



Whitepaper

# **THE OUTLOOK FOR CLIMATE CHANGE INVESTING**

Which are the  
opportunities and  
challenges?



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## Introduction

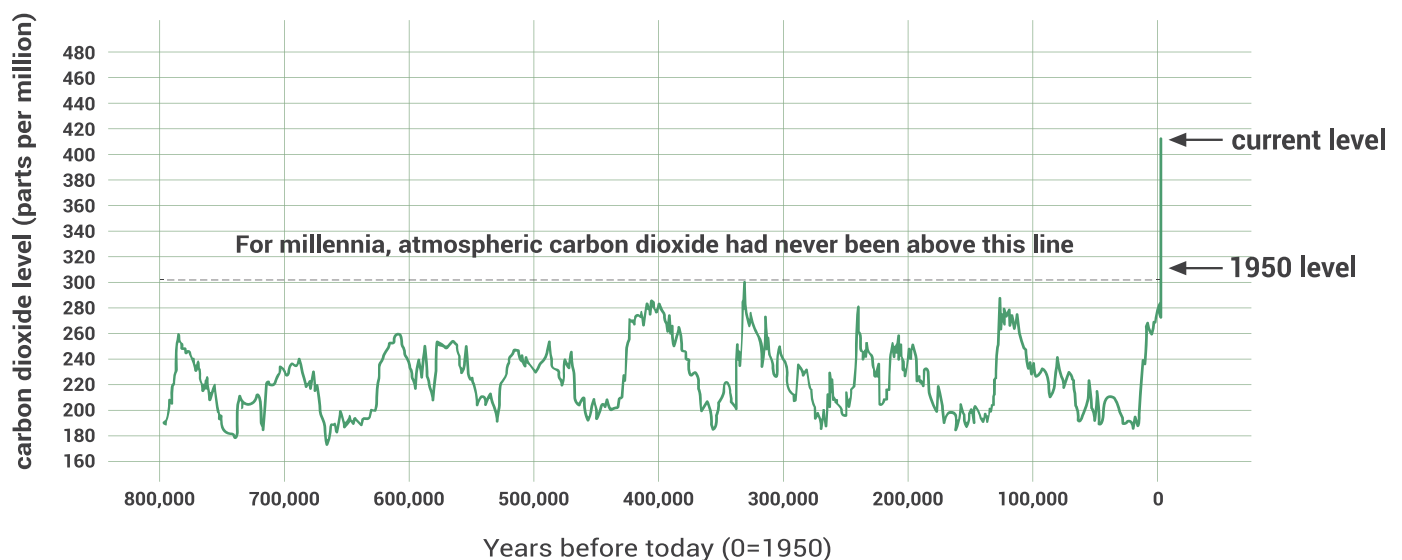
Over the past 20 years, annual greenhouse gases (CO<sub>2</sub> and equivalents) increased from 35 billion tons to 51 billion tons. Furthermore, the average temperature on our planet has increased by 1.14 degrees Celsius since the beginning of the 19th century. It is no secret that global warming has major consequences for humans, animals and society.

## Facts at a glance

- In the last 26 years, 279 billion tons of ice have melted annually in Greenland alone
- There has never been so much CO<sub>2</sub> in the atmosphere as in May 2020 (416 million CO<sub>2</sub> parts per million)
- The 20 warmest years on record since 1880 have occurred in the last 22 years
- More than 1 million animal species are threatened with extinction due to global warming

***The climate is clearly one of the biggest challenges of the future. There is no planet B!***

### ATMOSPHERIC CARBON DIOXIDE IS RISING (CO<sub>2</sub> PARTS PER MILLION)



Source: NASA

Since the COVID-19 crisis began, both investors and governments have accelerated climate-related actions in favor of carbon neutrality.

Climate change may offer one of the greatest opportunities of our time if we are willing to overcome the adverse effects of greenwashing and short termism.

Let us review why it is crucial, as investors, to support reduction of carbon emissions and how you can be a part of the solution.



# 1. Regulatory objectives and financial tools to achieve climate goals

## A. Sustainable Development Goals

The Sustainable Development Goals (SDGs) were drawn up by the United Nations and consist of 17 goals that should be able to transform our world in a positive way by 2030. These goals are backed by no fewer than 169 concrete targets. The SDGs tackle the fight against poverty, seek to provide clean water for everyone and put the focus on a greener planet.

The SDGs will, of course, have to be financed. Estimates from the United Nations suggest investments of USD 5 to 7 trillion per year are needed. These investments are desperately needed if the worst is to be prevented. The costs of climate change and the loss of biodiversity are significantly greater than the investment required.





