini-grids, drawing water from the ground or water treatment systems through solar-powered pumps. To collect water, people charge a smart card with credit bought onsite or via their mobile phones, insert it into the dispenser and pay for the water they need. This makes payment of water easy and transparent.

Lifelink was first introduced in Kenya and Uganda. Mobile phones are widespread on the African continent, so it is a good way to ensure that they have the ability to buy water without money having to change hands.

Since then, Grundfos has introduced a new solution, the AQtap, which supplies water against payment and enables the water utility to control the price and ensure that the water system is maintained, together with the AQpure treatment system that ensures that surface and river water can be treated to drinking quality. These solutions are being scaled to several societies in Africa and South East Asia in particular.

In 2012, Grundfos won a World Business and Development Award for their Lifelink water solution. Grundfos has signed an agreement with World Vision International to reach 2 million more people over the next 5 years on a global scale.

7 AFFORDABLE AND CLEAN ENERGY

ROW   BRISE   CHINA   OECD   USA

> All the needed technology is available, and especially energy efficiency and better transport solutions will reduce the need for some of the difficult investments. The main challenge is the will to act, which is difficult to predict. If the will is there, I am confident that all the targets you discuss can be met in all regions.»

Karen Sund, Sund Energy

We understand this goal partly addresses worldwide access to energy (affordable, reliable), and partly to its global (sustainable) and local (modern, i.e., non-polluting) environmental footprint. Energy is a key factor for ensuring prosperous economic development, and so access to energy is critical for increased wellbeing of poorer nations. The backdrop for this goal is that parts of the world's population today suffer due to lack of access to electricity. Many LDCs use little energy, and the little that they use is mainly served by burning locally available wood on open fires. This is problematic because it contributes to deforestation, which, in turn, contributes to climate change and desertification. In addition, pollutant soot represents a major health hazard, causing respiratory diseases.

Model input
The model contains information applicable to the three targets of SDG7 and is derived from populations in the various regions, the productivity growth, changes in energy intensity, and changes in the energy mix. The model builds on extensive analysis of past trends and their interactions, economic growth, energy intensity, and de-carbonization

Regional considerations
While the environmental footprint is a major challenge for all regions, poor energy access is mainly an issue for developing nations. We consider that the continued and enormous appetite for energy in USA is a sign that it fails to fulfil the goal's demand for "modern" energy.

Conclusion
China scores high on all indicators and gets a green rating. All other regions score low on some indicators and high on others, and so achieve yellow ratings
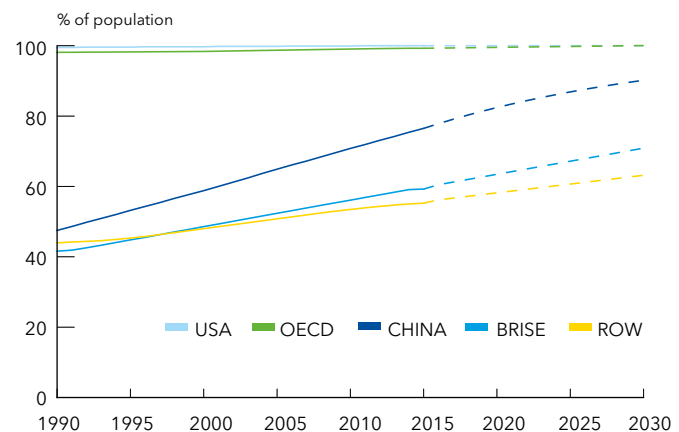
Historical data source: WHO/UNICEF Joint Monitoring Programme (JMP) for water Supply and Sanitation

Figure 7.1. Access to electricity
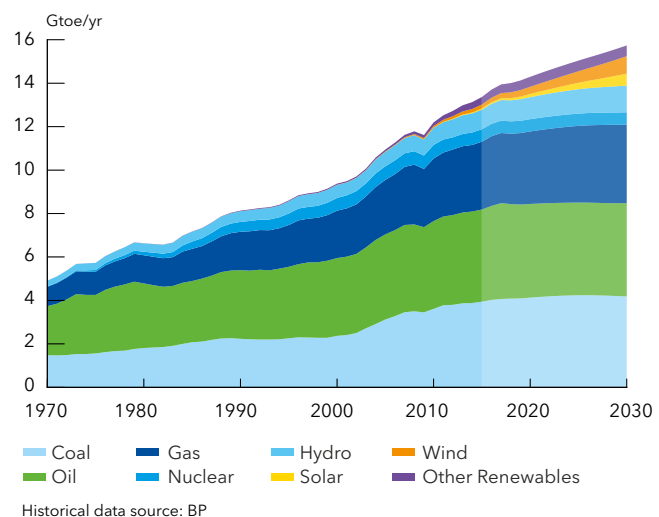
Historical data source: BP

Figure 7.2. World Energy use

# ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE, AND MODERN ENERGY FOR ALL

Assessment details

We assess energy used and access to electricity, renewable energy share, and decrease in energy intensity for SDG7.

TARGET 7.1

By 2030, ensure universal access to affordable, reliable, and modern energy services. *Indicators chosen: 1. Energy used per person, % of OECD. 2. Access to electricity % of population.*

ROW	BRISE	CHINA	OECD	USA
●	●	●	●	●
ROW	BRISE	CHINA	OECD	USA
●	●	●	●	●
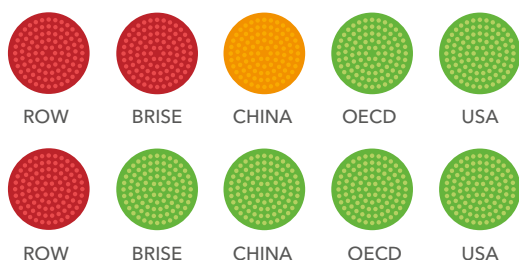
Energy used per person: The OECD average ensures sufficient energy availability; energy shortages are not a major hindrance to economic development or wellbeing of inhabitants. By 2030, China's energy use per person grows, and is about 90 % of OECD's, while USA declines even faster than OECD's, but remains over 50 % higher. For USA, we considered a red rating as electricity use is very high, but as the goal focuses on access rather than sustainability, we left it green. ROW is about 25 % and BRISE almost 50 % of the OECD yardstick in 2030.

Access to electricity: as indicated in Figure 7.1, only ROW falls far behind on this indicator, but it must be noted that within BRISE there is major uncertainty regarding India's future spread of power through its villages.

Here, we have translated this global target into separate regional targets where significance is set to at least

doubling the share of renewables (from 8-17 % to 16-34 %, depending on region today). Only ROW, China, and USA achieve this target in our forecast. It is interesting to note that OECD is the renewables champion throughout the period, but starting with a high share of renewable energy (17 %), the 34 % target is not met when it achieves a 29 % share in 2030. The model output on world energy use and energy mix is illustrated in Figure 7.2.

TARGET 7.2

By 2030, increase substantially the share of renewable energy in the global energy mix. *Indicator chosen: Achievement of doubling of renewable energy share from 2015.*

ROW	BRISE	CHINA	OECD	USA
●	●	●	●	●
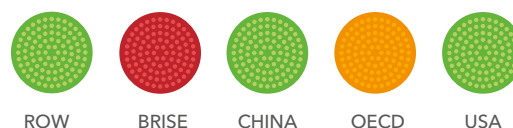
We define this target as one where regional annual reductions in energy intensity levels are doubled from today (the world average in the last five years was -0.88 %/y, and is forecast to be -1.83 %/y for 2025-2030). Since this target is about improvements, China gets a much "easier" job, as it starts from a period of very modest reductions in energy intensity, while OECD and USA are already on a quite steep downward trend in energy, and will not be able to double the annual improvement.

TARGET 7.3

By 2030, double the global rate of improvement in energy efficiency. Indicator chosen: Proportion of total water resources used. *Indicator chosen: Average decrease in GDP's energy intensity 2025-2030, compared to its 2010-2015 level.*

ROW	BRISE	CHINA	OECD	USA
●	●	●	●	●
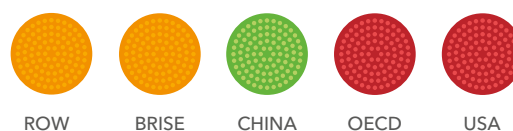
██████████████ SOLARWORLD

DEMOCRATIZING SUNSHINE

Modern society cannot function without a reliable energy service. Crucial sectors, from health to basic infrastructure, agriculture, and communications all depend on access to electricity. As developing societies in transition catch up, they have typically relied on what is most accessible: energy from cheap, but polluting, energy sources. Renewable energy – apart from a bit of hydropower – just hasn't been part of the mix for the developing world. But that, says Milan Nitzschke, Vice President of SolarWorld, is changing fast.

New, clean technologies can reorient development along a more sustainable trajectory. As renewables become cheaper than fossil fuel, their future dominance is inevitable. Renewables also allow decentralization, which will be a key driver for the energy turnaround all over the world, especially in countries without a developed energy infrastructure.

Assessment
For Milan Nitzschke the energy transition is not a question of if, but how rapidly it's going to take place and what sort of friction that will cause along the way. He believes it is theoretically possible to achieve the goals of SDG 7 by 2030; whether we will actually achieve them depends on a number of factors, and the current pace of progress is definitely too slow.

While he concurs with our assessment of Target 7.1, he points to the possible exception of China, where 80 % of the key electricity source is coal-based. China also still has a nuclear focus, despite strong development of solar and wind technology; it is difficult to predict what the country will do to meet its energy demands.

The drivers of market economies, however, are more predictable: while ever-more expensive extraction costs put upward price pressure on fossil resources, the technology-driven renewable industry can only go one way with both production cost and retail price – down. Nitzschke believes that 2030 might be a bit early for the developing world to meet the targets, but that ROW and BRISE countries should have done so by 2040. Already in the next decade solar energy will be affordable for many more people and massively accessible, even in areas where there is no traditional grid structure. He adds the caveat that unpredictable factors, like military conflict and migration, could make this harder to achieve.

While Nitzschke is optimistic about the world's energy future, he doesn't believe the "old instruments" will lead us there. Change will come through decentralization. Sunshine is available all over the world; nobody has a monopoly over it. "When we are no longer dependent on a utility, private

MILAN NITZSCHKE
Vice President, SolarWorld

SolarWorld is the biggest manufacturer of solar technology in Europe and the U.S. The company manufactures and markets photovoltaic products worldwide, integrating all components of the solar value chain. Headquartered in Bonn, Germany, SolarWorld recorded revenues of €763 million in 2015 and employs more than 3,700 people worldwide.

«We don't want three or four or five or 10 entities to decide on electricity structure, we want millions – in fact hundreds of millions – of people in the electricity business in the end.»

«When we are no longer dependent on a utility, private persons, as well as commercial entities, can start supplying themselves with renewable energy. This will be the key driver.»

persons as well as commercial entities can start supplying themselves with renewable energy. This will be the key driver."

He sees economies of scale leading to even cheaper energy, especially solar. The combination of cheap energy supply and a large number of participants will lead to a grassroots transition from the old structure to new ones.

SolarWorld solutions

In a sense, SolarWorld's continued success is its main contribution to SDG 7. The company has more than 40 years of experience in solar technology development and production. With innovative high-performance products made in Germany and in the United States, and with partners in Asia, it holds a leading role in the quality segment of the solar market. "With our commitment to innovation, we define technology standards for the industry," says Nitzschke.

A strong focus on R&D keeps SolarWorld "some 18 months ahead of the technology curve". Reducing costs by increasing automation allows the company to compete on attributes other than price – such as quality, longevity, reliability, and efficiency. It's a good environment to nurture skilled workers, and that allows them to attract the best brains in the field through funding research and education. "Since 2005 we have presented the SolarWorld Einstein Award to people who have rendered outstanding services in the area of solar power and are thereby helping to protect the planet. And since 2006 we have also honoured up-and-coming researchers for their scientific achievements in the field of photovoltaics."

At the beginning of 2007, the company set up the SolarWorld endowment fund, a six-figure endowment available to the chemistry and physics departments for the Freiberg University of Mining and Technology. Flagship projects include SolarWorld e-One, an emission-free plane powered exclusively by solar energy.

Regional development is at the heart of SolarWorld's social commitment. The company facilitates development through Solar2World, providing funding for a great many aid projects in emerging and developing countries, with a focus on Africa. "Our off-grid solar power solutions provided models for sustainable economic development and self-sufficient energy supply."

Since February 2014, SolarWorld has partnered with the Utopia foundation to be measured against ambitious sustainability goals in 10 areas. This self-commitment is part of the sustainability strategy of the SolarWorld group.

The Changemaker Manifesto, signed by the entire SolarWorld Board, sets out the group's environmental goals until 2020. SolarWorld published its first Changemaker progress report in 2014.

Business contributions

Nitzschke is convinced that the promise of technology and persuasion of economic forces has to go with courageous policy decisions.

Tear down boundaries, support local regional developments, and create a framework in which private persons and small and medium-size entities can invest in sustainable energy – that's Nitzschke's manifesto for the renewable energy economy.

Decentralized structures are required for energy to become independent from political decision-making. "This perfectly fits with renewable energies. We don't want three or four or five or even 10 entities to decide on electricity structure, we want millions – in fact hundreds of millions – of people in the electricity business in the end."

If the first part of the energy solution is to make high-quality, reliable solar, wind, and other renewables affordable and easily available, the second is to enable investment. But while it's relatively easy to invest in renewables within the stable political and structural framework of Europe, for example, it can be much more difficult in other parts of the world, where risk-adjusted required rates of return are far higher. Investing in developing regions to help create systems of stability, especially for the energy utility sector, is only part of the solution. "It's not about pumping money into the system", he says. "The key to bringing down financing costs is to take away barriers and introduce schemes that allow feeding in electricity into grids, for example."

In terms of increasing storage capacity, Nitzschke makes a case for a second life cycle for batteries. "We already have a movement towards decentralized battery storage. The simple way of looking at it is: you have several million electric vehicles, which all have batteries. The batteries will be replaced every two or three or four or five years. What are you doing with all those batteries – recycle them? Throw them away? You can give them a second life storing decentralized-produced solar electricity." ∎

Solar2World

Solar2World's many partnerships with NGOs in developing countries provide examples of how off-grid installations on a micro-scale can make a very big difference to people's lives.

Tambacounda is the name of the capital of Sénégal Oriental province, located in eastern Senegal on the edge of the Sahel. In Senegal itself, the Tambacounda region is a synonym for hopeless underdevelopment and backwardness. Since 2003, the Solar and Hygiene Center, which was built up by the Tambacounda Association, has been teaching locals about ecological construction, groundwater protection, and the viability of solar energy. Today, the Centre is mainly perceived as a venue for education and meetings, where people of different ages can learn about and discuss development issues. It has an Internet cafe, a library, a tailor, a computer science room, and a dry toilet.

Senegal's "Education Needs Energy" project provides solar power to the education and healthcare centre. The project aims at demonstrating that solar power is one of the future industries for the area; the people of Tambacounda are instructed on how the technology works through informational materials and workshops, and interested small trade enterprises can receive qualifications in the technology.

"The key thing is that that the NGO that is installing the technology teaches local people how to maintain it. So that it is not just a donation, but a means of increasing skills in those countries so that they do not remain dependent."

Typically, SolarWorld provides the solar modules for free, and sometimes also sponsors other components. As a joint project of several German photovoltaic companies, a 5 kW photovoltaic system consisting of 21 polycrystalline modules was installed by SolarWorld in early 2012, donated as part of Solar2World.

8 DECENT WORK AND ECONOMIC GROWTH

ROW BRISE CHINA OECD USA
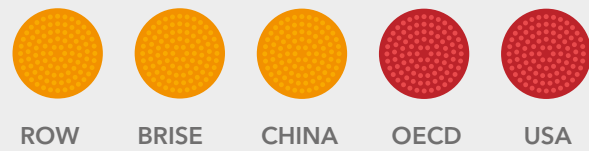
SDG8 is a complicated goal that takes into account economic growth, the sustainable aspects of such growth, employment, and the principle of leaving no one behind. Our forecast includes three factors - growth, footprint of said growth, and inclusiveness.

Model input
Our model gives direct input to all targets - GDP growth, GDP/person growth, and footprint intensity. The model does not give direct input regarding equality within countries, employment, or education. However, our forecast on Palma ratio is also informed from our model.

Regional considerations
SDG8 does not have a goal of high economic output, only on the growth rates. In our model, growth rates for the two regions that already have high output per person are expected to be very low, while China and the developing countries that have lower initial output per person, are expected to have much higher growth. The developing countries succeed better than the developed world on decoupling economic growth from environmental degradation, where significant improvements are expected. The employment figures are unreliable for large parts of the world and thus challenging to forecast, but the Palma ratio indicates large challenges with distribution all over the world.

Conclusion
ROW, BRISE, and China succeed with high growth and improved sustainability of this growth, but fail on distribution, and so get a yellow rating. USA and OECD fail both on growth and distribution of growth, but partly succeed on sustainability of growth. They get a red rating.
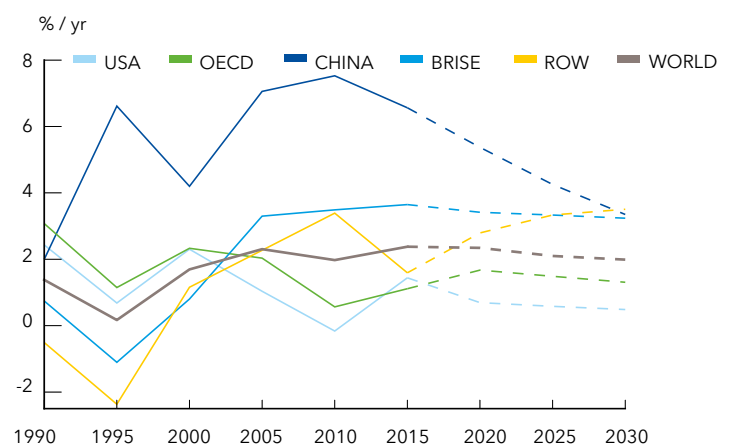

Figure 8.1. GDP/person growth – historical and forecasted

PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL

Assessment details

Targets 8.1, 8.4, and 8.5 represent the width of the goal; growth, sustainability of the growth, and inclusiveness.

TARGET 8.1

Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 % gross domestic product growth per annum in the least developed countries. *Indicator chosen: Growth rate of GDP per person.*

| ROW | BRISE | CHINA | OECD | USA |
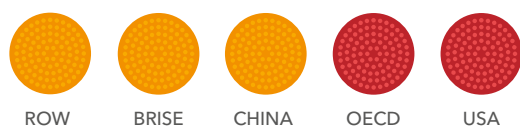
This target focuses solely on economic growth, and could therefore be at odds with the other targets that focus on sustainable and inclusive growth. Our model gives an average GDP growth of 5.0 %/ year and 3.6 %/person-year over the next 15 years for ROW. This is significantly higher than the last 15 years, but significantly less than the target of 7 %/ year (that, admittedly, is for least developed counties). Growth targets for other countries are not given in the target. China and BRISE remain with relatively high growth on just below 4 %/year in the coming 15 years, but both with lower growth than the previous period. With no quantitative benchmark, our assessment is subjective, but we give yellow ratings to the three regions that will have sustained, quite high economic growth. OECD and USA will have very low growth rates, at less than 1 %/person-year, and thus get red ratings.

TARGET 8.4

Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption. *Indicator chosen: Footprint intensity [gha/USD generated].*

| ROW | BRISE | CHINA | OECD | USA |
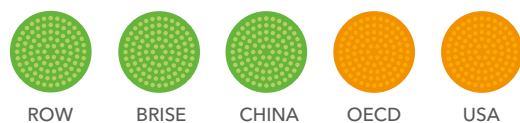
Environmental degradation is measured here as non-energy footprint per person, and we measure the footprint in m^2/person and divide it by the global output/person, to obtain a figure for footprint intensity. The footprint per person remains relatively stable in most regions, while GDP grows most in the developing countries. The footprint intensity improves by more than 40 % over the coming 15 years in ROW, BRISE, and China, and by around 30 % in USA and OECD. No quantitative thresholds are given for the target, but we rate the three best regions as green, leaving USA and OECD with yellow.

TARGET 8.5

By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. *Indicator chosen: Palma Ratio (color coding equal to Goal 10).*

| ROW | BRISE | CHINA | OECD | USA |
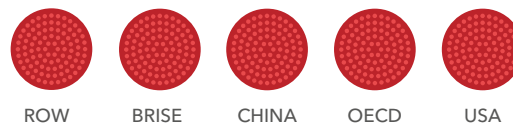
Employment statistics can reflect only to some extent whether or not this target is met. In many countries, reliable statistics are lacking, as large shares of the population may not be registered. Also the concept of "decent" work is challenging. Employment in the developed world often follows economic cycles and is difficult to forecast. Therefore, we used the Palma ratio as an indicator for this target. This is the best indicator for describing how wealth, and thus work, is shared among all people. The assessment of SDG 10 explains the Palma ratio in more detail.

———— NYK

DECENT WORK AND ECONOMIC GROWTH

NYK is, as DNV GL, a company with a proud and very long history of maximizing benefits to the company and society simultaneously.

