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U.S., EUROPE OR CHINA: WHO IS THE GLOBAL CLIMATE'S SUPERHERO?

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EXECUTIVE SUMMARY

Markus Zimmer
Economist, ESG

markus.zimmer@allianz.com

Anqi Dang
Allianz Investment Management

anqi.dang@allianz.fr

Arne Holzhausen
Head of Insurance, Wealth and Trend Research

Arne.holzhausen@allianz.com

Dhruv Patel
Research Assistant

dhruv.patel@allianz.com

Covid-19 will upend the old pecking order in the global economy – and in climate policy. China is not only leading the economic recovery post-Covid-19 but also seems to be shifting from laggard to leader in climate policy, with President Xi Jinping's pledge for net-zero emissions by 2060. The EU, too, raised its climate targets significantly in the framework of its "Green Deal" and underpinned them with its bold EU Recovery Fund. As for the U.S., the upcoming elections could be a turning point when it comes to climate leadership.

This gearing up of climate policy is welcome – and overdue. Decoupling economic growth from emissions growth isn't enough. Based on today's policies, the EU, China and the U.S.'s emissions combined will grow to 23.6 billion tonnes of CO_2 in 2030, far above the 5.5 billion tonnes that would be compliant with Paris Climate Agreement goals. Their combined shortfall of 18.1 billion tonnes of emission reductions is equal to 50% of 2018 global emissions. Emission intensity as measured by CO_2 emissions per dollar of GDP has been cut in half every 20 years in China, every 29 years in the U.S. and every 28 years in the EU. Our analysis reveals that this trend has been astonishingly robust for the past 50 years. Following these trends, zero emissions will never be reached.

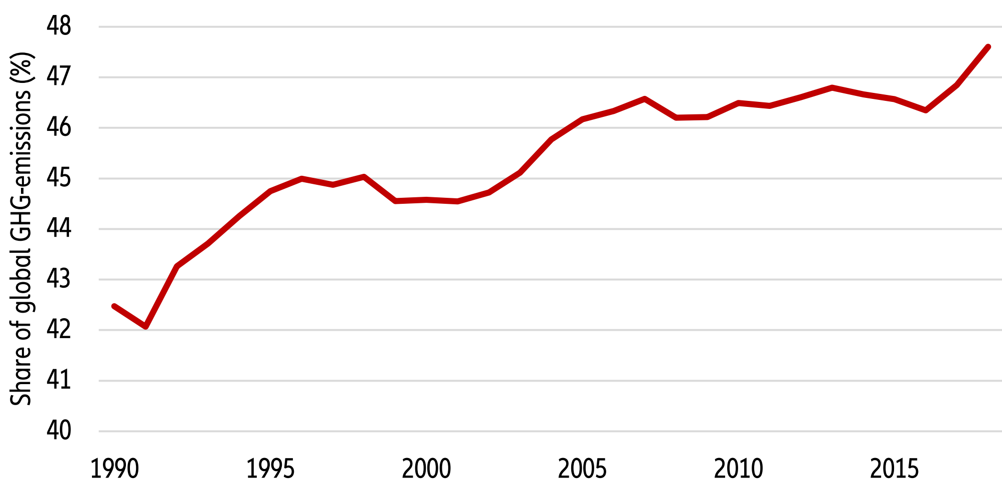
How do the three countries compare in climate policies? China is already leading the pack in renewable energy and electric vehicles, but is lacking in carbon capture and storage (CCS) technology and subsidies for fossil fuels. China's rise in renewable energy is breath-taking: it has recorded an over 800% increase in installed capacity for renewable energy since 2000, while the EU and the U.S. saw "only" 230% and 160%, respectively. As a result, installed capacity in the U.S. is now around one third of that in China, and the EU stands at two thirds. Back in 2000, all three economies were more or less on the same level. In addition, China's Electric Vehicles stock is higher than that of the U.S. and the EU combined. The U.S., however, is still leading CCS technologies and has the lowest subsidies for fossil fuel among the three economies.

The race for being a climate superpower is open – but it is too early to choose a winner. Our comparative analysis makes it clear that all three economies have to accelerate their climate efforts, materially and quickly. But all face different hurdles. China's commitment towards climate neutrality lacks visibility. The EU's Recovery Fund might be stuck or watered down in its Kafkaesque bureaucracy. And the U.S. has to overcome its highly divisive elections. Even after Covid-19, climate policy remains a race full of hurdles. But unlike the wrangle for technological and geopolitical hegemony, this might produce the right winner: the global climate.

U.S., EU, CHINA: NOT ON TRACK TO 1.5°C

The Paris Climate Agreement, adopted in 2015 and approved in 2016, set a long-term goal to limit an increase in the global average temperature to 1.5° C above pre-industrial levels, compared to the previous less ambitious goal of 2°C. China, the EU (defined to include UK) and the U.S. accounted for almost half of all global greenhouse gas (GHG) emissions in 2018, with a clear upward trend (see Figure 1). So the performance of these three economies will be decisive for reaching the Paris Climate Agreement goals.

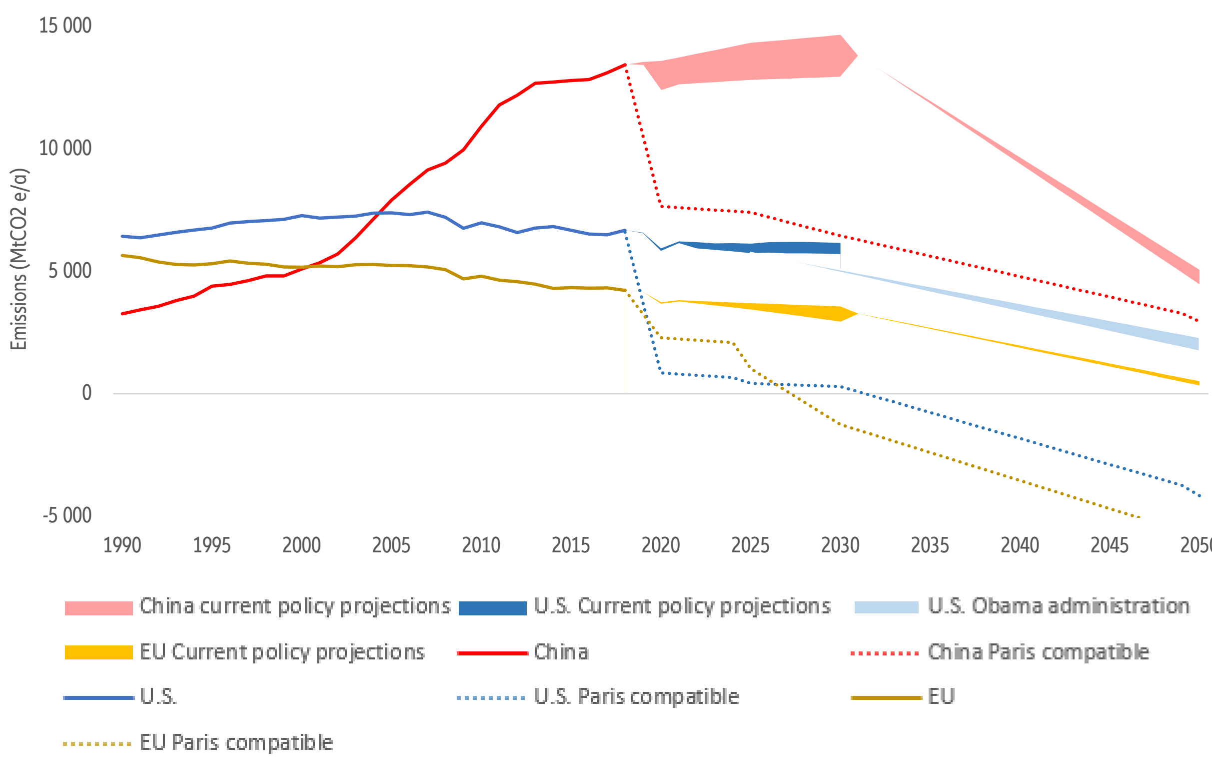
Figure 1: Combined greenhouse gas emissions of China, U.S. and EU



Sources: Climate Action Tracker; Allianz Research. For more information on the Climate Action Tracker, please refer to the appendix section.