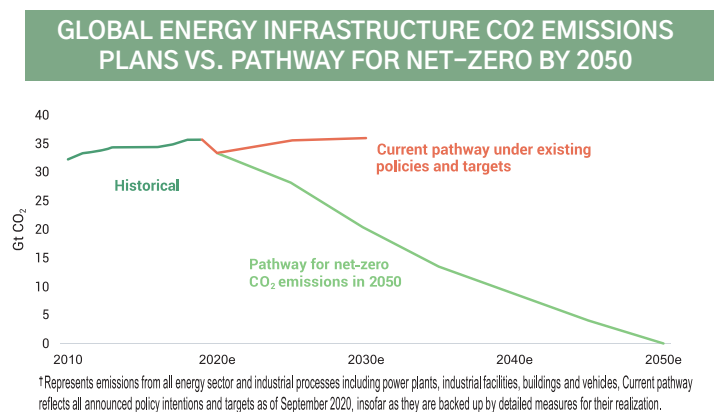
## B. Government commitments

Governments now want to get more and more involved in the fight. Recently, the European Commission unveiled 'Fit For 55', a package of reformed and new EU directives and regulations that aims to achieve the goals set out in the European Green Deal. The European Green Deal on its turn aims to achieve a climate-neutral Europe by 2050. By 2030, CO<sub>2</sub> emissions should already be 55% lower than in 1990. China, the largest emitter of CO<sub>2</sub> at the moment, announced that by 2060 it wants to be CO<sub>2</sub> neutral. The fact that Joe Biden is the president of the United States for at least the next 4 years is also positive for the fight against global warming. While Trump can be labeled as a climate denier, Biden is committed to a greener planet. Under Biden, the United States also plans to be climate neutral by 2050. 125 countries are currently committed to aiming for carbon neutrality. If each country achieves its goals, global CO<sub>2</sub> emissions could be reduced by 63%.

However, it is not enough that countries and governments want to combat global warming. There is still a lot of work ahead.

As can be seen in the graph below, many additional measures and investments will be needed in the coming years to achieve these ambitious climate targets. This, in turn, is music to the ears of the companies that will benefit from the forthcoming investments.

Sustainability is also increasingly important to companies. In addition to a healthy balance sheet and profitability, companies are being judged more and more on their impact on society. They therefore bear an important social responsibility. In addition to annual reports, companies are now publishing sustainability reports. Amazon, Wal-Mart and Nike want to use only renewable energy by 2025. By 2050, Microsoft even wants to wipe out all its historically caused CO<sub>2</sub> emissions.



## C. ESG principles

With the focus on climate change, the Green Deal in Europe and China and the fact that President Joe Biden has rejoined the Paris Climate Agreement, the 'E' in ESG has become very important to many investors, and has taken hold in the business world.

Expectations for the United Nations Climate Summit at the end of 2021 (COP 26) are also high. We are now seeing concerted actions in Europe, China and the United States to seriously tackle climate issues, while Asia will play an increasingly important role in setting the climate change agenda. We must also see the protection of biodiversity in this context.

A good sustainability strategy also devotes sufficient energy to the 'S' and 'G'. ESG should not be skewed only towards the environment. The social aspect is becoming more and more important, as we note from social evolutions such as the Yellow Vests movement and Black Lives Matter.

In 2021, companies will be increasingly pressured to assume their responsibility to society and their employees throughout the entire production chain. This has, of course, a lot to do with the severe consequences of the pandemic on the most vulnerable employees. According to figures from the International Trade Union Confederation (ITUC), more than 80% of global workers (3.3 billion people) have been affected by the partial or complete shutdown of their businesses. In total, there were 17.3% fewer working hours in the second quarter of 2020 than in the same quarter of 2019. Companies will have to demonstrate how they cater to their stakeholders.

These issues are closely related to governance: the standards and values that companies uphold in their business models.



***“Integrity is the most important quality of people.” Warren Buffett***

As in traditional financial analysis, ESG analysis assigns ratings to companies. They are useful as a first indication, but often lack consistency.

Much work has been done in recent years to improve ESG reporting, but there is still little standardization and transparency at the international level. There is no universally accepted set of principles and guidelines. This sometimes makes it difficult to compare and integrate sustainability factors into the investment process, which is the job of skilled analysts and administrators.

Regulations at European level will provide important reinforcement for sustainable investment in the coming years, from March 2021. The aim is to create a level playing field, channel as much money as possible into sustainable investments, combat greenwashing and improve ESG reporting. Asset managers and financial advisors will be very busy with this new set of regulations in the coming months. The new legislation resulting from the European Union action plan for a greener economy requires asset managers to classify all their investment products on the basis of sustainability by March 2021 in order to achieve the environmental goals of the Paris Climate Agreement and SDGs. The first important regulation is the SFDR (Sustainable Finance Disclosure Regulation). It aims to provide more transparency on how financial market participants such as asset managers and financial advisors include sustainability risks and opportunities in their investment decisions and recommendations. All mutual funds should be divided into three sustainability categories: gray, light green and dark green. All marketing material, documentation and reporting must be adapted accordingly. The SFDR entered into force in March 2021. It is the result of the European Union action plan to promote sustainable growth, which consists of ten points.

Reporting will also change with the Non-Financial Reporting Directive (NFRD), which tightens and clarifies the requirements in the field of non-financial reporting (the integration of ESG data) at companies. Companies have been required to include non-financial data in their annual reports since 2018, but this requirement is formalized and standardized by the NFRD.

## D. ETS certificates

ETS (or European Emissions Trading System) represents the price of one ton of CO<sub>2</sub>. It is a cost for ‘polluters’, but a benefit for companies that reduce emissions or can convert CO<sub>2</sub>. When ETS certificate prices are low, costs are low for companies that emit a lot of greenhouse gases, but unfortunately in this environment, companies that find solutions to reduce emissions can generate less additional income. The sharp price increase in 2021 is good news for the climate and ‘clean tech’ companies, but bad news for big emitters.

The ETS price has more than doubled in one year. The system has been in existence since 2005, but the price has remained low. It has only recovered since 2018, and a real boom started in the second half of 2020. The recent increase has to do with two structural aspects: the system was cleaned up; there were too many free allowances in circulation.