YASUO TANAKA
Senior Management Corporate Officer, NYK

NYK is a global logistics enterprise offering ocean, land, and air transportation, with the mission to contribute to better societies around the world through safe and reliable monohakobi (transportation of goods). NYK is headquartered in Tokyo, listed on Tokyo and Nagoya stock exchanges and reported global revenues of ¥ 2,272 Billion in 2015. The company was founded in 1885 and employs 35,000 people in 27 countries.

Assessment

"The forecast for the Spaceship Earth is providing interesting input and helps us in calibrating our initiatives that are 'Leveraged by Creative Solutions'," says NYK Senior Management Corporate Officer, Yasuo Tanaka. For instance, the relationship between the share of secondary industry sector and GDP per capita is interesting, and so is the expected decline in productivity growth. We think that the overall goals are well assessed, but we have different views on some of the details for some of the underlying topics.

The assumptions around world population and workforce seem reasonable, although we don't expect birth rates in Asia to recover. There are many ways to interpret reduced inequality and the forecast could be more detailed regarding redistribution effects and relative poverty within and across regions. The same might prevail for gender equality, specifically for agricultural segments in Asia where female employment is high.

"The concept of decent work is indeed challenging. Distribution of wealth might on a high level indicate fair distribution of work, but for the individual decent work starts with work at all."

As an example, assuming quick development of digitalization of the labour markets, we might not always see both human dignity and employment at the same time during the transition. Decency is culture-dependent and hard to measure on the same scale across markets. Maybe we will never come to a state of mind where we are satisfied with the level of decency. But maybe it's the best forecast to trust, namely that fair distribution and reduced inequality will not be achieved in any region.

As seen from NYK in Japan and where we are present globally, we have another view of the future development of decent work and economic growth in Asia. The forecast might need some more sophistication of parameters, especially around the development in China. We believe there is uncertainty related to a transformation to low-carbon energy social stability, and hence economic growth, in China. It's very uncertain whether renewables will provide 50 % of the world energy use in 2050, even a low-carbon energy mix will require a unprecedented huge shift from oil and coal to LNG and nuclear.

«Survival will be difficult for companies that society does not view as necessary.»

«Through safe and dependable transport, we contribute to the betterment of societies throughout the world as a comprehensive global logistics enterprise offering ocean, land, and air transportation.»

Tanaka continues: "Fundamental resources for decent work and economic growth i.e., clean water for all usages, as well as urban and rural sanitation, might be more difficult to achieve in BRISE and China than reflected in the assessment. We also expect the development in Philippines and Myanmar to be important, maybe more important than other countries currently in the BRISE category."

NYK solutions
"We have already strongly committed several R&D programmes for eco-friendly navigation support systems and promotion of greener shipping, like the NYK Super Eco-Ship 2030."

NYK recognizes our role in providing safe and reliable services for a broad range of trade and commercial activities that are the basis for developing the world's economies and cultures. Viewing adverse business conditions as providing a good opportunity for achieving improvements, we regard the current period as a transitional phase in which we can focus on heightening the quality and efficiency of operations.

We are proud of our programme for creative solutions, including "Exploiting Big Data to Boost Competitiveness" where we improve energy-efficient operations, also using big data to achieve CO_2 reductions goals from vessel transportation.

For decent work and economic growth, we believe in sustainable development and capacity building. Our Maritime Academy in the Philippines is an example of how we combine the two, offering formal Bachelor Programmes to merchant mariners to become highly professional seafarers in the global trade markets.

Business contributions
"The most important thing business can do, is to contribute to sustainable development and provide long-lasting capacity building for developing countries."

For business to succeed, public policy and strong governance for effective taxation, positive incentives and smart regulation are crucial. With a global level playing field, business can focus on solving problems and take on the role of Corporate Statesmanship. Of course, this is key in emerging markets and in countries currently facing governance challenges.

Fulfilling the world's basic needs for essential necessities requires trade. Take food: nutrition and agriculture are obviously very important. But as for many of the sustainable development goals, business can contribute to the achievement through trade in and between countries. Seafood is becoming a major global issue, and the fishery industry across the value chain can contribute considerably to decent work and economic growth.

We cannot survive in today's rapidly changing business environment by only repeating past actions. If we do not reform ourselves, emerging trends will leave us behind. However, if our predecessors' hard work established past advantages, then our generation too should be able to create new advantages for the future. This is in line with the definition of sustainable development and should appeal to all businesses striving to improve every day. These ideas do not have to be major inventions or technological developments that revolutionize the industry; they do not need to advance us a full step ahead of competitors. They just need to be sufficient enough to advance us, even if only half a step ahead, towards differentiation. Business drives innovation and innovation drives sustainability.

For us, this closes the circle with our company's more than 130 years of history and with our mission statement of "Through safe and dependable transport, we contribute to the betterment of societies throughout the world as a comprehensive global-logistics enterprise offering ocean, land, and air transportation." ∎

Exporting Japan's fruit and vegetables to the world

By 2020, Japan's government aims to increase exports of agricultural, forest, and fishery products to ¥1 trillion, twice the level of 2012. Furthermore, a rise in the number of countries participating in the Trans-Pacific Partnership is expected to increase overseas transport of fruit and vegetables.

Since 2013, we have developed technology for containers with controlled atmosphere (CA) as part of NYK's, and Monohakobi Technology Institute´s programme for 'Creative Solutions'. These containers control temperature and the concentrations of oxygen and CO_2. The internal humidity of these new CA containers is kept above 90 % at all times, and despite longer transport times than air transportation, the use of CA containers for ocean transport keeps fruit and vegetables fresh at roughly 90 % less cost.

Together with our programme for zero emission vessels – NYK Super Eco Ship 2030 – estimated to reduce CO_2 emissions by 69 % compared with 2008 by combining fuel cells and renewable energy and a lighter hull, the CA containers can reduce the carbon footprint of food transport considerably.

Digitalizing to to reduce costs and emissions

The energy efficiency of vessels transporting cargo improves as they become larger. Beyond a certain point, however, the benefits of enlarging vessels become marginal. As a result, efforts to reduce CO_2 emissions by improving vessels' energy efficiency through enlargement have almost reached their limit. In response, since 2007 the NYK Group has provided technology for energy- saving vessel operations that reduce CO_2 emissions by focusing on systemic innovations.

In brief, this technology enables solutions for:

- Live data visualization site
- Vessel performance analysis system
- Optimal route plans
- Energy-efficient hull modifications
- Optimal operations and prediction of maintenance

Exploiting big data to boost competitiveness with this technology also improves the cooperation between crew members and onshore personnel, and contributes to increased safety and efficiency, reducing costs in addition to the reduced emissions.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

ROW   BRISE   CHINA   OECD   USA

SDG9 is primarily concerned with fostering and strengthening the engines that build modern society. Knowledge building and information access are considered key elements to facilitate this. Capacity building in R&D and Internet access are important enablers for innovation, and were therefore chosen as key parameters in assessing SDG9. In addition, we have a third parameter concerned with industrial development. Sustainability and inclusion issues are assessed under SDG8 and not explicitly targeted under SDG9. Nevertheless, a good score on SDG9 contributes strongly to the sustainable transformation of industries.

Model input
The model-based forecast provides related data for this SDG, notably GDP/capita and investment spending. T21 addresses hunger and poverty used to assess the downside of Target 9.1. The model does not give input on Internet use and R&D personnel.

Regional considerations
Many countries perform well on this SDG, but the goal is also interconnected with other goals, e.g, poverty, and ROW and BRISE face a more complex picture. It is impossible for these regions to succeed with this SDG, without solving some of the other challenges simultaneously. Increased competence building is very strong in China. OECD and USA maintain and further develop their good bases.

Conclusion
China, USA, and OECD score well on the indicators and are rated green in total. BRISE scores red, yellow, and green on the three indicators, receiving yellow in the overall rating. ROW gets yellow, based on the two indicators that we were able to rate.

% of population   USA   OECD   CHINA   BRISE   ROW
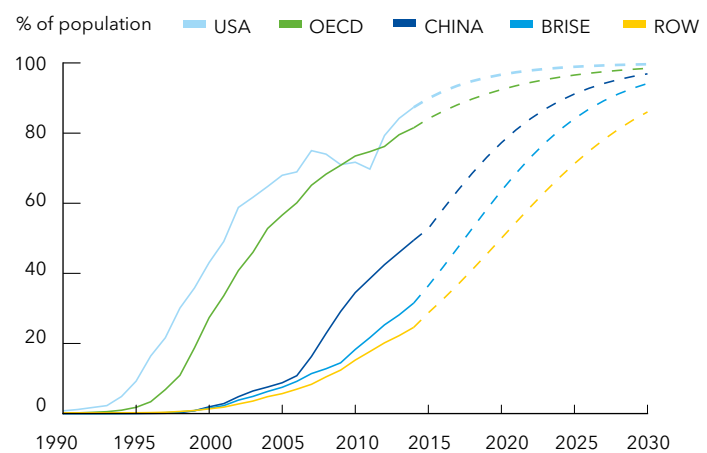
Historical data source: International Telecommunication Union, World Telecommunication/ICT Developm.

Figure 9.1. Rate of Internet access

Share of Secondary Sector [%]

Each circle represents 5-year average value for a country. Circle size denotes GDP [2005US$ppp/p-yr] Data Range: 1970-2015

GPD per capita [2005US$ppp/p-yr]
USA   OECD   CHINA   BRISE   ROW

Source: World Bank, Gapminder

Figure 9.2. Share of secondary sector in GDP

BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION
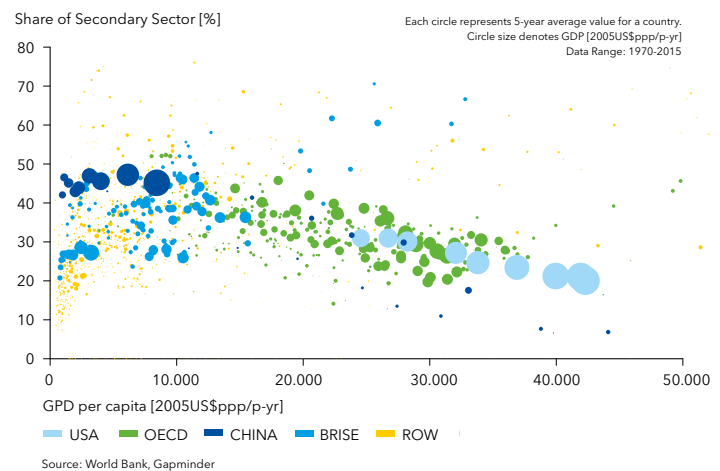
Assessment details

We included three targets in our assessment: access to infrastructure, innovation, and industrialization.

TARGET 9.1

Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all. *Indicator chosen: Share of population that are internet users.*

ROW	BRISE	CHINA	OECD	USA
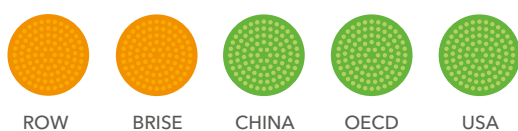
The spread of Internet infrastructure has been remarkable, and it is expected that general access should be easily obtained throughout the world by 2030. However, significant shares of the BRISE and ROW populations are forecast to remain in extreme poverty and suffer from hunger. That part of the population has more urgent priorities than Internet access. Hence, we expect the share of Internet users in ROW and BRISE to equal the share of population not suffering from extreme poverty or hunger. Nevertheless, these regions will close more than half the gap to 100 %, as illustrated in Figure 9.1, meriting a yellow rating. China, USA, and OECD will meet the target and are rated green.

TARGET 9.2

Promote inclusive and sustainable industrialization, and by 2030, significantly raise industry's share of employment and GDP in line with national circumstances, and double its share in LDCs. *Indicator chosen: Share of GDP coming from industrial sector.*

ROW	BRISE	CHINA	OECD	USA
		N/A	N/A	N/A

This indicator is considered relevant only for BRISE and ROW, and we consider significant here to mean at least 25 %. The other regions have been through their industrialization phase already, and, in our opinion, it would be meaningless to target a return to an industrial era for these regions; this is illustrated in Figure 9.2. The BRISE region mainly consists of the emerging economies, characterized by the ability to use this trajectory to move towards higher GDP. With their forecasted GDP growth, most will meet the 25 % target. For ROW the picture is even more diverse, with South-East Asian countries achieving it to a high extent, whereas most of the African countries are not forecast to climb high enough. We rate the average as yellow, as most of the ROW population in 2030 will be African. Sub-Saharan Africa alone would have scored red on this indicator.

TARGET 9.5

Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people, and public and private research and development spending. *Indicator chosen: Personnel in R&D (pr. mill habitants).*

ROW	BRISE	CHINA	OECD	USA
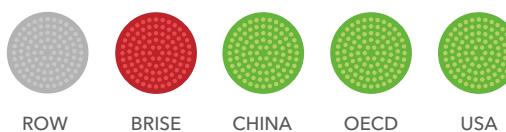
The ratio of R&D personnel in the workforce/population reflects the capability and willingness to invest today in knowledge for the future. We rate 'significant' here as 'at least 20 % increase over the next 15 years'. China has increased the ratio significantly after year 2000 and this is expected to continue over the next 15 years. OECD and USA have lower growth rates, but they are also on a good trend and are likely to manage. India comes out remarkably low, leading to a red score for BRISE. For the ROW countries, the statistics are scattered and it is difficult to provide a quantitative analysis. Therefore for ROW the score is white, but would probably have been red if a score was given.

HYDRO

FUTURE CIRCULAR

Hundreds of millions of people have emerged from poverty into the global middle-class during the last decade, and many more millions will do so in the coming years. But how does one reconcile continued economic growth with environmental sustainability?

This dilemma is at the heart of SDG 9, which, in part, calls for innovation to drive increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes.

The linear "take, make, dispose" way of doing things in the modern world is increasingly being challenged by circular economy thinking, which encourages the use of energy from renewable sources and the recirculation of non-biological (i.e, 'technical') inputs in the production/consumption cycle. If ever there was a poster child for the circular economy it would be aluminium, the so-called green metal, which is infinitely recyclable, durable, and lightweight – the metal of choice, for example, at Tesla Motors.

Even better, would be to produce aluminium from renewable energy. That is the raison d'être of Hydro in Norway, an aluminium company that is also the country's second-largest producer of hydro electrical power. We spoke to the CEO, Svein Richard Brandtzæg.

Assessment
Hydro recognizes that world has made significant progress in many areas in the last decade or so, but still there are huge disparities across and within countries. Technological progress is key to finding lasting solutions to both economic and environmental challenges, such as providing new jobs and promoting energy efficiency. Promoting sustainable industries and investing in scientific research and innovation, are important ways to facilitate such development.

"We know that technology will be a very important part of achieving the sustainability goals," says Hydro CEO, Svein Richard Brandtzæg. "I would say that the agreement reached at COP21 in Paris gives some room for optimism. We need to be optimistic, but it is not a situation that can be underestimated. Significant changes have to be made. If politics and industry and academia work together, I think it is possible to reach these goals."

Eradicating poverty requires more energy and better infrastructure. This doesn't have to contradict the ambition of curbing climate gas emissions. "Productivity in itself is a basis to move people out of poverty," says Brandtzæg. "Economic growth must still be a goal – it is the basis of this growth that has to become sustainable. It means changing some products, their content, the energy consumption and climate gas emissions in the production processes, and the ability to regain the materials when they have fulfilled their function."

SVEIN RICHARD BRANDTZÆG
CEO Norsk Hydro

Hydro is a global aluminium company with production, sales, and trading activities throughout the value chain, from bauxite, alumina and energy generation to the production of primary aluminium and rolled products, as well as recycling. Hydro's mission is to create a more viable society by developing natural resources and products in innovative and efficient ways. Headquartered in Norway, the company has 13,000 employees involved in activities in more than 50 countries on all continents, and recorded in2015 revenues of NOK 88Billion.

«We support a global price for CO_2. This has to happen. If CO_2 is for free, then we will not reach our target.»

«It should be more expensive to put the future at risk than to develop a sustainable product.»

Hydro solutions

As a global aluminium company, Hydro regards sustainability both as part of its license to operate and as key to its future competitiveness. "Doors will start to close on those who remain part of the problem, while new doors will open for those who are part of the solution," says Brandtzæg. "Not only do we want to avoid doors closing on us, but want to be among the very first to enter the doors that will open as the world moves towards a low-carbon reality. That is why we have one of the most ambitious climate strategies in our industry, which is to become carbon-neutral from a life-cycle perspective by 2020. We are a 110 year old company and we are talking about the next 100 years. We are thinking of long-term solutions and we are confident about the direction of the market. We know that if we are going to sell our products in the future, we need to be a sustainable company."

Hydro is the only player in the aluminum industry to encompass all parts of the value chain within its operations, taking cradle-to-grave responsibility for its metal through the three distinct phases of the aluminium lifecycle:

In the **production phase**, Hydro accounts for the total carbon emissions from bauxite mining, alumina refining and indirect emissions from its power mix, to production of primary aluminium in a global network of fully and part-owned metal plants.

Aluminium is lightweight, strong, corrosion-resistant, formable and infinitely recyclable. In the **user phase**, Hydro supports customers to develop products that help their customers to reduce their emissions through benefits such as light-weighting within the automotive and transport industries, aluminium used in construction to enable energy-efficient buildings, and packaging to preserve food and drink and avoid waste and reduce cooling needs.

Finally, aluminium can be **recycled** ad infinitum without quality degradation, using only 5% of the energy necessary to produce primary aluminium. In this way, aluminium could be described as an energy bank. In order to utilize this considerable climate advantage fully and bring more metal back to the loop, Hydro is on track with its ambition to more than double its recycling capacity to 250,000 tonnes/year by 2020. "We feel like we are producing a sustainable material," says Brandtzæg.

Business contributions

We have to avoid carbon leakage, which is an issue globally. This is why Hydro supports a high global price for CO_2. "If CO_2 is for free, then we will not reach our target," warns Brandtzæg.

As an industry we have the technological capacity to reach the SDG goals - this is not science fiction, but it does require innovation, research, and development. SDG 9 is also about sustainable industrialization, and for Hydro's industry, local mining and production companies that engage with local communities to ensure both productivity growth and decent work in many developing countries. Recycling of aluminium worldwide creates many opportunities for small enterprises.

Aluminium is the most recyclable of metals. Other commodity metals, standing head-and-shoulders above its nearest competitors such as steel, magnesium, and copper, can, be recovered reasonably easily, but small amounts of metals in, for example, electronic waste can be harder to recover. In these cases, the United Nations Environment Programme (UNEP) International Resource Panel therefore recommends recycling products rather than recycling individual metals. This shift is, however, currently hampered by a perception of higher costs, liability issues, and the fast pace of technological development.

"Right now, it costs more money to be sustainable and do the right things for the future, and that is going to change, in the end. It can't be more expensive to do business the sustainable way," says Brandtzæg.

Finding ways to produce and consume sustainably is not a hindrance to development and growth. On the contrary: finding, developing, and implementing new solutions that allow production and consumption to take place within the terms set by nature, will be the new mark of industrial progress.

"Industry can definitely contribute, in fact I think industry doesn't have a choice in the end. It will simply not survive without moving towards more sustainable solutions. I think the market will gradually regulate that. But companies that want to have a long future should regard sustainable operations as an investment, rather than a cost."

Industry players can collaborate and share technology across the value chain, to lower emission and energy consumption, and to help others to reduce their emissions.

