The Carbon Neutrality Global Challenge

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## 01/ONE Introduction

**Why achieving carbon neutrality is not an option?**

"2020 was one of the three warmest years on record, despite a cooling La Niña event", the International Meteorological Organisation (IMO) reports. Since 1880, first year of modern climate data recordkeeping, nine out of the ten hottest years ever recorded have occurred from 2005 onwards. This trend has dramatically accelerated during the past five years.

Nowadays it is a widely accepted notion that Global Warming (GW) is mostly due to human activities, especially to the large amount of greenhouse gases (GHGs) released by fossil fuel burning, intensive farming and the misuse of land.

The Intergovernmental Panel on Climate Change (IPCC) report[1] outlines:

- GW has already reached 1°C (probable range of 0.8-1.2°C) above pre-industrial levels and is likely to get to 1.5°C between 2030 and 2052 if it continues to increase at the current rate
- The atmospheric concentration of carbon dioxide ($CO_2$) has risen from close to 280 parts per million (ppm) in 1800 to 367 ppm in 1999. It has already reached around 417ppm in 2020

The Arctic Sea ice surface has shrunk from 7.05 million sq km in 1979 to 3.92 sq km in 2020[2], and the sea level has raised from -0.5 (± 4.0) mm in 1993 to 98 (± 4.0) mm in 2021[3].

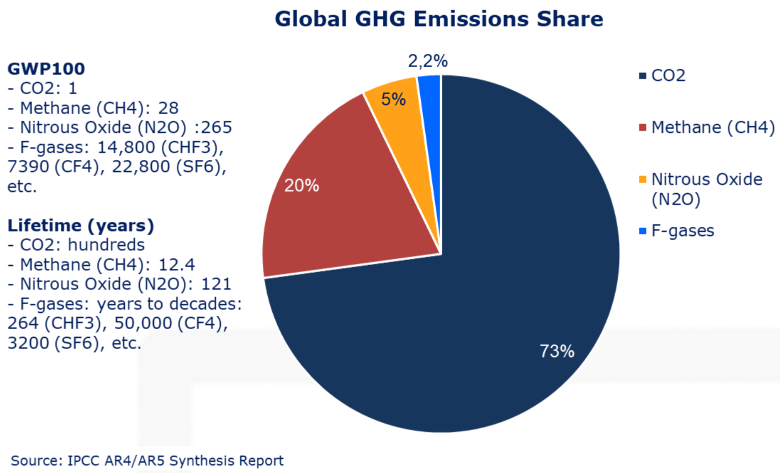
GW is the cause of increasingly frequent natural disasters and has an impact on food security, the economy, human health, and people's wellbeing in general. Recently, a debate ignited on how GW could also be contributing to the increased rates of infectious diseases, including COVID-19, as many of the root causes of climate change also increase the risk of pandemics[4]. The effects of GW are already too costly.

Even though $CO_2$ gasses account for the majority of GHG emissions (76%), a carbon footprint assessment should include all the following GHGs measured in terms of their $CO_2$ equivalence ($CO_2$e). The IPCC defines $CO_2$e as the measure used to compare the emissions from various GHGs based on their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of $CO_2$ with the same GWP. Furthermore, each GHG has different patterns of resilience in the atmosphere ($CO_2$ some centuries, $CH_4$ a few decades, etc.).

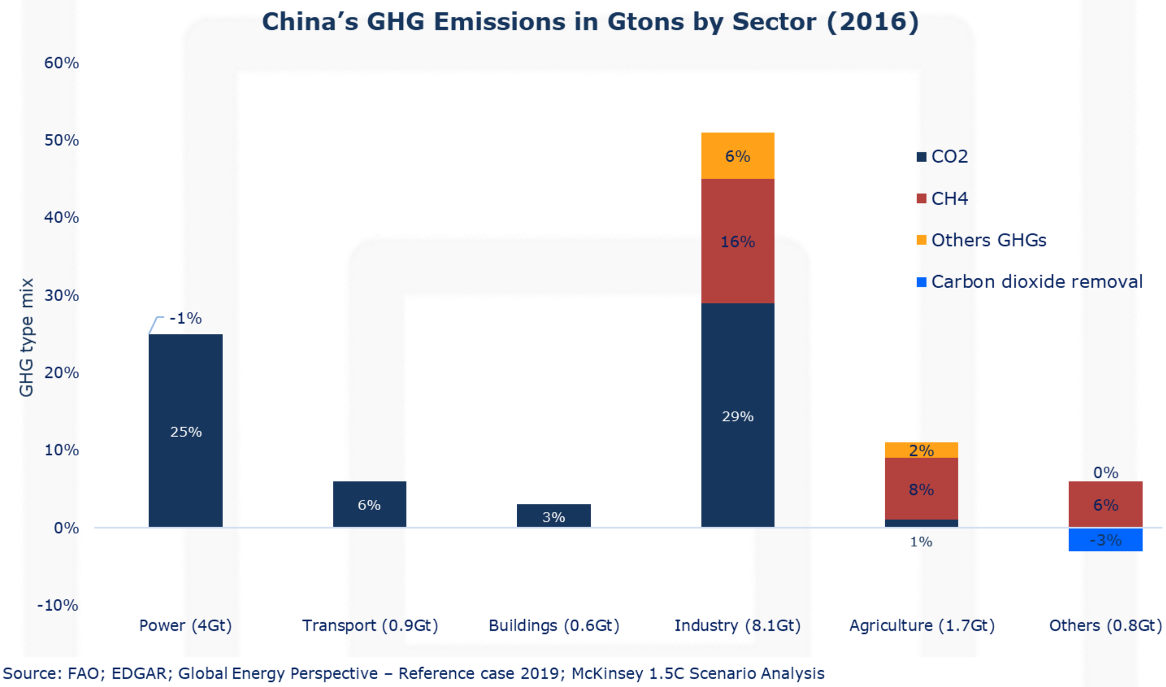
$CO_2$ and methane ($CH_4$) amount to 73% and 20% of global GHG emissions respectively, with nitrous oxide ($N_2O$) accounting for 5% and the F-gases ($CHF_3$, $CF_4$, $SF_6$, etc.) for another 2.2%. Although the F-gases account for the minority of GHGs, they can remain in the atmosphere for centuries. They are powerful GHGs, with a global warming effect up to 23 thousand times greater than $CO_2$, and their emissions are rising remarkably[5].

Notably, more than 70% of global $CO_2$ emissions are generated in China, the European Union (EU) and the United States (US). These major economies therefore have the responsibility to lead a coordinated path to decarbonisation. China's GHG emissions reached 16 GT of $CO_2$e, $CO_2$ represents over 60% of total GHG emissions and $CH_4$ adds another third.

[1] "Global warming of 1.5°C", IPCC, 2019. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf
[2] "Facts of sea level," NASA, 2020. https://climate.nasa.gov/vital-signs/sea-level/
[3] "Facts of Arctic Sea Ice Minimum," NASA, 2020. https://climate.nasa.gov/vital-signs/arctic-sea-ice/
[4] Dr. Aaron Bernstein, "Coronavirus, Climate Change, and the Environment," Harvard Chan C-CHANGE, 2020. https://www.hsph.harvard.edu/c-change/subtopics/coronavirus-and-climate-change/
[5] "Fluorinated greenhouse gases," European Commission. https://ec.europa.eu/clima/policies/f-gas_en




Achieving carbon neutrality to mitigate climate change is a global imperative. However, it is crucial to remember that "carbon" should refer not just to $CO_2$, but to all greenhouse gases (GHGs) and that their contribution to greenhouse gas effects should be measured accurately.




## The Paris Agreement and carbon neutrality

Since the adoption of the Paris Agreement at COP21 in 2015 – aimed at limiting global warming to 2°C, preferably to 1.5°C compared to pre-industrial levels – the 196 signatory countries have committed to the vague goal of achieving net-zero emissions (or climate neutrality) by mid-century. Namely, an overall balance between GHG emissions produced and GHG emissions taken out of the atmosphere must be achieved.

However, during the recent summit held in Cornwall, G7 leaders failed to agree on a deadline to phase out coal usage for power generation, highlighting the lack of coordinated, holistic, yet pragmatic approaches in tackling carbon neutrality.

Over the past years, China stepped up to take the global leadership in fighting climate change. President Xi caught the world by surprise when at the UN General Assembly in September 2020 he announced that China's carbon emissions will peak in 2030 and carbon neutrality will be accomplished by 2060.

Global commitments and scattered actions are increasing, but up until now, they are far from what it takes to effectively confront the issue.

More urgency needs to be attached to a coordinated, holistic, and pragmatic approach to carbon neutrality commitments. As argued by Alok Sharma, the incoming President of COP26 – taking place in Glasgow in November 2021 – countries must now consolidate options and draft a text that can be swiftly finalised and adopted.

Without drastic and concrete measures to cut GHG emissions and reduce energy and carbon intensity, meeting the Paris Agreement goal of keeping global warming below 1.5°C is unlikely.

**Challenges of defining and achieving carbon neutrality**

When discussing climate action and the reduction of GHG emissions, the terms "climate change", "climate neutrality", "net-zero (carbon) emissions", "decarbonisation" and "carbon neutrality" are often used interchangeably or wrongly. Pollution and GHGs are also often confused.

The table below clarifies the different terms and concepts:

| Term | Definition |
|---|---|
| **Climate change** | A long-term change in the average weather patterns that have come to define the Earth's local, regional and global climates. Changes observed in the Earth's climate since the early 20th century are primarily driven by human activities, particularly the burning of fossil fuels. |
| **Pollution** | Refers to the overall and general contamination of air, water and soil with solid, liquid and gas contaminants not naturally produced by nature, affecting wildlife, human wealth and soil health. GHGs only represent a proportion of pollution: some GHGs are not harmful to human health (e.g. $CO_2$). |
| **Climate neutrality** | Refers to bringing all GHG to the point of zero while eliminating all other negative environmental impacts of an organisation. |
| **Net zero carbon emission** | This means that an activity releases net zero carbon emissions into the atmosphere (often considered synonymous with carbon neutrality). |
| **Net-zero emission** | Alludes to achieving a balance between the whole amount of GHGs released and the amount removed from the atmosphere. |
| **Decarbonisation** | Decrease the ratio of $CO_2$ or all GHG emissions related to primary energy production. |
| **Carbon neutrality** | Any $CO_2$ emissions released into the atmosphere as a result of a company's activities are balanced by an equivalent amount being removed. |

Source: PlanA Academy, 2021; NASA; Word Resources Institute

According to the IPCC, carbon neutrality (or net-zero emissions) also refers only to $CO_2$ and is a state of balance between the $CO_2$ emissions released into and those removed from the atmosphere[6]. Nevertheless, when an organisation or a business announces its emission reduction targets, all GHG emissions should be taken into account. Even though $CO_2$ neutrality may be achieved, other GHGs like $CH_4$ can continue to trap heat in the atmosphere.

[6] "What's carbon neutrality?" Sphera, 2020. https://sphera.com/glossary/what-is-carbon-neutrality/

Energy-intensive businesses (power generation, iron and steelmaking, oil and gas, mineral processing, concrete manufacturing, etc.) are among the major sources of GHG emissions. Stepping up net zero emissions action means that companies must first quantify and assess their carbon footprint. When doing so, they often neglect to consider the whole life cycle of the products they manufacture or services they provide, including the entire supply chain, distribution and consumption. These omissions lead to partial evaluations of their carbon footprint. Looking at net zero emissions from a full life cycle perspective is crucial if offsetting frameworks are to be effective.

From a technological standpoint, apart from the replacement of conventional technologies for power generation with cleaner solutions, much emphasis has been put on artificial carbon sinks, especially carbon capture, utilisation and storage (CCUS) technology. However, at present such projects are usually too expensive for most businesses to justify, in spite of decisive corporate social responsibility (CSR) goals. A reliance on expensive CCS/CCUS should not be cited as an excuse to delay or avoid carbon neutrality actions.

