Global Climate Change Policy and Its Implication for Municipalities

The implication of the Paris Agreement, EU-Commissions 2050 Strategy and IPCC-Report for municipalities & cities

INTRODUCTION:

"You are never too small to make a difference" – Greta Thunberg. What is true for age also covers the administrative area. The international level of politics increasingly recognises the importance and the capabilities of municipalities and cities when it comes to climate change mitigation and adaptation. A lot has changed in the recent years in terms of scientific findings and policy goals. We want to summarize the most important documents and translate the findings and impacts to the sub-national level for municipalities and cities, to – ideally – improve the knowledge about what is happening at a global scale and list options to mitigate and adapt to climate change.

ANALYSIS: PARIS AGREEMENT, IPCC-REPORT AND THE EU-2050 STRATEGY

To start off the analysis, we need to understand the process of international climate policy. In 1997 the first important step was made, the **Kyoto Protocol** [a] got signed, as result of a process that started in Rio de Janeiro in 1992 and the *United Nations Framework Convention on Climate Change* (UNFCCC) was established. The Kyoto Protocol was the first international treaty to recognise human made climate change and to set goals to reduce *greenhouse gases* (GHG) to mitigate climate change. The protocol distinguishes between developed and less developed countries. It is binding under international law and includes certain mechanisms – like emissions trading. However, the goals were set too low, and even then missed at a global scale. Some countries even pulled out of the protocol, despite others having achieved their goals. The necessity for a steeper CO_2 reduction to fight climate change was urgent.

International negotiations continued through the UNFCCC, and after a severe failure to reach a global agreement in 2009 in Copenhagen, the **Paris Agreement** [b] followed in 2015. The central commitment is: "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, rec-

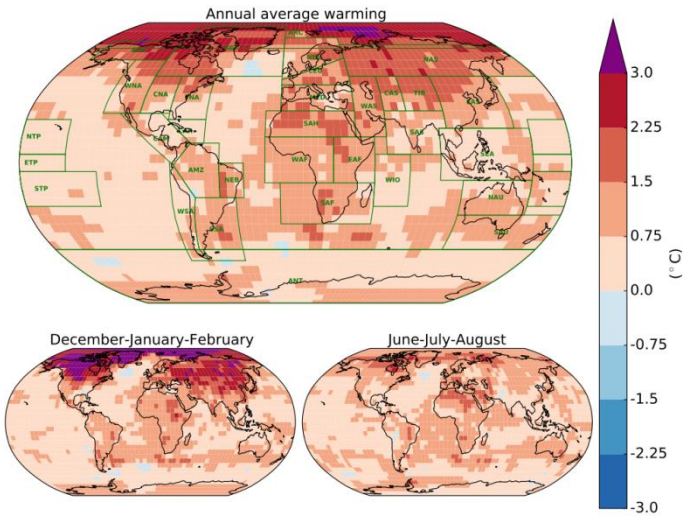
ognizing that this would significantly reduce the risks and impacts of climate change".

According to the Agreement, to accomplish that, every signatory country shall state their "ambitions" *national determined Contributions* (NDC´s). The NDC´s are not binding under international law and there are thus no consequences for not achieving pledged emissions reductions.

As a result of the Paris Agreement, the *Intergovernmental Panel on Climate Change* (IPCC), a scientific body of the UN to give scientific insight on climate issues, accepted the invitation to create a *special report* (SR15) on the impacts of 1.5°C of global warming compared to preindustrial levels, as well as other temperature thresholds beyond that.

This **IPCC-Report**[1] [c] is the state of the art of current scientific findings on climate change. It gives an in-depth view on the global impacts of climate-change, the related consequences and proposes multiple pathways to mitigate damages for nature and mankind. Its key findings include that:

Climate change depends on the total amount of GHG in the atmosphere. The remaining CO_{2e} amount that can be emitted, to mitigate the risk of an above 1.5°C warming is 420GtCO_{2e} (66% probability). At the current rate of global emissions this budget would be exhausted in about ten years.