"We are participating in several associations and initiatives," says Brandtzæg. "For example, the Aluminium Stewardship Initiative is a consortium of suppliers and customers of aluminium that aims to develop more sustainable solutions and lift the standards of the entire industry." ∎
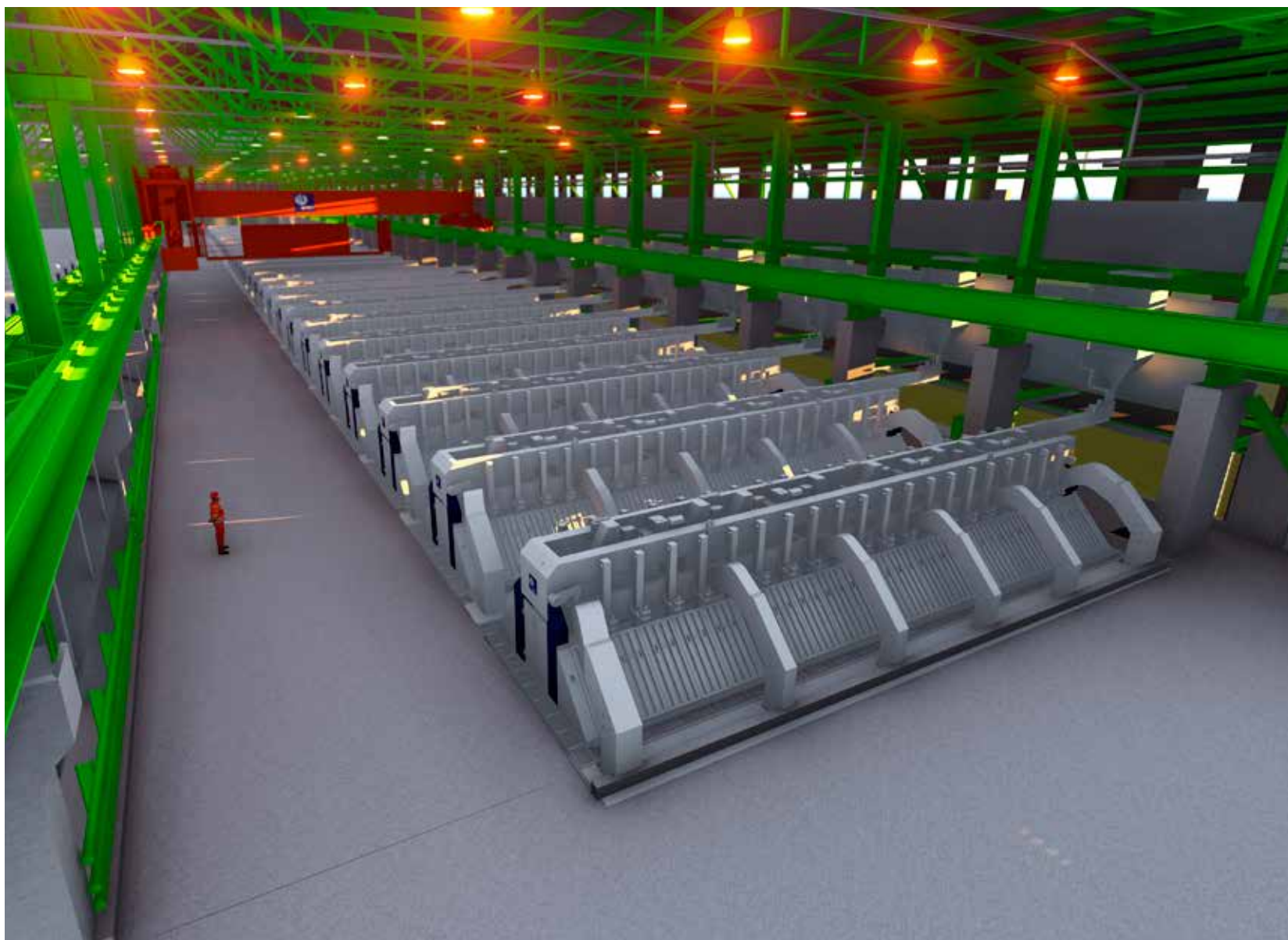
Karmøy technology pilot

Hydro researchers have developed a next generation electrolysis technology that is at the heart of a full-scale technology pilot at Karmøy, Norway. When it begins operation in the second half of 2017, the ambition is that it will feature the most climate-friendly and energy-efficient aluminium production technology in the world. At over a half billion US dollars, Hydro's investment in the Karmøy technology pilot is the largest single investment in Norwegian mainland industry in the last decade.

The pilot targets around 15 % reduction in kWh/kg aluminium produced, compared with the world average outside China, with multiple technology spin-offs that could also be implemented to improve the efficiency and footprint of existing production.

"If we succeed, the new technology as a whole can be installed in future aluminium plants, and some technology elements can be implemented in existing plants to improve energy efficiency and operational stability," says CEO Svein Richard Brandtzæg.

Direct CO_2 emissions with the new technology in the pilot will be 0.8 kg lower per kilo of aluminium than the world average. That translates into 60 000 fewer tonnes of CO_2 per year.

Ensuring renewable resources to power the plant is also important for Hydro. Aluminium produced using hydropower creates only one-fifth of the CO_2 emissions of aluminium produced using electricity from coal power plants. By using hydropower instead of coal, the pilot plant at Karmøy will prevent over a million tonnes of CO_2 from entering the earth's atmosphere annually.

10 REDUCED INEQUALITIES

ROW   BRISE   CHINA   OECD   USA
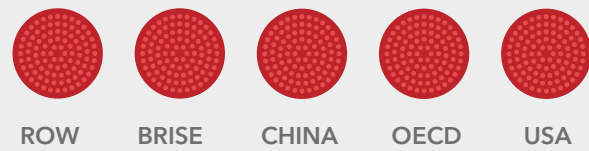
SDG10 requires the adoption of sound policies to empower low-income earners and promote economic inclusion of all, regardless of sex, race, or ethnicity. This involves improving regulation and monitoring of financial markets and institutions, encouraging development assistance, and directing investment to regions where the need is greatest. Facilitating the safe migration and mobility of people is also key to bridging the widening divide. To achieve our overall assessment for this SDG, we rate only one target, Target 10.1 on achieving and sustaining income growth for the bottom 40 % of the population at a rate that is higher than the national average. Most of the other targets involve issues that we have been unable to quantify at present.

Model input
The model does not give input to inequality within countries, and these inequalities do not really correlate with GDP or other factors that we forecast. The model does give input on inequality between regions

Regional considerations
Figure 10.1 shows development in the Palma ratio, while Figure 10.2 shows current income inequality around the world, as measured by the Palma ratio. The results are enlightening. There is a wide range of inequality across countries – from Palma ratios of 0.8 in Slovenia and Norway to one of 8.5 in South Africa. For many countries, data are lacking, as the Palma ratio is quite a new indicator. For this reason, quality assurance is done using the Gini coefficient. This can include data from more countries, but assesses the same challenge.

Conclusion
With growing inequalities generally worldwide, none of the regions reach the goal, and all get a red rating. There is significant uncertainty in our assessment, and, taking into account that regional differences are likely to reduce, a better rating could have been given.
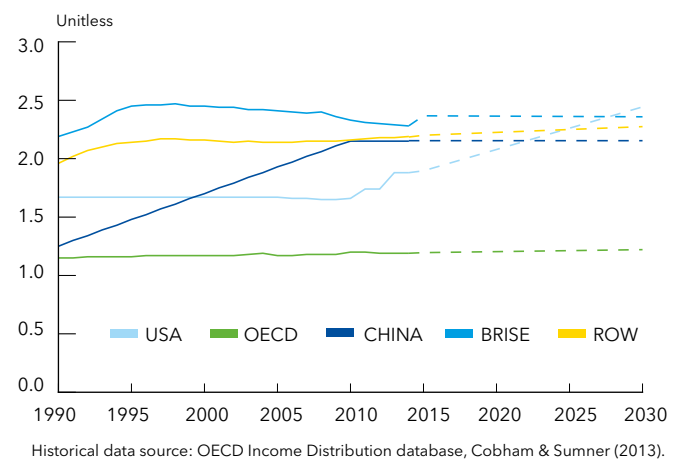

Historical data source: OECD Income Distribution database, Cobham & Sumner (2013).

Figure 10.1. Palma ratio

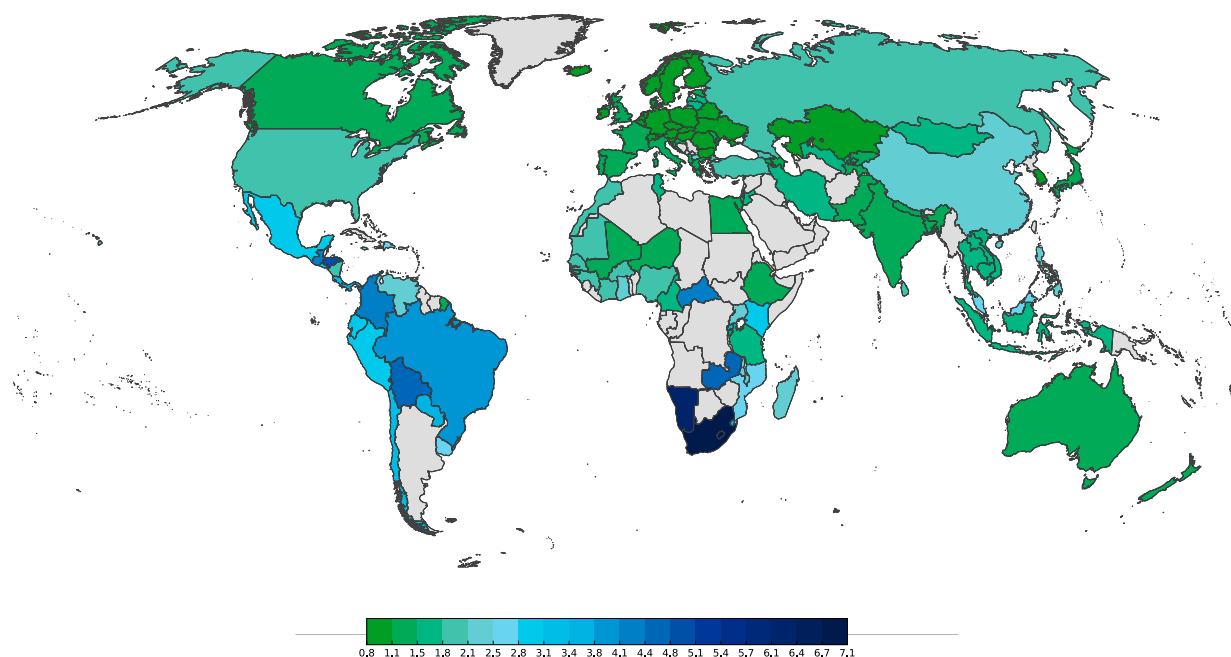# REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES

Figure 10.2: Palma ratio illustrated globally (Cobham and Sumner, 2013)

Assessment details

Concerns about inequality focus on the top and bottom ends of the income distribution. The Palma ratio, defined as the ratio of richest 10 % of the population's share of gross national income (GNI) divided by the poorest 40 % of the population's share, seeks to overcome some of the limitations of the widely used Gini Coefficient that fails to take into account changing demographic structure. The Palma ratio is in generally highest in developing countries, but with notable exceptions, such as Pakistan,

TARGET 10.1

By 2030 progressively achieve and sustain income growth of the bottom 40 % of the population at a rate higher than the national average. *Indicator chosen: Palma Ratio (HDI).*

ROW   BRISE   CHINA   OECD   USA

Egypt, Mali, and Ethiopia. Southern Africa and Latin America have the highest values and Europe the lowest, as illustrated in Figure 10.2.
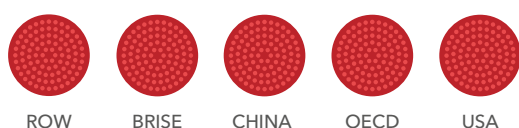
Our forecast demonstrates a significant increase in the Palma ratio in USA towards 2030, and almost flat in the other regions. This is confirmed by the similar trend in the Gini coefficient. There are few signs that the trend is about to change, with USA probably demonstrating the largest negative change, and BRISE and ROW showing minor improvements. The target addresses improvement. We interpret "achieve and sustain" improvements as being at least 25 % improvement in the Palma ratio over the next 15 years being sufficient to score green. As none of the regions is expected to achieve sustained higher growth of the bottom 40 % of the population, all regions get a red rating.

The Palma ratio and Gini index measure income inequalities within countries, but they don't measure between countries. Data from our model indicate that regional differences will be reduced, as developing countries grow faster than developed countries. This is of limited help if inequalities within the countries remain.

SDG 10

STEPPING INTO THE GAP

"We are the 99 %." In 2011, the rallying cry for the Occupy Movement drew attention to the vast gulf between rich and poor – in the world's wealthiest countries. Very quickly, the conversation turned to global inequality, where the yawning gap between rich and poor continues to widen. The richest 1 % of the world's population now control up to 40 % of global assets, while the poorest half owns just 1 %.

The Gini coefficient for income distribution still points to sub Saharan Africa and parts of South America as having the greatest inequality. Elsewhere, political instability and mass migrations of refugees have brought these realities home to societies that previously felt themselves immune to the problem of glaring inequality.

Much as business can fuel economic growth and broad wealth creation, it can also intensify inequality. Unchecked market fundamentalism erodes social capital, and corruption always deepens inequalities. Safaricom CEO Robert (Bob) Collymore has strong opinions on what he calls "a fancy word for stealing from the poor to give to the few rich." But also feels surprisingly positive about the ability of business to combat inequality. The world, he says, is waking up.

Assessment
Bob Collymore acknowledges that we are heading in the wrong direction, and understands why this DNV GL report rates every country negatively in terms of the likelihood of them meeting the target of higher income growth rates for the poorest. He is also ad idem with DNV GL that gross inequality negatively impacts all the other SDGs, and tackling inequality is needed to reach most of the other SDGs as well.

"We live in a more unequal society now than we did 20 years ago," he says. Children in poorer countries are 3 times less likely to reach their 5th birthday; people with disabilities pay 5 times as much on catastrophic health expenditure; inequalities are leading to mass migration in Europe. These threats are so severe that Collymore believes that they have the power to rouse the world from its slumber.

He believes that the narrative is about to change to a more inclusive growth agenda: "Many of the underlying issues that drive inequality can be addressed, and we are more likely to take action now. The pure fact of the unrealised buying power of the billions of poor people in the global markets, will at least drive higher growth margins, if not close the gaps. I think we will be able to achieve most of the targets, simply because the world is seeing the opportunities in reduced inequality."

BOB COLLYMORE
CEO Safaricom

Safaricom Ltd is Kenya's leading mobile network operator and the biggest communication company in East and Central Africa. The company has over 25.1 million subscribers, and employs over 4000 people. Safaricom is dedicated to work collaboratively to impact positively the lives across the country. The company is listed on the Nairobi Stock Exchange and has annual revenues exceeding $1 billion.

«Technology can take power away from the corporates and put it into the hands of the consumer.»

«We want to become a 100-year-old company. To get to 100 years old, you have to operate in an environment which is just and equal.»

Part of this achievement is due to interconnectivity – something he knows a great deal about, since it's a core facet of his business. "We are living in an increasingly interconnected world. So China can see the impact of the growing youth unemployment in Africa, and understands that it needs to do something to address that problem or risk feeling the impact of it at home. We are no longer in the isolationist world that we were in in the past – which opens up for vast opportunities also for business."

Developing countries have lived with stark inequalities for decades; developed countries may have been able to look the other way. No more. Mass migration – whether economic, political, or due to climate change and natural disasters – has changed that. "Migration will continue to flow. It doesn't matter how big the wall or how deep the moat you build around countries. Rich, developed countries are seeing the impact of that, and understand that if they don't address the issues in the far-flung parts of the world – the developing world – it will come and land on their doorstep."

Safaricom solutions
Safaricom is a young company with ambitions to grow old gracefully. "We want to become a 100-year-old company. To get to 100 years old, you have to operate in an environment which is just and equal."

Collymore maintains that purpose-driven organizations are the only ones with sustainable futures. Happily, his industry is working towards addressing many of inequality's most pressing challenges.

Time was when a mobile phone company was about making calls. Today it's about much, much more.

Safaricom provides voice, data, financial services, and enterprise solutions for a range of subscribers, small businesses and government, using a variety of platforms and with over 100 different products under its portfolio. The services don't necessarily, in themselves, address the inequality gap, but Collymore and his team are dedicated to transforming the lives of customers, communities, and their colleagues for the better.

Besides accessing a world of information, education, healthcare, and other services, Safaricom's innovative flagship offering, M-PESA, enables customers to transfer funds at reduced cost – a lifesaver for many Kenyan citizens

and migrant communities. The success of this innovative solution for "everyone" in the domestic market allows for technology transfer internationally.

Being a purpose-driven company means that Safaricom invests in future customers by providing free access to the Internet for public primary schools. "We believe that if you can bridge the digital divide and reduce digital illiteracy in society, you will also reduce the inequalities."

Business contributions
Collymore suggests that businesses should use the SDGs as a lens through which to find business opportunities. "Rather than saying what can we do for healthcare, ask how the gap in healthcare presents a business opportunity."

The key challenges that the world faces today are related to inequality, and no one is immune. What happens in Africa will affect Europe and China and the U.S. "Kenya alone has close to a million young people who are coming into the non-existent jobs market every year," he says. "If you can't provide 800,000 jobs, those people will not simply vanish. You will have a problem. " Global business needs to look at this demand as an opportunity to create jobs. "How can DFID, how can USAID, work with existing and future businesses to go to the source of the problem and arrest the problem there, rather than wait until those people become migrants?"

We live in a much more transparent world, which makes it easier for customers to hold businesses to account. But this is not the only reason that ethical business is good business. "If anybody believes that they can operate successfully in an unjust and an unequal environment in the long run, then they are massively mistaken."

Corruption is the high-octane fuel for inequality. Because of systemic corruption, hospitals and schools don't get built, and teachers aren't paid. Collymore lays the blame squarely at the feet of business.

"We often talk about corruption in the public sector, we talk about corrupt government, but the source of the corruption is from the private sector. Businesses need to understand that this unpredictable and variable tax on their businesses is not only unnecessary, but fuels inequality because the people who suffer the most are the poor and the vulnerable. We need to call the CEOs out, otherwise we're never going to deal with it." ∎

M-PESA moves much more than money

Using your mobile phone to transfer money; that is the simple but transformative promise behind M-PESA. Safaricom pioneered commercial mobile money transfers, and turned it into the most successful service of its kind anywhere in the world.

There are now more than 25 million customers across markets in Africa, Asia, and Europe and over 200,000 M-PESA agent outlets in 11 M-PESA countries. Kenya is the epicentre of mobile innovation, with 80 % of the world's mobile money transactions happening in East Africa. Kenya has an adult population of over 20 million; 93 % of Kenyans are mobile phone users and 73 % of those are active mobile money customers. A quarter of those now use mobile money at least once a day.

M-PESA is primarily a money transfer platform, enabling people to send and receive money. But it is also much more than that. It brings people previously left out of the financial services sector into the fold, with the ability to save and borrow with dignity. It also provides a platform for other innovative programmes in the energy, healthcare, food, and agricultural sectors.

"This has been a game changer," says Collymore, "especially in to provision of micro-credit that has been ploughed in productive sectors of our economy, helping in wealth creation." This is especially true of female entrepreneurs and marginalized small businesses. "A poor female farmer would not have been able to access any kind of financial services without something like M-PESA. The scale effect of female entrepreneurs better securing their own incomes is very robustly reducing inequality bottom-up."

From the initial concept, M-PESA has developed into a range of business solutions benefitting the poorest, such as:

- M-KOPA: Solar energy in off-grid areas through a Pay-as-you-Go power model. So far, this is now lighting an average of 500 homes every da.y

- Mobile banking services, enabling customers to operate savings accounts and loans without having to visit banks.

- M-TIBA: Mobile solutions for setting up healthcare funds for services and medication locally.

- Cashless access to food for refugees through the 'Chakula Chap-Chap' initiative, a partnership with UNHCR and the World Food Program.

The scale of impact is impressive. Over 500,000 tea farmers across Kenya now have access to a cashless payment service via M-PESA, which has boosted efficient in factory operations and the Kenyan government uses M-PESA to send fertilizer subsidies to 3-5 million smallholder farmers of food crops like tea, coffee, and sugarcane.

In all of this, mobile solutions that eliminate middle-men in transactions reduce the opportunity for corruption and the cost of distributing services and goods. For the bottom 40 % of the population, that is good news. For the rest of the population on planet earth, reduced inequality is even better news.

The M-PESA concept is now being internationalised. In India the launch of an M-PESA smartphone app enables Indian customers to use M-PESA to pay for goods on Ebay, for taxis with TabCab, and to book train tickets on India's national railways. Enterprises including Walmart are using M-PESA in India to improve cash management and business efficiency.

11 SUSTAINABLE CITIES AND COMMUNITIES

ROW   BRISE   CHINA   OECD   USA

With an increasing share of the world's population living in cities, SDG11 is increasingly important. The goal covers a wide range of areas, from safety to resilience and sustainability, and also overlaps with other goals. In essence, the goal's "inclusive" wording emphasizes that no one should be left behind. Thus, eliminating slums is key to achieving the goal.

Model input
Our models inform this SDG to only a limited extent. There is some input on losses from climate-related disasters, but they do not dominate in our assessment. There is a correlation between GDP growth and some of the targets here, such as the slum indicator. Hence we expect that with a growing GDP, the positive trend will improve. But the model input cannot quantify the improvement.

Regional considerations
Many of the areas covered by the SDG are mainly challenging for developing countries, but others are of a more global nature. The developed countries have generally succeeded best within the safety perspective (represented here by air pollution). They also have a greater economic capacity to continue this trend during the next 15 years.

Conclusion
ROW is unlikely to ensure the safe wellbeing of the urban population over the coming 15 years and so gets red. China faces huge challenges, both with slums and pollution, and thus also gets red, although this is uncertain, and could also be yellow. BRISE is more diverse and gets a yellow rating, with somewhat better figures on both indicators. OECD and the USA are rated green.