The debate around carbon neutrality also focuses on the fact that different countries are at different stages of development, and may, wrongly, consider the carbon neutrality pathway to be at odds with economic development. Many European states already reached their "carbon peak" around the 1980s, the US and Japan around 2007 and 2010, respectively. Most developed countries have incorporated climate protection into legal procedures. Yet most emerging and developing economies still rely on public resources to finance new energy projects and do not incorporate emissions reductions into their planning. To this end, improvements in regulatory and policy frameworks would ease the international capital flow to support the deployment of clean energy production plants and the upgrade of conventional ones.

Different, decentralised, and flexible energy production and distribution models must be adopted in emerging and developing countries for making carbon neutrality possible, sustainable and the base of new development models. The current strongly centralised energy models adopted in emerging countries are incompatible with carbon neutrality goals.

IEA has recently released “Net Zero by 2050”, a comprehensive although preliminary study towards net-zero $CO_2$. It includes over 400 milestones to guide the path and is marked as the “world’s first comprehensive study of how to transition to a net-zero energy system by 2050, while ensuring stable and affordable energy supplies, providing universal energy access, and enabling robust economic growth”. The key sectoral milestones set by IEA are[7]:

- In the construction sector, emissions will drop by 40% to 2030 and more than 95% to 2050
- In transportation, emissions will decrease by 20% to 2030 and 90% to 2050
- In the secondary sector, emissions will reduce by 20% to 2030 and 90% to 2050
- Electricity demand will grow rapidly in the Net Zero Emission (NZE) scenario, rising by 40% from today to 2030 and by more than two-and-a-half-times to 2050
- Fossil fuel use will fall drastically by 2050

Though outlining the pillars to build a clean energy world by 2050 (based mostly on renewable energy sources) by calling for increasing international cooperation between governments, the IEA’s is a top-down approach that legitimately cannot take into account specific characteristics of different industrial, social and economic contexts, indispensable to design effective decarbonisation pathways.

**Frameworks and tools to identify and assess green and sustainable projects or assets**

Decarbonisation joint efforts will only succeed whether there is full alignment on concepts and methodologies. Joint mechanisms recognized globally should be adopted in the near future. For example:

[7]“Net Zero by 2050 – A Roadmap for the global energy sector,” International Energy Sector, 2021. https://iea.blob.core.windows.net/assets/20959e2e-7ab8-4f2a-b1c6-4e63387f03a1/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

**Green taxonomy**

To achieve the climate and decarbonisation goals, the EU devised a comprehensive framework to systematically classify and define economic activities or investments that meet priority environmental requirements, driven by the financial sector (led by Multilateral Developments Banks), more and more involved in “green development”. The EU taxonomy for sustainable activities came into force in July 2020. The classification system provides effective guidance for market participants to identify eligible green and sustainable assets, reduce the risk of "greenwashing", and support additional policy actions to further scale up green financing.

Over the past few years, apart from the EU, several governments, institutions, and Multilateral Development Banks (MDBs) worldwide have sought to develop green taxonomy systems (e.g. the Green Bond Endorsed Project Catalogue by the People’s Bank of China and the Green Bond Principles and Green Loan Principles by the International Capital Market Association).

**ETS and carbon pricing**

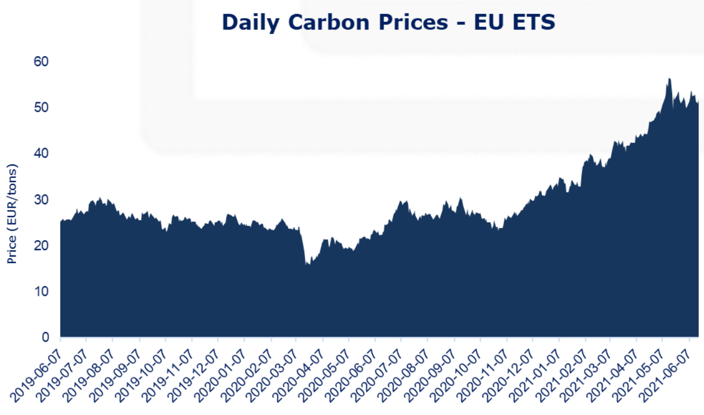
The Emissions Trading System (ETS) is potentially a key tool for boosting the GHG emission reduction in a cost-effective manner based on, theoretically, “market driven mechanisms”.

The EU ETS, established in 2005, is the world’s first international “cap and trade” carbon emissions trading system, which also inspired carbon trading in other countries and regions. By implementing specific mechanisms such as the ETS, carbon emissions offsetting – that is, balancing emissions generated in one sector by decreasing them elsewhere – is expected to accelerate. However, ETS has so far not lived up to expectations. Its effectiveness has been restrained by the overallocation of permits that ended up in maintaining carbon prices low, which in turn resulted in a significant number of emitters being allowed to pay to contaminate, hence implying the adoption of the “price adjustment mechanism” (market stability reserve)[8] in the EU in 2019, which has resulted in higher and more stable carbon prices. Although meant to be supported by market-driven mechanisms, the “cap” and “allowances” concepts and their quantification are political choices affecting ETS effectiveness.

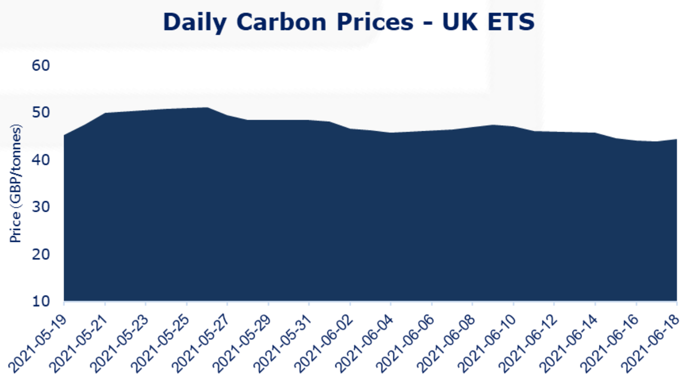
As one of the core policy tools to achieve the emission peak and carbon neutrality targets, China’s National Development and Reform Commission (NDRC) released the initial ETS framework in 2017. The Chinese national carbon trading scheme is planned to be officially launched in mid-2021.

ETS could become effective only if its trading mechanisms reflect actual costs of $CO_2e$ emissions to be balanced, becoming the financial tool for accelerating decarbonisation. Current gaps between $CO_2$/tons prices in different countries and the lack of an international regulated market limit the effectiveness of the system.

The EU ETS price as of June 17, 2021 is 50.91 EUR/tons, while the UK ETS[9] price is 44.4 GBP/tons (or 51.78 EUR/tons). The graphs below illustrate the price trend of both EU and UK ETS[10].




Source: ICE (Intercontinental Exchange)




Source: ICE (Intercontinental Exchange)

[8]“Market Stability Reserve,” European Commission. https://ec.europa.eu/clima/policies/ets/reform_en
[9]A UK Emissions Trading Scheme (UK ETS) replaced the UK's participation in the EU ETS on 1 January 2021.
[10]“Daily Carbon Prices”, EMBER. https://ember-climate.org/data/carbon-price-viewer/

Another measure to deal with carbon emissions is applying carbon pricing – a carbon tax explicitly setting a price on carbon by defining a tax rate on GHG emissions or, more commonly, on the carbon content of fossil fuels. Sweden has the highest carbon price in the world, charging about 119 USD/t$CO_2$e, then followed by Switzerland (99 USD/t$CO_2$e), Finland (68 USD/t$CO_2$e), Norway (53 USD/t$CO_2$e), and France (49 USD/t$CO_2$e). However, carbon pricing is far from being adopted on a global scale and prices excessively low to make a difference. Multinational cooperation is a must so that countries can share experience and knowledge to build one system that stabilises carbon prices and increases market liquidity.

**Carbon Border Adjustment Mechanism (CBAM)**

The European Parliament passed a resolution proposing the Carbon Border Adjustment Mechanism (CBAM) on March 10th, 2021. The discussion is still undergoing among major countries (EU, China, USA, Canada) mainly about framing CBAM within WTO rules and regulations. According to the current status, from 2023, countries that trade with the EU would be requested to comply with carbon emissions rules, implying that exports to the EU might face carbon tariffs for offsetting EU based costs to be compliant with EU carbon regulations. The latter can also successfully limit the risk of "carbon leakage". However, some argue that CBAM will impact the international trade mechanism of the WTO and is questioned as trade disguised protectionism.

## 02/TWO China carbon neutrality pathway

### China's energy transition status

Over the past few years, China has been making great efforts in transforming its energy structure. The growing need to counter the harmful effects of pollution (e.g. Blue Skies regulations) and a firm move by the authorities to boost renewable energy generation have turned China into a leading actor in the global energy transition. Some remarkable progress has been made according to the figures released by the government:

- The carbon intensity is 48.1% lower than 2005's levels
- China's power capacity of renewable energy accounts for about 30% of the global total, making it the country with the largest installed renewable energy capacity
- Among all renewable sources, the installed capacity of hydropower, wind power, photovoltaic and biomass power generation ranks first in the world
- In 2020, coal consumption accounted for 56.8% of total energy consumption, with a decrease of 11.7% since 2012
- Clean energy sources, including renewables and nuclear power, accounted for 23.4% of total energy consumption, 8.9% more than in 2012. Solar and wind power generation added up to 9.7% of total power consumption in 2020, and is set to raise to around 11% by the end of 2021

Nevertheless, China is still the world's biggest source of $CO_2$, responsible for around 28% of global emissions.

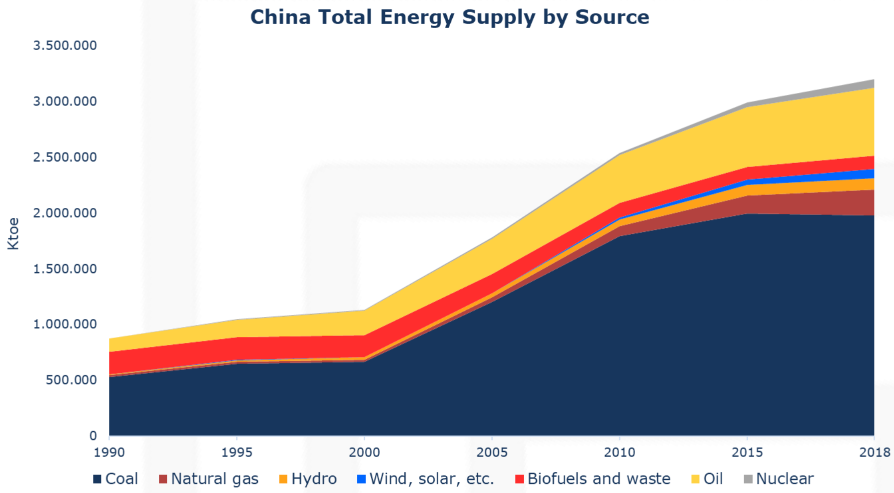
### China's decarbonisation goals

Following President Xi's decisive commitment to carbon neutrality, China's 14th Five-Year Plan (FYP 2021-2025) identifies among its pillars the "Green Development" that is deemed indispensable to build an "ecological civilisation" – China's vision of environmental sustainability.

[11]"Pricing Carbon," World Bank. https://www.worldbank.org/en/programs/pricing-carbon
[12]"State and Trends of Carbon Pricing 2020", World Bank Group, 2020. https://openknowledge.worldbank.org/bitstream/handle/10986/33809/9781464815867.pdf?sequence=4&isAllowed=y
[13]Carbon leakage refers to the situation that may occur if, for reasons of costs related to climate policies, businesses were to transfer production to other countries with laxer emission constraints. This could lead to an increase in their total emissions. The risk of carbon leakage may be higher in certain energy-intensive industries (EU).
[14]"China releases 2020 action plan for air pollution," China Dialogue, 2018. https://chinadialogue.net/en/pollution/10711-china-releases-2-2-action-plan-for-air-pollution/