Global warming has not just started today. When released in October 2018, the IPCC-Report detected the average global temperature already about 1°C higher in relation to the pre-industrial time. Therefore we only have 0.5°C remaining, before we reach the 1.5°C threshold.

Global warming does not spread evenly over the planet. While oceans warm up less, the influence of global warming in the arctic and landmass is higher. The average annual temperature in Europe has already risen 1.7°C over the last decade, compared to the pre industrial level [e]. Meaning that the higher rate of

[1] In this - over 500 pages long - 2018 released SR15, *91 authors were involved and* over 6,000 scientific references are contained.

warming, than the global average is expected to be 3°C in mid-latitudes at a global warming of 1.5 °C and respectively 4°C at a 2°C average warming. Leading to a change in growing seasons and contributing to global crop yield reductions, reduced fresh water availability and also putting biodiversity under further stress [g]. Cities are particularly heavily affected, due to the additional urban heat island effect. Higher temperatures of up to 10°C in city centres compared to surrounding areas might occur[d].

The rate and intensity of extreme weather events will increase. Frequent floods and droughts as well as hot extremes will rise. The highest rise of hot days is projected in the tropics. Climate related migration will rise to 140 million by the year 2050 due to the consequence of uninhabitable landscapes.

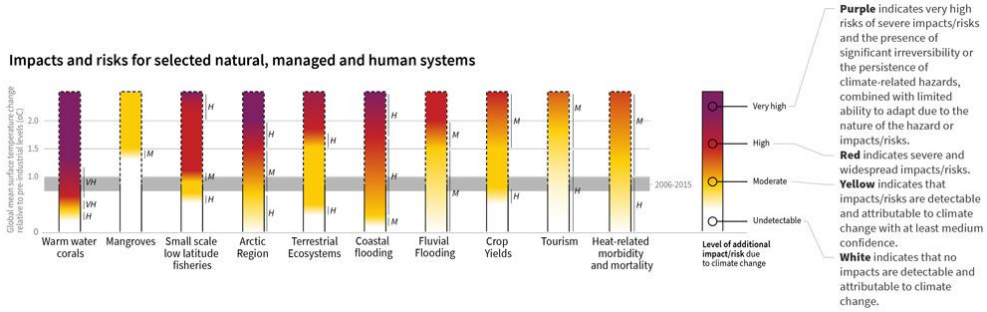
Sea level rise will displace millions of people and an irreversible melting of the Arctic-Sea ice will occur at a global warming between 1.5°C and 2°C, which would result in a multi-meter sea level rise over the following centuries.

Climate change also effects biodiversity in all forms. Out of all studied species, 6% of insects, 8% of plants and 4% of vertebrates are projected to lose over half of their climatically determined geographic range for global warming of 1.5°C, compared with 18% of insects, 16% of plants and 8% of vertebrates for global warming of 2°C. The climatic conditions in the Amazon region's ecosystem lead to rich biodiversity. The majority of the world's flora and fauna find their habitat in this region, but rainforests and their native biodiversity are in severe danger due to global warming – also increasing indigenous peoples risk for health and loss of habitation.

Further the **risks for health, food and water supply, human security as well as economic growth will rise** at a global warming of 1.5°C and further at 2°C. The list of threats and challenges could be continued, but a full explanation of all consequences is not the aim of this paper[2]. Recent analysis of the IPCC 1.5 science d by major cities noted that "2°C of heating has long been cited as the threshold to avoid dangerous levels of climate change. We now know that even 2°C of heating is dangerous. The projected impacts of 2°C versus 1.5°C of heating include half a billion more people struggling to get enough to eat, double the number of people

[2] The **Summary for Urban Policymakers** (**https://bit.ly/2RHwyT3**), gives a more detailed breakdown of the IPCC SR1.5.

suffering from water scarcity, and dramatic increases in ecosystem loss" [h].