% of urban population

CHINA   BRISE   ROW
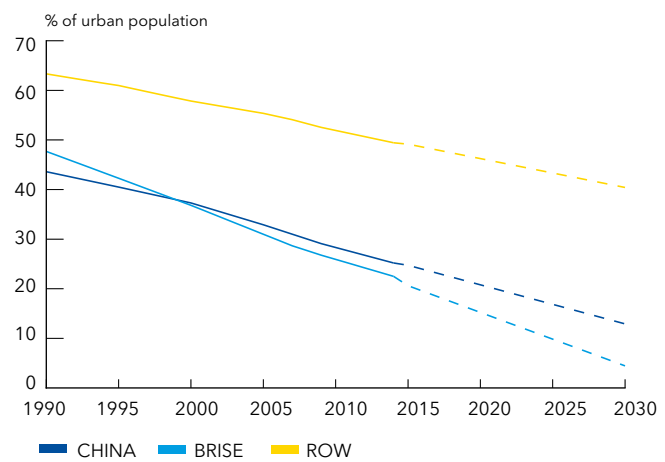
Historical data source: UN-HABITAT

Figure 11.1. Slum population as percentage of urban population

«The exercise provides clear conclusions that can be easy to communicate, in order to push for pragmatic action in those regions with unsatisfactory performance.»

Carlos C Gaitan, La Ciudad Verde

MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT, AND SUSTAINABLE

«Although measuring advances in this arena often proves to be difficult, sustainable transport holds the key to significant advances with regards to urban sustainability.»

Carlos C Gaitan, LaCiudad Verde

Assessment details

Although the goal has many dimensions, we chose only two relatively easily quantifiable indicators and targets in the more detailed assessment. We would have liked to include one on access to public transport, but statistics are not easily available.

TARGET 11.1

By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums. *Indicator chosen: Percentage of urban population living in slums or informal settlements.*

| ROW | BRISE | CHINA | OECD | USA |
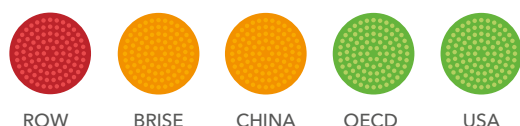
Many of the LDCs have a large proportion (50–80 %) of their urban population living in slums, and the challenges to meet the targets seem overwhelming. In many developed countries, and also in ROW, progress has been significant. Increased urbanization and no improvements in differences within the countries (ref. SDG 10) means ROW does not come close to the target, as illustrated in Figure 11.1, by heading towards approximately 40 % slums in urban areas in 2030. China is improving, and is on track to close half the gap by 2030. In BRISE, progress has been faster, and with continued strong GDP growth, we expect the current trend will bring BRISE to just above 5 % slums in 2030. The rating for BRISE is close to green.

TARGET 11.6

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management. *Indicator chosen: Mean urban air pollution with particulate matter (PM10 and PM2.5).*

| ROW | BRISE | CHINA | OECD | USA |
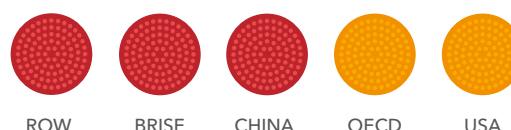
The targets on water (6.1) and sanitation (6.2) are strongly connected to this goal. Air pollution is one of the key issues impacting the safety of people living in cities, and it is a challenge not only in the developing world, but also in certain cities in the developed world. According to WHO standards for particulate matter (PM2.5 and PM10) concentrations, we see that cities all over the world have PM concentrations that are not only high above the air quality guideline of 10 μg/m^3 (PM2.5) / 20 μg/m^3 (PM10), but also high above the upper interim targets of 35 μg/m^3 (PM2.5) / 70 μg/m^3 (PM10) (WHO, 2014a). USA has, in general, the lowest values, with OECD, and Europe in particular, being higher. The three other regions are higher still, and well above threshold. Measuring air pollution with proper indicators is relatively new, and few long-term trends exist. There are, however, strong indications that air pollution in larger cities has worsened in the last five years, with only Europe and certain Asia Pacific regions improving (WHO, 2014b). With increasing focus this might improve in the coming 15 years, but the change needed to reach acceptable levels is significant.

11 SUSTAINABLE CITIES AND COMMUNITIES

SIEMENS

▬▬▬▬▬ SIEMENS

CITY CENTRED

With 66 % of the world's population expected to live in cities by 2050, urban centres are tasked with the fundamental changes needed to meet every one of the SDGs. Cities will need to be cleaner, safer, resource-efficient, resilient, and more inclusive – and not just to place themselves on a sustainable footing; they will need to tick these boxes in order to compete with each other, and to attract skilled people and inward investment.

Half the world's population lives within 60 km of the sea and that percentage is rising rapidly. Already stressed by population influx, coastal cities will need to build further resilience into their very fabric in order to expand and maintain existing systems as well as withstand extreme weather linked to climate change. "Wherever our future is going, it is going to be defined in cities." Elaine Trimble, Director, Siemens, Global Center of Competence Cities, shared her company's vision for cities.

Assessment

Trimble is a supportive participant in the Spaceship Earth project: "You are taking some very idealistic goals and not only asking how realistic achieving them can be, but how will we actually get there? You are creating a roadmap, and giving an idea of how hard these challenges are going to be. That is incredibly important."

While she agrees with many of the points in DNV GL's assessment of SDG 11, she questions the prediction that energy, particularly electricity, demand will plateau. "Per capita energy consumption is decreasing in most developed cities in Western Europe, but those same cities face population growth, which can still mean overall increases." If more public and private transport is electrified, (e-buses and e-cars), and higher temperatures result in more air-conditioning in our buildings, then demand for electricity is likely to increase. The good news about electricity is that it can be generated through renewable and cleaner sources.

Siemens solutions

"Cities are the biggest energy consumers and carbon emitters. If you really want to talk about energy efficiency and climate change, then you have to talk about cities." Helping cities to make more informed decisions, based on real city data and fact-based analysis of technology solutions, is where Elaine sees her efforts bringing the most value to cities.

"It's amazing how many cities don't have an integrated strategy for infrastructure to improve local quality of life, enable economic growth, and boost competitiveness," she says. But cities and city managers are seeing the connection, and they are implementing new technologies.

ELAINE TRIMBLE
Director, Siemens, Global
Centre of Competence Cities

Siemens AG, headquartered in Berlin and Munich, is a global technology powerhouse and a leading pioneer in energy-efficient, resource-saving technologies across a range of infrastructure and industrial sectors. These include: energy, buildings, transport, and health. The company has a clear commitment to think and act in the interest of future generations, balancing People, Planet and Profit. Siemens is active in over 200 countries, and employs 348,000 people worldwide with reported global revenue of €75.6 billion in 2015.

«Cities are the biggest energy consumers and carbon emitters. If you really want to talk about energy efficiency and climate change then you have to talk about cities.»

«We wanted to show that with technology you can build a beautiful, iconic, and green building in an historic, dense city that imposes real limitations.»

For example, cities are utilizing technology to increase capacity in existing transport systems and to make those systems easier to understand and utilize. The ultimate goal of the smart city is being able to deliver better services more efficiently to more people. Cities are embracing technology partially because many of their citizens have access to so much more information and people expect their cities to communicate with them through technology.

McKinsey Global Institute estimates that about US$57 trillion will be needed in infrastructure through 2030 - and that's just to keep pace with current GDP needs, not including meeting the development goals. Cities depend on the effective and reliable operation of infrastructure systems to deliver energy, mobility, water, sanitation, shelter, information, emergency responses, and other critical services.

The Siemens Urban Development Team works with cities, helping them focus on optimal technologies to reduce their carbon footprint and improve local quality of life, while building in resilience to expanded and upgraded infrastructure. The three key focus areas are: energy, transport, and buildings.

Siemens's flagship building, The Crystal, in London, demonstrates how it can be done. Hailed as one of the most sustainable buildings in the world through both its design and the technologies it uses, The Crystal is an all-electric building. It was designed to minimize the electricity that it uses and also features an impressive exhibition on the future of cities. "We wanted to show that with technology you can

build a beautiful, iconic, and green building in a real city with site limitations," says Trimble.

On show are some of the building technologies and infrastructure concepts that Siemens offers to cities. Places like New York, whose infrastructure was hard hit by Hurricane Sandy in 2012 (see case study), or Copenhagen.

Copenhagen is one of the world's most sustainable cities, and the first capital to target carbon neutrality by 2025 publicly. It ranked top of Siemens' European Green City Index in 2009, and is making great strides towards meeting its 2025 target.

Siemens' Green Cities Index was initially developed to rank cities on energy consumption; the City Performance Tool (CyPT) has an even wider scope to help cities make informed infrastructure investment decisions. The CyPT looks at the underlying city data, analyzing the energy mix of the city, the population growth, and how its buildings actually operate. The CyPT identifies the best energy, transport, and building technologies for reducing carbon emissions and improving local air quality, and adds new jobs in the local economy.

Business contributions
The SDGs will be made or broken in the world's cities, which will need to absorb well over 2 billion additional people by 2050. Cities occupy only 3 % of the world's landmass, but consume over two-thirds of global energy. These are staggering numbers, and it will be up to businesses to provide many of the digital, physical, and economically 'smart' solutions needed to reach SDG 11.

Bronx microgrid weathers the storm

Superstorm Sandy lashed the north east coast of the United States in October 2012, causing an estimated $50 billion in overall damage to the greater New York area.

During, and for varying amounts of time after the storm, more than 8 million people were without electrical power. But there were two notable beacons of light in the darkness – Princeton University and Co-Op City, Bronx, New York. Both locales were able to fall back on microgrids for uninterrupted power.

Microgrids are localized power grids that operate in synchrony with, or independently from, the main grid. As such, they offer resilience against both physical and cyber disruptions. A variety of microgrid designs have been developed in recent years.

Some are truly 'off-grid', but other systems are integrated into the local grid and serve discrete communities like universities and corporate campuses. Thus, a microgrid is not characterized by its size, but rather by its functionality.

They also open up opportunities for distributed energy sources, both conventional and renewable, as well as storage devices such as batteries.

Microgrids are poised to play a strategic role in the future landscape of electricity distribution. "The genesis of Co-Op City was a social project – a Bronx development wanted to deliver cheaper energy to its residents," says Trimble.

Co-Op City boasts a 40 megawatt combined heat and power (CHP) plant, powered in part by two Siemens dual fuel turbines. The microgrid serves 14,000 apartments in 35 towers. During the storm, the microgrid continued to provide electricity, heat, hot water, and air conditioning for 60,000 residents, while neighbouring areas sat in darkness. "Ironically when everyone in Manhattan was without power, this social project in the Bronx was still going."

The upfront investment for this microgrid paid back after just five years, aided by the sale of surplus power back to the grid.

Among these will be infrastructure improvements, such as communication and automation technologies for self-driving cars; material, heating or ventilation technologies for energy efficient buildings; or solutions for the sharing economy of car-pools or recycling of materials.

Businesses can cooperate to conceive smart buildings that produce more energy than they consume. Using solar as the main energy source, combined with energy storage, heat-pumps, and the capacity to charge electric vehicles, will turn buildings into energy hubs, offering city dwellers much needed flexibility.

Siemens, own technologies touch almost every aspect of urban life. Many of its technologies are helping cities and industry to reduce their carbon emissions. Siemens itself is aiming to achieve a net-zero carbon footprint by 2030 and to halve its CO_2 emissions as early as 2020. Siemens will be investing some €100 million over the next three years

to reduce the energy footprint of its production facilities and buildings. Siemens also expects to recoup these costs through an annual energy savings estimated at €20 million.

Recent events have changed our cities' understanding of their risk profile, and shown that investment in resilience is not only necessary, but financially imperative. Trimble sees many opportunities for financial services, from increasingly sophisticated green finance, to insurance companies, which bear the financial risk after extreme weather events. "I think we are going to be hearing more from insurance companies in terms of resilience," Trimble says.

Business also has a key role in building scale, and huge international conglomerates such as Siemens have a global reach, but also need to find partners around the world to extend that reach even wider. The digital technologies and transparent future will help spread ideas and solutions from one city and community to the next. ■

12 RESPONSIBLE CONSUMPTION AND PRODUCTION
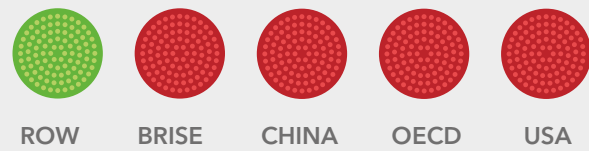
ROW   BRISE   CHINA   OECD   USA

«Human activities consume resources and produce waste, and this must be in line with nature's regenerative capacity.»

SDG12 is about ensuring that we produce and consume goods and resources in line with a sustainable ecological footprint. This goal also requires efficient production and supply chains, food security, and a resource-efficient economy. For this SDG, we have decided to use one indicator, the ecological footprint per person. This does not specifically address any of the targets set in the SDG, but rather enables us to give an assessment at the goal level. Human activities consume resources and produce waste, and this must be in line with nature's regenerative capacity.

Model input
The footprint we use as an indicator for this goal is a direct output from our model.

Regional considerations
There are significant differences in the various regions of the world, with the largest challenges being the high footprint of the developing world, with US on the top, as shown in Figure 12.1.

Conclusion
All regions have a 2030 footprint that is above the threshold, with the exception of ROW that is more or less on the threshold, giving it a green rating. There is high uncertainty in the assessment we should give for ROW, and some uncertainty for BRISE. The uncertainty for China, OECD, and USA is low.
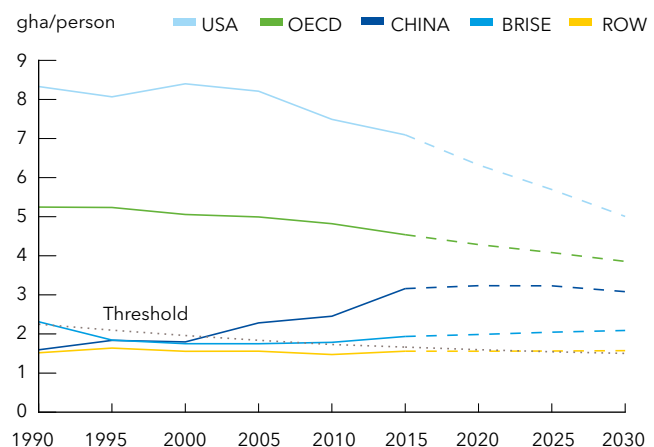
Historical data source: Global Footprint Network

Figure 12.1. Ecological footprint per person-year

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

Assessment details

To achieve our overall assessment for this SDG, we reference theecological footprint developed by the Global Footprint Network (2015). This measures human demand on the Earth's ecosystem, in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated. The most commonly reported type of ecological footprint is defined as the area used to support a defined population's consumption. The consumption footprint (in gha – global hectares) includes the area needed to produce the materials consumed and the area needed to absorb the CO_2 emissions. The consumption footprint of a nation is calculated in the National Footprint Accounts as a nation's primary production footprint, plus the footprint of imports, minus the footprint of exports, and is thus, strictly speaking,

a footprint of apparent consumption. The ecological footprint is a good measure for assessing whether we are in line with sustainable consumption and production patterns. The world passed the total bio-capacity threshold in 1975. According to our forecast, illustrated on the previous page, all regions except ROW are currently above the threshold and will remain above the threshold in 2030, thus the rating is red. ROW follows the threshold throughout and is thus coloured green. We have, in addition, tried removing CO_2 emissions from the equation, and the non-energy footprint per person forecasts more positive results, with only OECD and USA being above the threshold, as shown in Table 12.1. In other words, energy consumption is the main reason behind the unsustainable ecological footprint. It is, however, incorrect to exclude the energy footprint, hence our rating is based on its inclusion.

Region	1990	1995	2000	2005	2010	e2015	f2020	f2025	f2030
Threshold	2.3	2.1	2.0	1.8	1.7	1.7	1.6	1.5	1.5
NEFFP, World	1.2	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.9
NEFFP, ROW	1.3	1.2	1.2	1.2	1.1	1.0	1.0	1.0	1.0
NEFFP, BRISE	1.4	1.1	1.1	1.0	1.1	1.0	0.9	0.9	0.9
NEFFP, China	1.0	1.1	1.1	1.1	1.0	2.2	1.0	1.0	1.0
NEFFP, OECD	2.7	2.6	2.5	2.4	2.2	2.2	2.2	2.1	2.1
NEFFP, USA	3.0	2.6	2.8	2.8	2.4	2.4	2.4	2.4	2.3

Table 12.1 Non-energy footprint per person [gha/person-year]

██████████ **MARKS & SPENCER**

AWAKENING OUR INNER SUSTAINABILITY NEEDS

As the SDG Compass project points out, simply taking today's portfolio of goods and services globally and trying to produce it sustainably is not going to work. The laudable effort involved will simply fail to meet global emissions targets, will run into natural resource constraints, and, above all, will fail to meet the growing demand for basic needs, including food, water, sanitation, and access to energy.

A fundamental change in consumption patterns is required – particularly in industrialized economies, where there is ample room for consumers to reduce their ecological footprints. Business has a leading role to play here, to inspire customers towards more sustainable lifestyle choices.

Marks & Spencer's response to these challenges, outlined through their Plan A Sustainability Programme, aims to embed sustainability into every aspect of their production, consumption, and disposal cycle. Mike Barry, Director of Sustainable Business ('Plan A'), Marks & Spencer, told us more.

Assessment

 "We have to find a different way to satisfy consumer needs in the future," says Barry. "One that isn't just about using 2 % less energy per year, but a step-change in terms of our impacts. More than different business models, that demands entirely new business models – truly sustainable ones."

Barry admits that meeting the targets for SDG 12 is "a tall order", but labels himself a cautious optimist. "I do believe that we are heading in the wrong direction now, whether it's climate change, or plastic pollution in the ocean, or the kind of social upheaval that we are seeing right across the world."

His optimism stems from the advances made over the last 20 years in poverty reduction, the deployment of renewables, and from the kind of successes that happen "when the planet puts its mind to solving a problem" – e.g. banning CFCs to address the ozone hole in the 1990s.

Barry is particularly positive about new collaborations helping to develop scalable solutions. "For the first time we have solutions in front of us to become a more sustainable society. What we need to do is scale them up, fast."

MIKE BARRY
Director Plan A, Marks & Spencer

Marks & Spencer is a global, multi-channel retailer of mainly own-brand food, clothing, and home products. The company sells 3 billion items every year to 35 million customers at 1,200 shops. Their plan A is a way to help protect the planet – by sourcing responsibly, reducing waste and helping communities. It has 83,000 employees and tens of thousands of factories and farms that contribute to the production and delivery of these consumer goods. In 2015 Marks & Spencer recorded revenues of £10.3billion.

«The key to scale is working in collaborative partnerships.»

In DNV GL's Spaceship Earth assessment the Rest of the World (ROW) category glows green, but for the distressing reason that people in lesser developed countries have, by definition, a lower ecological footprint.

"There is a very great risk that we turn around to the rest of the world and say we got to where we got to by polluting the planet, now you're not allowed to develop," says Barry. "We must not create barriers to developing solutions around the world." He adds that many developing countries simply don't have an industry yet to help support the right kind of change, citing the example of low carbon refrigeration, which is well underway in Europe, supported by regulation, technology, and training, but lags behind in Latin America, India, and China.

He cites Tesla as a prime example of business using its innovative power to design appropriate solutions that "… effectively awaken sustainable consumption needs in customers that they were previously unaware of. That's success."

Marks & Spencer solutions

"As a retailer, somewhere in our value chain we touch every social and environmental issue on the planet because of the very broad range of products that we sell," Barry says. "The good news is that more and more examples of innovative approaches to sustainable consumption are emerging."

In 2007 Marks & Spencer launched their sustainability Plan A ("because there is no Plan B for our planet, which is the only planet we've got"). More than a response to the shortage of planetary resources and increased pressure for business to be socially useful, it was also about recognising a technology revolution on the horizon.

Plan A introduced 100 social and environmental commitments, which the company has "remorselessly driven" over the past ten years. Marks & Spencer wants its products to be environmental storytellers. "By 2020 every one of the 3 billion items we sell will have at least one sustainability story to tell – it will be MSC fish, or FSC wood, or made in an eco factory." As M&S's manufacturers and suppliers move up the sustainability ladder (see case study), those stories-per-product will multiply. "Once every product has a story, then two, then three, then you are on the path towards truly sustainable products. This is not about having a niche eco range, or a Fairtrade organic range in the corner of a shop and everything else is unsustainable. It's about improving every M&S product and service in the store."

The M&S Plan A report is independently assured by DNV GL. Barry estimates that the company is currently 25 % sustainable; the remaining 75 % will come about through new sustainable business models. "Even if our food or clothing has much less impact than 10 years ago, that's still not enough. There's too much volume entering for incremental carbon efficiency improvements to be enough. So we're experimenting with new business models. For example, we're taking back 3 million garments a year from our customers who have finished with them; we donate these responsibly or sell them on to raising money to tackle poverty around the world."

Barry's 'Big Five' future improvement areas are:

- continuing to reduce the company's footprint across everything it sells;

- building new sustainable business models;

- engaging customers, colleagues, and employees on why a sustainable economy is important and how to build it;

- integrating even greater sustainability into the business;

- and finally, but perhaps most significantly, ensuring that the solutions are scalable across the marketplace.

"The key to scale," Barry says, "is working in collaborative partnerships."

Business contributions

Collaboration is vital to developing new business models, and applying these at the kind of scale necessary to make a discernable difference and achieve the goals of SDG 12.