ETS prices are a major driver for companies that sell climate-friendly technologies (eg. sustainable building materials, recycled materials, CO<sub>2</sub> capture installations). They also provide support for industrial companies that are already working greener compared to their competitors and thus have a competitive advantage. This makes ETS an incentive for investments in renewable energy (windmill manufacturers, bioenergy, solar panels, etc.), green hydrogen (producers of electrolysis installations, network operators, hydrogen producers, producers of hydrogen engines, etc.) and companies in the bio-based economy (biofuel industry) or circular economy.



## ETS certificates CONTINUED

**There are not only winners:** higher ETS prices are detrimental to many companies and can weigh heavily on their share price. These include big polluters in industry that lag behind the competition in terms of CO2 efficiency. Without carbon border adjustment mechanisms, high CO2 prices can be very damaging to European industry, which is very CO2 efficient compared to Chinese or American competitors.

In summary, the sharp rise in CO2 prices in Europe, as expressed in ETS prices, will have a huge impact on the economy and stock prices. You can take advantage of this shift. Investing with the climate as a beneficiary is not simply a pipe dream, but a real possibility.

## 2. Main solutions to stop climate change

The sustainable production of renewable energy, food, recycling, transport and living (CO2-neutral buildings, LED lighting and insulation) will all contribute to a more sustainable, better and greener world.

Companies that respond in one way or another to these themes and offer concrete solutions to tackle the many climate-related problems will have a bright future in the coming decades. There is a wide range of climate solutions that will benefit from strong secular growth in the coming years.

**Drawdown**, a book by professor and climate expert Paul Hawken, is a very helpful guide analyzing the 100 most efficient science-based ways to achieve climate neutrality by 2050.



PROFESSOR PAUL HAWKEN ON A KEYNOTE PRESENTATION FOR ECONOPOLIS IN 2019



## A. Renewable energy

Renewable energy is used to designate energies which, on a human scale at least, are inexhaustible and available in large quantities. There are five main types of renewable energy: wind, solar, geothermal, hydraulic and biomass. What they have in common is that they don't produce polluting emissions (or little) during the operating phase, and thus help fight the greenhouse effect and global warming.

Renewable energy is increasingly important, but production and consumption will have to be more sustainable if we want to achieve our climate goals.

The coronavirus ensured that CO2 emissions this year will be 7% lower than last year, the largest absolute drop ever. However, this does not alter the fact that we will have to shift gears in order to achieve the ambitious climate targets. This means that hundreds of billions of euros will be invested in green projects in the coming years.

Green energy is becoming cheaper as we learn more, innovate and benefit from economies of scale. Today, various forms of solar and wind energy are even among the cheapest ways to generate energy. According to a study by Lazard, it costs \$36 per megawatt hour to generate solar energy on a large scale, and \$40 per megawatt hour for onshore wind turbines. In comparison, generating energy from coal and nuclear power costs \$112 and \$164 per megawatt hour, respectively. It is important to note that the cost per megawatt hour depends on multiple factors like the technology used and the presence of the energy source. It goes without saying that solar energy can be produced cheaper in Abu Dhabi than in Belgium or Switzerland. Furthermore, geothermal energy also offers many possibilities. However, climate neutrality will require much more than just renewable energy.

We expect that solar energy will continue to gain in importance in the coming years. There is still a lot of potential for this sustainable energy source, especially in the emerging markets. According to some estimates, it should even be possible to produce solar energy at \$0.01 per kWh by 2040 in sunny regions. There are many interesting companies that are responding to this trend.

## Wind energy

When you think of the climate and green energy, you undoubtedly also think of wind energy. Last year already, 15% of total electricity consumption in the EU-28 came from wind turbines. Over the past 8 years, the wind energy market has grown by no less than 11% annually. It is therefore an excellent way to drastically reduce global CO2 emissions, and it can be expected that wind energy will continue to gain in importance in the future. Investing in wind energy is a win-win situation for our clients: they benefit financially while contributing to a greener, healthier and more sustainable world.

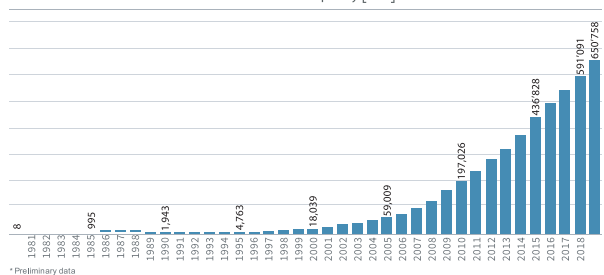
Windmills have existed for centuries; the first were built around 500 BC. The wind turns the blades of wind turbines, which can have a rotational diameter of no less than two football fields. This rotating movement is then accelerated in a gearbox which, in turn, drives a generator. This generator contains a magnet that starts rotating very quickly. The rotating movement generates charged particles and creates electricity. This same principle applies to the dynamo of a bicycle lamp.

In general, an important distinction can be made between onshore (on land) and offshore (at sea) windmills. Onshore windmills are currently the most accessible. Last year, 76% of new wind installations were onshore, the remaining 24% were built at sea. This is because it is currently more difficult and expensive to successfully place wind turbines at sea.

Project Drawdown tells us that by the end of 2016, wind energy had created no less than 1.16 million jobs. Global wind turbine capacity is now more than 650,000 megawatts. To illustrate: 1 megawatt can supply about 1,000 households with electricity at the same time.