However, at this stage, none of them has even come close to reaching the path required to limit the rise in global temperature to 1.5°C (Figure 2). In fact, the current policy projection paths suggest the global mean temperature could increase by 2.8°C. The divergence from the paths compliant with the Paris Climate Agreement objectives is huge for each economy, signifying a need for more aggressive and progressive climate action policies[1]. According to current policy projections, Chinese GHG emissions in 2030 will be more than double its Paris Climate compliant level (14,242 mega tonnes vs 6,452). The absolute discrepancy is 40% smaller for the EU: Estimated 3,382 mega tonnes of emissions in 2030 are pitted against Paris compliant negative GHG emissions of -1,262 mega tonnes[2]. For the U.S. the absolute gap lies right in the middle, as it is estimated to emit 5,934 mega tonnes of GHG emissions in 2030, whereas the Paris Climate compliant levels suggest that it should have GHG emissions of only 292 mega tonnes.
However, this is before taking into account the more lenient climate policy of the current Trump Administration. While China and the EU remain among the signatories, the U.S. national government announced to withdraw from the Paris Agreement in November 2020. Its current policy projection path for the period 2025-2050 is derived from Obama administration climate policies and thus might err on the lower side. But given the uncertainty around future U.S. climate policy, these projections remain the best approximation for the time being. More details about the sectoral consequences and required emission reductions are included in the appendix 'Sectoral decomposition of climate action ambitions'.

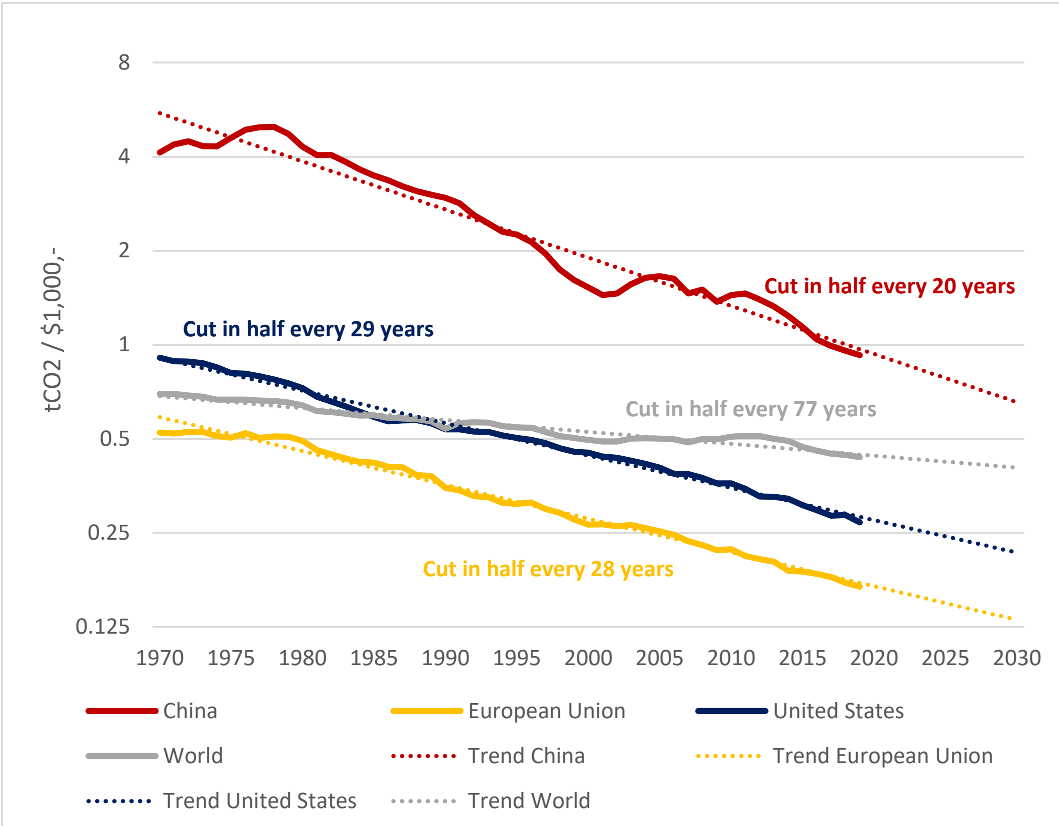
Figure 2: Greenhouse gas emission projections: 2.8°C current policies vs. 1.5°C Paris ambitions



Source: Allianz Research, Data: Climate Action Tracker [3]

[1] For an overview of existing climate policies see appendix.
[2] Negative emissions are further explained below. Net negative emissions result from more CO2 being captured and stored in carbon sinks than CO_2 being emitted into the atmosphere.
[3] For the policy projections and NDC, the Climate Action Tracker website focuses on emissions from energy consumption, industry, agriculture, and waste sources – representing about 93% of global GHG (Greenhouse gases) emissions. It does not consider GHG emissions from land-use, land-use change, and forestry (LULUCF) in current policy projections and NDCs. GHG emissions from LULUCF source are excluded from the consideration because a decrease in LULUCF emissions may distort the true state of decarbonisation by masking an increase in emissions from energy and industry sector.

Figure 3: CLIMATE ACTION OR JUST A NATURAL TREND? Emission intensity: CO2 emissions per unit of GDP (kgCO2/$1,-GDP, logarithmic scale, in constant 2010 $)