Building on the findings of the IPCC Report and aiming to play its part in limiting global warming to 1.5°C, the **European Commission published its plan for a net-zero[3] Europe by the year 2050** [f]. It aims to raise the investment for energy and related infrastructure to 2.8% of GDP up from 2%, "through a socially-fair transition in a cost-effective manner". Energy is viewed the most important sector, as it is accountable for 75% of today's CO_2 emissions in the EU. The plan identifies seven key building blocks to reach the net-zero goals:

- Improved energy efficiency to reduce energy consumption substantially;
- Increasing the amount of renewable energy sources;
- Secure and 'connected' mobility;
- Competitive industry with a circular economy;
- Development of a smart network infrastructure and inter connections;
- Bio-economy and essential carbon sinks (including sustainable bio-mass);
- Tackle the remaining emissions by *Carbon Capture and Storage* (CCS).

Yet the commission does not intend to launch new policies or revise the 2030 targets with this publication. On the other hand, the plan is expected to have a high impact on future EU policy nonetheless.

Yet, **current scheduled policies are by far insufficient** and would lead to 1.5°C of warming between 2030 and 2052 and 3°C warming by the end of the century, with warming continuing afterwards. Therefore the unavoidable question is:

WHAT IS NEEDED TO LIMIT GLOBAL WARMING TO 1.5°C?

Aiming for 1.5°C non-overshoot pathways, therefore never surpass a 1.5°C global warming, requires "rapid and far-reaching transitions in energy, land, urban and infrastructure, and industrial systems". Such pathways require an unprecedented

[3] "net zero emissions" is a misleading, not definitively defined term, often used interchangeable with words like "climate neutral" or "CO2 neutral". Terminologies such as these imply the use of offset mechanisms and the use of unsafe technologies. For these and further reasons we will discuss our positioning on this topic at the annual conference in Rostock.

rate of change and at a unique scale. Half of the calculated 1.5°C pathways with no or limited overshoot, show emission reductions requirements of 40-50% from 2010 levels before 2030. Current emission-reduction plans for 2030 would have to be increased by factor 5-6 to keep in line with the 1.5°C goals.

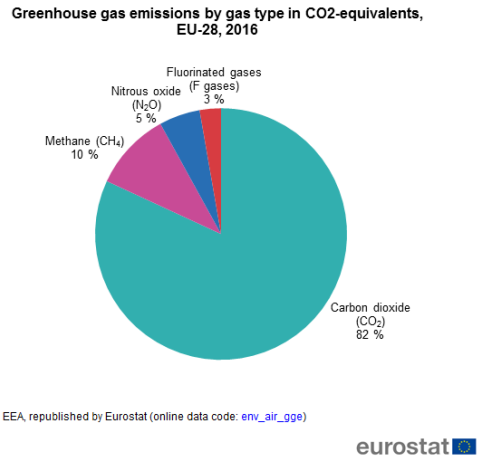
As the For Cities by Cities report notes, each year we delay emission reductions, the window to reach zero emissions is reduced by approximately two years to remain below 1.5°C. The sooner and more boldly we act, the greater the likelihood of success. The longer we wait, the more expensive and difficult it will be to reduce emissions and the more natural, managed, and human systems will be exposed to significant risk.

Other pathways, with a higher overshoot above 1.5 Degrees of temperature rise (and then returning to at least that level), assume the use of *Carbon Dioxide Removal* (CDR), to reduce the warming.

The IPCC-Report as well as the European Commission's plan for net-zero emissions at 2050, including the use of CDR technologies, including CCS and *Bio Energy with Carbon Capture and Storage* (BECCS) (especially for paths with a temperature overshoot). The aim of those technologies is to capture emitted CO_2 and store it, thereby reducing the total CO_2 amount in the atmosphere and compensating unavoidable CO_2 emissions. Those measures have different approaches and were (partially) tested in small scales. However there is no evidence, that those technologies are compatible on a big – yet global scale. Therefore we reject the use of those CDR technologies and encourage a focus on a massive CO_2 emissions reduction[4].