### GLOBAL WIND INSTALLATIONS

Total Installed Capacity [MW]



\* Preliminary data

## Wind energy CONTINUED

It is therefore becoming cheaper to build windmills. For example, the energy a windmill can produce in 20 years lays 80 times higher than the energy that is needed to produce this windmill. This perpetual cost reduction ensures that wind energy will become one of the least expensive power sources. Today, it costs \$0.036 per kilowatt hour to generate utilitarian solar energy, \$0.04 per kWh for wind energy, \$0.06 per kWh for natural gas and \$0.11 per kWh for coal.

***“40% of all electricity in Denmark is already generated from wind energy today.” – Paul Hawken***

The future for wind energy looks promising, as it is expected to be one of the cheapest ways to generate energy by 2030. The cost continues to fall because wind turbines can be built taller and taller, which means using longer blades that produce more energy. The technology surrounding offshore wind turbines is also evolving in the right direction. For example, at this moment there are innovative projects focusing on developing floating wind turbines.

According to Paul Hawken, wind energy could produce 21.6% of all electricity by 2050. This would provide a cumulative reduction in CO2 emissions of no less than 84.6 gigatons (84,600,000,000 tons). Offshore wind turbines should also be able to grow in the next thirty years from 0.1% to 4% of worldwide energy production, which would cut global CO2 emissions by another 15.2 gigatons. The investment required for this would amount to about \$1.8 billion, while it could save as much as \$8.2 billion in costs over 30 years.

There are many companies dealing in windmills and everything related to them. Investing in these companies could have provided you with a very nice return in the past years. A portfolio of wind energy stocks grew by 17.2% and 13.3% annually in the last 3 to 5 years, respectively. However, please note that historical returns offer no guarantee for future returns.

When investors capitalize on wind energy, they not only fuel their investment portfolio, but also contribute to a more beautiful, greener and healthier world.

## Solar energy

Solar energy has been around since 1884, when the American inventor Charles Fritts installed the first working solar panel in New York City, but only really started to gain importance in the 1980s. Since then, the market has grown significantly. Over the past 20 years, the solar energy market has grown almost a thousand times (!), with annual growth of 40%.

The generation of solar energy is very intuitive. The sun sends a large amount of energy towards our earth. Solar panels consist of several solar cells that absorb this energy, creating direct current (DC). This means that electric current flows from the negative to the positive terminal. This current is then converted into alternating current (AC) via an inverter, generating electricity in a sustainable way. This is called the photovoltaic effect (PV).



## Solar energy CONTINUED

As with wind energy, the advantage of solar energy is that it provides an almost unlimited, green and free source of energy. According to a study by Elia, last year 4.2% of all electricity in Belgium came from solar panels. This means that Belgium owes 32% of all its green energy to the sun. At the end of last year, a whopping 580 gigawatts (580 billion watts) of capacity had been installed.

Solar energy was initially mainly used in developed countries, but it is now gaining in importance in emerging countries, where there is a lot of potential. Today, countries such as Chile, China, India and South Africa are investing heavily in PV, increasing access to affordable, clean energy. This is a powerful tool in the fight against poverty. In Bangladesh, one of the most densely populated countries in the world, 165,000 jobs were created directly and indirectly through solar systems. No fewer than 3.6 million solar panels have now been installed. The more consistently the sun shines, the greater the potential of solar energy for the region. Long-term opportunities abound in Africa, for example.

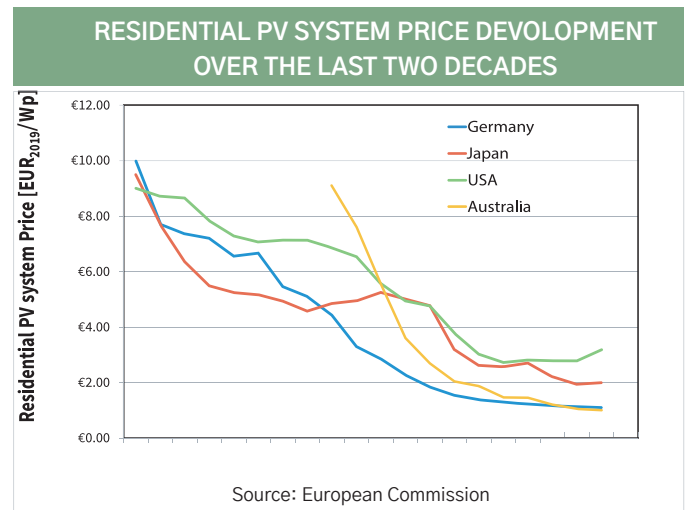


A mother with her 2 children living on Lake Titicaca (between Peru and Bolivia). They received a solar panel that was installed at an altitude of more than 3800 meters. This solar panel makes the use of kerosene unnecessary for the family. – Source: Drawdown

Solar energy is also becoming cheaper to generate. From 2010 to 2019, the cost of solar cells dropped by as much as 82%, according to a study by The International Renewable Energy Agency (IRENA), exceeding the most optimistic expectations. The graph below shows changes in prices of residential solar panels. Abu Dhabi has the most efficient solar park in the world, which produces solar energy at a cost of barely \$0.135 per kWh.

## Solar energy CONTINUED

It can be expected that the cost of PV will continue to fall in the coming years, likely driven more by technological developments than scale. The International Energy Agency (IEA) predicts that the PV market will grow at an annual rate of 16% over the next 30 years and expects that the average cost of solar energy will be \$0.05 per kWh by 2030. Others even say that these predictions are too conservative. For example, the American technologist Rameznaam predicts that by 2040, it should be possible to produce solar energy at \$0.01 per kWh in sunny regions. In the future, we may therefore import PV from sunny countries such as Morocco and Abu Dhabi. Floating solar panels also certainly offer opportunities on the long term.