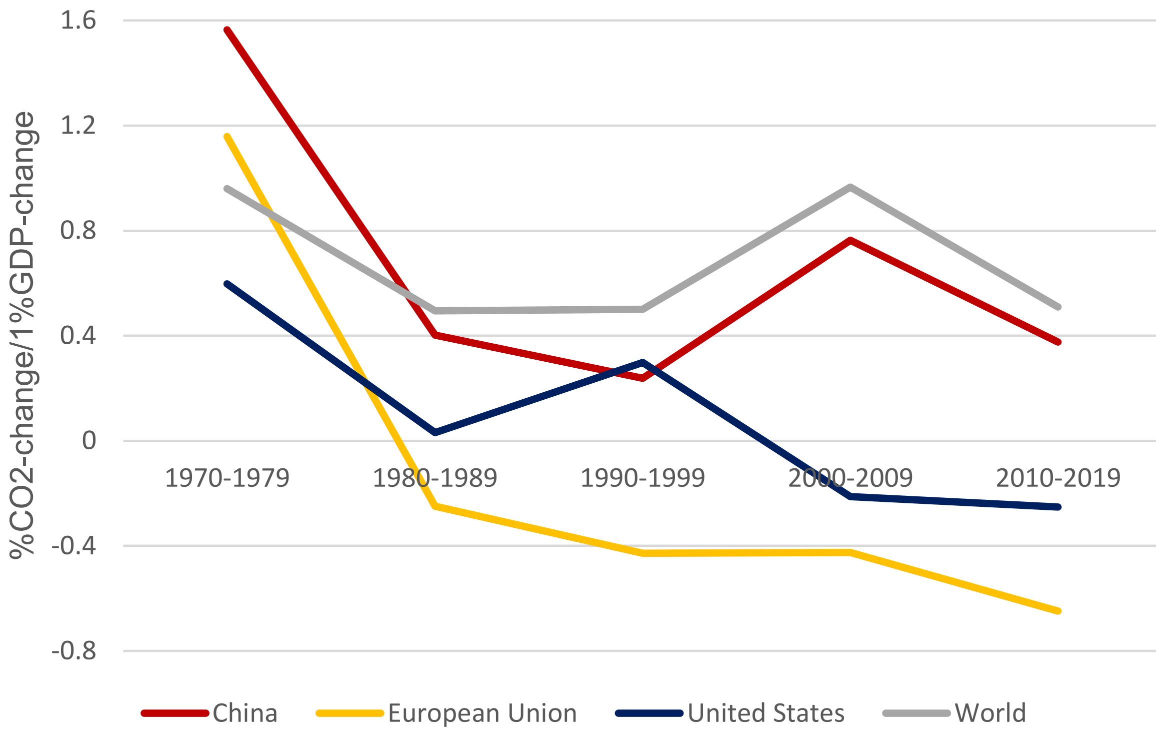


Sources: Allianz, Data: World Bank (WDI) European Commission (EDGAR)

The good news is that we are already in the midst of a transformation. Although past emission data (e.g. Figure 2) suggest that there was almost no progress over the last decade, a closer look – taking growth dynamics into account – leads to a more optimistic conclusion: All three economies made considerable progress in decoupling economic growth from emission growth.

Figure 3 shows the CO2 emissions required to generate a dollar of GDP. In all three economies, this metric has been steadily declining. The vertical scale is expressed in logarithmic values, which reveal astonishingly robust trends over the last 50 years. China, while starting higher due to its economic structure being tilted more towards manufacturing, is now below 1 kg of emissions per dollar (in 2010 inflation adjusted value). The decline of China's emission intensity has been the fastest among the group. The CO2 emissions per dollar have halved every 20 years there, while a 50% reduction of the emission intensity requires almost 30 years, or a generation, in the U.S. and the EU. Keeping all trends constant, China will still need until 2140 to catch up with the U.S. and until 2200 to catch up with the EU, though it would already catch up with the world average in 2050.

Figure 4: 'Coupling index' percentage change of emissions per one percent growth of GDP (10-year brackets, constant 2010 $)



Sources: European Commission Edgar; World Bank WDI

It is obvious that relying on these trends alone is not a viable option, as zero emissions would then only be reached… never. Still, the observable progress becomes more evident if the growth dynamics are analyzed (Figure 4). Historically economic and emission growth have been positively correlated which holds true for all countries in Figure 3. Annual point values vary a lot, but observing trends indicates that all countries start with an average increase between 0.6% and 1.6% in CO2 emissions for a 1% increase in GDP, with China, as an emerging country, having the largest increase. But already from the 1980s economic and emission growth seems to have largely decoupled in the EU, with the U.S. following in the late 2000s. The analysis, however, also shows that there has not been much progress since the 1980s. Just decoupling economic and emission growth won't be enough; future economic growth must rather result in significant reductions in emissions. The EU is already on the right track and shows negative coupling (see Figure 4) although efforts still need to increase.

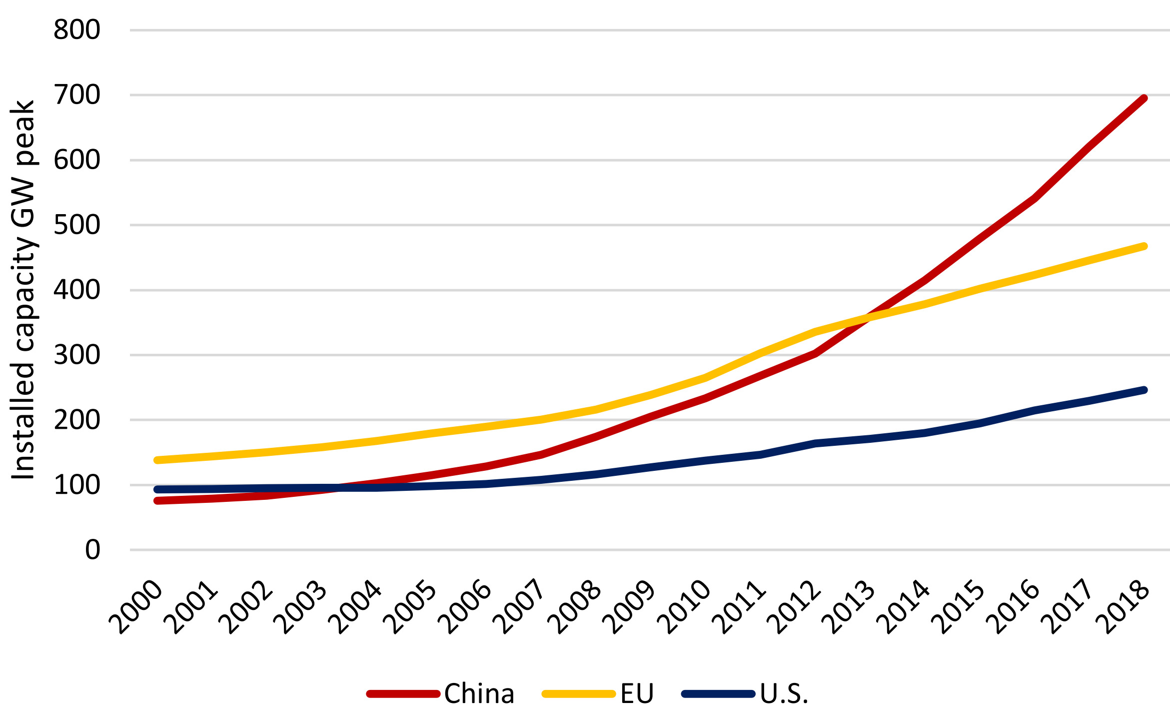
A STOCKTAKING OF CLIMATE (IN)ACTION

Greening the energy supply

Besides the changing structure of the economies – from manufacturing to services – one decisive factor behind decoupling is the greening of energy supply. Over the years, China, the EU and the U.S. have become the significant drivers of renewable energy resources: Their share in the global installed capacity for renewable energy rose from 41% in 2000 to 60% in 2018. However, China is far outpacing the EU and U.S. in this regard.

Figure 5 shows the developments in renewable energy installed capacity over the period of 19 years since 2000. While China has recorded a growth of more than 800% in its installed capacity for renewable energy (from a mere 76GW in 2000 to 695GW at the end of 2018), the EU and the U.S. observed growth of "only" 230% and 160%, respectively. As a result, installed capacity in the U.S. is now around one third of that in China; the EU stands at two thirds. Back in 2000, all three economies were more or less at the same level.