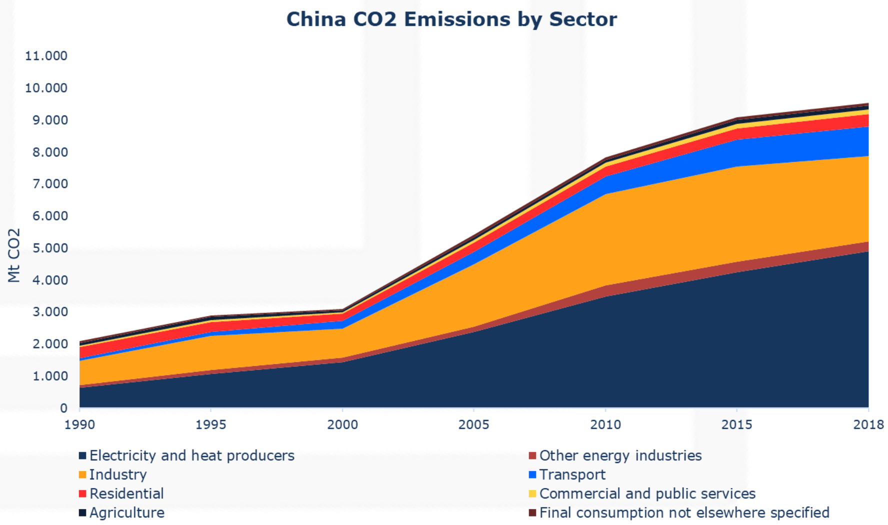
However, the FYP has not yet given significant indications of specific objectives, although the need to strengthen ecological and environmental protection has been explicitly acknowledged. The few targets included in the national FYP, i.e. reducing $CO_2$ intensity by 18% and energy intensity by 13.5% over a period of five years, are still timid and not yet in line with the top-down commitments towards carbon neutrality adopted by other countries. The various ministries and government bodies in charge – including the Ministry of Ecology and Environment, National Development and Reform Commission, National Energy Administration, Ministry of Housing and Urban-Rural Development – are expected to release detailed plans over the coming months.

## Most pressing issues and challenges to achieve carbon neutrality




Source: IEA (International Energy Agency)

Despite its significant achievements, China's pathway to carbon neutrality still faces significant challenges, mostly concerning its energy mix, intensity, and infrastructure. In terms of energy mix, China still relies heavily on coal and oil, which account for 76.6% of the total consumption, while natural gas and non-petrochemical energy for only 23.4%.

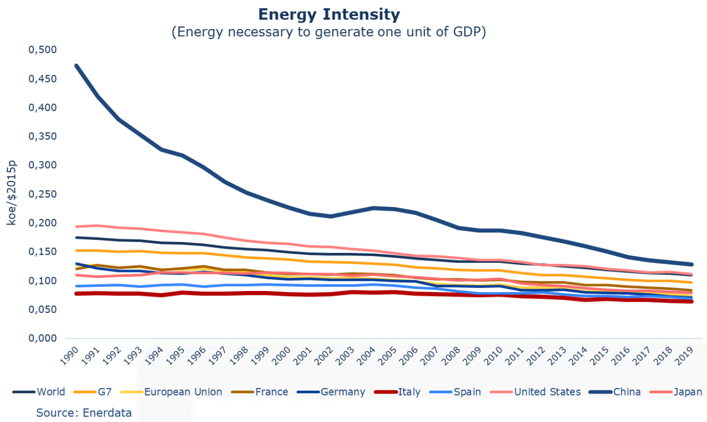


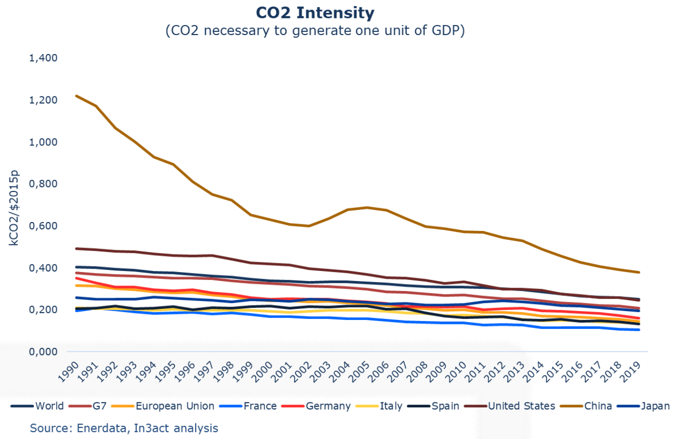

Source: IEA (International Energy Agency)

According to the IEA, coal will remain China's primary source of power generation for decades. Electricity and heat production are responsible for more than 65% of the country's $CO_2$ emissions. Unstructured planning, the slow implementation of regulations and the COVID-19 pandemic have slowed China's transition from coal to greener fuels, first and foremost natural gas.

Despite the improvements made over recent decades, energy intensity in China is still high, around 1.2 times that of the US, 1.7 times that of the EU and 2 times that of Italy. The lack of a comprehensive framework to control factories and buildings' energy intensity, as well as a lack of adequate infrastructure, are the most relevant blocks to reducing energy consumption. Investment in new energy infrastructure and the upgrade of existing facilities could have a huge impact on GHG emissions reductions in the long term. However, in 2020 China brought 38.4 gigawatts (GW) of new coal-fired power capacity into operation – more than three times the total amount built in the rest of the world. A total of 247 GW of coal power is now at the planning stage or under development[15].

[15]"China's new coal power plant capacity in 2020 more than three times rest of world's: study", Reuters, 2021. https://www.reuters.com/article/us-china-coal-idUSKBN2A308U




China does not seem to be trying to move away from coal at the moment. Its high dependence on coal remains a substantial threat to the country's carbon neutrality objectives.

Furthermore, Chinese companies or financial institutions are involved in around 240 coal projects in 25 countries along the Belt and Road (B&R)[16], including Bangladesh, Pakistan, Serbia, Kenya, and Ghana. China is also backing nearly half of planned new coal capacity in Egypt, Tanzania, and Zambia. These projects are ongoing despite recent commitments towards a "greener" BRI have been taken with the Ministry of Ecology and Environment of China (MEE) establishing the BRI International Green Development Coalition (BRIGC) to build a cooperation platform for green BRI development[17].

The preliminary and most important step towards an effective decarbonisation strategy is restructuring the country's energy mix. The scope of commitment remains limited in the absence of clear timetables and action plans. The present inertia is unlikely to enable China to achieve its net zero carbon goals by 2060.

**EU companies' role in helping China achieve carbon neutrality**

China and Europe have both made formal commitments with stringent goals towards decarbonisation. Both are facing unprecedented challenges in drastically reshaping their economic models across all value and supply chains and the daily lives of individuals towards decarbonisation. But the challenge is truly unprecedented. China is allocating massive resources (in the range of RMB 140-500 trillion, or EUR 18-65 trillion, over the next decades) to support its carbon neutrality objectives. These will require China to decommission at least 700 GW of coal-fired power plants (approximately the total installed power capacity in Europe), and eliminate about 12 $GtCO_2e$ yearly.

The Chinese traditional energy sector, however, has historically been dominated by State-Owned Enterprises (SOEs), while innovation typically flourishes in a market-led context where private businesses thrive. Foreign energy and environmental protection companies have the opportunity to invest across all priority sectors. For instance, in the renewables supply chain, investment opportunities may concern the developers of facilities and the manufacturers of technological solutions. Other key areas include resource recycling, energy efficiency, demand side electrification, district energy modelling, energy storage, hydrogen, and digitalisation. European companies have the credibility and expertise to provide reliable, advanced, and sustainable solutions. They can also bring their experience in operating in heterogeneous geographical, industrial, and social conditions.

[16] "How China's Big Overseas Initiative Threatens Global Climate Progress", Yale Environment 360. 2019. https://e360.yale.edu/features/how-chinas-big-overseas-initiative-threatens-climate-progress
[17] "Jointly building a green Belt and Road with concerted efforts to create synergies for global biodiversity conservation", Global Times. 2020. https://www.globaltimes.cn/content/1207143.shtml

## 03/THREE Rethinking the approach to facing carbon neutrality

### The need for a holistic and systemic approach

The path towards carbon neutrality is much more intricate than traditional "green development". The mere application of clean energy technologies cannot ensure effective decarbonisation, unless these form part of more comprehensive, holistic, and contextualised solutions.

The electric vehicle (EV) sector illustrates the issues facing China's move to reduce emissions: in China, each time an EV battery is charged at least 60% of the electricity is derived from coal (if it is not produced locally from renewable sources). The production of 17 kWh – the necessary amount of electricity required to travel 100 kilometers – generates as much as 15.5 kg of $CO_2$. This is comparable with emissions from Nat6 internal combustion engine vehicles (ICEV) travelling the same distance and is much higher than a natural gas-powered engine.

**CO2 Emissions in China by Vehicle Type** (running 100km/day in a 5-years life cycle*)

| | EV | NGV | ICEV |
|---|---|---|---|
| Operations footprint (tCO2e - 100km/day - 5 years) | 28.1 | 16.4 | 28.1 |
| Manufacturing footprint (tCO2e) | 14.6 | 5.6 | 9.6 |
| **Total footprint (tCO2e - 100km/day - 5 years)** | **42.7** | **22.0** | **37.7** |

*excluding end of lifecycle

Source: In3act analysis

Looking at the whole supply chain, it is worth noting that the manufacturing process for an EV emits 1.5 times more $CO_2$ than for an ICEV, mostly due to the Li-ion batteries, the traction motor, and the significant number of additional electronic components. All in all, in China a traditional National 6 ICEV is in general "greener" than an EV (total footprint of 37.7 versus 42.7 $tCO_2e$) with the current energy mix and electricity market constraints. Evidently, natural gas vehicles (NGVs) have by far the lowest environmental impact (22 $tCO_2e$). Large-scale vehicle electrification is not sustainable if it does not take place in parallel with a drastic change in the energy mix. On the contrary, it may even raise the global transportation carbon footprint.

All industrial and service sectors must play a coordinated, proactive role, especially those involved across the energy supply chains. New economic models, lifestyles, and a radical cultural shift are equally important drivers in the path to carbon neutrality.

### In3act three-steps methodology

In our view, quantitative planning and "unconventional" approaches are prerequisites for long-term, impactful solutions to achieve net zero GHG emissions.

In3act has designed a comprehensive and pragmatic methodology based on the existing standards and best practices (e.g. the GHG protocol, PAS 2060, ISO 14067, etc.). The methodology takes into account all internal and external emitting factors (including population behavioural patterns) linked to a designated area/economic entity – be it a city, an industrial district, a business cluster, or a company – where to assess, minimise and offset the carbon footprint. The In3act approach strives to go beyond the conventional method of calculating the footprint by converting an entity's energy consumption into $CO_2e$ emissions, and then reducing and compensating them, within or outside an entity's perimeter.

The international standards for carbon footprint quantification based on the ISO 14040 standard for life cycle assessment mainly include ISO 14064 (1-3), ISO/TS 14067, GHG Protocol, PAS 2050 as well as the major standards related to carbon neutrality, PAS 2060, INTE B5 and ISO/WD 14068. The PAS 2060 specification, developed by the British Standards Institution (BSI), is an internationally recognized procedure aimed at setting out requirements for quantification, reduction, and offsetting of GHG emissions for organisations, products and events[18]. Furthermore, the upcoming ISO 14068 standard has the ambition to incentivize a common understanding of carbon neutrality and the methods to achieve it. Despite the aforementioned and other relevant efforts, the general lack of clear rules as to what should be state of the art for climate-neutral action remains an obstacle to successfully accomplish effective carbon neutrality.

In3act pragmatic approach aims to complete the toolbox for designing and planning effective "carbon neutral" pathways, in three steps:

***Step #1 - Assess:*** The goal is to **evaluate and assess** the actual entity's **carbon footprint** (considering all GHGs). A mix of existing standards and In3act proprietary adjustment tools (e.g. adjusted Direct Plus Supply Chain, or DPSC, methodology) is adopted for a **comprehensive evaluation including services and goods consumed within the entity but produced elsewhere**. Based on the location average performance, excluding mitigating solutions, a baseline solid and comprehensive footprint is assessed

***Step #2 - Minimize:*** Starting from the baseline scenario, climate-based **strategies and green technologies are selected to minimize the carbon footprint** through ad-hoc solutions taking into account the **local context** and economic **sustainability**. To build a carbon free city/area/company, all possible integrated solutions are identified and selected, including "passive" CO2 industrial and urban innovative setups. In this step, it is essential to **rethink the design of the entity energy patterns as well as the entire planning process**, from its early stages through the project completion

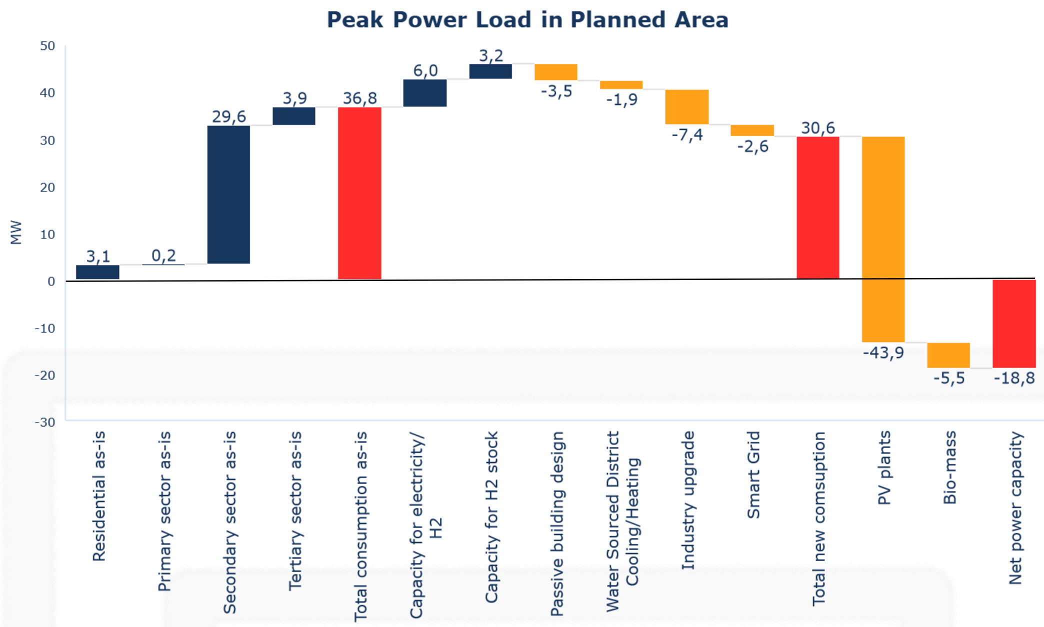
***Step #3 - Offset:*** The **final carbon footprint** is assessed considering the project specifics and existing emission trading schemes (ETS). To achieve decarbonization, **residual emissions are offset** through investments in renewables, passive buildings, CCUS and other carbon-neutral solutions outside the location. As a result, an area, city, or company is transformed into a "**virtual carbon sink**"

**A practical example: In3act three-steps methodology – case study**

In3act methodology has been applied to real-life scenarios. Below we discuss the design of the new energy and carbon emissions planning in a city of 20,000 inhabitants in Zhejiang province.

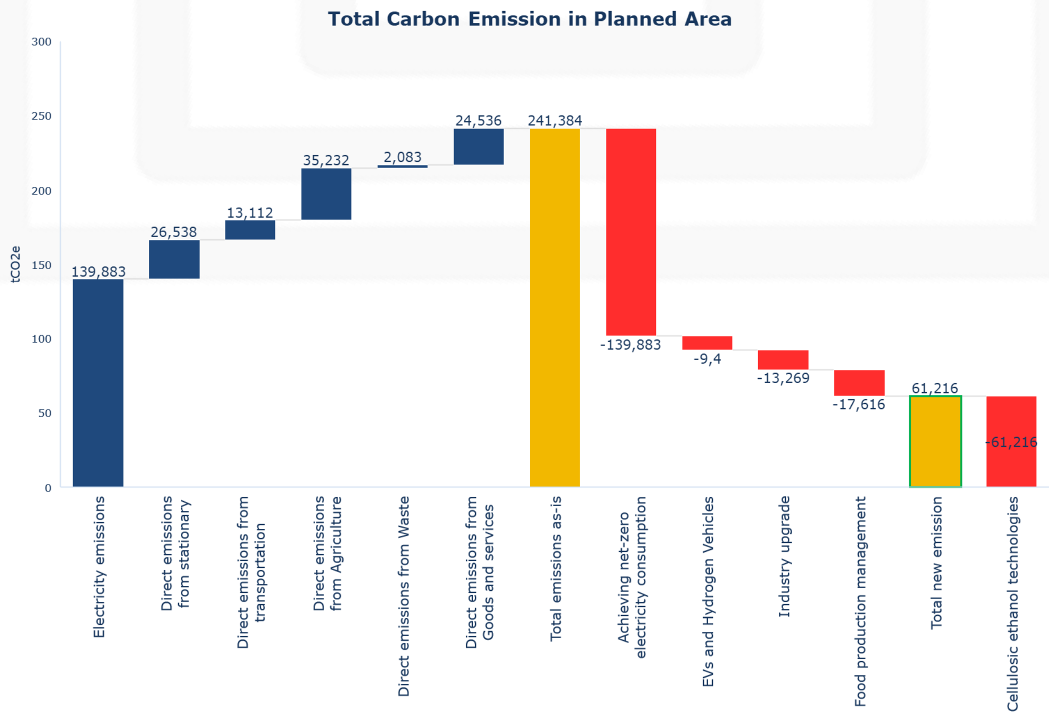
First, a feasibility study was carried out to assess the current potential energy generation pattern. The study confirmed that the surging electricity consumption caused by the deployment of EV and hydrogen ($H_2$)-powered vehicles can be offset by making full use of the area's maximum potential of 43.9MW of peak photovoltaic (PV) power (installed on factories and buildings' roofs). The PV load would also allow a 106-ton-stock of $H_2$ to mitigate intermittencies.

[18] "PAS 2060 carbon neutrality," BSI. https://www.bsigroup.com/en-GB/pas-2060-carbon-neutrality/

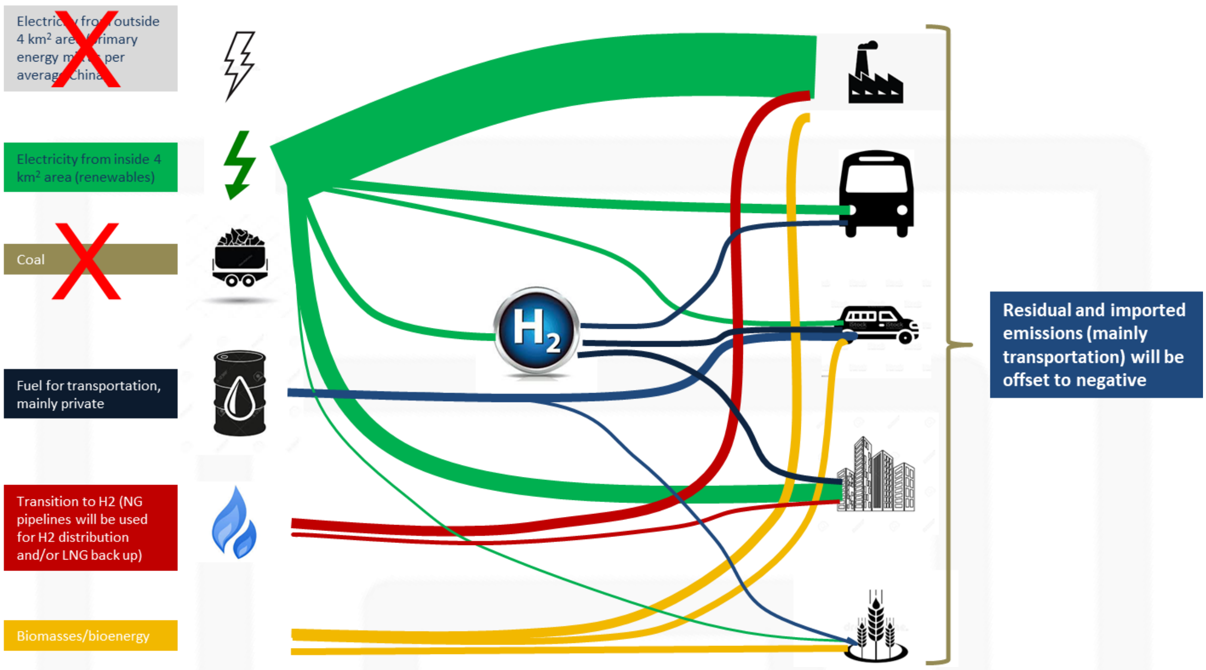



The designated area's tons of $CO_2e$ ($tCO_2e$) were estimated to peak at around 240,000 $tCO_2e$ with the current set-up. The following assumptions illustrate the path to carbon neutrality:

- Electricity generation will only exploit renewable sources from within the 4km$^2$ area
- All power-related emissions will be offset by achieving net zero electricity consumption
- Incentives for EVs powered by solar energy and $H_2$ vehicles would reduce 90% of transportation emissions, i.e. 9,400 $tCO_2e$
- An industrial upgrade – achievable by attracting more companies with green credentials – would allow savings of 50% of direct carbon emissions
- Food production management would reduce emissions from agriculture production by 50%
- Cellulosic ethanol production using locally sourced wheat straw would offset the remaining 61,216 $tCO_2e$ through ETS



Taking into consideration all available technology and existing infrastructure, this new energy supply model for the area has been designed and assessed to be sustainable and feasible. The system is based almost entirely on clean energy consumption. Coal is absent from the energy mix and the marginal, residual emissions generated using fuels in private transportation can be offset.




Eliminating the carbon footprint demands the adoption of bottom-up approaches. In China, in particular, this requires in-depth knowledge of the different contexts.

## 04/FOUR Closing remarks

- Achieving carbon neutrality in 30-40 years is the world's most urgent mission. It is also the first subject in history, apart from the Covid-19 pandemic, that aligns all great powers in the belief that GHGs have no borders and that that exceeding 2°C of global warming would cause destructive consequences at socioeconomic level
- Shared objectives towards decarbonisation must become the common ground so that countries can act jointly in addressing the challenges despite geopolitical tensions
- "Decarbonisation" should not remain a buzzword. It cannot be achieved without new economic models, paradigms, outside the box thinking, holistic approaches and innovative solutions
- Driven by the transformation necessary to achieve China's decarbonisation goals, immeasurable business opportunities are opening up in all industrial and service sectors for foreign companies who lead the way to a carbon-neutral future
- Everyone must play a proactive and coordinated role to overcome the decarbonisation challenge, first and foremost all actors along the energy and environmental protection supply chains
- Cutting-edge technologies, processes and solutions must be paired with innovative and highly contextualised approaches: technologies alone will not achieve decarbonisation
- Achieving actual carbon neutrality is feasible but requires rapid, coordinated, and concrete action

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## About In3act

In3act is an Italian Business Strategy and Investment Advisory firm mainly focusing on solving challenging business issues with significant impact on business growth and stability. In3act consulting services are designed to answer all questions critical to every company, regardless of industry or geographical location, with the goal of delivering creative, long-lasting and sustainable results.

In3act approach is substantially different from that of traditional strategy consulting firms. Business strategy, finance, M&A, negotiation, and implementation are combined at In3act to deliver the right solution for every stage of a client's project through hands-on rigorous methodology.

Founded in Milan in 2004 by Guido D. Giacconi and Davide Roncaglioni – both with outstanding background in industrial firms and long experience as Partners in leading Strategy Consulting firms (McKinsey, Bain & Company, Booz Allen & Hamilton, Roland Berger). In3act is present with consolidated practices in Europe, China, Russia, USA.

Since 2006, In3act is active in China (Beijing) serving both foreign and Chinese companies and entities, either public or private, including the Chinese government for strategy projects. In3act sectors of expertise include Energy & Environmental Protection, Automotive, Manufacturing, Healthcare, Agriculture, Consumer Goods.

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