The main vehicle for partnership and collaboration for Marks & Spencer and other retailers is the Consumer Goods Forum (CGF), which brings together companies like Coca Cola, Pepsi, Walmart, Tesco, Nestle, and Unilever. "Even though we are big competitors, we work together to tackle issues like low carbon refrigeration, food waste, humane supply chain, deforestation," says Barry. "We realised that none of us can solve this on our own. By working together we can scale solutions quicker and with more impact."

The CGF has developed a series of resolutions to tackle social and environmental issues, including stopping deforestation in supply chains by 2020, eradicating forced labour from supply chains, halving food waste by 2025, and introducing trials for low carbon refrigeration systems.

Action can drive policy, but policy also needs to be put into action. "Sometimes as a world we are very good with coming up with solutions like COP21. What we are not good at as a global society is getting the detailed technical infrastructure in place to turn the words on paper in to reality."

Barry stresses that it is no longer a question of intellect or policy. "We have the intellectual solutions, we have the policy framework with Global Goals – what we need now is change on the ground. Not just a few big companies like Unilever and M&S, but tens of thousands of companies to adopt these models. That is all that matters."
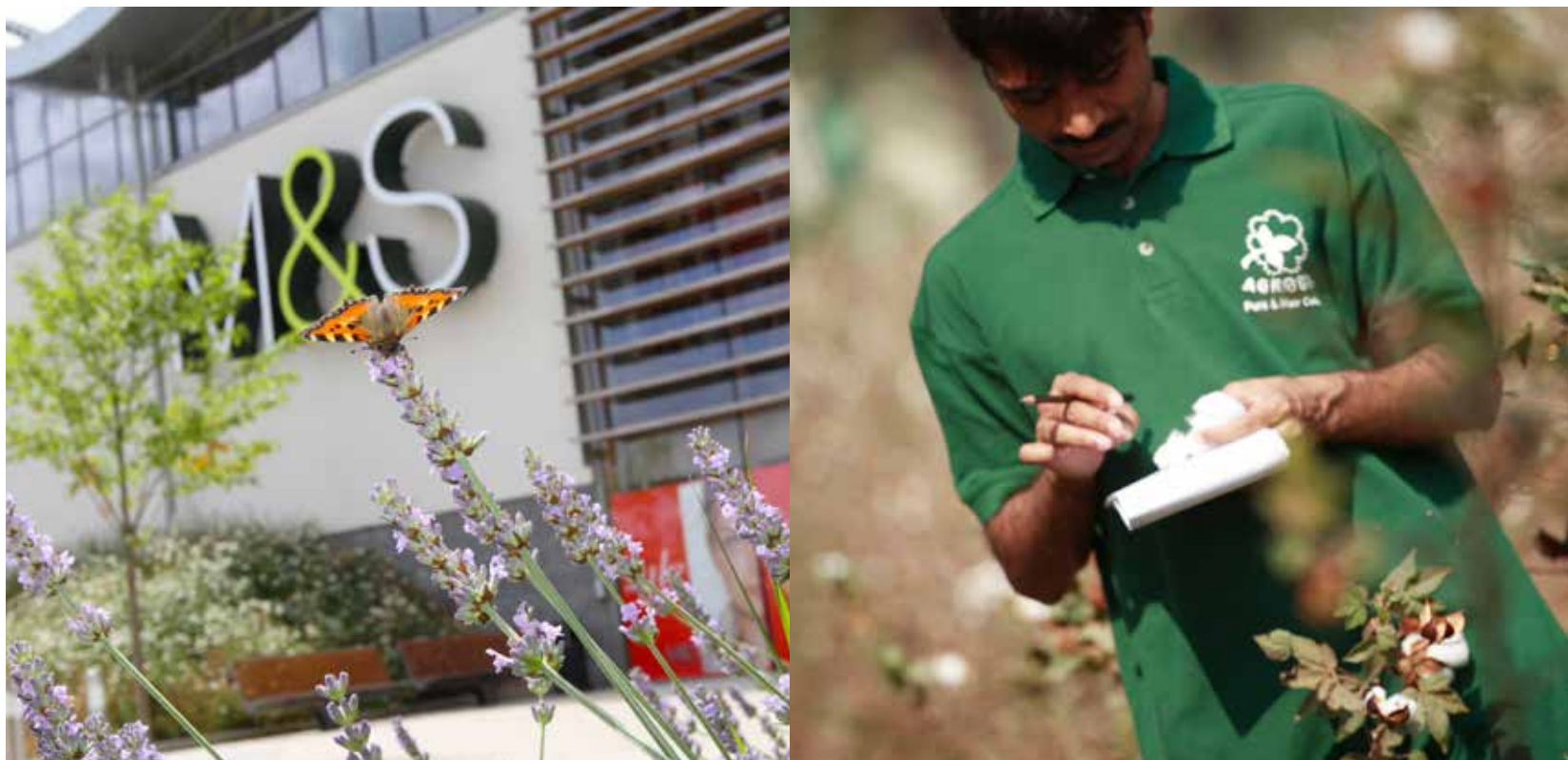
M&S sustainability ladder:
Plan A scorecard & frameworks

The M&S supply chain is broad and complex, with 600 factories in the food chain alone. "Over 90 % of M&S impacts fall outside of our own operation and within the supply chain," says Mike Barry. "The M&S Plan A Supplier Frameworks were developed to ensure that we are working with our suppliers to reduce their impacts."

In 2010 the company introduced the Framework as one of the key Plan A commitments, to reward and incentivize suppliers to improve sustainability, with defined measures in terms of energy, waste, and water use.

The aim is to embed sustainability (ethical, economic, and environmental) within the Foods Supply Chain; 93 % of foods volume is covered by the programme.

Suppliers work through the bronze, silver, and gold framework across 3 pillars – HR , Environment, and Lean Manufacturing – and are awarded an overall score. The objective is to have 100 % of volume from a Silver level factory by 2020, and develop leading factories to move on to 'gold' status.

M&S created the programme in collaboration with its suppliers and a number of key external stakeholders to ensure they were able to make transformational change and embed sustainability in the heart of how they do business.

If sites achieve 'silver' they are awarded a Plan A attribute; M&S buyers are targeted on the number of products they manage to attain with a Plan A attribute, so they have an incentive to ensure their suppliers are working to minimum silver standard. "Last year 48 % of food came from Silver suppliers," says Mike Barry.

While most suppliers are generally good at one element of the programme, M&S admits that it is more challenging to show leadership over all three pillars; nonetheless the ultimate aim is for suppliers to excel through all three elements.

"This programme enables suppliers to prioritise what's important to them and work over time to really embed change and excellent performance," says M&S Sustainability Manager, Hazel Culley. "We now have over 300 supplier sites involved in the programme accounting for 93 % of foods volume and 58 sites currently assessing themselves at silver. We know a lot more about our suppliers now and are able to track the progress they're making."

13 CLIMATE ACTION

ROW   BRISE   CHINA   OECD   USA

SDG13 is both about mitigating and adapting to climate change. Most importantly, and in line with IPCC and common approaches to mitigation, the global temperature increase must be limited to less than 2 °C above pre-industrial temperatures. In order to conclude on whether we succeed with this, a time horizon longer than 2030 is needed. Our forecast looks at 2050 and the indicator we chose is accumulated CO_2 emissions from pre-industrial times. We hold the view that the main measure of success or failure of this goal should be whether we succeed with limiting global warming.

Model input

The DNV GL model forecasts CO_2 emissions from fossils as being by far the most important factor for determining future GHG emissions and global temperature rise. We forecast that global CO_2 emissions from energy use will peak at around 2025, thereafter reducing, although relatively slowly. The model does not quantify emissions after 2050. Based on these figures, the carbon budget will be emptied in 2037. The model assumes that CO_2 emissions from agriculture, forestry, and other land use (AFOLU), as well as those from cement, remain at current global levels of about 3 $GtCO_2$/y each. The model furthermore divides regional climate adaptation efforts into those that aim at prevention of damages and those that repair them. There will be an exponential growth in both efforts. They will double by 2030, and almost quadruple by 2050.

Regional considerations

On the mitigation part of this target, the planet succeeds or fails together. Furthermore, our model reflects our current limited understanding and does not allow for differential regional adaptation efforts. Therefore all regions are said to suffer similarly.

Conclusion

Our most likely forecast is that carbon emissions will remain at a level that empties the remaining carbon budget in 2037, and continues thereafter. We are therefore unlikely to meet the goal, and give a red rating. There is little uncertainty in this assessment. Adaptation efforts are not counted as part of the overall ranking here, but it is clear that the adaptation capacity is highest in USA and OECD.
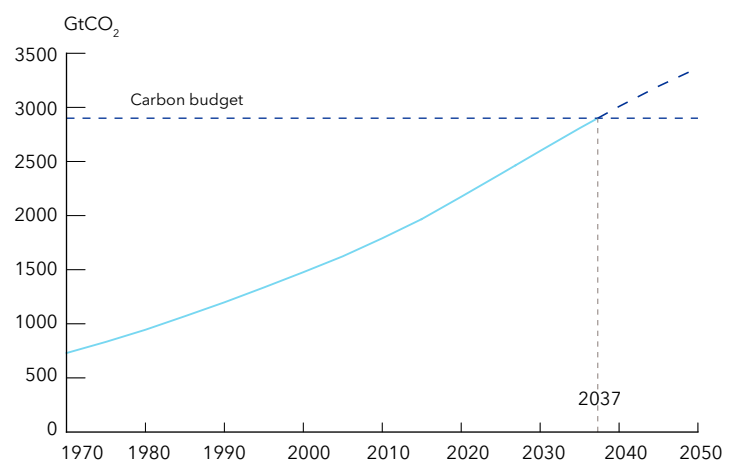

Figure 13.1. Global accumulated anthropogenic CO_2 emissions since pre-industrial times

TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

«We hold the view that the main measure of success or failure of this goal should be whether we succeed with limiting global warming.»

Assessment details

For SDG 13, a detailed assessment of the targets is not included. The three targets in this goal, 13.1, 13.2, and 13.3, have vague formulations, and the key indicators on CO_2 emission from energy use, CO_2 emissions from AFOLU, losses from climate-related natural disasters, and official climate financing from developed countries, are the most important factors in determining whether we will meet the goal.

The DNV GL model forecasts global CO_2 emissions from energy use to be 102 % of 2015 emissions in 2030, and 67 % of 2015 emissions in 2050 as illustrated in Figure 13.2. Based on these figures, we cross the carbon budget in 2037, and by 2050, we will have emitted 500 Gt more CO_2 than the remaining carbon budget. The model does not quantify emissions after 2050, but in 2050 we still emit significant amounts of carbon, hence, the emissions will continue albeit at a lower rate.

In SDG 15, we forecast gradual slow-down in deforestation, indicating that the net decrease may slow, but is not likely to be reversed short term, hence not contributing significantly towards SDG 13 before 2030.

As climate emissions continue to accumulate, temperatures will rise and climate will suffer. Though regions will respond, for example by revising building codes for housing and infrastructure and devote increasing proportions of their GDP to climate resilience, this will not suffice before 2030. Such woefully inadequate measures will cause climate damages to multiply and humans and their habitat will suffer. Clearly, there is an opportunity to accelerate climate adaptation measures, and this SDG thus contains a vast upside potential for limiting physical and civilization degradations.
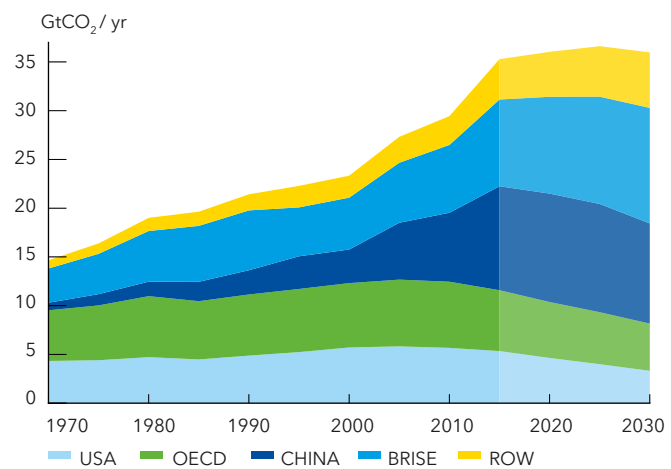
GtCO$_2$/ yr

Historical data source: US DOE ORNL

Figure 13.2: Energy-related emissions

SDG 13

━━━━━━━━ **IBERDROLA**

DEEPENING DECARBONIZATION

Climate change affects all of us, but has a particular impact on marginalized groups who may already have difficulty accessing basic resources or live in vulnerable regions. Universal access to energy, especially in developing countries, is vital for achieving the SDGs, but there is an urgent need to decouple CO_2 emissions from economic development.

The COP 21 agreement in Paris set a clear signal of the need to decarbonize the world's energy model, not only to maintain at least a 2°C scenario trajectory, but also to combat the health effects of air pollution, which causes more than 7 million premature deaths around the world every year.

Electricity is the only energy form that can be efficiently decarbonized on a grand scale. Electrification can also decarbonize sectors, such as agriculture, transport, and buildings. As a world-leading multinational group in the sustainable energy sector, and the world's leading provider of wind energy, Iberdrola is fast-tracking this process through innovation, new technologies, and new business models. But as Iberdrola Director of Energy Policies and Climate Change, Carlos Sallé says, "it will take collective willingness and fundamental changes at policy level to make the changes happen on the necessary scale before it's too late." For Iberdrola, mitigating climate change is smarter than adapting to the severe impacts of it.

Assessment
Carlos Sallé finds the DNV GL report timely and based on rigorous analysis, and agrees with the "diagnosis", with one critical condition: "Business as usual will definitely not get the job done."

Nonetheless, Iberdrola's Director of Energy Policies and Climate Change is optimistic. "Today we have the solutions and technologies that we didn't have in the past." He concedes that there are some policy and logistical barriers to overcome in order to implement these solutions. "If we have the will to make the necessary modifications we will arrive at the solution. If we continue with business as usual we will have problems."

Sallé stresses the need to look at the effects of energy and climate policies on long-term planning, and recommends strong carbon price as the most efficient signal to promote investment in renewables. "Consistent and predictable climate and energy frameworks and policies are key to attracting investment. Divergent national approaches, policies, and goals lead to distortions that jeopardise cost efficiency and effectiveness."

The task is urgent. "We cannot wait 10 years. If we lose the next 10 years it will be difficult to meet the targets by 2030."

CARLOS SALLÉ
Director of Energy Policies and Climate Change, Iberdrola

Iberdrola is a Spanish multinational electric utility company with a focus on renewable energy, in particular wind power, and on networks. The company's mission is to create value in a sustainable way and it is committed to social dividend. Iberdrola operates in more than 40 countries, employs 30,000 people and has over 28 million customers. In 2015, the company recorded revenues of € 31 Billion.

«Carbon pricing is imperative. It is the signal for efficiency, it gives the signal for investment, and it gives the signal for political principles to be implemented. Environmental reforms based on the 'polluter pays', principle will promote the transition towards an efficient and carbon neutral energy model.»

Iberdrola solutions

The future has arrived. We now have the technologies to generate and distribute enough electricity to meet the world's demand sustainably – we just need the policy to ensure they are implemented.

Iberdrola can certainly make a thorough assessment on the technology perspectives. It is world leader in renewable energies, with an installed capacity of almost 26 GW, and a strong commitment to deploying onshore and offshore wind, solar and pumped hydroelectric energy storage. "The recipe is simple" according to Sallé:

"more clean energy...
...more storage capacity...
...sufficient backup power...
...more and smarter grids...
...and more digitisation".

"Start now, combine these factors and, through a greater electrification of the global economy, we will meet climate change targets in due time."

The company has set itself an ambitious challenge – a 50 % reduction in CO_2 emission intensity by 2030 compared to 2007, and to be fully carbon neutral by 2050. As at the beginning of 2016, Iberdrola had 66 % emission-free capacity, and was 34 % below the European average in this respect. Furthermore, Iberdrola is already about to reach its 2020 target of a 30 % reduction in carbon intensity vs 2007 levels.

Results like these garner Iberdrola a lot of recognition. For example, it is the only European electrical utility to have been included in all 16 editions of the Dow Jones Sustainability Index. It is also listed by FTSE4Good, the Carbon Disclosure Project, Carbon Ranking Global 800, and Newsweek's Green Ranking.

The future of renewables looks rosy, but without change at policy level, it won't be implemented at the timing and kind of scale that is needed to meet SDG 13. For Iberdrola, if there is one overarching policy that will bring all the others in to line it is this one: make the polluter pay.

Sallé points out that this has to be done with a particular sensitivity to the energy needs of developing countries, and that it is necessary to help them to invest in clean energy solutions. "These countries have a right to increase their energy demand and grow their economies," he says. "We have to make sure that we transfer technology, as well as financial support, to help these regions deploy advanced technologies and business models for the future."

Business contributions

To reach the climate goals we need to decarbonize our current energy model: carbon pricing is the key that will unlock the door to a more sustainable future.

"Nobody is going to put money on the table if it is not legally binding." Sallé highlights this message from Iberdrola's Chairman and CEO speech at the COP21 summit in Paris 2015. With 200 countries having signed the Paris Agreement, there is positive pressure for capital markets to invest in renewables. "The urgency to decarbonize now, so as not to produce instability in our global climate system, means that the capital markets are reducing their risk premium in clean energy and increasing the risk premium in the non-clean energy."

Sallé sees a triumvirate between firms, consumers, and innovation, underpinned by policy that supports and fast-tracks the green electrification process.

"If you were to design policy to keep below the 2 °C degree scenario target, you would include policies to alter behaviour through pricing and regulation. While you are at it, you could address traffic congestion, health, and local environmental impacts through cycling infrastructure, congestion charges, and so on. Easy enough on paper, but implementing these policies requires partnerships."

Iberdrola is involved in a number of partnerships to share and develop innovative technologies. In offshore wind energy, the company is working closely with equipment manufacturers and with the UK Government to promote initiatives that improve the efficiency. As a result, the cost of the new 714 MW East Anglia One wind farm, which will start operations in 2019, will be 20 % lower than other offshore wind in the UK, and efforts continue at industry level to bring down costs even further.

The catalytic effect of these offshore projects goes beyond efficiency improvements or environmental sustainability, constituting an important driver for growth and employment creation. One example is the Wikinger project, a 350 MW offshore wind farm that Iberdrola is building in the Baltic Sea. Sallé highlights that this project has contributed to boost Spanish shipyard industry and its suppliers. This includes the construction of the substation and its platform at the Navantia shipyards in Puerto Real; the 29 wind turbine platforms at the Navantia shipyards in the Ferrol Ria; the piles that will secure these platforms and the wind turbine towers crafted in Avilés, as well as the wind turbines built by Gamesa.

In addition, Iberdrola is leading several initiatives to ensure that electricity networks are ready to accommodate an increasing flow of renewable energy and to promote the electrification process. Both are essential to align the energy model with the solution to the sustainability challenges. The company has already installed close to 8 million smart meters worldwide and is playing a key role in partnerships such as the Prime Alliance.

In the field of electromobility, Iberdrola is a member of Green eMotion, a four-year cross-European initiative to promote electromobility, where Iberdrola partners with both government and industry. Increased use of electric vehicles, electrification of public transport, and corporate electric car-sharing services are also enabled through alliances with car companies.

In addition, Iberdrola has set up a Sustainable Mobility Plan involving staff members, customers and suppliers. T he 23 specific initiatives include electric vehicles, car sharing, charging points, certified renewable energy and e-bill services. ∎

Carbon pricing as the keystone of climate action

Sallé explains: "Carbon pricing is imperative. It is the signal for efficiency, it gives the signal for investment, and it gives the signal for political principles to be implemented. It needs to go hand-in-hand with the reduction of subsidies and other barriers that send the wrong signals to energy stakeholders."

Carbon pricing schemes are proliferating across the globe. More than 1,000 companies are using internal carbon pricing or preparing to do so by 2017, according to CDP. Some 450 of these companies use a price of US$40/t CO_2e or higher. According to the World Bank (2016) about 13 % of total emissions are subject to a pricing mechanism. At the COP21, 90 nations committed to using market mechanisms to bring down carbon emissions. By 2019, countries representing 89 % of global GDP are expected to have some kind of carbon pricing.

However, current price levels vary significantly, from less than US$1 to 130/t CO_2e, with around 75 % of emissions priced at less than US$10/t CO_2e. This is far from the needed prices of US$50-90/t CO_2e to meet the internationally agreed goal of limiting global warming to 2° C.

Iberdrola advocates for a strong carbon price signal in several international partnerships with other companies and institutions.

In fact, Iberdrola can be considered as an example when talking about internalization of the carbon price signal in business reality and strategy. On the one hand, almost all of its power generation plants are located in countries with explicit carbon pricing frameworks (EU ETS, UK carbon price floor, Mexico). On the other, its business plans consider some implicit prices of CO_2, which support the strategy, mainly focused on clean energy and renewables.