Figure 5: Total renewable energy: installed capacity



Source: Allianz Research, Data: OECD

Again, it is worthwhile to take a closer look as the development trends in installed capacity for subsectors (wind, solar, hydro) vary substantially. Figure 6 shows the trend development of installed wind energy capacity in the three economies. Growth was rapid both in China and the EU, with China overtaking the EU in 2017. In contrast, the progress of the U.S. in wind energy capacity is rather lacklustre.

Figure 7 shows the developments of hydro energy installed capacity for the three economies. Thanks to less restrictions for mega projects, China has significantly increased its hydro energy capacity by a whopping 300% since 2000, from 80GW to 352GW. Over the same period, the EU and the U.S. recorded only marginal increases.

Figure 6: Wind energy: installed capacity

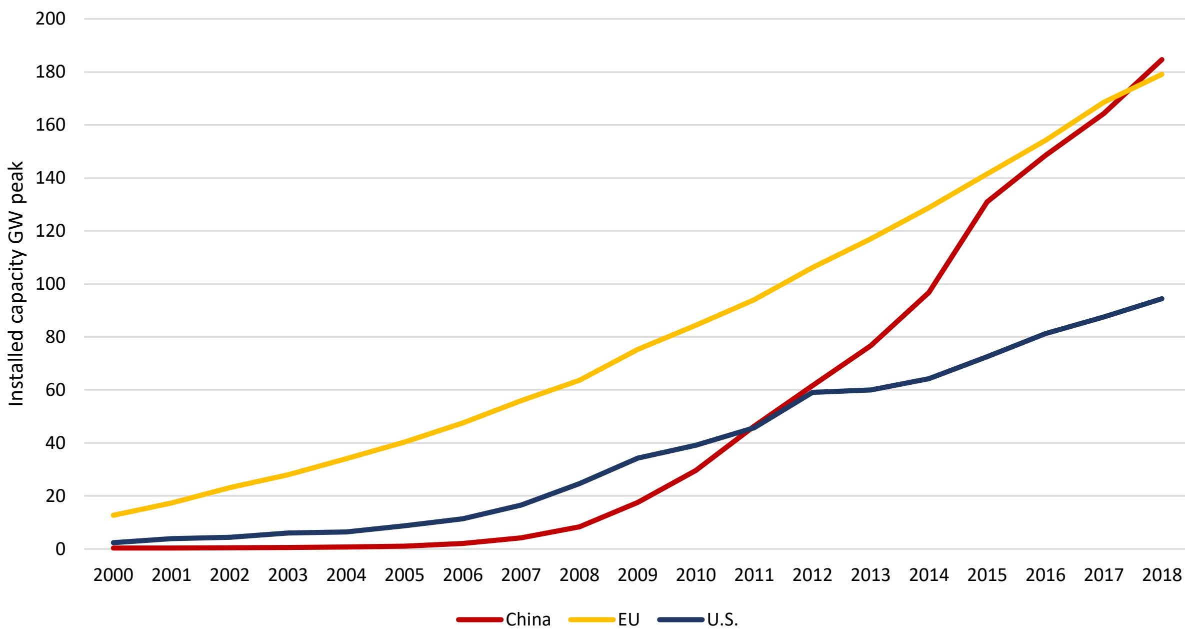
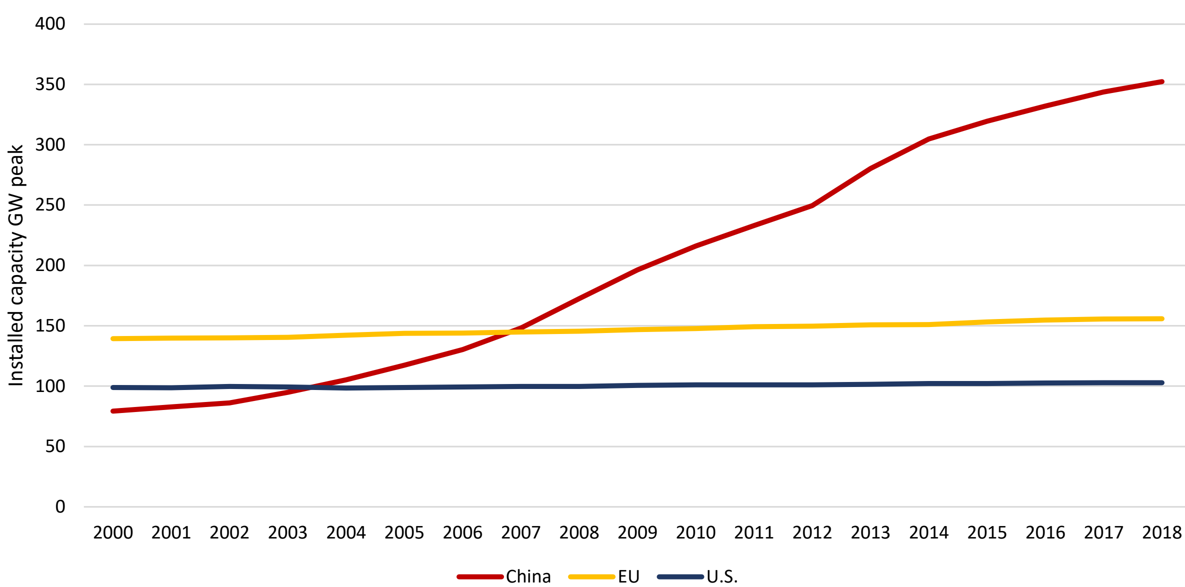


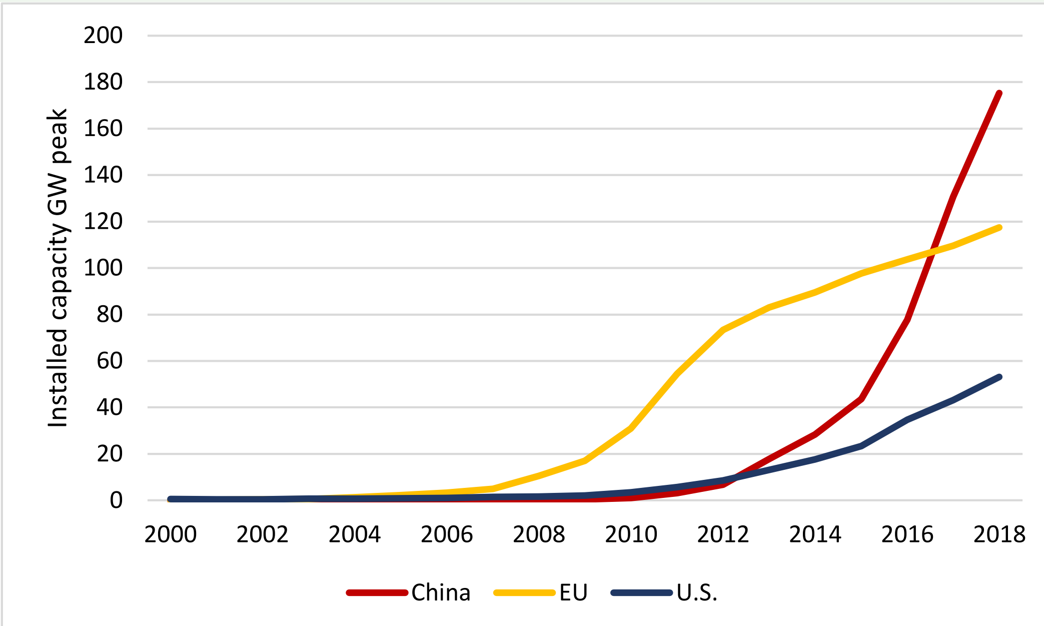
Figure 7: Hydro energy: installed capacity



Sources for both figures 6 and 7: IRENA; Allianz Research.