THE MUNICIPAL LEVEL

Municipalities are prominent actors on climate change. While laws and treaties are determined at the (inter-) national level, implementation for the most part is done locally and regionally. Municipal capabilities and responsibilities range from heating and cooling using electricity to climate adaptation and further sectors.



There are two main aspects for municipalities to address. The first one is how to mitigate global warming by reducing emissions, the second onerelates to building resilience and reducing risks to natural and human systems by

[4] Read **Fern's article on BECCS** (**https://bit.ly/2lB3E7R**)for example, **this article** (**https://bit.ly/2wX5ZMU**) and our **2008 Resolution** (**https://bit.ly/2lWI3qQ**)

understanding climate impacts and adapting to expected and observed changes. Each of these needs to be addressed bearing in mind social equity and the principles of a fair and just transition.

Cities and Municipalities have already done a lot, especially municipalities that have an eye on climate change – our member municipalities for example commit to reducing their GHG emissions continuously – take a leading role mitigating and adapting to climate change already. Yet the previous chapter shows a clear pattern. We are far off from limiting global warming to the 1.5°C threshold when current policies and goals are considered. Being well aware, that China and North America for example have a bigger share on global emissions, it is nonetheless our duty to give our best effort and take a leading role globally.

Mitigating climate change as a municipality focusses on reduction of GHG emissions. Mainly CO_2 but also methane and nitrous oxide are responsible for global warming.
CO_2 mostly is emitted in the energy sector, while methane and nitrous oxide are primary emitted in agriculture.

Heating and Buildings:

Adapting the temperature of buildings to a desired level requires a lot of energy. Nowadays the majority of heating systems are powered by fossil fuels (mainly gas, but also coal and oil) despite heavily varying prices.

Renewable heating and cooling options are on the rise, but are still in the minority. While (renewable) gas from natural biochemical processes can be used for heating, while it still emits CO_2 it is not additional to the natural decomposition process; While wood pellets can work in the same way. Synthetic gasses, like hydrogen, generated through excess renewable electricity, could be an option in the future. Solar-thermal and electricity (using renewable electricity) based options could also be considered. Heat Pumps, gaining heat from the surrounding ground or water can greatly reduce emissions too. A **combination of renewable options** is often considered the best path.

District heating is seen as the most efficient method of local heat distribution in many cases, especially the newer generations of district heating. But the viability should be verified at the local level, as it is more attractive in densely built areas. In this context, also taking the excess heat from industry and reusing it for heating of buildings could be a supplementary option. As shown, there are many different paths, now it is necessary to set the incentives and push for those technologies that support climate mitigation.

Insulation of buildings to reduce heat demand is at least equally important; older buildings often lack good insulation, hugely increasing the energy requirement for heating. Cooling too requires a lot of energy. Besides good insulation, the efficiency of systems should also be taken into account. **Renovating and retrofitting** existing buildings, as well as amending new building standards to passive house or at least a very low energy standard for new buildings should be a focus too. In this

way, the required energy for heating can be reduced to a large extent, which leads to renewable options being more attractive too. Leading by example and placing a focus on emission free municipal buildings should be considered. Therefore we see a broad spectrum of possible actions to reduce the energy required and the choice of heat sources to reduce CO_2 emissions in this sector. Those mitigation options are rather easy to implement, as they are technically available now and also the cost effectiveness is high.

Electricity is indispensable in a modern society. Stable access is necessary for daily life and a functional economy. A key criticism to renewable electricity sources is that they are not consistent enough to power the entire grid. And that is partially true; especially as wind- and PV-electricity production depend on weather. But the solution is already viable: Storing the Electricity. “Power to x” for example takes excess energy during high energy production and transforms it into a substance like hydrogen in which the energy is stored. This then could be converted CO_2 free and produce electricity for fuel cell cars, or more general purposes. Pumped-storage hydroelectricity may also be viable in some circumstances as a second option to store energy.

The rise of renewable electricity sources is ongoing. Germany has reached 40%, Austria surpassed 70% already and Norway as the global leader reached 100% renewable electricity production (with 95% from hydropower). Reasons to further increase the renewable energy share are not just related to global warming; onshore wind, as well as **PV electricity is cheaper already than coal produced electricity**, with a tendency further strengthening renewable sources.

As a municipality, the possibilities for renewable electricity generation vary depending on location and other factors which can’t be fully covered in this broad paper, but investing in renewable energy sources is profitable and key for mitigating climate change.

It can also be an effective means to engage the citizens of your municipality, by enabling them to invest in new projects – a wind turbine for example – and become shareholders.

Mobility is one of the most difficult, but important fields, that requires a massive change as rapidly as possible. Transport is the only sector where emissions rose in recent years, making change in this sector even more important. Municipalities have limited capabilities to support the transition to a GHG free transport sector, but still can make a significant change. Aviation and shipping will not be taken into account here, as municipalities have very limited options in this field.

Public transport is primarily the responsibility of many municipalities (especially for cities). Reaching a CO_2 free local transport is not impossible. Subways, local trains and trams are already mostly powered by electricity. Buses too can be

powered electricity, including by overhead cables for example. Providing an efficient public transport system and introducing low prices (Vienna for example offers an annual ticket for 365€[5]), sets incentives to the public to reduce car use. Transitioning towards becoming a car-unfriendly municipality (with higher parking fees, city centre congestion fees etc.) is an option.

Public transport infrastructure is another key area that is alterable by municipalities. Supplying good **infrastructure for electric cars** as well as positive discrimination is a good possibility. Providing better parking slots, allowing such vehicles to use bus lanes, free parking in the city centre etc. can help to make electric cars more attractive to buy;

Additionally, **conditions for cyclists** can be improved almost everywhere, and riding the bike is not just emission free, but also healthy.

Agriculture and Food has a bigger impact on anthropogenic global warming than often expected. The biggest part of anthropogenic methane (CH_4) emissions originate in this sector (mostly ruminants and rice cultivation). Livestock alone (with life cycle emissions) accounts for 14% of anthropogenic GHG emissions. Emissions in this sector have different sources, many of them are very hard to mitigate. CH_4 Emissions from ruminants have a big share. Fertilizers (natural and chemical) are the main contributors of nitrous oxide (265 times more potent than CO_2 over a century). Mitigating those factors is seen as very difficult. Changes in nutrition for ruminants in experiments show that the CH_4 output can significantly be reduced. Also changes in fertilizer use can help to lower the GHG emissions. But we should not take the consumers out of the equation. **Eating habits** need to be changed. A **less meat heavy** (especially beef), more **local** (less transport ways) and **seasonal** nutrition would help to mitigate the emissions of this sector. A figure to keep in mind in this context is, that if everybody in the world would only eat vegan, the food related GHG emissions would be reduced by up to 49%. With less demand for GHG heavy food, the Industry has incentives to change its focus. Also with the growing global population, a less meat focused nutrition is also more efficient to fight hunger. Spreading this awareness and setting incentives for the food and agriculture industry are key actions in this sector. The latest IPCC Report on Climate Change and Land [g] strengthened those findings and stated, that a change in dietary habits and a change of Food management (waste of food and loss after production) could each lead to a mitigation of 3 $GtCO_{2e}$ per Year. Besides that, those changes would have a positive effect on world hunger, reducing the number of people suffering from hunger by 100 million.

Forests are often titled “the lungs of the world”. Keeping woodland intact and afforestation has the potential of temporarily storing two thirds of all anthropogenic emissions. Yet the global amount of forests declined about 3% since 1990, with the main share of this accounted for by the deforestation of rainforests. Greed to build more profitable palm oil plantations has led to increasingly rapid deforesta-

[5] For further information: **https://bit.ly/2Fj18Jm**

tion of the rainforests (with deforestation especially increasing in Brazil recently); that leads to a reduction of captured CO_2, counteracting climate change mitigation. As the **protection of the rainforests** is a big concern for Climate Alliance, a position paper, strengthening the support on an indigenous REDD+ approach was published on that topic[6].

By spreading awareness and opposing deforestation of rainforests, municipalities can have a positive impact. Aiming for sustainable forestry locally is important, as global warming weakens the resilience of forests.

Waste and Reusability have significant potential to mitigate climate change, and a deep change in this sector is important for a sustainable society. Waste separation, to begin with, has many advantages; it supports the reusability of certain materials (Plastic, Glass etc.) and also biological waste has various areas of application like heat and energy. A transition to a **circular economy**, which is also aimed for in the EU-Commission plan for 2050, with a focus on reusability, reparability and a longer life cycle for products, leads to a more resource efficient economy with less waste over all. This is important, as living on a planet with limited resources requires their smarter use. Also a deep societal transition, towards **less consumption** overall is supportive and necessary to address this issue, but is hard to accomplish, especially on a municipal level. Improving waste separation and reusability, as well as setting incentives towards a circular economy are actions to take in this sector.

Despite all mitigation efforts, the earth has already warmed and will, despite rising efforts, further warm up. As mentioned in the first part, the average temperature in central Europe is about 1.7°C higher already than in pre industrial times. This change of temperature leads to a change of natural phenomenon thus **we need to adapt** to climate change besides giving our best to mitigate it. Of course the challenges depend on geographical location and a detailed study is necessary to identify local adaption needs.

Heat:
A figure of global warming of 1.5°C is a global average temperature rise, conditions will vary highly in different parts of the globe. Heatwaves and days of extreme heat will happen more frequently, the warmer the global average gets. Cities will be particularly heavily affected due to the additional urban heat island effect, with temperatures up to 10°C higher than in surrounding areas. Temperatures above 37°C are particularly demanding on the human body and are dangerous to many. **Infants, small children and elderly people in particular face the highest risk**. In 2018 more people died in Austria due to extreme heat, than in car accidents.

Also, rising temperatures could lead to desertification in certain parts of Europe. New diseases like malaria could be introduced due to increased ranges of new

[6] See our **position paper** (**https://bit.ly/2IvodCK**) for further Information

species and other endemic species vanishing. The risk of droughts will also rise, leading to crop shortfalls and health risks.

To tackle this challenge, there are numerous options which need to be observed in each local case. Still, **green infrastructure**, functioning as heat sinks in cities mitigate the urban heat island effect and can help to reduce the impacts of global warming. Green roofs of buildings, corridors for airflow and trees in urban spaces and streets also play their part. Co-benefits of a greener city include better air quality and improved biodiversity for example.
Also, a consistent cooling option needs to be implemented, especially for people that are vulnerable to heat. Also implementing a **heat action plan** may help to inform people of upcoming heatwaves and enable them to change their plans and behaviours during the time of severe heat. Switching to drought resistant crops and preparing for new diseases are further adaption options.

Floods:
Climate change is increasing extreme weather not just heating. Heavy rainfall and floods are happening more frequently, so we need to adapt to these hazards too. Floods lead to significantly less fatalities, but to **bigger economic damage** than heat extremes. As a result of melting glaciers and increasingly heavy rainfall, rivers will tend to flood more often (eg. Danube having major floods in 2002 and 2013).

To increase resilience and adapt to the risk of floods, **natural drainage** is especially important in cities. Densely built areas and tarmac seal the natural drainage, but different green solutions already exist to address this problem.
Evacuation plans and building restrictions in highly flood prone areas can help to reduce losses. As the adaptation options differ enormously, the following summarized case study should give a better picture.

The Eferdinger Becken, in upper Austria, borders the Danube River; in the past two decades it suffered severe damage from floods. After those floods, it became clear that relocation was the only reasonable means of adaptation in this scenario; therefore, the national and local governments agreed to fund moving out of the basin with 80% value of the affected house. The program did not force anyone to leave, but promoted the action with financial benefits. Out of 154 properties, 80 households decided to move. The downside was that mostly younger people took the offer, while older, less resilient, households decided to stay. In general, the project is still seen as a success.

The risk of droughts, storms, water scarcity as well as sea level rise and increased risks for forests (fires, diseases, draughts and loss of economic value) will be points to consider for adaptation. On the website Climate adapt, you can find a support tool, case studies and adaption options to various scenarios: **https://climate-adapt.eea.europa.eu/**

Besides financial resources, **public support for climate action is essential**. Building broad public support for the rapid change needed to mitigate and adapt to climate change can be done in different ways. Education and awareness raising are very important and effective. If people understand that they will benefit from the changes, then they are more likely to support them and amend their actions. Looking back, the rising *Fridays for Future* movement shows that a rising number of people are already aware of the current climate crisis. Declaring a **climate emergency** helps to underline the priority of this topic, as well as legitimising further action. A committed society helps to pressure regional and national authorities for a more progressive climate policy.

Conclusion:

Things have changed, as has the climate. The recent scientific findings are largely unanimous, and the perspective has become increasingly clear. In the Paris Agreement, national governments agreed on an approach to try to limit maximum temperature increases to "well below 2°C", however the recent IPCC reports show that this goal is not sufficient. The changes to humankind and nature differ enormously between 1.5°C and 2°C. Aiming for a global warming of no more than 1.5°C is therefore a must. To achieve this, a rapid massive change in society is necessary. Changes on all levels, from international down to the individual need to happen and all levels should interact and support each other. Municipalities are important contributors to climate mitigation and adaptation, as they have already done a lot, but there is still a long path ahead. This paper shows that there are many sectors where (further) mitigation of emissions can and must happen. As the impacts of climate change already affect our lives, the necessity for adaptation is also present. We need to keep in mind, that even if we give our best effort, we might not be able to meet the 1.5°C goal, but if we don't commit to it, we will certainly lose.

MAIN SOURCES:

[a] UNFCCC (1997): Kyoto Protocol to the United Nations Framework Convention on Climate Change, 3rd Conference of the Parties, Kyoto, United Nations.

[b] UNFCCC (2015): *Adoption of the Paris Agreement*, 21st Conference of the Parties, Paris, United Nations.

[c] IPCC, 2018: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland.

[d] EEA (2017): *Climate change, impacts and vulnerabilitiy in Europe 2016,* Luxembourg, Publications Office of the European Union.

[e] EEA (2019): *Global and European temperature,* Copenhagen, European Environment Agency.

[f] European Comission (2018): *A Clean Plantet for all – A European strategic long-term vision for a prosperous, modern, competative and climate neutral economy*, Brussels, European Comission.

[g] IPCC, 2019: *Climate Change and Land. An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems* [A. Arneth, F. Denton, J. Gensuo, E. Shevliakova, A. Mirzabaev, J. Wu, H. Barbosa, L. Olsson, C. Mbow, C. Rosenzweig, J. N. Nkem, P. Smith, M. Hurlbert, J. Krishnaswamy] World Meteorological Organization, Geneva, Switzerland.

[h] For Cities by Cities, Key Takeaways for City Decision Makers from the IPCC 1.5°C Report and Summary for Urban Policymakers (2019). Read online: **https://bit.ly/2mnAbyR**

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THE CLIMATE ALLIANCE

For more than 25 years, Climate Alliance member municipalities have been acting in partnership with indigenous rainforest peoples for the benefit of the global climate. With some 1,700 members spread across 26 European countries, Climate Alliance is the world's largest city network dedicated to climate action and the only one to set tangible targets: each member city, town and district has committed itself to reducing greenhouse gas emissions by 10 percent every 5 years. Recognising the impact our lifestyles can have on the world's most vulnerable people and places, Climate Alliance pairs local action with global responsibility. **climatealliance.org**