In this regard, Iberdrola is member of the Carbon Pricing Leadership Coalition, the World Business Council for Sustainable Development and its Low Carbon Technology Partnership Initiative, the UN Global Compact Lead and the Prince of Wales' Corporate Leaders Group (Green Growth Platform). Iberdrola reports to the main sustainability and disclosure indices like the CDP and Dow Jones Sustainability Index. "Of course, market transparency is crucial for market efficiency", finishes Sallé.

14 LIFE BELOW WATER

ROW   BRISE   CHINA   OECD   USA
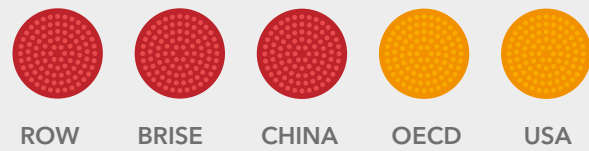
SDG14 is primarily concerned with taking care of the oceans. A secondary goal is to ensure a resource base for continued marine harvesting. Sustainability is squeezed from multiple directions: the degradation of the resource base, a lack of global-scale governance of the drivers of ocean acidification and warming, and a lack of rational local and regional governance of drivers/subsidies for marine resource use.

Model input
The model provides CO_2-emissions projections and ppm-values of CO_2-concentrations in the atmosphere. These define our acidification forecast. Our model suite does not cover specific marine pollution or fishing.

Regional considerations
Eutrophication is mainly a local issue. CO_2 emissions will have a global impact, and implications will be visible at the global scale. For coral reefs, there will be regional differences, but a constantly negative impact. Coastal fisheries will be well regulated in much of the developed world, but other regions will not regulate in a way that ensures continued high levels of reproduction. Fishing is increasingly a global issue, and ocean fishing also has an impact on the sustainability of local fishing. The stressors act in concert with each other, and the resultant impacts are not easy to predict, either in scale or in geographical terms.

Conclusion
ROW, BRISE, and China will continue facing huge challenges on the local scale, as well as global challenges with acidification, and so receive a red rating. USA and OECD will solve many of the local challenges with continued global warming, but remain vulnerable to acidification and global fishery challenges, and hence receive a yellow rating. Uncertainty is high on various factors, except acidification that has low uncertainty.
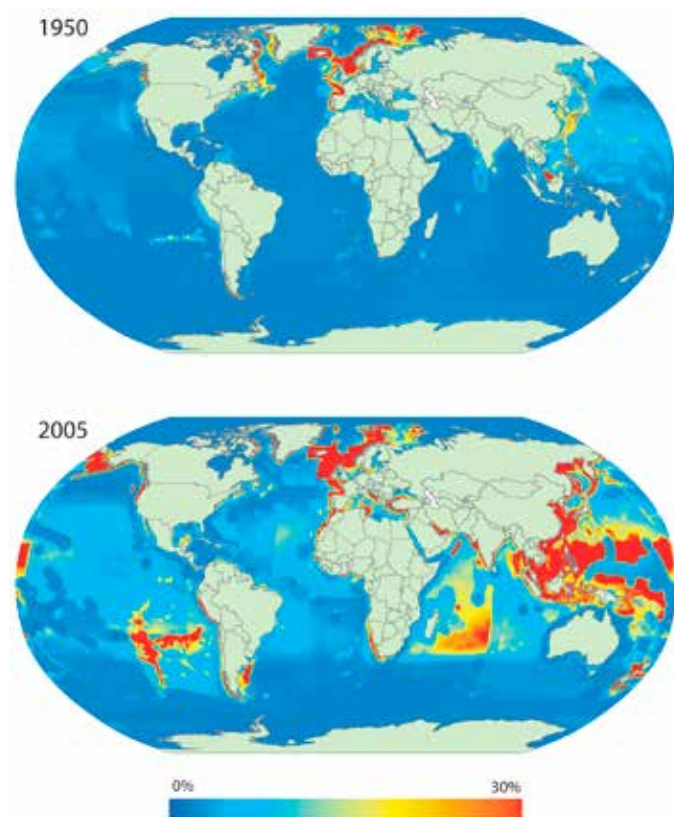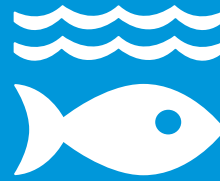

Figure 14.1. Overfished ocean regions (Swartz et al., 2013)

«We will need to become a lot smarter and more sophisticated to properly manage marine resources.»

Kevin Noone, Swedish Secretariat for Environmental Earth System Sciences

CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT
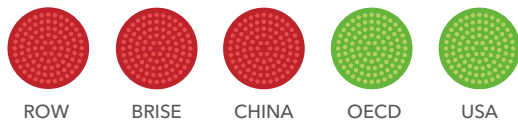
Assessment details

We have chosen three indicators, two addressing conservation and one sustainable use.
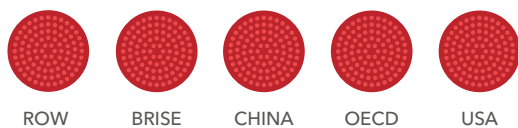
TARGET 14.1

By 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution. *Indicator chosen: Eutrophication of major estuaries*

ROW	BRISE	CHINA	OECD	USA

Eutrophication occurs due to excess nutrients, the dominant sources being fertilizers used in agriculture and household waste (nutrients in wastewater). OECD and USA have marginal increases in fertilizer use and moreover have wastewater treatment in place. Further environmental improvements are expected, giving a green rating. Strong growth in fertilizer use, especially in South East Asia, and wastewater treatment improvements being slower than required, especially in Africa, gives ROW a red score. The same applies to BRISE, although mitigation measures are stronger here. China has similar challenges within fertilizer use and nutrients in wastewater, and although they have more structure to adjust this, they are scored red as this must be proven before it is credited.

TARGET 14.3

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels. *Indicator chosen: CO$_2$-emissions.*

| ROW	BRISE	CHINA	OECD	USA

TARGET 14.4

By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics. *Indicator chosen: Likelihood of achieving universally agreed fisheries management plans.*

ROW	BRISE	CHINA	OECD	USA
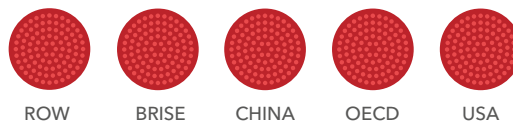
Ocean acidification is a consequence of increased CO$_2$ accumulation in the atmosphere. Our model indicates that there will be increased emissions and concentrations of CO$_2$. This will contribute to further acidification and lead to harsher conditions for coral reefs. Potential local mitigation will be scattered and unable to address the issue of ocean acidification effectively as a whole. Poleward migration of fish is another consequence of climate change (warming of surface ocean water) that has implications for the next indicator.

Based on lack-lustre success in global negotiations thus far, we forecast that putting a global action plan in place by 2020 is impossible, and all regions get a red rating. There are many indications that overfishing is ongoing, see also Figure 14.1. The world's fishing fleet continues to cover greater distances from their home base, and consequently bigger areas (see article linked to illustration). At present the subsidies in place provide incentives for development in the wrong direction. This results in increased pressure on available resources.
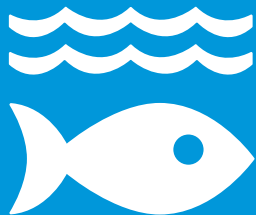
━━━━━━━━━━ **CERMAQ**

FISHING FOR SOLUTIONS

Life began in the ocean, and oceans remain vital to sustaining life on our plant. We invest a great deal of hope in their waters. We hope they will absorb the excess CO_2 we send into our atmosphere. We hope sea levels won't rise to flood coastal communities. We hope that the weight of plastic will not actually exceed that of fish in the world's oceans by 2050, as is currently predicted. We hope some corals will survive the bleaching effect of acidic waters.

The Intergovernmental Panel on Climate Change (IPCC) asserts that the three principal impacts of climate change on the world's oceans – warming, oxygen depletion, and acidification – will substantially alter ocean ecosystems.

The WWF Living Planet Index (LPI) for marine populations, which is based on trends among 1,234 marine species and prepared together with the Zoological Society of London, shows a decline of 49 % between 1970 and 2012.

Yet despite the threats from pollution, acidification and overfishing, we still hope that our seas and oceans will help feed the more than 8 billion people that will call this planet home in 2030.

Per capita consumption of fish has doubled the since 1960, and fish is the major source of protein for over 3 billion people. But the global catch hasn't increased much since the late 1980s, and we're now in a position where a third of marine fish stocks are overfished at biologically unsustainable levels (FAO, 2010). Can aquaculture close the gap and ease the pressure on wild fish?

For the sake of the planet and its people, one hopes so, but there are environmental sustainability concerns, including the sustainability of fish feed in aquaculture, genetic dilution of wild stocks, destruction of mangroves, and impacts on sensitive coastal areas.

"These are difficult but not insoluble challenges", says Cermaq's CEO, Geir Molvik. He shared his views about the state of the industry.

Assessment

Although he basically subscribed to DNV GL's assessment, Geir Molvik stresses that, "Overfishing in international waters is extremely concerning. As the world's largest fish vendor, our parent company, Mitsubishi, has

GEIR MOLVIK
CEO Cermaq Group

Cermaq is one of the world's largest salmon farmers, with sales of over 160,000 tons of fish each year, equivalent of more than 2 million meals every day. The Business Idea of Cermaq is to bring sustainable salmon from egg to plate. The company is 100 % owned by Mitsubishi Corporation, headquartered in Norway, with operations in Norway, Canada and Chile, and employs some 4000 people. In 2015 Cermaq recorded revenues of the NOK 6.4 billion.

«Sustainably farmed salmon speaks to the majority of the SDGs. Fish farming is very local, which means it can provide jobs and economic development in the most remote areas in the world, and provide nutritious food to a growing world population.»

«Wild catch has not increased for a number of years and is unlikely to do so.
We may even be faced with a lower catch.»

some insight into the issue. The company purchases from different fleets, and Mitsubishi adheres to international rules and regulations."

"On the positive side, many nations have been very clever in regulating their wild stock. If you go back a few years, there was a lot of overfishing, but many countries have been able to manage the wildlife within their 200 km zone."

Molvik cites Norway's success with cod and herring, as well as the positive achievements that came from cooperation between nations around the Mediterranean. "Massive overfishing took out tuna in the Mediterranean, and there was a ban on tuna fishing for many years. Now tuna resources are recovering and they have started opening up again. It's not yet back to what it was before, but they are making progress."

Peru is another example. The country's vast anchoveta resource was being overfished, until a government agency, the Marine Institute of Peru (IMARPE), began to regulate it in a sustainable manner. "They managed this extremely well - so well that bodies from Canada and elsewhere now go to Peru to learn. So there are success stories, although there is still a way to go."

Cermaq solutions
Industrialized aquaculture has a significant potential for protein production. But can it do so while safeguarding life below water?

This century has seen a tremendous growth in the demand for salmon, in particular farmed salmon: Global farmed salmon production has increased with 134 % since year 2000 and 43 % only the last five years.

One way of reducing strain on the oceans and wild species is to have effective aquaculture that can be done at a cost lower than wild catch. The volume of Norwegian aquaculture has drawn level to that of wild-caught catch. "Wild catch has not increased for a number of years and is unlikely to do so. We may even be faced with a lower catch", says Molvik.

Fish farming has a low carbon footprint, and salmon farming compares favourably to other proteins, having a lower footprint than beef, lamb, or pork, and only marginally more than chicken.

Aquaculture is a relatively young industry. "In Norway it started in the late sixties, which makes it the same age as the oil industry," says Molvik. But in that short time the industry has seen major developments in genetics, sourcing fish oil, farming practices, and fish health. "We have developed a huge resource base in all important aspects of aquaculture."

To contribute to the global agenda of sustainable development, Cermaq has aligned its sustainability strategy with five SDGs where Cermaq can have the highest impact, including Life Below Water. Molvik furthermore sees Cermaq as a technology leader, which consequently places a responsibility on him and his colleagues to help global aquaculture become more effective. "Our success is twinned with the industry success. For example, we have leading sustainability programmes within Cermaq, and we are transparent about our results." Transparency and partnerships are key ways for Cermaq to influence sustainability developments globally and improve own performance.

Through the Global Salmon Initiative, Cermaq's partnerships with the UN-FAO helps to identify areas where the industry can help promote efficiency in fish farming. The technology transfer is not limited to farming practices, but includes disease management and feed as well.

"This is, in my view, probably by far the most effective thing we can do to eradicate world hunger, but it also has other sustainability aspects," says Molvik. "Fish farming is very local, which means it can provide jobs and economic development in the most remote areas in the world. And there is a multiplier effect; each small farm is in many ways a cornerstone business in the local community. So you can have more local protein production, which helps eradicate hunger locally, while creating small businesses."

Business contributions
International cooperation to regulate fishing in international waters is key. However, ensuring that people actually adhere to rules and regulations, along with effective monitoring and policing, is difficult. Molvik suggests that pressure should be put on people who buy fish products, so that they only buy from regulated companies that can demonstrate that they follow rules and regulations - both in terms of how they fish, and in terms of how they treat the species that they don't aim for.

"Here there is a lot of room for agreement," Molvik says. "Business can do a great deal in terms of only purchasing fish from producers that have certain certifications, such as the Marine Stewardship Council (MSC). ISO standards are the foundation of certifications and at Cermaq we are also involved in a number of others standards. We are also certifying our farming sites according to the Aquaculture Stewardship Council (ASC), an industry-specific standard with around 150 sustainability criteria.

"It is tough for an industry to relate to a multiple of standards, some of them are overlapping and some of them are narrower in their scope. Which is one of the reasons why in 2013 we decided as an industry to establish The Global Salmon Initiative (GSI), a leadership initiative of 14 salmon aquaculture companies". ∎

Global Salmon Initiative

Cermaq is a founder member of the Global Salmon Initiative (GSI), which encourages industry transparency in communicating sustainability performance by worldwide industry. The industry established GSI in 2013, and Cermaq's previous CEO, Jon Hindar, served as co-chair for 2 years.

"One of the things we decided in GSI is that, rather than run after a jumble of standards, we would get together and support ONE comprehensive standard, which is the one we certify by." That commitment comes at CEO level, making it what Geir Molvik calls a "pre-competitive collaboration".

Being a member of the GSI requires a strong commitment to sustainable farming practices, dedication of resources and time, and transparency in reporting." Any salmon farmer in the world can be a member. Today our members account for around 50 % of global production of salmon. Of course we'd like to have everyone on board, but you have to meet certain commitments which might be challenging for smaller companies." Those commitments include monitoring and reporting on all aspects of the business, from OHS and fish

health to impacts on local communities, but also engaging in the common GSI initiatives to address the sustainability challenges in the industry.

One such initiative is accelerating commercial development of Omega 3. The Global Salmon Initiative (GSI) launched a tender in 2015 for large quantities of oils rich in marine Omega 3 from novel sources, and this project is now taken over by the fish feed companies who will purchase the oil in the fish feed.

For both fisheries and aquaculture, the proportion of total catch that is discarded is generally considered a wasteful misuse of marine resources, and presents potential to increase the utilization of marine by-products to feed growing populations. Companies are increasingly utilising these by-products in the feed sector, for human applications such as Omega 3 in functional foods and dietary supplements, protein hydrolysates for bioactive applications, and medical food.

15 LIFE ON LAND

ROW   BRISE   CHINA   OECD   USA

«I think the target 15.2. is rated too optimistically, as I find it unrealistic that China, OECD and US will be able to restore degraded forests and substantially increase afforestation/reforestation. I believe these scores should be yellow, and not green. The proposed plans from the relevant countries do not imply that they are on track to reach these targets by 2020, although there are some positive signs in the right direction.»

Nina Jensen, WWF Norway

SDG15 is concerned with sustainable management of our terrestrial ecosystems, in a more densely populated and resource-taxed world. Many of the targets are not quantifiable. Forest area is a primary indicator for preserving ecosystems, and includes both conserving existing forest and re-establishing forest areas – these are summed up in the indicator on total forest area. We have also included a pure conservation indicator – the biodiversity measure.

Model input
The model gives input to the amount of cultivated land, which is not a direct indicator, but we use it to assess agricultural area and restoration of land. The model does not give input to the biodiversity dimension.

Regional considerations
The needed combination of efforts in development, growth, and restoration is a challenge in developing countries, but developed countries also face challenges in many areas of SDG15. The regions are classified according to expected similarities in economic development rather than geography and topography. In particular, BRISE is a very diverse region that contains both huge boreal forests in the north and rainforest around the equator, as well as urban and densely populated areas. Although there are large geographical variations within the regions, our assessment is based on average regional values.

Conclusion
BRISE and ROW achieve low scores on all indicators and are rated red. China, OECD, and USA are likely to achieve some targets and not others, and are given a yellow rating.
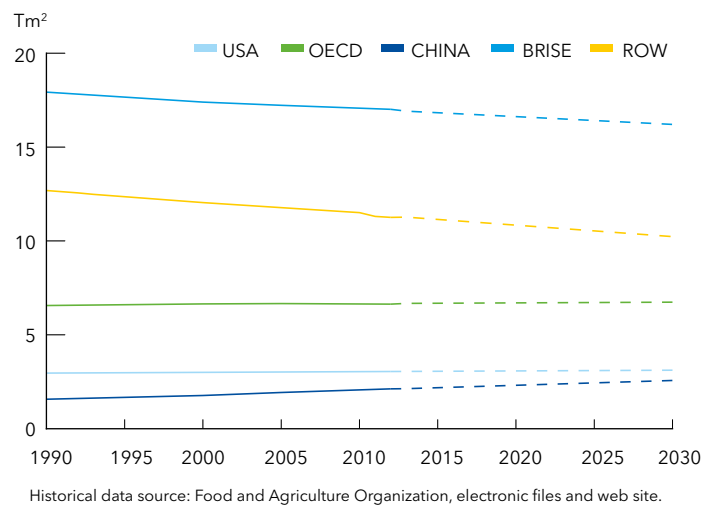

Historical data source: Food and Agriculture Organization, electronic files and web site.

Figure 15.1. Forest Area

Historical data source: Food and Agriculture Organization, electronic files and web site.
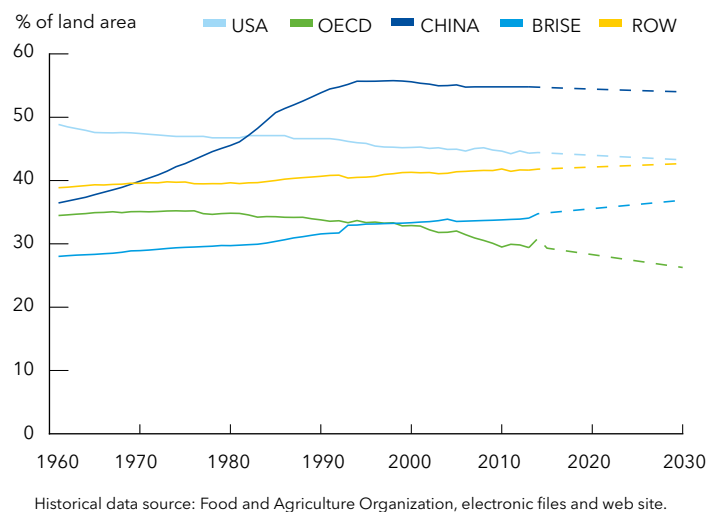
Figure 15.2. Agricultural Land

PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF
TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS,
COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND
DEGRADATION AND HALT BIODIVERSITY LOSS

Assessment details

For SDG15, we assess forest area, agricultural land,
restoration of degraded land, and the Red List Index.

TARGET 15.3

By 2020, promote the implementation of sustainable
management of all types of forests, halt deforestation, restore
degraded forests and substantially increase afforestation and
reforestation globally. *Indicator chosen: Annual change in
forest area.*

ROW	BRISE	CHINA	OECD	USA
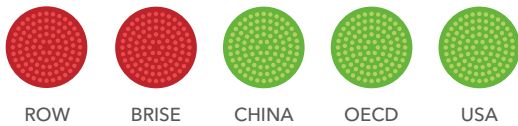
As seen in Figure 15.1, we forecast a marginal increase in
China's forest area. We expect USA and OECD to show
flat development, and as the target is mainly about halting
deforestation, these 3 regions get a green rating. Both
ROW and BRISE are on a clear, continued, downward trend.
Towards 2030 they may manage to turn this trend, but
the target only looks at the next 5 years.

Agricultural land area is a relevant indicator here, but does
not give as detailed a picture as needed. To compensate
for this, we have cross-checked with forestry data and the
results from our model. OECD has a strong decrease in
agricultural land and there is no net positive effect of any
restoration measures, and thus unlikely to reach the target.
Figure 15.2 illustrates the previous and expected trend.

TARGET 15.3

By 2030, combat desertification, restore degraded land and soil,
including land affected by desertification, drought and floods,
and strive to achieve a land degradation-neutral world. *Indicator
chosen: Agriculture land/ restoration of degraded land.*

| ROW	BRISE	CHINA	OECD	USA
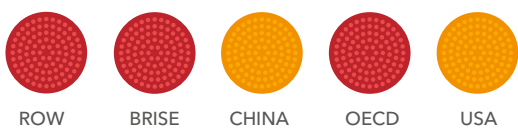
Both BRISE and ROW increase their agricultural land.
This is supported by our model that confirms the additional
cultivated land statistics. The indicator on forest shows
a reduction, indicating that the net increase does not
come from restoration of degraded land, but rather from
deforestation. Ongoing water stress and overgrazing could
also contribute to continued degradation of land, even
if the total area has increased. We assess that BRISE and
ROW are unlikely to reach the target. Both China and USA
are close to maintaining their total agricultural area while
simultaneously increasing their forested area, and may
reach the target.