Figure 8 shows the trend developments in installed capacity for solar energy for the three economies. All three saw rapid growth in their installed solar power capacity in recent years. But once again, China recorded the largest installed capacity (175GW), whereas the EU and the U.S. lagged behind (117GW and 53GW, respectively).

Figure 8: Solar energy: installed capacity



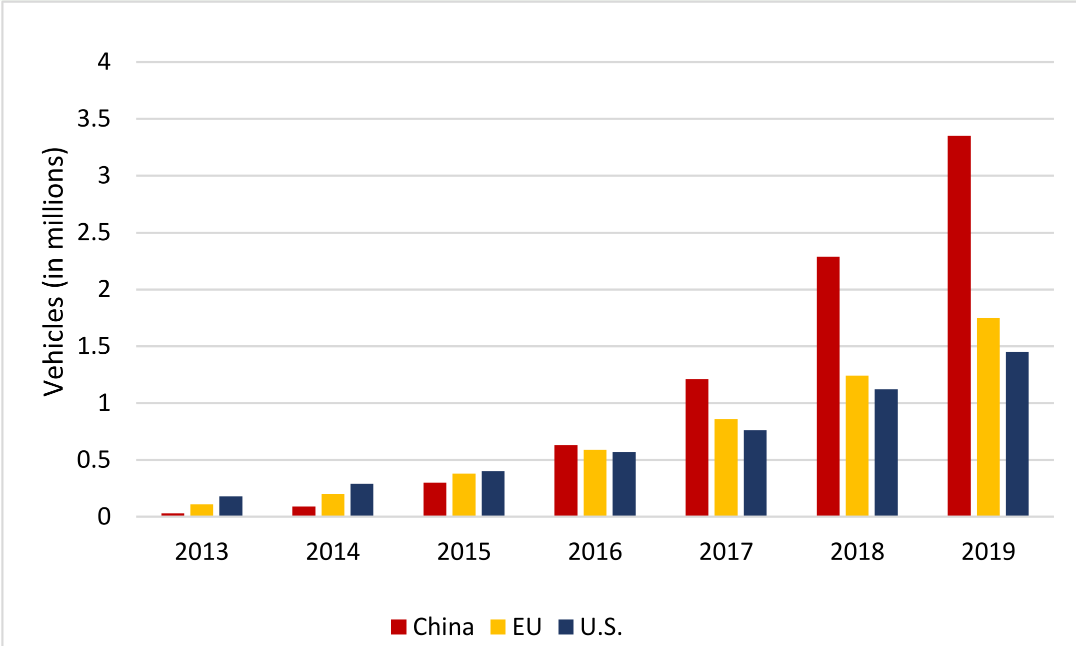
Sources: IRENA; Allianz Research.

Electrifying the transport sector

As transportation accounts for one fourth to one fifth of all GHG emissions (based on well-to-wheel emissions), the shift to electric vehicles is of utmost importance for reaching Paris climate goals. An all-electric vehicle (EV) has zero direct emissions (tail-pipe emissions) and a hybrid-electric-vehicle is more efficient than a traditional fuel based vehicle. Even if well-to-wheel emissions are considered, electric vehicles emit lower emissions than an internal combustion engine vehicle, provided certain basic conditions are fulfilled (IRENA 2017).

China, the EU and the U.S. are clearly the frontrunners in EVs. In 2013, the three economies had 80% of the global EV stock, which increased to 91% in 2019 (Figure 9). However, while in the early years of this decade the EU and the U.S. had a relatively higher stock of EVs, China has outpaced all other economies in recent years. At the end of 2019, China had an EV stock of 3.35 million – a more than 50% increase from 2018 (2.29 million). In comparison, the EU and the U.S. had EV stock of 1.75 million and 1.45 million in 2019, respectively. Over the years, the EV stock of the EU has outgrown that of the U.S., leaving the latter with the lowest EV stock of the three economies. Looking ahead, we expect the pace of growth of all three EV markets to increase amid dedicated EV policies by major governments, dividends from further development of ancillary infrastructure (EV charging infrastructure) and a shift in consumers' preferences.

Figure 9: Electric vehicles stock



Sources: IEA; Allianz Research.

Negative emission technologies

Specific and ambitious policies that explicitly address the removal of carbon dioxide from the atmosphere will play an important role in achieving the Paris Climate goals. Negative emissions technologies and solutions such as afforestation/reforestation and Bioenergy with Carbon Capture and Storage (BECCS) are prominent means to remove carbon emissions from the atmosphere.

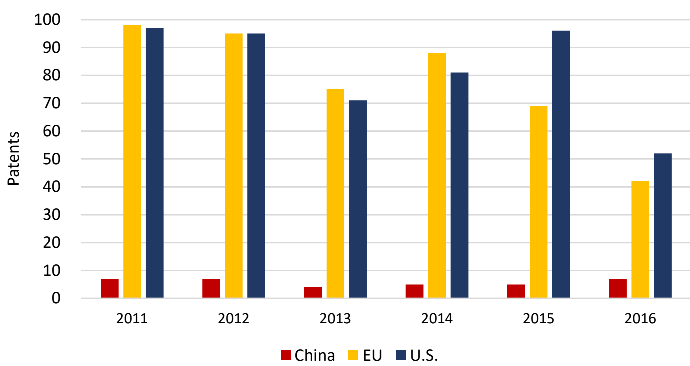
China has the lowest forest coverage among the three economies – 22% vs 34% in the U.S. and 40% in the EU (2016) – but by far the most ambitious forest policy: China's Natural Forest Conservation Program is the largest forest conservation program in the world. It includes massive tree-planting programs, an expansion of forest reserves and a ban on logging in primary forests. The Chinese government spends heavily on these forest programs—more than either the U.S. or the EU and more than three times the global average per hectare[4]. The country has set a 2035 forest coverage target of 26% as well as an intermediate target of 23.04% by 2020. China already planted more than 7 million hectares of forest per year between 2016-2018[5].

Carbon Capture with Storage technology (CCS) will also play a critical role in the reduction of emissions. This process that involves capturing carbon emissions and storing them, rather than releasing them back into the atmosphere. A comparative analysis of the reserve capacity of CCS is rather difficult on account of the lack of adequate data and the lack of a standardised measure for comparison. However, the development of CCS-related patents are suggestive of the potential. Figure 10 shows that the EU and the U.S. have significantly higher CCS patent issuances than China. Thus, CCS seems to be the one field in which the EU and the U.S. appear to lead.