In general, a distinction can be made between solar parks and 'rooftop solar'. According to professor and climate expert Paul Hawken, solar parks should account for 10% of total electricity consumption by 2050, avoiding 37 gigatons of CO<sub>2</sub> emissions and saving 5 trillion dollars in costs. Rooftop solar, in turn, should be able to guarantee 7% of total electricity production by 2050, saving \$3.46 trillion and further reducing CO<sub>2</sub> emissions by almost 25 gigatons.

There are many interesting companies benefiting from the increasing demand of solar energy, it is first important to know that you can respond to different parts of the value chain, from solar glass manufacturer Xinyi Solar to SolarEdge, a supplier of power optimizers, inverters and monitoring systems for solar panels.

Although Europe is traditionally very strong in renewable energy with companies such as Falck Renewables and Iberdrola, we are much weaker in solar energy. Especially in the United States and the emerging markets, many interesting companies can be found that respond to solar energy. For example, the American company Sunrun is the market leader in offering solar panels to consumers. They control about 15% of the market and benefit from the strong advance of solar energy.

In the developing markets, we follow the Brazilian companies Omega Geracao (focus on wind, water and solar energy) and CPFL Energia (produces various renewable energy sources), as well as the Chinese Xinyi Solar, the largest solar glass producer in the world with a market share of 30%.

## Geothermal energy

The major advantage of geothermal energy is that it is a constant and stable source of renewable energy. Unlike solar and wind energy, it's available day and night.

Geothermal energy still has a lot of growth potential. Today, we estimate that only 6 % to 7% of all geothermal resources have been drilled. Various researchers expect the market to grow by 3.5% to 5% annually in the coming years. Geothermal energy could generate more than \$1 trillion over the next 30 years.

The Earth is an active planet. Heat continuously flows from the center of the Earth towards the crust, creating plate tectonics, earthquakes, volcanoes, and mountain ranges.

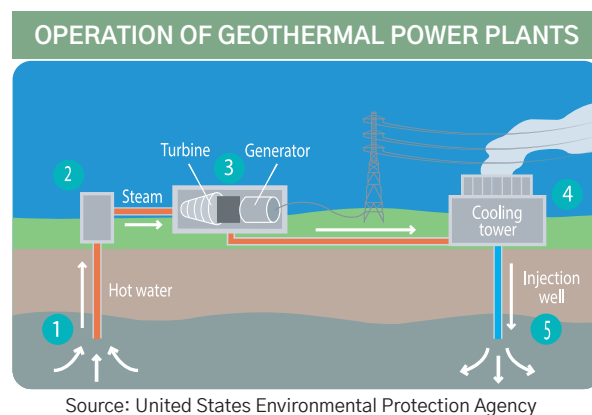


## Geothermal energy CONTINUED

The Earth's inner core temperature is estimated to be about 5000 to 6000 degrees Celsius. The heat energy generated by the earth is approximately 100 billion (!) times greater than global energy consumption. This means that geothermal energy, which literally means 'earth heat', has a lot of potential. It can be used directly for heating or cooling or generate electricity by making use of the temperature difference between the Earth's surface and heat reservoirs located in the earth. Geothermal energy was first generated in Larderollo, Italy in 1904.

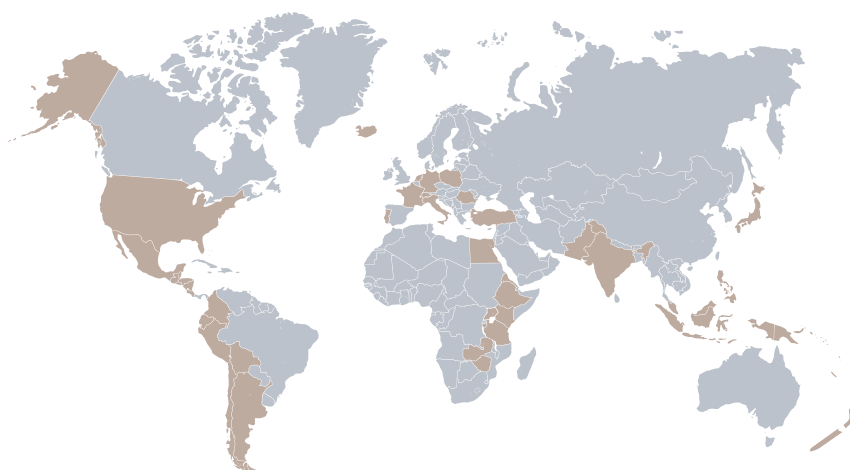
Geothermal energy has many advantages over other energy sources. For example, windmills do not produce electricity when there is no wind, and solar panels logically offer no added value at night. **Geothermal, on the other hand, can be used day and night, under any weather conditions. It is an efficient and reliable energy source.** Emissions per megawatt hour are 10 to 20 times lower than those of coal-fired power stations.

Today, geothermal energy accounts for 0.66% of global electricity production. It is already being used in 20 countries. The United States is the largest producer, while in Iceland, many buildings and even swimming pools are heated using geothermal energy.



The image below shows where geothermal energy is already being used. Since hot water is the essential component for geothermal power plants, these plants are built where hydrothermal water reservoirs are available. Think geysers, hot springs and volcanic areas.