The Red List Index shows that all regions have difficulties
maintaining biodiversity at existing levels. The number of
threatened species has increased continuously over recent
decades and this trend is forecast to persist, even beyond
2020. The uncertainty on this rating is lower than the
uncertainty on the other two indicators.

TARGET 15.5

Take urgent and significant action to reduce the degradation of
natural habitats, halt the loss of biodiversity, and, by 2020, protect
and prevent the extinction of threatened species.
Indicator chosen: Red list index.

ROW	BRISE	CHINA	OECD	USA
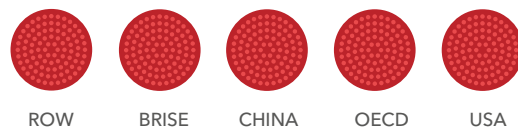
APP

PLUNGING TO ZERO DEFORESTATION

With its headquarters in Indonesia, the world's fourth most populous country and one of the fastest-growing economies, and with dozens of pulpwood suppliers managing concessions of 2.6 million hectares of forests, APP is at the nexus of challenges around the sustainable use of natural resources.

Tropical forests hold large stores of carbon, are packed full of important biodiversity, and are critical for millions of people who depend on forests for their livelihoods. But as Greenpeace points out, "Companies that have been converting tropical forests to plantations for commodities like palm oil or paper have come under increasing pressure to prove their operations and supply chains are not causing deforestation" (Greenpeace, 2016).

After years of pressure from communities, NGOs, stakeholders, and the media to address forest management issues, including deforestation of peat and natural forest, and conflict with communities in their concession areas, APP launched their Forest Conservation Policy in February 2013. This committed the company to zero deforestation. In just over three years they have won the approval of some of their most ardent former critics.

APP has chosen to meet critics head on, adopting a strategy of continuous engagement and 'brutal transparency' and says it is now in an industry leading position in developing a new business model to meet the challenges of sustainable development. We spoke to APP's Managing Director of Sustainability & Stakeholder Engagement, Aida Greenbury.

Assessment

"It's very clear from DNV GL's assessment that it will be challenging to meet this SDG, for a mixture of reasons," says Greenbury. "But I've seen a lot of progress in the last five years, and growing leadership from many countries. Our president in Indonesia made a clear commitment that there will be no further exploitation of peat land - that is a huge step, which we're supporting with our policy on no-deforestation, and on responsible peat land management."

However, Greenbury feels that DNV GL underestimates the role of the private sector in maintaining momentum in the anti-deforestation movement. "Businesses are seeing the need and the logic for business models and consumption patterns that are not harmful to ecosystems. These are not just developing countries' issues; we see changes now coming in many countries. For example, there are initiatives in the UK that are focusing on re-wilding and protecting peat land.

AIDA GREENBURY
Managing Director of APP Sustainability & Stakeholder Engagement

As one of the world's largest pulp and paper companies, Asia Pulp & Paper Group (APP) operates across Indonesia and China with an annual combined pulp, paper, packaging product and converting capacity of over 19 million tonnes per annum. APP is committed to a journey that places sustainability at the heart of their operation, acknowledging the challenges that lie ahead. Today, APP markets their products in more than 120 countries across six continents and employs 37,951 people. In 2015, APP recorded revenues of US$ 5.7 Bn.

«The question is not *whether* SDG 15 is attainable. It is a question of how quickly we can achieve it, it is a question of survival.»

"We need to work together to find solutions to make sure that these ecosystems remain intact. The responsibility lies with all of us. The producers of commodities, the consumers of those commodities, as well as governments."

Greenbury believes that APP's journey is proof that this is possible. "For us it is not a question of feasibility, it is a question of survival. Not just for our business, but also for our country and for the world."

APP solutions

In June 2012, APP published its 'Sustainability Roadmap Vision 2020', which placed sustainability at the centre of every operation. In 2013, they published their Forest Conservation Policy, and committed to 'zero deforestation' and an immediate end to all natural forest clearance throughout their supply chain. They were the first Indonesian company to put their concession maps and suppliers online for public scrutiny, inviting NGOs and stakeholders to oversee implementation of the policy and monitor APP's progress.

One of those partners is The Forest Trust (TFT), who calls APP's efforts "one of the most ambitious commitments ever made in forestry history." APP is the first to admit that it is a company in transition. Greenbury describes Zero Deforestation not so much as a policy but a tool to help APP and others develop a new business model built around sustainability. "The issues for us are climate, conservation, community, and commerce, and we are determined to find a way to enable these four to thrive in harmony with each other." When they began their transformation process, APP had no roadmap. Greenbury described the feeling as jumping off a cliff and hoping to grow wings on the way down. "It was rather crazy but it requires crazy people to achieve what seems to be impossible!"

Assistance came from many quarters, including TFT, which helped APP broker the deal that saw them commit to Zero Deforestation, and immediately ceasing all natural forest clearance in its operations. "Having previously campaigned against APP, the NGO community was pleased, but sceptical," says TFT. "Action on the ground and transparent progress reporting is helping to build NGO relationships. After a decade-long campaign against APP, Greenpeace is recognizing the work being done with TFT to conserve forests and respect the communities living and working within them." (See case study.)

In spite of all this, APP still faces criticism – for example during the fires which raged in Indonesia in 2015, some of which occurred in lands controlled by APP's pulpwood suppliers. APP's response was transparency. "Be open with your issues. Be transparent. Don't hide your problems. And call out for assistance if you need it," Greenbury says. "We publish grievances, complaints and criticisms and give our response. If we can't solve the problems ourselves we reach out to others who might be able to help us."

Five years ago, Greenpeace was one of Greenbury's harshest critics. "We talked and found common goals and now Greenpeace is becoming our biggest ally in implementing our zero deforestation commitments. The same applies to communities or shareholders - if you think

their interest is conflicting the best thing is to sit down with them, find common goals and move forward."

Greenbury believes the company is on the right track. There are many measures that can be cited, but Greenbury's 'tiger barometer' is perhaps the most striking. "Before we implemented our deforestation policy, our suppliers used to convert natural tropical forests into pulpwood plantations. I used to receive calls 24/7 about animal/human conflict in concessions – such as human and tiger. Since our suppliers stopped converting natural tropical forests I have not received one call of complaint about human-tiger conflict. I think that is a very strong message."

Business contributions

Greenbury believes the only way forward is through cooperation between businesses, communities, NGOs and government. "The further we have gone in implementing our Forest Conservation Policy, the more we have realised that ending deforestation and restoring degraded landscapes cannot be achieved by private sector actors alone – all hands across the landscape are needed. This means partnering with others who are working to implement similar policies with our shared objectives. But it also means talking to those with opposing views and understanding the different types of land use and pressures on forests across the landscape."

For this to happen effectively requires a radical new business model, which, in turn, will require significant investment. APP has invested more than 200 million dollars in the last three years to set its own building blocks in place: ceasing natural forest conversion, mapping natural forest and peat lands, identifying best management practices, and engaging with communities to develop their livelihoods and increase their income without damaging the environment.

"We have invested quite a lot in order to build this new business model, and we have made sure we are not doing it alone. Every programme we run involves many stakeholders, not just communities but also scientists from around the world, local and national government authorities, and other private sector companies with aligned interests."

Greenbury highlights a few key areas that she thinks will make the difference in achieving SDG 15 – being climate finance and greater consumer responsibility. Greenbury has raised her voice for a coordinated mechanism to unlock global finance. "How can we unlock the funding that has been promised and turn the promises and rhetoric into impact on the ground, that is felt by the community and felt by the forest?" It starts with bringing the private sector into the fold and putting in place both incentives and regulation that will facilitate greater private sector investment.

Greenbury would like to see a "standard of expanded consumer responsibility." Most of all, she says, we need action. If consumers demand it – from both their governments and companies, a swift shift can happen. "We need more communication, more campaigns, more advocacy to influence the needed changes in policies to protect biodiversity." ■

The High Carbon Stock approach

All natural forest is valuable, but some areas are more valuable than others. The High Carbon Stock (HCS) approach distinguishes viable natural forest areas from degraded lands (former forest) that now contain only small trees, shrubs or grasses. In addition to storing a lot of carbon that would be released if converted into plantations, HCS forests invariably have rich biodiversity values. Other HCS areas, like peat land, hold vast amounts of soil carbon – usually significantly more carbon than that stored by primary forest – and are ecologically sensitive. By contrast, non-HCS areas can be prioritized for plantations and other development in consultation with local communities.

The HCS methodology was originally developed by Greenpeace, The Forest Trust (TFT) and Golden Agri-Resources (GAR), and is now governed and further refined by a multi-stakeholder body called the High Carbon Stock Approach Steering Group – in which APP is a key participant.

"How do we support communities living on peat land, but at the same time protect those areas? This was an impossible question five years ago but now it is possible," says Greenbury. In this half decade APP has worked closely with many experts and NGOs. "We have tried to use science as the basis, including the High Conservation Value / HCS approach, while respecting the land use rights and livelihoods of traditional communities."

"We are not there yet, but we have taken big steps by making the HCS approach a part of our new business model," says Greenbury. "We conducted one of the world's largest HCS assessments, we used LiDar (light detection and technology) to map 4.5 million hectares of peat land, and we have shared this information with the public. We've also followed the HCS approach in order to develop Integrated Sustainable Forestry Management Plans in each of the areas where our pulpwood suppliers have concessions. As a result of the combination of science and community engagement in each of the ISFMPs, we have increased conserved forest area by as much as 35 percent, without negatively impacting livelihoods."

Grant Rosoman, Forest Campaign Solutions Coordinator for Greenpeace in South Asia has worked closely with APP. He says the "HCS approach is now a practical and robust tool used by plantation companies that have made a commitment to exclude deforestation from their supply chains."

16 PEACE AND JUSTICE

ROW	BRISE	CHINA	OECD	USA

SDG16 addresses a divided world, where some regions enjoy sustained levels of peace, security, and prosperity and others fail to move out of a cycle of conflict and violence. It is a comprehensive goal, with targets that are hard to quantify. Even when quantification is possible, different and deficient data sets preclude within- and between-region comparisons.

Model input
The model gives no input to this goal, except the general input on reduced equalities between regions.

Regional considerations
The dimensions of SDG16 are relevant for all regions, but addressing them is often more challenging in developing countries. Conflict and insecurity are linked to poverty eradication and sustainable development. Marginalized countries and populations are generally more affected by violence. For many of the poorest countries in the world, violence and insecurity hinder poverty reduction and achievement of economic growth. By 2030, 75 % of people in extreme poverty will live in countries at risk from high levels of violence.

Conclusion
ROW and BRISE score high on both violence and corruption, and get a red rating. USA and OECD get a rating of yellow on both targets. China is borderline and also gets a yellow rating. All assessments here have high uncertainty, but the challenges seem overwhelming for the LDCs.
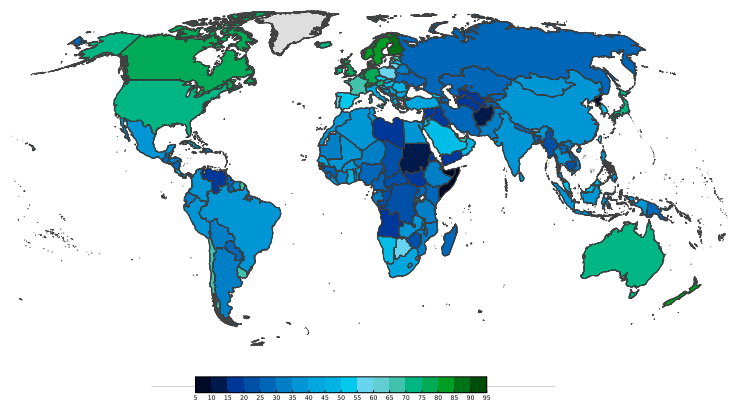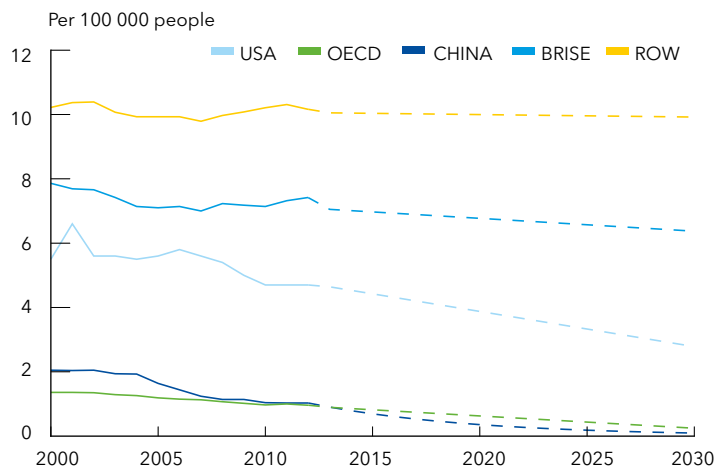

Figure 16.1: Corruption perception index 2014 (Transparency International, 2015)

Per 100 000 people

Historical data source: United Nations Office on Drugs and Crime

Figure 16.2. Homicides per 100 000 person-years.

PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL AND BUILD EFFECTIVE, ACCOUNTABLE AND INCLUSIVE INSTITUTIONS AT ALL LEVELS
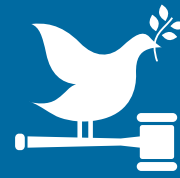
Assessment details

This goal is very broad, with many dimensions. For this assessment, we chose to provide forecasts for two targets where we have the best available data and that also represent two of the key issues, violence and corruption. Many of other relevant targets do not have quantifiable indicators or data availability is very limited.

TARGET 16.1

Significantly reduce all forms of violence and related death rates everywhere. *Indicator chosen: Violent injuries and deaths per 100,000 person-years.*

ROW	BRISE	CHINA	OECD	USA
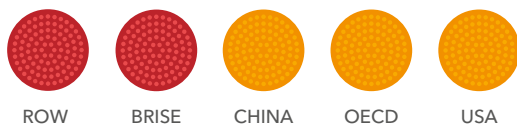
Looking at the rate of change and the forecasts, violent deaths are not estimated to reduce 'significantly', as demanded by the target. In fact, violent deaths are projected to remain relatively steady, with worryingly high numbers, e.g., in Brazil, the country with highest absolute number of murders in the world, 56,000 people were killed violently in 2012; in South Africa the homicide rate from 2014 was around five times higher than the 2013 global average; and in USA, the number of homicides in 2013 was 4.9 per 100,000 (more than six times higher than in the average developed country) (Attree and Moller-Loswick, 2015). Among violent deaths, 75 % are projected to occur in Latin America and the Caribbean, sub-Saharan Africa, and South Asia. We interpret green rating and significant reduction here as 50 % reduction, with yellow closing half the gap, i.e., 25 % reduction. The three regions with the lowest figures are also the ones with the largest reduction, although not 50 %. USA, OECD, and China therefore get yellow rating. ROW and BRISE have the least improvement and get a red rating.

TARGET 16.5

Substantially reduce corruption and bribery in all its forms. *Indicator chosen: Perception of public sector corruption.*

ROW	BRISE	CHINA	OECD	USA
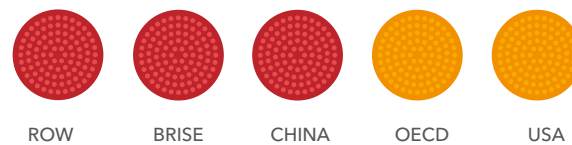
Corruption is at the forefront of public consciousness, thus ensuring that business practices of large organizations and companies are under ever-increasing scrutiny around the world. The perception of public corruption is improving in all regions. Factors influencing corruption are weak rule of law and lack of institutional capacity. This undermines efforts to fight rooted systems of patronage, while exposure to corrupt public officials and a reliance on third party agents is also higher (Verisk, 2015). In USA and OECD, the perception of corruption in general is relatively low. It is improving in OECD, and while relatively flat in the USA in the last years, the situation is expected to improve before 2030. Thus, in 2030 both regions get a yellow rating. Though perception has improved in China, and the regime is now taking measures to reduce corruption, the level is high, and is not yet on track to close 50 % of the gap to where they should be, hence the red rating. BRISE and ROW are improving very slowly from a low level, and get a red rating.

CALVERT

GOING LONG ON VALUES

Our world is a divided one. Some regions enjoy sustained levels of peace, security, and prosperity, while others fail to move out of a cycle of conflict and violence. Promoting peaceful and inclusive societies for sustainable development will rely on effective, accountable, and inclusive institutions.

Can the private sector help? As a trailblazing social investor, John Streur, CEO at Calvert Investments, certainly believes so. For him, the minimum requirement is the expectation that corporations behave in a responsible manner. However, investing for financial and social return means that Calvert seeks out companies that show positive leadership in improving environmental and societal outcomes, and actively works with companies to enhance their impact. This includes impacts in areas that pertain directly to this SDG such as civil rights, conflict minerals, labour conditions, diversity and corruption.

Assessment

"If the world carries on with business as usual, then I see the same outcomes as DNV GL – in other words, a pervasive failure to achieve the SDGs," says John Streur. "But that is why I am running this particular company: we are trying to change business as usual!"

We are living in a global capitalist system, in which the activities of corporations have a significant impact on the lives of virtually everyone on the planet. "If we are unable to improve those behaviours", says Streur, "the implication is that, based on this forecast, we will not significantly improve the security and the opportunity for the part of the population that is least able to benefit from our global capitalist system."

Connecting corporate activity to positive societal outcomes is a critical function of the capital markets. The strength of this connection should be priced into capital markets, and investors should have to take this into consideration. "Because if we don't get this right our global capitalist system certainly won't achieve its potential, and most would say that the system itself will become unstable."

The business of connecting corporate behaviour to capital markets is happening, but not fast enough for Streur. He believes there are potentially significant changes in societal norms that could establish a degree of variance with forecasts like DNV GL's. But there is also inertia. "I don't think the situation is hopeless, but I do think time is running quite short and that change needs to accelerate."

JOHN STREUR
President and Chief Executive Officer, Calvert Investments Inc.

Calvert Investments is a global leader in responsible investing. Calvert is one of the largest responsible investment companies in the United States, operating from the foundational belief that investment performance is inextricably linked to responsible corporate behaviour. As of December 31, 2015, the company had $12.2 billion in assets under management. Headquartered in Bethesda, Maryland, Calvert has just over 100 full-time employees.

«What do we need to do to make DNV GL's forecast too pessimistic? Essentially, we have to connect capital markets to the SDGs.»

«We attempt to account for the full set of impacts that a company has on society, and on the environment, and incorporate that into our investment decisions.»

Calvert Solutions

Calvert is a global asset manager that pursues what Streur calls a fairly advanced form of responsible investing. "We attempt to account for the full set of impacts that a company has on society, and on the environment, and incorporate that into our investment decisions."

The acronym ESG stands for 'environmental, social and governance factors' and is shorthand for the non-financial factors that Calvert and other values-based investment companies incorporate into their investment decisions. Calvert specifically seeks companies with business practices that solve the most difficult challenges that society faces, and who do so with a high degree of transparency and in a manner that makes financial sense.

"In addition to having built the research systems to do that, we also have an engagement process whereby we work with company management on changes that we would like to see, both in their transparency and in their business practices, including governance structures. Where necessary we file shareholder resolutions to bring them to account."

Calvert is in the process of mapping the SDGs to the Sustainability Accounting Standards Board (SASB) material ESG indicators, seeking to establish a set of standards that companies should meet in terms of environmental social governance disclosures and essential practices.

"By mapping the SDGs to SASB standards, we will have created a tool for ourselves and ultimately for other investors, to be able to identify how companies are doing with regard to actually moving society forward, and potentially integrating that into security prices."

Business Solutions

There are many things that businesses can do that would contribute to Peace and Justice to help those most in need, particularly involving worker exploitation in the global supply chain.

According to the 2015 Global Slavery Index, there are close to 46 million people living as slaves; standards and an audit process within corporate supply chains are extremely important.

Beyond this, Streur says, security, peace, and stability for those most in need is fundamentally dependent on access to clean water and sanitation. Even within relatively stable regions, there are real challenges to very poor people who don't have access to basic sanitation and clean water. "That is something that corporations certainly have a hand in."

Access to safe, cheap, clean energy is another critical factor essential to moving peace, stability, and security forward in the long term. "Certainly if you understand the difference between regions in which the concentration of power is also associated with oil, versus regions where it is not, there is a correlation there," says Streur. "So I think that nexus between energy and water, combined with the right metrics to measure any corporate policy and contribution, is very important in order to achieve this particular goal."

Connecting information streams to security prices is another essential business function. Streur sees a world where a company's quarterly earnings report is accompanied by mandatory reports on its performance against the various SDGs. That vision is fast becoming reality. "Capital markets are beginning to connect with these issues - once that happens, everybody cares." The ultimate goal, of course, is that all investing will become 'responsible' investing. ∎

Advocating for extractives revenue transparency

Investors in the securities of oil, gas, and mining companies face a range of challenges, from volatility in commodity pricing to acute social, political, and regulatory risks related to natural resource extraction in countries with poor governance.

"Whether it is the threat of production disruptions in the Niger River Delta, nationalization or abrupt changes of tax policy risks in Venezuela, or tenuous license to operate in Guatemala, project-specific social and political risks are becoming more significant as companies push further into the frontiers of petroleum and mineral exploration," says Stu Dalheim, Vice President, Governance and Advocacy at Calvert Investments.

Calvert has advocated for regulation that would require extractives companies to disclose the payments they make to governments. Transparency not only helps investors make better decisions about the stability of oil, gas, and mining operations around the world, but can also help the people of resource-rich developing countries demand a more equitable distribution of their mineral wealth.

From May 2008, when they were first introduced in the House of Representatives, Calvert was a strong advocate for amendments to the Securities Exchange Act of 1934 ("Exchange Act") mandated by Section 1504 of the Dodd-Frank Act. Calvert took a leading role in engaging Congress, other investors, industry representatives, and allies in the

"Publish What You Pay" coalition in building the case for greater disclosure of extractive industries, payments to governments of domicile countries.

On June 27, 2016 the Securities and Exchange Commission (SEC) voted to enact a rule to implement section 1504 of the 2010 Dodd-Frank Act, which requires oil, gas, and mining companies to report their payments to governments by project in every country of operation.

Calvert's work on section 1504 helped to set the baseline for mandatory disclosure requirements that have developed internationally. Parallel disclosure requirements are now on the books in the EU, Canada, and Norway. With the SEC approval of the implementing rule for Section 1504, the global transparency standard for the extractives sector extends to the United States, the world's largest extractives market.

Throughout their advocacy campaign, Calvert acted as the leading investor, coordinating many other institutional investors, working with NGO allies and Senate and House offices, and engaging with and debating extractives companies about the regulatory reform.

"It is wonderful example of investor and stakeholder interests aligning. While these are the kinds of examples we are seeing more and more often, the degree of alignment is unusual in this case," says Dalheim.

17 PARTNERSHIPS FOR THE GOALS

ROW   BRISE   CHINA   OECD   USA
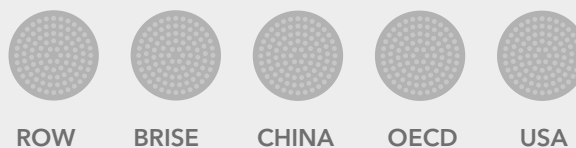
«I like the proxy «tax revenue» for domestic resource mobilization. But I am not convinced at all that ODA is a good one. A way out would be the construction of a new proxy that captures «good will» and willingness for cooperation.»

Georg Kell, Arabesque

SDG17 is very comprehensive and divided into 17 targets, covering areas such as technology, trade, policy, and partnerships. One aim is to enhance North-South and South-South cooperation by supporting national plans to achieve all the targets. Sustainable development requires partnerships between governments, the private sector, and civil society. These partnerships require common principles and values, and a shared vision and goals that place people and the planet at the centre, at global, regional, national, and local levels.

Model input
The DNV GL model does not give input to this SDG.

Regional considerations
The world today is better connected than ever. Throughout the globe, we witness the establishment of new partnerships for supporting developing countries to promote their international trade, but also achieving fair and just trade (UN, 2015). Furthermore, international partnerships to enhance community engagement for human rights play an important role in low and middle-income countries.

Conclusion
For this goal we chose to not give an overall rating for the regions. We have found two indicators that describe part of the goal, but the goal is very complex and has so many dimensions, that in our opinion they do not give a good enough representation to assess the overall goal.
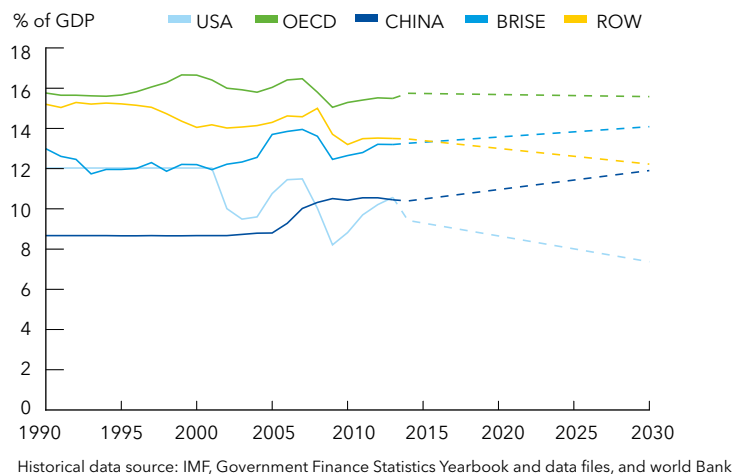

Historical data source: IMF, Government Finance Statistics Yearbook and data files, and world Bank

Figure 17.1. Tax Revenue as percentage of GDP
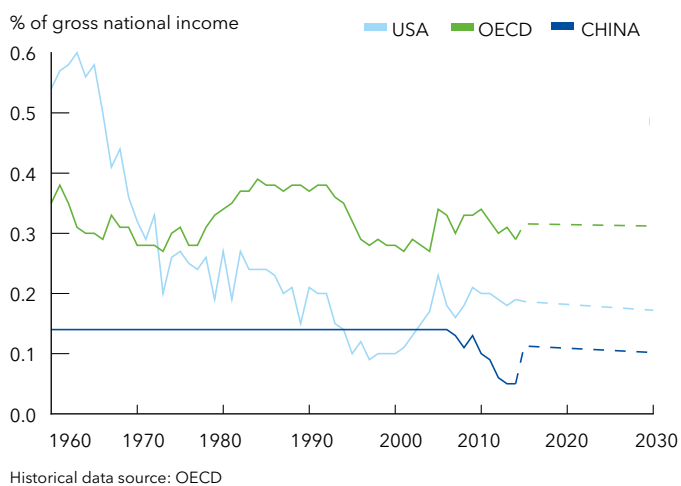

Historical data source: OECD

Figure 17.2. Net official development assistance.

STRENGTHEN THE MEANS OF IMPLEMENTATION
AND REVITALIZE THE GLOBAL PARTNERSHIP FOR
SUSTAINABLE DEVELOPMENT

Assessment details

SDG17 has a number of targets, but most of them are almost impossible to measure. The most easily quantified target is 17.1 on tax revenue and 17.2 on Official Development Aid.

TARGET 17.1

Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection. *Indicator chosen: Tax revenue as share of GDP.*

ROW	BRISE	CHINA	OECD	USA
🔴	🟢	🟢	🟠	🔴
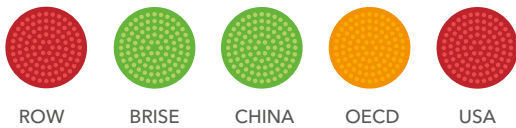
Strengthening governmental financial tax revenues will strengthen domestic resource mobilization capacity. Other governmental revenues are also relevant, but the quality of the data is poor. The target is not quantified, and we interpret a positive development as green, flat as yellow, and negative as red. We lack solid input to argue that the regions will deviate from their current trends (illustrated in Figure 17.1). These show a positive development in China and BRISE, flat development in OECD, and negative development in ROW and USA. It should be noted that for China, it is hard to measure tax revenue, as a lot of governance income comes from state owned enterprises.

TARGET 17.2

Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 % of ODA/GNI to developing countries and 0.15 to 0.20 % of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 % of ODA/GNI to least developed countries. *Indicator chosen: Official development assistance and net private grants as percent of GNI.*

ROW	BRISE	CHINA	OECD	USA
⚪	⚪	⚪	🔴	🔴
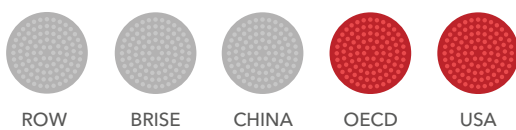
This target requests that developed countries commit to spending 0.7 % of GNI in official development assistance (ODA) to developing countries, of which 0.15-0.20 % goes to least-developed countries. ODA makes up more than two thirds of external finance for least-developed countries.

The expenditure on aid as a proportion of GNI can fluctuate substantially as it depends on political will. This is subject to national politics and policies that should be in alignment with international strategies for international aid. In this context, a global partnership is a prerequisite, showing coherent policy development. In the years 2000-2014, the ODA from developed countries increased by 66 % in real terms, and imports from least developed countries increasingly receive preferential treatment from developed countries (UN, 2015). However, as shown in Figure 17.2, as most developed countries do not devote 0.7 % of their GNI to developing countries, we do not expect they will reach this target by 2030. In fact, Figure 17.3 (OECD, 2015a) shows that the share of revenue going to LDCs is not increasing.

Only 5 of the OECD countries (Sweden, Luxembourg, Norway, Denmark, and UK) exceed the 0.7 % target today. Thus, we rate this target as red for USA and OECD. We do not rate China, as it is not categorized as a developed country. We have figures for a few other countries in ROW and BRISE that also are providers of development assistance, but they are scattered and cannot be considered representative, so they are not included in the figure. They are not rated as they are mostly developing countries.
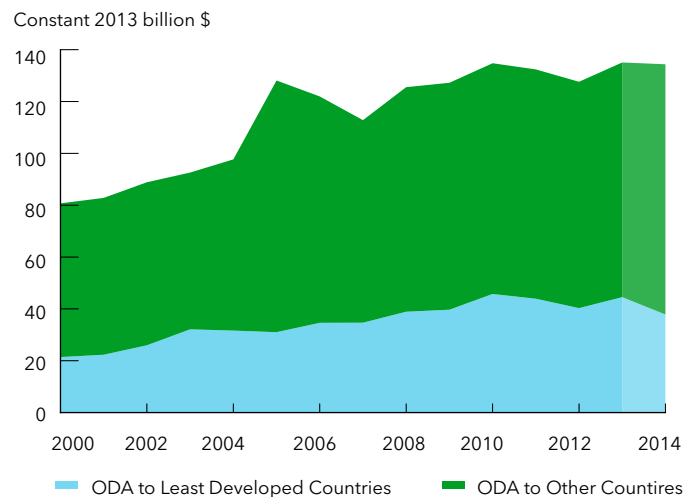

Data source: OECD

Figure 17.3: Share of Official Development Assistance (ODA) going to LDCs

———— UNILEVER

ALL TOGETHER NOW

There is a growing phenomenon of 'co-opetition' in the private sector – a challenging, but potentially very rewarding, mechanism for firms to address major technological challenges. Co-creation is also on the rise in technological, fast-moving markets, where innovation is a co-evolutionary process between innovative companies, their supply chains, and their customers. The stronger the links between the various parties, the more innovation is accelerated.

These collaborative mechanisms can boost collective impact from business for social change. Yet, partnerships can be messy, and the difficulties of managing them are proportional to the scale of the problems they are intended to solve. Within the private sector, it may be true to say that no company has been more active, visible, or successful in forging partnerships for sustainable outcomes than Unilever. We spoke to Rebecca Marmot, Vice President, Global Partnerships and the Unilever Foundation.

Assessment

"It is potentially scary," says Rebecca Marmot of the DNV GL forecast. "On the other hand, the forecast might jolt people into a greater sense of responsibility. I also like the way that readers can enter into your forecast at different levels, whether they have only a superficial understanding of the SDGs, or have been involved in developments with a particular interest in specific indicators that are relevant to them."

However, when it comes to progress on SDG 17, the real measures are the number and strength of the sustainable development partnerships between governments, the private sector, and civil society. These last two are not measured in the DNV GL report.

"The conversations I have had over the past months have been about a structural framework for partnerships, a lot around blended finance and what that means, and a lot around new partnership models and different ways of working. So many of the SDG indicators rely on private sector involvement in one way or another, and I think there is growing acceptance, even enthusiasm, for more involvement from the private sector," says Marmot.

REBECCA MARMOT
Global VP Partnerships
& Foundation, Unilever

Unilever is an Anglo-Dutch multinational consumer goods company, co-headquartered in Rotterdam, Netherlands, and London, United Kingdom. The company's purpose is to make sustainable living commonplace. Its products are available in around 190 countries and include food, beverages, cleaning agents, and personal care products. Unilever employs 172,000 people and recorded €53 Bn in revenues in 2015.

«It is no longer possible to have a strong, functioning business in a world of increasing inequality, poverty, and climate change.»

Paul Polman, CEO Unilever

Solutions

"Six years ago we launched a new Unilever sustainable living plan ('USLP'), which was really a direct response to our vision for how we can ensure that we are successful and competitive in this volatile, complex, and ambiguous world we live in," says Marmot.

The plan has helped Unilever increase the size of its business, while minimizing environmental impact and maximizing social impact. "Underneath that we have over 50 very tightly-bound and very specific targets, grouped into different areas of relevance to Unilever's business. It could be around WASH (water sanitation, hygiene). It could be about nutrition and around sustainable agriculture, livelihood, a big chunk on deforestation and climate change, the role of women, et cetera."

"My job is to create, and then lead, the global partnerships through my team that will help us to achieve the USLP. The key is to identify the right kinds of implementation partners."

She cites the example of how Domestos, a global toilet cleaner brand, teamed up with UNICEF, the UN agency with responsibility for WASH, in an effort to address the sanitation issues targeted by the Millennium Development Goals. "Although there was remarkable progress towards the MDGs," says Marmot, "sanitation was one of the areas that fell woefully short of the targets."

"The first thing we did was to design a programme that we could work on together to help make a very practical and tangible contribution towards the sanitation crisis."

Some 5 % of sales of Domestos now goes to UNICEF to help to fund the programme. "This enables us to talk about issues like open defecation and sanitation in a much more consumer-friendly way, because these are difficult topics for people to get their heads around."

The next step in the process, she explains, was to link the social impact activity specifically with the brand. "Where we put the social mission of a brand at the heart of what we do, it translates into good business sense. So all our brands that have a good social mission - brands like Ben and Jerry's, Dove, Domestos - are our fastest-growing brands because consumers want companies to lead them and help them make the right choices in a world of overwhelming choices."

Beyond social impact, and the related brand story, Unilever also spends a lot of time thinking about the kind of partners it should be working with from an advocacy and policy perspective. "With UNICEF we did a lot of work last year, really lobbying hard for an integrated WASH Goal for SDG 6," says Marmot.

A final and critical step in the partnership process is employee engagement. "Being able to put purpose at the heart of what we are doing is incredibly important to us in attracting and retaining the best talent."

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«We attempt to account for the full set of impacts that a company has on society, and on the environment, and incorporate that into our investment decisions.»

Partnerships

Paul Polman, Unilever CEO, is also a UN SDG Advocate with specific portfolio responsibility for SDG 17. He considers the SDGs to be "… a once in a lifetime opportunity to end poverty and tackle climate change … Transformational change requires transformational partnerships. Delivering the goals can happen only if business, governments, and civil society work together."

An example of this kind of partnership is the 'Transform' initiative by Unilever, the UK Government, and the Clinton Foundation following the launch of the SDGs in New York in December 2015. "In Transform there is a variety of cash, of time, and of people, to invest in social enterprise in developing and emerging markets to help solve WASH or energy-related issues," says Marmot. "I think the SDGs themselves have got people thinking and combining in new ways."

She cites new, blended finance models as an additional transformational area emerging in the wake of the SDGs. Funding from a variety of sources – private sector, grant capital, NGO, government, etcetera – backing special purpose vehicles or mini commercial entities. "This is a critical area for the private sector to address if we are going to meet the SDGs."

For Marmot, seeing the unity between the global goals of tackling poverty and climate change is paramount. "If you can't get the climate issue right, then the development issues by nature fall behind because so much of the impact of the climate is particularly felt in the developing and emerging economies."

This insight fuels the work of the "Champions 12.3", where Unilever is working with a coalition of leaders and organizations to achieve Target 12.3 – to halve per capita global food waste by 2030.

The Paragon partnership is another collaboration catalyzed by Unilever – with leading consumer brands companies and marketing research firms to help achieve the SDGs through collaboration, data sharing, and market research .

Marmot speaks about how the data crunching, insight-generating capabilities of the private sector can help to identify many business cases in the gaps targeted by the SDGs. This is the central aim of the Global Commission on Business and Sustainable Development, a group which

aims to quantify the business case for helping to achieve the SDGs. The Commission was pulled together by Paul Polman and now operates under the chairmanship of Lord Mark Malloch Brown. It will be releasing its first full report in January 2017 – and promises to be a milestone moment for the private sector and the SDGs.

Marmot offers a preview of the kind of issues the Commission's report will target: "I think for us the big thing we are talking about is not only sourcing from developing countries, which we have done for many years, but actually integrating small-holder farmers into our supply chain, because I think that is a great way to try and overcome some of the income disparities that exist and really boost peoples' lives in a sustainable way."

Unilever CEO Paul Polman was among those to address the UN General Assembly as part of the Global Compact +15 presentation. Photo credit: UN Global Compact/Marc McAndrews

THE FUTURE WE WANT

In 2015, DNV GL and UN Global Compact launched the report *"Impact: Transforming Business: Changing the World"* at the UN General Assembly. The report assessed the UN Global Compact's first 15 years and provided insights into business risks and opportunities related to sustainability.

In *Impact*, we said: "… more companies across the world need to engage … rethink their corporate purpose, and recalibrate their goals." That statement still holds true, but we see clear indications that the launch of the Sustainable Development Goals (SDGs) has accelerated progress in just 12 months.

These days it is hard to find a multinational company that is not engaged with the SDGs in some way. Many companies are calibrating their sustainability-related work with reference to the SDGs, for example, in their sustainability reporting. These are encouraging developments, but the even more inspiring step-changes that we are noticing are from those companies that are directly leveraging the SDGs to create value for their stakeholders. That is the business frontiers we cover in this publication.

What have we learned by engaging with people in the frontier companies?

A culture of optimism – the ability to see opportunities in challenges, and to act quickly and pragmatically on these insights. As one of the CEOs we interviewed asked: "Why see unemployed youth only as a problem? Why not explore the many ways they can represent an opportunity?" These are companies that practice what author Philip Binkley calls the magic of 'and' – i.e., the ability to deliver both growth and sustainability. These firms have transformed their business models to include elements from the circular and sharing economy, and have developed their businesses through cooperation and partnerships. This is why they often appear to be able to combine the best elements from seemingly competing concepts.

The power of connectedness – many of the solutions that the frontier companies are rolling out are related to, or build upon, the dramatically increasing connectedness in the world. They are using, in particular, mobile-based solutions that enable end-users to leapfrog knowledge-related barriers to development. Embracing the social role

of technology in ways that allow companies to co-innovate with consumers and suppliers in near-real time is a defining feature of the age of digitalization; it also has profound effects on the sustainability of supply chains and in creating new forms of demand in under-served markets. Digital solutions not only create efficiency potentials, but are paving the way towards greater transparency.

What people want – the SDGs are the most comprehensive description yet of the future that humanity desires. In some ways, the SDGs represent the greatest piece of market research ever. Those companies who use the SDGs as an approach to understanding current needs and anticipating future ones, and who then bring a service mind-set to the market demand arising from those fundamental needs, seem to be those companies that are not just at the forefront of sustainability thinking, but are the market leaders in their industries. They are also the companies most likely to enjoy regulatory and policy support, and most able to participate in successful public-private partnerships.

Failure is not an option
In DNV GL, we will continue to dedicate our resources, competencies, and knowledge towards our vision of "Global impact for a safe and sustainable future". For us, the SDGs describe the kind of future that we are working towards and that we desire. The phrase "failure is not an option" may conjure up images of Ed Harris in the control room of Apollo 13 (the film), but also illustrates very succinctly how the frontier companies featured in this publication are tackling the SDGs – with urgency, but without panicking. These companies are systematically deploying their very best minds towards solving seemingly insoluble problems, to weighing and considering all of the options, except one – failure.

Because there is no Plan B for Spaceship Earth.

Bjørn Kj. Haugland
Chief Sustainability Officer
DNV GL

Clockwise from top left (courtesy of globalgoals.org): **Qiciao and Qixi, a pair of giant panda twins**, inspect a flag to represent SDG 7, raised at the Chengdu Research Base of Giant Panda Breeding in China. Credit: Mr. Yuan Tao and Ms. Yan Lu. **A child from the Zaatari Refugee Camp** raised a flag to represent SDG 6 in Jordan. Credit:unicefjordan/badran. Free diving world champion Umberto Pelizzari, raised a flag to represent SDG 14 off the coast of Formentera. Credit: Enric Sala. **A flag to represent SDG 11**, is raised in Sydney, Australia. Credit: Shane Thaw

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And credit to all our DNV GL colleagues throughout the world, connecting the project team to the 17 frontier companies

WHAT ARE YOUR THOUGHTS?

We encourage our readers – both inside and outside DNV GL – to interact with our forecast model and to give us your view on Spaceship Earth.

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