[4] Sandalow, 2019

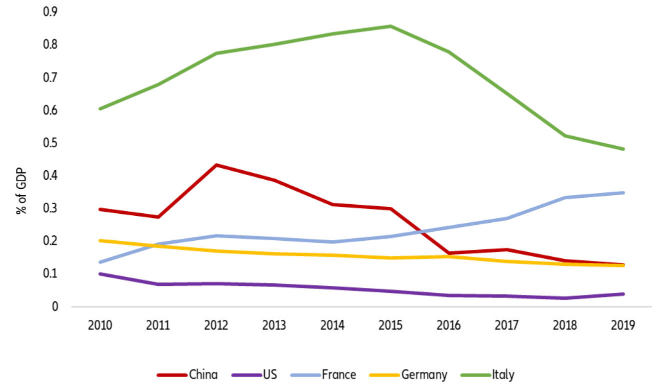
[5] NDRC, *China's Policies and Actions for Addressing Climate Change* (October 2016) at p.20; NDRC, *China's Policies and Actions for Addressing Climate Change* (October 2017) at p.15; NDRC, *China's Policies and Actions for Addressing Climate Change* (November 2018) at p.16. See also National Bureau of Statistics, *Statistical Bulletin on National Economic and Social Development in 2018* (February 28, 2019) at Part XII; National Bureau of Statistics, *Statistical Bulletin on National Economic and Social Development in 2017* (February 28, 2018) at Part XII.

Figure 10: New CCS patents



Sources: OECD; Allianz Research.

Figure 11: Fossil fuel subsidies (in % of GDP)



Sources: IEA; Allianz Research.

Ending fossil fuel subsidies

Ending fossil fuel subsidies is the flip side of subsidizing green technologies – and often overlooked. Fossil fuel subsidies can inhibit sustainable economic development and climate action progress by inefficiently allocating resources, distorting relative prices of energy and adversely affecting the price competitiveness of low-carbon energy businesses. A cross-country comparison of fossil fuel subsidies is not straightforward because there is no agreed upon unique definition of subsidies amongst countries. We use the OECD's definition of fossil fuel subsidies, considering both direct budgetary transfers and tax expenditures based on an inventory approach. Figure 11 shows the development of fossil fuel subsidies as a percentage of annual GDP for China, the U.S. and three big EU countries (Germany, France and Italy)[6]. In the case of both China and the U.S., the magnitude of fossil fuels as a percentage of GDP has been decreasing since 2010. However, at the end of 2019, China's relative fossil fuel subsidies were still higher than that of the U.S. The development in the EU is less encouraging. Not only is the relative level of subsidies significantly higher, but the trend is also worrying, at least in France, where fossil fuel subsidies have increased threefold as a percentage of GDP.

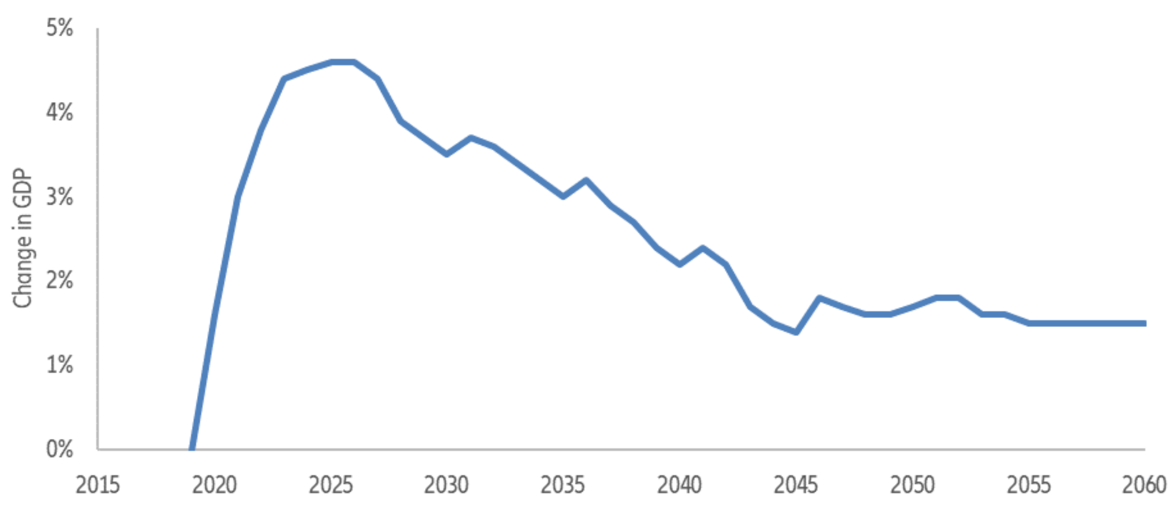
[6] There are no collective data for EU due to the EU subsidy taxonomy. Governments of EU member states have authority over the domain of fossil fuel subsidies. In addition, EU climate policies do not prescribe any specific caps or targets in relation to fossil fuel subsidies except the specification of declaration of phasing out fossil-fuel subsidies by national governments.

HOW GREEN IS THE GREEN RECOVERY?

The economic rebuilding after Covid-19 represents a historic window of opportunity to accelerate the global transition to a net zero emission society. Moving from short-term rescue to longer-term recovery packages, the focus should also shift to long-term climate benefits. China and the EU seem to be ready to prioritize climate-friendly investments that stimulate economic growth.

At the UN General Assembly on 22 September, Chinese President Xi Jinping announced a pledge that **China's CO_2 emissions will reach net-zero by 2060**. This move may not only help the climate – it could lower the global mean temperature increase by around 0.25°C – and China's soft power, but may also pay off in pure economic terms. According to an analysis by Cambridge Econometrics[7], this will have a positive overall net impact on China's GDP, resulting from a combination of positive spillovers from the investment activities in other sectors, enhanced technological progress and leadership in green technologies, reductions of the fossil-fuel import bill and an increase in self-sufficiency and consequently a strengthening of the domestic market. As a result, in the Cambridge Econometrics analysis, China's GDP could increase by close to 5% in the net-zero scenario relative to the baseline, as shown in Figure 12. However, at this stage, there is (very) low visibility on the measures under the new climate target. More details about the planned policy action are included in the appendix 'Overview of climate policies pre-Covid-19'.

Figure 12: Reaching net-zero by 2060 would raise China's GDP (Change in China's GDP in the net-zero pathway, relative to the baseline)



Source: Cambridge Econometrics modelling via www.carbonbrief.org .

[7] https://www.carbonbrief.org/analysis-going-carbon-neutral-by-2060-will-make-china-richer

The EU is not only equally ambitious but also has a more concrete plan: The European Green Deal (EGD) was already presented in December 2019 (see appendix for full details). Its overarching strategy/goal is the transformation of the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy, net-zero GHG emissions by 2050[8] and economic growth decoupled from resource use. While these targets sounded quite lofty when announced, the recent EU Recovery Fund – the EU's answer to the Covid-19 shock – has put some meat to the bone i.e. underpinned the proposals with real money. A green recovery is within reach for the EU.

And the U.S.? It seems to be moving in the opposite direction, at least at the federal level. The U.S. initiated the withdrawal process from the Paris Agreement back in 2017 and will finalise its exit in November 2020. Furthermore, the current U.S. administration devised the Affordable Clean Energy Rule (2018) to replace the Clean Power Plan of the previous administration. But the new policy has been subject of litigations in courts. Thus, a state of stagnation pervades at the federal level in relation to climate policy. However, once the fog of the elections has settled, the U.S. might also join the other two economies in pushing for a green recovery. Thus, it is still too early to identify a clear winner in the race of climate predominance.


Photo by Science in HD on Unsplash

[8] The EU has no legally binding net-zero emission goal yet, but the Commission proposed on 4 March 2020 the first European Climate Law to enshrine the 2050 climate-neutrality target into law.

APPENDIX1: Overview of climate policies pre-Covid-19

Chinese climate goals and policies

The Chinese government has announced four principal climate goals:

1. **To ensure that peak carbon dioxide emissions is reached around year 2030** – with efforts to achieve the peak earlier than 2030. The goal was declared in November 2014 in a China-U.S. summit in Beijing.
2. **To lower carbon intensity of the Chinese economy by 60% - 65% from the 2005 level by 2030.** The carbon intensity is defined as carbon emissions per unit of GDP – a measure of how much emissions a country is creating to generate a unit of domestic product. By 2018, China's carbon intensity had fallen by 45.8% in comparison to the 2005 level with a recorded decline of 4 percentage points in year 2018 [NDRC (2019) at p.3.] In addition to the above mentioned long-term goals, the State Council has set an intermediate 2020 policy target of reducing carbon intensity by 18% from 2015 levels.
3. **To increase the share of non-fossil fuels in primary energy consumption to around 20% by 2030.** In 2018, the NDRC reports that non-fossil fuel energy accounted for 14.3% of energy consumption – increasing by 0.5 percentage points from 2017 figure of 13.8%. [NDRC (2019) at p. 8].
4. **To increase the forest stock volume by 4.5 billion cubic metres by 2030 from 2005 level.** In 2019, the target of an increase of 4.5 billion cubic metres was met (Sandalow, 2019) .

China Energy Strategy: Generally, for all major economies, the energy sector contributes a significant portion of GHG emissions. For China, energy emissions contributed roughly 78% of GHG emissions in 2012. The Chinese government has formulated a specific climate policy focused on sustainable and green energy developments for the energy sector – the China Energy Supply and Consumption Revolution Strategy (2016-2030). It lays down strategies for the development of energy for the period of 2016-30.

China Energy Strategy proposes new 2030 energy targets for climate action:

- Primary energy consumption should be controlled within 6 billion tonnes of coal equivalent.
- Non-fossil fuel share of the primary energy consumption shall be higher than 20%.
- Non-fossil fuel sources account for more than 50% of the total power generation.
- Ultra-low polluting coal power plants should represent more than 80% of the fleet.

China Energy Strategy reinforces the existing 2020 targets as well:

- Primary energy consumption should be controlled within 5 billion tonnes of coal equivalent.
- Non-fossil fuel mix in the energy consumption should be higher than 15% by 2020.
- Energy intensity reduces by 15% in comparison to the 2015 level.
- Carbon emission per unit of GDP reduces by 18% in comparison to the 2015 level.

EU climate goals and policies

A binding 2030 target to reduce EU GHG emissions by at least 40% below 1990 levels.

As part of the European Green Deal, the European Commission aims to propose raising the EU target to at least 50% (from the present 40% target) and towards 55%. The EU had an intermediate target of reducing GHG emissions by 20% in comparison to its 1990 levels by 2020. The EU has already achieved the intermediate target - at the end of 2018, the EU had already reduced its GHG emissions by 23% in comparison to its 1990 levels.

A binding target of renewable energy accounting for 32.5% of final energy consumption. The original target of 27% share of renewable energy was revised upwards in 2018. There is a review clause of an upward revision of the renewable energy target. At the end of 2018, the share of renewable energy in energy consumption increased to 18.9% from 9.6% in 2004. However, there is prevalence of heterogeneity in the renewable energy share amongst member nations on account of differences in the endowment of natural resources. The share of renewable energy was highest in Sweden (54.6%), followed by Finland (41.2%) and Latvia (40.3%). The renewable share was lowest in the Netherlands (7.4%), Malta (8.0%), and Luxembourg (9.1%).

A headline EU target of at least 32.5% for energy efficiency to be achieved by 2030. Energy efficiency can be measured by energy intensity – the ratio of energy consumed to GDP in euros (PPP) terms. The original target of at least 27% for energy efficiency was revised upwards in 2018. The least energy intensive economies in the EU in 2018 were Ireland, Denmark, and Romania. The most energy-intensive economies in the EU were Malta and Estonia.

EU renewable energy directive: The agreement sets a 32% binding target for RES by 2030. For the transport sector, the agreement established a 14% target share of renewable energy sources in transport fuels for the member nations with a 3.5% share of advanced biofuels and biogas (1% by 2025). Additionally, the directive implements a 7% cap on the share of first-generation biofuels in road and rail transport.

The EU must make additional investment of EUR170 billion to EUR290 billion every year to achieve its 2030 climate and energy objectives. In order to achieve current 2030 climate goals, the EU is required to invest an estimated additional EUR260 billion each year. Apart from the above mentioned 2030 goals, the EU also introduced a more ambitious climate policy, the European Green Deal, in 2019.

U.S. climate policy

U.S. Climate Alliance: Despite the lack of national policies for climate action, 25 states in the U.S. have formed an alliance to progress towards the Paris Agreement climate goals and develop a clean energy economy. These states represent 55% of the U.S. population, 40% of GHG emissions and $11.7 trillion of the economy (U.S. Climate Alliance fact sheet). If the alliance member states were one country, it would be the third-largest economy in the world after the U.S. and China.

Each member state of the U.S. Climate Alliance is required to make following mandatory commitments:

- Implement policies that aim to reduce GHG emissions by at least 26-28% below the 2005 levels.
- Accelerate new and existing policies to reduce carbon pollution and promote clean energy deployment at state and federal levels.

Based on the climate and clean energy policies in place, Alliance member states are projected to reduce GHG emissions by 18%-25% by 2025, compared to their 2005 levels. The Alliance member states have formulated separate climate policies with heterogeneous climate targets. Thus, the development of sustainable economy will not be homogenous across different member states – some states have more ambitious climate targets than others. However, the Alliance member states are expected to have more favourable progress than non-member states. According to GHG emissions trends, the Alliance member states of California, Pennsylvania, Illinois, New York, and Michigan rank among the top ten contributing states towards U.S. GHG emissions. For a more incisive analysis of U.S. Climate policies framed since its withdrawal from the Paris Climate Agreement, a review of notable climate policies for the five referred major emitters Alliance member states is presented in this section.

California: California has set a long-term target of achieving carbon neutrality by 2045. It has mandated a state-wide goal to reduce GHG emissions 40% below 1990 levels by 2030. California has also set the target of introducing five million zero emissions vehicles (ZEVs) on roads by 2030 along with an intermediate target of putting 1.5 million ZEVs on roads by 2025. The state has planned an installation of 250,000 electric chargers by 2025 and set a goal to transfer public transport vehicles to zero-emission bus fleets by 2040. California's Building Energy Standards have set a net-zero energy goal for all new residential construction by 2020 and for all new commercial construction by 2030.

Pennsylvania: In 2019, Pennsylvania set its first GHG reduction target of reducing emissions by 26%-28% below 2005 levels by 2030. Pennsylvania also has a long-term target of reducing GHG emissions by 80% by 2050. In relation to energy, Pennsylvania has mandated that electricity distribution companies must obtain 8% of their electricity supply from renewable sources. The state has also set a target to replace 25% of public transport vehicles with electric vehicles.

Illinois: Illinois has set the target to achieve 26%-28% reduction in GHG emissions from its 2005 levels by the end of 2030. Illinois has set a 25% target share of renewable energy in total installed capacity. Illinois has mandated installation of at least 3000MW of solar power capacity and 1300MW of wind power capacity by 2030.

New York: New York has set a target of reducing its GHG emissions 85% below its 1990 levels by 2050 and offset the remaining 15%. The state also has a long-term target of achieving carbon-free electricity by 2040. New York also has an intermediate target of 70% share of renewable energy in electricity by 2030. New York has also announced the target of 6GW of distributed solar by 2025 and 9GW of offshore wind by 2035. New York has announced the development of 10,000 charging stations by 2021 and 200 fast chargers in 2020. The state is expected to mobilise $1.46bn-$1.70bn for investment in sustainable infrastructure

Michigan: Michigan has a long-term GHG emissions reduction target of 80% below 2005 levels by 2050. The state also has an intermediate GHG emission reduction target of 20% below 2005 levels by 2020. Michigan has a long-term target of 35% share of renewables in electricity by 2035 and an intermediate target of 15% share of renewable in electricity by 2021.

APPENDIX 2 Sectoral decomposition of climate action ambitions

Climate policies are good starting point to assess the climate action ambitions of any economy. This section provides an overview of climate action goals and policies for China, the EU and the U.S.. The three economies' climate goals cannot be readily compared on one-to-one basis, because their economic and environmental states are different. However, an overview of all policies and goals provide interesting insights into the state of economies – both economic and environmental – and can help in providing contextual information. For instance, China, being a developing and manufacturing-intensive economy, will have climate goals that may already be a current feature or facet for the EU economy.

A glimpse into the future: climate scenarios. An objective comparison of European, Chinese and U.S. climate policy is extremely difficult due to their fundamentally different legal, economic and governance states and structures. Most promising is the approach to assess how much policy ambitions contribute to the final goal of eliminating GHG emissions. This is also the logic that is underling the Climate Action tracker shown in Figure 2. Considering the national composition of the economy, the policy ambitions of the 2015 Paris NDC pledges can be translated into sectoral emission reductions, which in global aggregate result in a specific global warming path. The sectoral emissions scenario can be compared to the sectoral emission reduction requirements for limiting global warming to well below 2°C. Figure 13 shows the results of model calculations by the Pacific Northwest National Laboratory (PNNL). The first block shows the sectoral emission reductions until 2060 resulting from implementing the 2015 NDC pledges. At the time when the agreement was reached, it was clear that the pledges would not sufficiently limit global warming and the model results show an increase in global mean temperature by 2.8°C. But even the (non-committed) increased emission reduction ambitions identified by then, and shown in the second block, would result in a global warming of more than 2°C. Striking in the second block is that the EU in the more ambitious Paris scenario still needs to decrease emissions in the electricity sector by an absolute 14% of current emissions in addition to the already pledged 97%. This results in negative total emissions already discussed above and the EU is expected to be the frontrunner in this respect. The final block illustrates what is the remaining difference to a zero-emission regime, which is the minimum requirement for limiting global warming to 2°C.

Figure 13: Global Change Assessment Model (PNNL) 2060 Emission projections for differing sectors and policy ambitions.

	World	EU-15	U.S.	China*
2.8°C: Paris NDC emissions vs. 2015 policies emissions				
Electricity	-37%	-97%	-81%	-40%
Industry	-27%	-44%	-29%	-50%
Transport	-3%	-6%	-3%	-8%
Buildings	-14%	-25%	-13%	-27%
2.2°C: Further emission gap to fullfill increased Paris ambitions				
Electricity	-38%	-14%	-13%	-22%
Industry	-25%	-9%	-8%	-10%
Transport	-5%	-2%	-2%	-2%
Buildings	-14%	-4%	-6%	-4%
<2.0°C: Remaining emission gap from increased ambitions to zero-emissions				
Electricity	-25%	11%**	-6%	-38%
Industry	-48%	-47%	-63%	-39%
Transport	-91%	-92%	-96%	-90%
Buildings	-72%	-71%	-81%	-69%

* China has expressed to increase its climate ambitions considerably and to reach climate neutrality by 2060.
** EU has a positive value for the electricity sector because emissions in the increased ambition scenario are reduced by 111% and thus are negative.
Source: Allianz Research calculations based on Pacific Northwest National Laboratory (PNNL) projections via www.climatewatchdata.org "pathways".

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OUR TEAM

Chief Economist of Allianz and Euler Hermes

Ludovic Subran
Chief Economist
ludovic.subran@allianz.com

Head of Economic Research, Euler Hermes

Alexis Garatti
alexis.garatti@eulerhermes.com

Head of Capital Markets Research

Eric Barthalon
eric.barthalon@allianz.com

Head of Insurance, Wealth and Trend Research

Arne Holzhausen
arne.holzhausen@allianz.com

Macroeconomic Research

Ana Boata
Head of Macroeconomic Research
ana.boata@eulerhermes.com

Katharina Utermöhl
Senior Economist for Europe
katharina.utermoehl@allianz.com

Selin Ozyurt
Senior Economist for France and Africa
selin.ozyurt@eulerhermes.com

Françoise Huang
Senior Economist for APAC
francoise.huang@eulerhermes.com

Manfred Stamer
Senior Economist for Middle East and Emerging Europe
manfred.stamer@eulerhermes.com

Georges Dib
Economist for Latin America, Spain, Portugal and Trade
georges.dib@eulerhermes.com

Dan North
Senior Economist for North America
dan.north@eulerhermes.com

Capital Markets Research

Jordi Basco Carrera
Fixed Income Strategist
jordi.basco_carrera@allianz.com

Lina Manthey
Equities Strategist
lina.manthey@allianz.com

Patrick Krizan
Senior Economist for Italy and Greece, Fixed Income
patrick.krizan@allianz.com

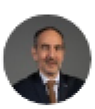
Insurance, Wealth and Trends Research

Michaela Grimm
Senior Expert
michaela.grimm@allianz.com

Markus Zimmer
Senior Expert, ESG
markus.zimmer@allianz.com

Patricia Pelayo Romero
Expert, Insurance
patricia.pelayo-romero@allianz.com

Sector Research



Maxime Lemerle
Head of Sector Research
maxime.lemerle@eulerhermes.com

Marc Livinec
Sector Advisor for Chemicals, Pharmaceuticals, Transportation, Agrifood and Transport Equipment
marc.livinec@eulerhermes.com

Aurélien Duthoit
Sector Advisor for Retail, Technology and Household Equipment
aurelien.duthoit@eulerhermes.com

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Director of Publications: Ludovic Subran, Chief Economist
Allianz and Euler Hermes
Phone +33 1 84 11 35 64

Allianz Research
https://www.allianz.com/en/economic_research

Königinstraße 28 | 80802 Munich | Germany
allianz.research@allianz.com

allianz

@allianz

Euler Hermes Economic Research
http://www.eulerhermes.com/economic-research

1 Place des Saisons | 92048 Paris-La-Défense Cedex | France
research@eulerhermes.com

euler-hermes

@eulerhermes