Geothermal energy has a lot of potential in the Ring of Fire, Indonesian islands and in the west of the Americas



Source: <https://www.globalgeothermalalliance.org/>

Various sources conclude that geothermal energy will gain in importance in the coming years. For example, Allied Market Research expects this market to grow to a value of \$6.8 billion by 2026, equivalent to annual growth of 5%. Mordor Intelligence, in turn, assumes that by 2025 geothermal energy will gain 3.5% annually, with the most growth potential located in Europe.

## Geothermal energy CONTINUED

A CO<sub>2</sub>-neutral world by 2050. That is what we should strive for. Geothermal energy can certainly contribute to this. In time, 39 countries should be able to provide 100% of their electricity needs with geothermal energy. Currently, it is estimated that only 6 to 7% of all geothermal energy resources have been tapped.

In his book *Drawdown*, Paul Hawken assumes that geothermal energy will provide 4.9% of global electricity production by 2050, compared to 0.66% at present, avoiding 16.6 gigatons of CO<sub>2</sub> emissions. This would require an investment of just over \$155 billion and save more than \$1 trillion in energy costs over a 30-year period. Given the long lifespan of geothermal plants, the savings could even exceed \$2 trillion.

There are only a handful of companies that capitalize on geothermal energy. The main ones are the American Ormat and the Swedish companies Climeon and Nibe.

Ormat has a market capitalization of 3 billion dollars and is the only player worldwide that vertically integrates geothermal energy. The company develops, produces and manages geothermal power plants, generating predictable cash flows.

Climeon is a Swedish small cap that makes it possible to generate electricity from energy in waste and geothermal heat. Nibe develops, produces and markets many different ecologically-friendly and energy-efficient solutions for smart heating systems. A geothermal heat pump, for example, can reduce energy consumption by 80%.

## Hydraulic energy

The world's waterways brim with kinetic energy. We have been harnessing this energy for millennia, first to turn waterwheels, then to generate electricity. Hydropower uses the vertical distance that water falls, or head, to generate electricity. Hydroelectric dams produce massive amounts of electricity, but also take up swaths of natural and human habitat.

The focus is now shifting from giant dams to smaller, in-stream turbines which work like underwater wind turbines. They require careful design and installation to minimize impact on fish populations. Hydrokinetic turbines are excellent candidates for providing electricity in remote areas, as they can be installed in small waterways. This technology is currently being tested for native communities in rural Alaska, for example, to replace expensive and diesel generators.

An assessment of U.S. hydrokinetic resources reveals that more than 100 terawatt-hours per year of in-stream energy is technically recoverable, but the technology required to do is relatively new and rare. The sector currently benefits from the surge in research and investment in similar tidal energy. If in-stream hydro power grows to supply 3.7% of the world's electricity by 2050, 4 gigatons of CO<sub>2</sub> emissions will be avoided and \$568.4 billion will be saved in energy costs.

## Biomass energy

One solution to bridge the status quo to fully renewable energy is biomass. Biomass energy can produce electricity on demand, helping the grid meet changes in load and complementing variable sources like wind and solar. Solar energy is captured and stored as carbohydrates in biomass, which, if left intact, would eventually become the carbon-dense coal, oil, or natural gas fossil fuels that currently dominate electricity production and transportation. Or, it can be burned for energy. Biomass energy trades in carbon that is already in circulation by growing plants to sequester carbon, then processing and burning biomass. If balance is achieved between carbon emissions from biomass combustion and carbon uptake from replanted vegetation, net zero new emissions are created.



## Biomass energy CONTINUED

In order to be viable, biomass must use appropriate feedstock, such as waste from wood and agricultural processing or sustainably grown energy crops. In the United States, most biomass plants burn wood as fuel, or plan to do so. Proponents say that they will be powered by waste from commercial logging operations, but the amount of slash generated by logging falls short of what would be needed to fuel the biomass burners. This means that biomass energy requires cutting and burning trees, which will grow back, but slowly. Between its potential impacts on deforestation, land use and food security, biomass is a controversial energy source.

Biomass is on the rise in China, India, Japan, South Korea and Brazil, which requires investment in production facilities and infrastructure. If all biomass is derived from renewable feedstock (not forests, annuals or waste), it could reduce CO2 emissions by 7.5 gigatons by 2050.

## B. Climate-friendly technologies

There are many sources of greenhouse gases which require many solutions in multiple sectors of the economy.

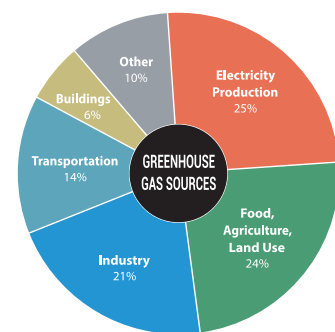
Wholesale transformations in technology, policy, business models, and behavior are needed to address the climate crisis. The world must be transformed in many different ways, in many different sectors and areas of human activity.

In its 2018 special report, the Intergovernmental Panel on Climate Change (IPCC) calls for “rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems.” The good news is that many of the means to achieve the necessary transformation.

**Below we will examine a few examples of the most promising industries for decarbonization:**

- Electric vehicles
- Green hydrogen
- Buildings
- Circular economy and recycling
- Food and agriculture

### GREENHOUSE GAS SOURCES



SOURCE: DRAWDOWN PROJECT

## Electric vehicles

Today, only 1% of all cars in circulation are electric. Over the next 20 years, the importance of electric cars should increase by almost 20% annually, meaning that at least 30% of all cars sold should be electric by 2030. In addition to electric cars, electric bicycles and scooters also offer a lot of potential. With urbanization, these modes of transport will be used more and more. There are many interesting companies that capitalize on these secular trends.

Contrary to popular belief, electric vehicles are nothing new. The first EV was designed in 1891 by William Morrison, an Iowa chemist. By 1900, there were even more electric than diesel and petrol vehicles in use. It wasn't until around 1920, when more and more people started to travel greater distances with their cars, that diesel and petrol cars became the norm.

## Electric vehicles CONTINUED

Today, about 99% of all cars still run on fossil fuels and as much as one third of the world's oil consumption is used as fuel for vehicles. Transport is the second-largest emitter of CO<sub>2</sub> worldwide, responsible for 23% of all emissions according to Paul Hawken. Only the production of electricity emits more carbon dioxide.

The automotive industry as a whole has been under pressure over the past year. Global car sales fell 18% to approximately 62 million units. At the same time, sales of electric cars, including plug-in hybrid cars, increased by about 34%. In Europe, figures were nearly double. Although electric cars are still significantly more expensive than fuel cars today, a convergence in prices can be expected. In the coming years, batteries for electric cars will become more efficient and cheaper, which will make EVs considerably more affordable, as batteries today represent 30% of the total cost of an electric car.

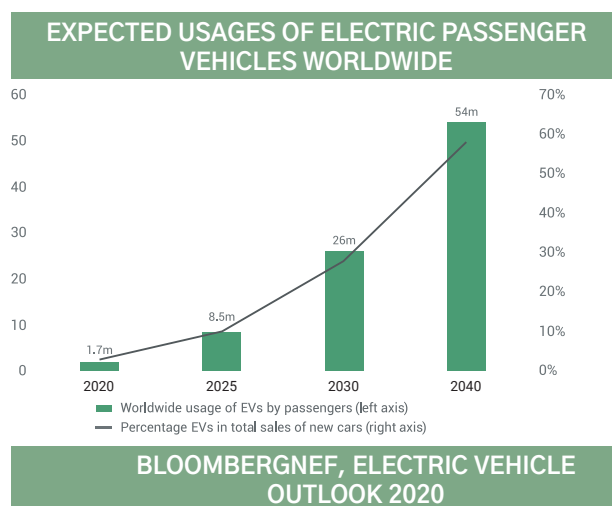
Electric scooters and bicycles also offer a structural solution to ambitious climate targets. In China, there are currently twice as many that use electrical bicycles than cars. Last year, 3.7 million electric bicycles were sold, and this figure is expected to grow to 17 million by 2030. The market value for electric bicycles is estimated today at just under \$15 billion. Although the automotive market is more than 300 times larger, urbanization means that people will have shorter and shorter commutes. Electric bicycles and scooters are an environmentally-friendly, healthy and time-efficient solution for this.

Today, there are approximately 7.5 million electric cars in circulation (including plug-in hybrids) and the market for EVs is growing at a rapid pace. About one and a half million new electric cars were produced last year and research shows that by 2030 at least 30% of all new cars sold will be electric cars. This means that use of electric cars will grow by 18.9% annually over the next 20 years. By 2040, it is estimated that more than 60% of all new cars sold will be electric.

Statista estimates that by 2050, more than 80% of car sales will be electric vehicles. In his book Project Drawdown, Paul Hawken assumes very conservatively that **by 2050, 16% of all car transport will be done with electric cars. That could avoid 10.8 gigatons of CO<sub>2</sub> over the next 30 years.** It could also save as much as \$9.7 trillion. In addition, electric bicycles and scooters could reduce cumulative carbon dioxide emissions by 1 gigaton over 30 years.

There are many opportunities in the financial markets to capitalize on the rise of electric cars, from producers of batteries and chips to providers of EV software systems.

The Chinese company Niu, for example, produces and sells electric scooters. They offer an environmentally-friendly option that allows users to move quickly in cities, while companies such as BYD, Xpeng and Geely, which are listed in Hong Kong, produce and sell electric cars themselves.



In the United States, Lear Corporation manufactures auto parts. They specialize in passenger seats and all kinds of e-systems that make transport as comfortable as possible. Albermarle, meanwhile, is the largest lithium producer in the world. Lithium is an essential component for electric car batteries.

There are also companies that deal with EVs, such as the Dutch company Alfen, which makes charging stations for electric cars.

## Green hydrogen

Green hydrogen will also gain in importance as this energy carrier will become more prominent in the next 5 to 10 years. Currently, only 1% of the global hydrogen production consists of green hydrogen. In other words, the market is still in its infancy, and many companies are currently responding to this challenge.

Green hydrogen has a lot of potential in heavy transport as they can be used in buses, trams, delivery vans, heavy trucks, forklift trucks, logistics vehicles, drones and more. Furthermore, hydrogen can also be used for energy storage and in heavy industries. Some people even say fuel cell cars (hydrogen) can compete with electric vehicles. The advantage of hydrogen-powered vehicles is that refueling only takes a few minutes. It is significantly faster than charging an electric vehicle.

We see a lot of potential in hydrogen vehicles, specifically for heavier means of transport such as trains, trucks and ships. In practice, it is already difficult to produce electric trucks, let alone a freight train or ship. This is due to the fact that batteries for these means of transport are very heavy and take up a relatively large portion of the charging capacity. One of the advantages of hydrogen is that it has a better energy-to-weight ratio, meaning that much more energy can be stored per kilogram of hydrogen. The situation is different for passenger cars, however, which can easily be electrified. Electric cars are more efficient than hydrogen cars, since hydrogen cars lose a lot of energy during the conversion process.

There are 4 major players that we would like to map out: Nel Hydrogen, McPhy, Plug Power and Powercell. In the electrolyser and hydrogen filling station segment, Nel Hydrogen is the clear international leader for green hydrogen PEM electrolyzers, while McPhy is a solid number two. In the fuel cell segment, we want to draw attention to Plug Power and Powercell. Plug Power supplies hydrogen and fuel cell systems used to power electric motors, primarily for industrial mobility applications (including electric forklift trucks and electric industrial vehicles). It already has an established global customer base. The company offers its products to retailers, wholesalers and food distribution centers and manufacturing facilities worldwide. The Swedish company PowerCell, which split from Volvo in 2008, has made important steps forward in recent years. For example, last year it entered into an agreement with Robert Bosch that granted Bosch the exclusive right to manufacture and sell the new and improved version of PowerCell S3 for cars, trucks and buses. This agreement has enabled Bosch to become Nikola Motor's main supplier for hydrogen propulsion.

## Buildings

An energy neutral building is a building that produces at least as much energy as it consumes during a year. Logically, there will be months with energy shortages, and months when a surplus of energy is produced. For example, electricity production from solar and wind depends on the climatic conditions. Net zero buildings offer many advantages: in addition to being more efficient and cheaper in the long run, they are also more resistant to natural disasters and power outages.

There are several ways to optimize the energy consumption of homes and buildings. Think solar panels, heat pumps, (four) double glazing, insulation, efficient windows and sun blinds. These solutions reduce CO2 emissions and reduce the need for fossil fuels. In practice, the water consumption and waste are the first issues to be addressed through collecting rainwater and composting. In addition to the ecological benefits of energy-neutral homes, there are also financial benefits with lower energy costs and often tax breaks.

Buildings are complex systems that require a lot of energy: air conditioning and heating systems, water heating, lighting, and so on. Large buildings increasingly rely on computerized building management systems that monitor, evaluate and intervene when opportunities arise, increasing efficiency. These systems can reduce the energy consumption of buildings by 10 to 20 percent. They switch lights off automatically when no one is around and automatically ventilate rooms to optimize air quality and temperature.

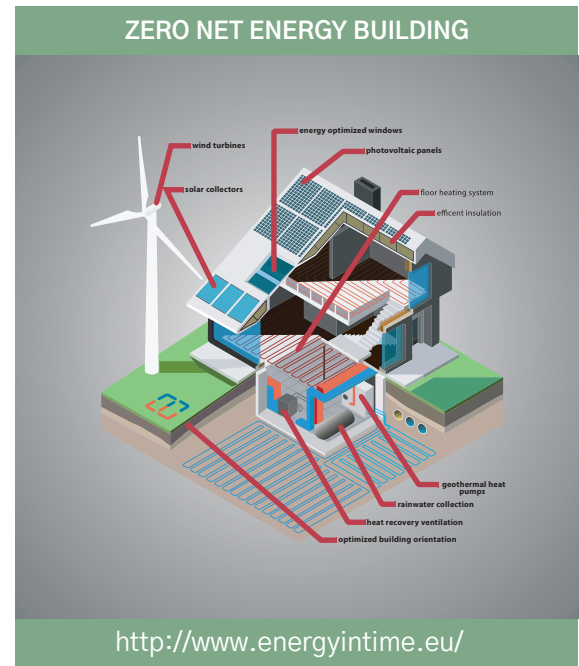


## Buildings CONTINUED

There are currently 580 zero energy projects in the United States. That's 10 times as many projects as in 2012, when the New Buildings Institute (NBI) began studying the situation.

A good example of a zero-energy building is the headquarters of biotechnology company United Therapeutics in Maryland. The headquarters is even more than energy neutral as it produces significantly more energy than it consumes. It has an elliptical shape, providing maximum exposure to the north and south, and each floor is slightly smaller than the previous one in order to allow the 3000 installed solar panels to operate as cost-effectively as possible. Geothermal energy is also used to optimally heat and cool the buildings.

Net zero buildings can be summarized as a combination of different environmentally-friendly solutions, such as smart windows that automatically provide sufficient ventilation and light, efficient cooling and heating systems, good insulation, and so on.



Paul Hawken states that if about 10% of all buildings were energy neutral by 2050, no less than 7.1 gigatons of CO<sub>2</sub> emissions could be avoided. Computer-controlled building management systems will only gain in importance and should be able to make room heating and ventilation 20% more efficient. They can also improve lighting control. If by 2050, half of all buildings use these systems, 4.6 gigatons less of CO<sub>2</sub> will be emitted. The cost of the required investment (\$68 billion) is only a fraction of the \$880 billion that could be saved over the next 30 years.

Solar panels, geothermal energy, insulation, and smart windows: these are just a few of the many tools that can be used to make buildings energy neutral.

The German company Steico, the Danish company Rockwool and the American company Installed Building Products (IBP) are examples of players who are strong in insulation. Steico, for example, produces insulation material that is made from ecologically-friendly wood fibers. Rockwool uses rock wool solutions to insulate buildings. Finally, Installed Building Products installs insulation for some leading manufacturers.

The Japanese company Daikin and the French company Schneider Electric can also contribute to energy-neutral buildings. Daikin is a major player in heat pumps and Schneider Electric is a major provider of digital automation and energy solutions for buildings. Finally, