ClimateActionTracker

For the Talanoa dialogue: Steps towards global decarbonisation in key emitting sectors

Second Input from the Climate Action Tracker

29 October 2018

Summary

The Climate Action Tracker (CAT) is pleased to submit another input to the Talanoa Dialogue in an answer to the Dialogue's "How do we get there?" question.

This submission assesses sectoral progress toward decarbonisation on a global level and outlines concrete steps that can be taken in key emitting sectors to bring emissions in line with a Paris Agreement compatible pathway: electricity generation, passenger and freight road transportation, buildings envelope and appliances, heavy industries and agriculture.

The key climate actions highlighted in the paper are:

- **Electricity generation:** phase out coal and unabated natural gas and increase the share of renewables
- **Road Transportation:** accelerate deployment of zero emission vehicles
- **Buildings:** Implement and enforce building codes with high energy efficiency standards and incentivise deep renovation rates
- **Industry:** decarbonise through electrification, innovation, new products and processes
- **Agriculture:** reduce waste, shift to healthy diets, farm efficiently

The CAT submission is based on our sectoral analyses that illustrate required pathways for safeguarding the global temperature limit and on our tracking of decarbonisation progress through our data portal. The portal tracks 41 sectoral indicators for 34 countries and the world and compares projected (I)NDC and current policy pathways with national and sectoral decarbonisation rates consistent with the Paris Agreement.

CAT assesses countries' mitigation targets and actions and aggregates them at the global level. In the spirit of the Talanoa Dialogue, this submission focuses on global progress. More information on individual countries is available on our website www.climateactiontracker.org.

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Introduction

The CAT's March 2018 Talanoa Input focussed on the aggregate effect of countries' current policies and pledges, illustrating "Where are we?" in comparison to "Where do we want to go?". We stressed that the majority of pledges assessed by the CAT are not in line with a fair contribution to meet the Paris Agreement's long-term temperature limit. The full implementation of current Paris Agreement commitments would lead to a median global temperature increase in 2100 of 3.2℃, and currently implemented national policies would lead to a temperature increase in 2100 of 3.4 ℃. We will announce an update of our warming projections during COP24.

The recently published IPCC 1.5℃ Special Report highlights the need for deep reductions and urgent action in all sectors (IPCC, 2018), to limit temperature increase to 1.5℃. All key emitting sectors—energy systems, transport, buildings, industries and agriculture—have to strengthen and accelerate decarbonisation efforts so that global emissions start to decline by, latest, 2020. Total carbon dioxide emissions must be cut in half by 2030 compared to 2010 levels and reach zero around 2050. Total greenhouse gas (GHG) emissions overall need to be 40–55% below 2010 by 2030, 80–95% below 2010 by 2050 and reach global zero roughly in the 2060s (IPCC, 2018).

The IPCC report highlights the advantages of early action for sustainable development benefits, poverty alleviation, health, and access to clean energy. The Climate Action Tracker has analysed important steps to accelerate efforts in key sectors.

This briefing focuses on the Dialogue's "How do we get there?" question, evaluating sectoral progress toward decarbonisation on a global level and suggesting concrete steps that can be taken in key emitting sectors to bring emissions in line with a Paris Agreement compatible pathway.

In this briefing, we look at key sectors and sub-sectors that represent a large share of overall GHG emissions or CO_2 emissions from fuel combustion (as illustrated in Figure 1) and that are key for the transition to a low-carbon economy: **electricity generation** (42% of CO_2 emissions from fuel combustion), **passenger and freight transport** (total transport sector equals 24% of CO_2 emissions from fuel combustion), **buildings envelope and appliances** (8% of CO_2 emissions from fuel combustion), **industries** (19% of CO_2 emissions from fuel combustion and processes accounting for 9% of GHG emissions) and **agriculture** (13% of GHG emissions).

The briefing builds on recent CAT sectoral analysis (refer to references below) and recent findings from the IPCC 1.5°C Special Report (IPCC, 2018).

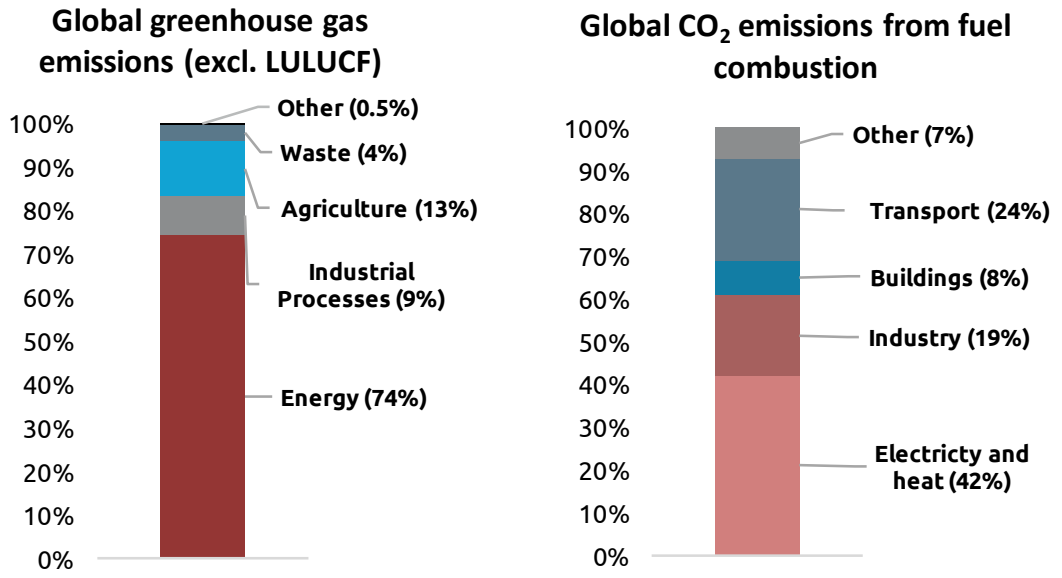

Figure 1: Sectoral contributions to global greenhouse gas emissions (2015) and global CO_2 emissions from fuel combustion (2016), which make up part of global GHG emissions from energy (Gütschow et al., 2018; IEA, 2018a).

Assessment of sectoral progress and required steps forward

Electricity generation: phase out coal and unabated natural gas and increase the share of renewables

The electricity generation sector emitted 42% of global CO_2 emissions from fuel combustion in 2016 (IEA, 2018a). Over the period 1990 to 2015, the world average share of renewables in the electricity generation mix increased from 19% to 23% (Climate Action Tracker, 2018b). The share of coal-based electricity generation stayed near 37% between 1990 and 2005, peaked at around 40% between 2008 and 2013 and then slightly decreased to 38% in 2015 (IEA, 2017).

The decarbonisation of the power sector is of great importance, as zero-carbon electricity is the catalyst for achieving emission reductions in other sectors. Especially in transport and buildings, Paris-compatible pathways foresee demand reductions and electrification with a decarbonised electricity supply. Electrification of production processes and hydrogen production with decarbonised electricity is an important strategy in the industry sector as well, for example for steel-making.

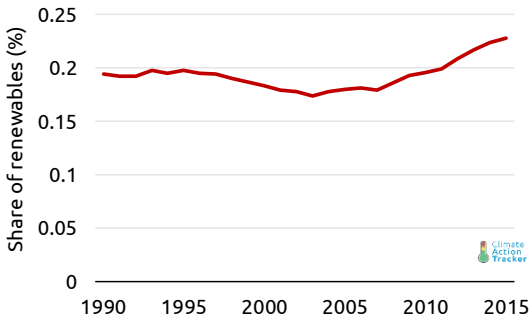

Figure 2: World average electricity renewable intensity in % renewable (Climate Action Tracker, 2018b).

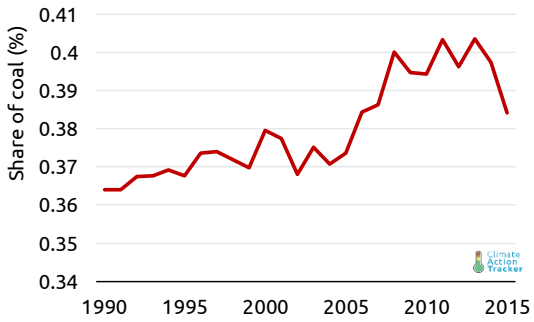

Figure 3: World average share of coal in electricity generation in % coal (IEA, 2017).

The power sector needs to undergo the fastest transition to be in line with the Paris Agreement's 1.5℃ limit, for three reasons: the technologies are already available with competitive costs in many regions (IRENA, 2018), substantial co-benefits exist, and zero-carbon power is a prerequisite for decarbonising other sectors such as transport or buildings (Climate Action Tracker, 2016c). The electricity generation sector globally will first need to make a rapid transition away from coal and transform itself completely to become fully decarbonised by 2050. Globally, coal needs to be phased out of electricity generation by 2050 (IPCC, 2018).

Immediate steps to a Paris Agreement compatible pathway include:

- **Sustain and accelerate the growth of renewables**: Electricity generation needs to be essentially carbon free by 2050. Of the carbon-free options for electricity generation, renewables show the most promising development, and their current growth must be accelerated, reaching a share of 47–65% in 2030 and 69–87% by 2050 (IPCC, 2018). Rapid action is required to ensure our power systems are ready for them: large shares of variable renewable energy sources require increased flexibility in the energy system and new regulatory and market approaches. On the longer term, efforts should be accelerated to reach a fully decarbonised power sector globally by mid-century (Climate Action Tracker, 2016c).

- **Eliminate fossil fuel subsidies:** Fossil fuel subsidies hinder clean energy investment by making fossil fuels artificially cheaper. Scrapping these subsidies is a win-win strategy to contribute to achieving the Paris Agreement temperature goal and reduce public spending (Climate Action Tracker, 2016c).

- **Build no new coal plants, reduce the use of coal in electricity by two-thirds between 2020–2030 and phase out coal globally by 2050, following the principles of a just and fair transition:** Policymakers need to implement a dedicated and managed approach to phasing out coal by banning the construction of new coal plants starting today (Climate Action Tracker, 2016c) and achieve a global coal phase out by 2050 (IPCC, 2018). In most 1.5°C consistent pathways, investments in fossil fuels decline with investments in unabated coal stopping by 2030 (IPCC, 2018). A global phase-out of coal from electricity generation by 2050 means that OECD countries need to exit coal by around 2030, China and some other developing countries by 2040 and the rest of the world by 2050 at the latest. This phase-out stands in strong contrast to current and planned coal capacity worldwide that represents a high risk of stranded assets, and that is often no longer the most economically viable option in the wake of falling renewable energy costs (Climate Action Tracker, 2016c). A coal phase-out needs to be accompanied by a solid strategy to mitigate the socioeconomic employment and social impacts that result from a coal exit in affected regions (Climate Action Tracker, 2016c).

- **Natural gas close to phase out from power sector by 2050:** The requirement for zero CO_2 emissions by 2050, combined with increasing competition from renewables, results in a dwindling role for natural gas in the power sector towards the middle of the century. In most 1.5℃ consistent pathways, unabated natural gas (gas without CCS) is phased out almost entirely by 2050 (82–99% below 2010 levels) (IPCC, 2018). Although it is conceivable to remove 85–90% of the CO_2 emissions from gas, it is unlikely that there would be a role for gas with CCS in the evolving power system: the increasing market share of renewables due to their rapid cost decline will leave only a small part of the electricity supply for non-renewables in most regions (Climate Action Tracker, 2017a). Despite this, governments and companies are still planning significant investments in new natural gas infrastructure, locking in a dependency on fossil fuels, while ignoring the increasing role of low-carbon alternatives. This increase in investments, combined with a demand that is likely to decrease, will lead to significant stranded assets in a Paris Agreement-compatible future. Natural gas is often perceived as a 'clean' source of energy that complements variable renewable technologies. However, fugitive emissions during gas extraction and transport are an on-going problem. There are numerous options for integrating renewables that reduce and ultimately eliminate the need for natural gas in the power sector (Climate Action Tracker, 2017a).

Road Transportation: accelerate deployment of zero emissions vehicles

Transport accounted for 24% of global CO_2 emissions from fuel combustion in 2016 (IEA, 2018a). The emissions intensity of road transport globally (in CO_2 emissions per kilometre travelled) has been decreasing steadily between 2000 and 2015, but will need to decrease more quickly to be aligned with a Paris Agreement compatible scenario, in which the entire transportation sector needs to be decarbonised by around 2050 (Climate Action Tracker, 2016b).

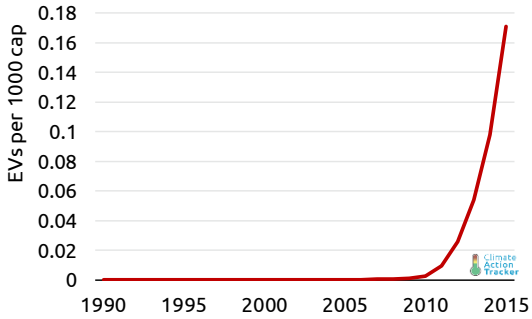

Figure 4: World average EVs per capita (Climate Action Tracker, 2018b).

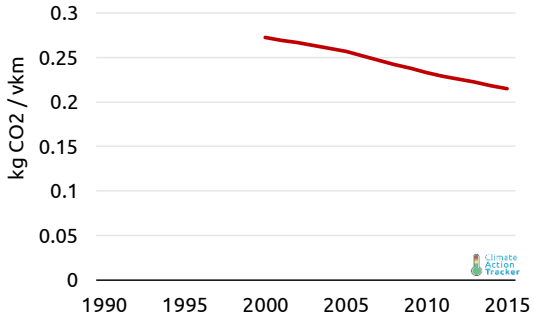

Figure 5: World average road transport emissions intensity (Climate Action Tracker, 2018b).

Passenger road transport: deploy zero-carbon powered EVs and enable shift to public transport, walking, cycling

Sales of electric vehicles are rising globally, with over one million cars sold in 2017 (IEA, 2018b). Shares of electric vehicles will need to increase rapidly in a Paris Agreement compatible scenario and must be powered by zero carbon electricity, requiring a simultaneous decarbonisation of the power sector.

Steps to a Paris Agreement compatible pathway for passenger transport include:

- **Implement stringent vehicle emissions standards in the short term:** Fuel economy and emission standards help to reduce transport sector emissions, and need to be stringent enough to support a transition to zero emissions transport in line with the Paris Agreement (Climate Action Tracker, 2016b).

- **Deploy electric vehicles powered by renewable or other zero-carbon energy swiftly and extensively:** Paris Agreement compatibility requires a swift uptake of zero-emissions vehicles unless major shifts occur in transport behaviour (Climate Action Tracker, 2016b).

- **Sell the last fossil fuel powered vehicle by around 2035:** Vehicles can stay on the road for many years, meaning that to fully decarbonise the passenger road transportation sector by mid-century, the last fossil fuel car should be sold by around 2035, if not earlier (Climate Action Tracker, 2016b).

- **Complementary action: promote major shifts in passenger transport behaviour:** Enabling major shifts in passenger transport behaviour, for example shifting to low-carbon public transit, cycling, or walking can also lead to emissions reductions (Climate Action Tracker, 2016b) and achieve benefits for health and better living (Harvard Health, 2016; WHO, 2018).

Policy packages to support increased electric vehicle shares have been successful in some countries and regions and typically combine increasingly stringent fuel efficiency or carbon emissions standards, as well as financial and behavioural incentives. These can include lowered taxation rates for electric vehicles, direct purchase subsidies, and/or access to bus or carpool lanes or better parking spaces. Charging infrastructure must also be developed while simultaneously decarbonising the power sector (Climate Action Tracker and ClimateWorks Foundation, 2017).

Freight transport: improve efficiency, incentivise modal shift and deploy zero-carbon powered trucks

To be compatible with the Paris Agreement's long-term goal, freight trucks need to be almost fully decarbonised by around 2050.

Steps to a Paris Agreement compatible scenario for freight transport include:

- **Incentivise road to rail modal shift, improve energy efficiency, and reduce demand in the short term:** Road to rail modal shift, energy efficiency improvements, and demand reduction are important policies to reduce emissions from freight transport and are options that are available now. However, they are insufficient to meet the Paris Agreement goal in the long-term. To fully decarbonise remaining road freight by around mid-century, the remaining road freight needs to move to low-carbon vehicles (Climate Action Tracker, 2018c).

- **Achieve mass market deployment of low-carbon powered electric and fuel cell trucks by 2030 and complete decarbonisation by 2050:** Biofuels, if produced sustainably, are one of the few greenhouse gas emissions reduction options for road freight available immediately. Other options include zero- or low-carbon electricity powered electric trucks, renewables-based hydrogen fuel cell trucks, and synfuels. These can help electricity sector transition to renewable energy power by storing and using excess electricity. First examples of electric trucks and hydrogen fuel cell trucks have entered global markets, and low-carbon technologies should be deployed at scale by around 2030 (Climate Action Tracker, 2018c).

Policy options to accelerate the decarbonisation of freight transport and deployment of low-carbon trucks include introducing stringent fuel efficiency standards, developing charging infrastructure for electric trucks while decarbonising the power sector, supporting research into advanced technologies and their sustainability, developing hydrogen and synfuels infrastructure and incentivising zero emissions vehicles (Climate Action Tracker, 2018c).

Buildings: Implement and enforce building codes with high energy efficiency standards and incentivise deep renovation rates

Buildings accounted for 8% of global CO_2 emissions from fuel combustion in 2016, excluding emissions from electricity production (IEA, 2018a). At a global level, buildings emissions per capita have been relatively stable between 2010 and 2015 but total energy consumption in buildings is set to rise instead of decline as would be necessary in a Paris Agreement compatible pathway.

Buildings emissions come from electricity and direct energy use for heating, water heating, cooking, lighting, and appliances.

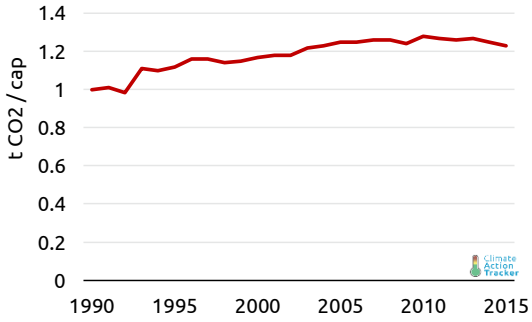

Figure 6: World average buildings emissions intensity per capita (Climate Action Tracker, 2018b).

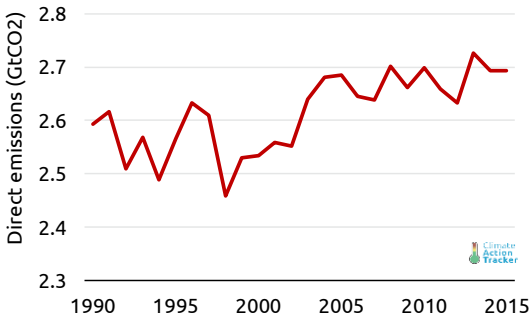

Figure 7: World total direct emissions from the building sector (IEA, 2017).

Building sector: increase deep renovation rate and build zero energy buildings

Decarbonisation of the building sector plays a key role in achieving the Paris Agreement long-term temperature goal. While the technologies required to make new buildings zero-emissions are all available, the sector is not taking up those technologies as fast as it could, and renovation rates are low (Climate Action Tracker, 2016a).

Steps to a Paris Agreement compatible scenario for buildings sector include:

- **Make all new buildings zero-energy by 2020 to 2025 globally:** The continued growth of buildings emissions contrasts starkly with the maturity of the technological solutions available: We have known how to build zero-energy buildings for several decades. Initial designs were very expensive, but now they can be designed and constructed cost effectively. Every new building that is not "Paris Agreement-proof" in its construction will lead to a further "lock-in" of emissions and will require future renovation (Climate Action Tracker, 2016a).

- **Incentivise deep renovation rate of 5% per year by 2020:** Existing renovation efforts in developed regions are currently too slow (~1% of stock renovated per year), and too shallow. Deep renovation is needed to achieve the required rate of energy efficiency (90% reduction of fuel and heat demand per retrofit) in the overall building stock (Climate Action Tracker, 2016a).

The most important **policy drivers** in both developed and developing countries are the enforcement of—and compliance with— building codes with stringent, economy-wide, energy efficiency standards. But differences in culture (e.g. building types and occupant behaviour) as well as geography (e.g. heating/cooling needs and renewable energy resources) prohibit a one-size-fits-all approach toward building design. Integrated solutions should always be tailored to the specific situation (Climate Action Tracker, 2018c).

The barriers to transforming the building sector are largely financial, with higher up-front investment costs (but lower running costs), and **incentives and regulatory support** are required. Another barrier is the landlord-tenant issue, where the landlord does not get a direct benefit from reducing a building's energy use. This calls for innovative **financing schemes** (Climate Action Tracker, 2018c).

Appliances and lighting: Implement minimum energy performance standards

Energy efficiency improvements for appliances and lighting is one of the key short-term measures to support deep and rapid decarbonisation of the building sector by 2030. Increasing the energy efficiency of appliances and lighting decreases final energy demand and will help to attain faster overall decarbonisation of the power sector, a crucial enabling factor to stay within a 1.5˚C warming limit. Our analysis found that if the highest existing minimum energy performance and labelling standards were applied globally, they could save around 4,500 TWh in 2030, the equivalent of closing 1,140 average coal-fired power plants (600 MW).

Steps to a Paris Agreement compatible scenario for appliances and lighting include:

- **Enforce, harmonise and continually strengthen minimum energy performance standards:** Coupled with a low-carbon power supply, existing highest energy performance and labelling standards for appliances and lighting could bridge the emissions gap required in the sector by 2030 to achieve the Paris Agreement temperature goal (Climate Action Tracker, 2018a).

Policy design is crucial and both public and private actors need tailored initiatives that specifically address barriers for energy efficiency uptake in appliances and lighting. The barriers can be broadly grouped into (1) financial barriers (higher upfront costs for more efficient appliances and lighting, often accompanied by lack of access to finance to allow purchase of higher priced appliance), (2) market failures (such as imperfect information about energy savings) and (3) behavioural and organisational barriers (tendency to ignore small opportunities for energy savings).

The selling points for energy efficiency measures are manifold: they deliver energy and CO_2 reductions while also reducing total costs and bringing additional co-benefits such as reduced air-pollution and natural resources conservation.

Industry: decarbonisation through electrification, innovation, new products and processes

Industrial process emissions accounted for 9% of global GHG emissions (excl. LULUCF) and industrial energy use accounted for 19% of CO_2 emissions from fuel combustion in 2016 (Gütschow *et al.*, 2018; IEA, 2018a). Within the industry sector, the sub sectors iron and steel and non-metallic materials (predominantly cement) are the largest contributors (Climate Action Tracker, 2017b).

Although the absolute emissions of the two main emitting sectors increased over time, the steel and cement emissions intensity (i.e. kg CO_2 per tonne product) slightly decreased between 1990 and 2015 (Climate Action Tracker, 2018b).

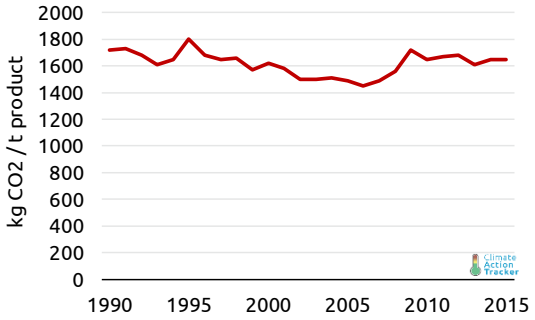

Figure 8: World average steel emissions intensity in kg CO2 per tonne product (Climate Action Tracker, 2018b).

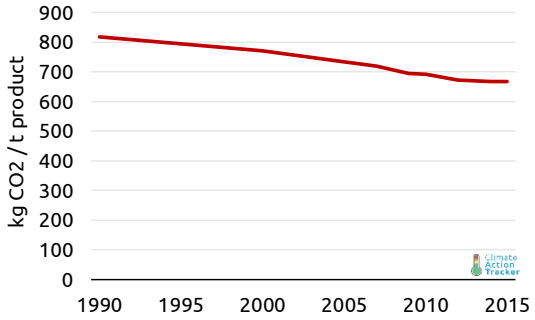

Figure 9: World average cement emissions intensity in kg CO2 per tonne product (Climate Action Tracker, 2018b).

In a 1.5 °C scenario, industrial emissions need to be reduced by 75–90% from 2010 levels by 2050 (IPCC, 2018), while industrial production is expected to grow significantly. Decarbonisation of both the steel and cement industries with technologies currently available—even when including a shift towards a circular economy—would not be enough to achieve the deep cuts in GHG emissions needed to be in line with the Paris Agreement.

Further measures are needed and steps to a Paris Agreement compatible pathway for steel and cement production include:

- **All new installations in emission-intensive sectors are low-carbon after 2020**: From 2020 onwards, all new installations need to be built according to the best available low or zero carbon technology standard (Climate Action Tracker, 2016c). This implies immediate deployment of innovative low or zero carbon steel and cement making technologies. This includes the use of top gas recycling blast furnaces and direct reduction using renewable hydrogen for steel and clinker replacement for cement (Climate Action Tracker, 2017b).

- **Maximise material efficiency and substitute products**: There is significant untapped mitigation potential through material efficiency improvement and substitution products. Primary material production can be reduced by reducing material use per service demand, using products more intensely, extending life and reusing and recycling materials. A near-complete decarbonisation of global heavy industry will require more holistic thinking about wide-reaching changes to industrial sub-sectors (e.g. a circular economy concept that involves moving away from linear to circular value chains) (Climate Action Tracker, 2017b).

The decarbonisation of heavy industry is key to achieving deep cuts in emissions and will require a combination of new and existing solutions, including electrification, hydrogen, sustainable bio-based feedstocks, product substitution, and carbon capture, utilisation and storage (CCUS) (IPCC, 2018). A number of options need further development to enable large-scale deployment indicating that support is still needed from policymakers, e.g. for focussed research and development initiatives in partnership with industry.

Agriculture: reduce waste, shift to healthy diets, farm efficiently

Agriculture accounted for 13% of global greenhouse gas emissions (excl. LULUCF) in 2015 (Gütschow *et al.*, 2018). Limiting agricultural emissions must focus on non-CO_2 emissions, and although these cannot be reduced to zero, they must be reduced as much as possible to contribute to the goal of net-zero GHG emissions by roughly the 2060s (Climate Action Tracker, 2018d).

Measures to decrease non-CO_2 emissions from agriculture can focus on both the supply side and on the demand side, with demand side measures leading to potentially greater emissions reductions. Reducing food waste and shifting to healthier diets could lead to emissions reductions over three times higher than changing farming practices alone. These measures together could put the agricultural sector on a Paris Agreement compatible pathway and achieve significant co-benefits without compromising global nutritional heath (Climate Action Tracker, 2018d).

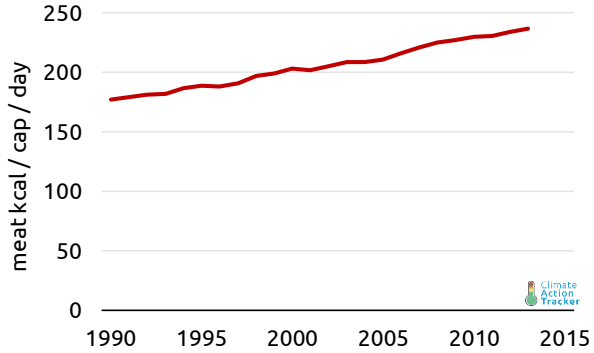

Figure 10: World average meat consumption per capita in kcal / cap / day (Climate Action Tracker, 2018b).

Daily meat consumption per capita globally increased 34% between 1990 and 2015 (Climate Action Tracker, 2018b), and livestock is the largest source of agricultural non-CO_2 emissions (FAOSTAT, 2016). A global shift to healthy diets could dramatically reduce emissions, but implementing such a transition requires careful consideration of local contexts and nutritional needs. A worldwide adoption of the "Harvard diet"—which implies reductions in meat consumption in the developed world and increases in countries with protein-deficient diets—could bring about reductions in non-CO_2 emissions (compared to a reference scenario without diet shifts) on the order of 1.5 GtCO2e/year by 2030 (Climate Action Tracker, 2018d).

Steps to a Paris Agreement compatible scenario for agriculture include (Climate Action Tracker, 2018d):

- **Reduce food waste:** reasons for food waste vary. In some countries, more efficient storage and distribution systems are needed to reduce on-farm and post-harvest losses. In other contexts, food waste may be linked to best-before date marking, or supermarket rejection of food based on shape, size, or colour, in addition to consumer behaviour.

- **Shift to healthy diets, while carefully considering local context and nutritional needs**: shifting to healthy diets can reduce emissions while contributing to the Sustainable Development Goal to end hunger, achieving food security and improved nutrition.

- **Implement best farming practices:** such as improving diet management for livestock and manure management, efficient fertiliser use, and draining rice paddies during the wet season. Appropriate best practices will depend on regional conditions.

Production and consumption patterns vary globally, and policy measures would need to be tailored to local conditions. Depending on the context, these could include changing date labelling requirements for food, investing in more efficient food storage and distribution systems, introducing guidelines on sustainable diets, or implementing fertiliser taxes (Climate Action Tracker, 2018d).

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The Climate Action Tracker is an independent science-based assessment that tracks the emission commitments and actions of countries. It is a joint project of the following organisations:

Climate Analytics

Climate Analytics is a non-profit institute based in Berlin, Germany, with offices in Lomé, Togo and New York, USA, that brings together inter-disciplinary expertise in the scientific and policy aspects of climate change with the vision of supporting science-based policy to prevent dangerous climate change, enabling sustainable development. Climate Analytics aims to synthesise and advance scientific knowledge in the area of climate, and by linking scientific and policy analysis provide state-of-the-art solutions to global and national climate change policy challenges. Contact: Dr. h.c. Bill Hare, +49 160 908 62463

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Ecofys, a Navigant company, is a leading international energy and climate consultancy focused on sustainable energy for everyone. Founded in 1984, the company is a trusted advisor to governments, corporations, NGOs, and energy providers worldwide. The team delivers powerful results in the energy and climate transition sectors. Working across the entire energy value chain, Ecofys develops innovative solutions and strategies to support its clients in enabling the energy transition and working through the challenges of climate change. Contact: Prof. Kornelis Blok, +31 6 558 667 36

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NewClimate Institute

NewClimate Institute is a non-profit institute established in 2014. NewClimate Institute supports research and implementation of action against climate change around the globe, covering the topics international climate negotiations, tracking climate action, climate and development, climate finance and carbon market mechanisms. NewClimate Institute aims at connecting up-to-date research with the real world decision making processes. Contact: Dr. Niklas Höhne, +49 173 715 2279

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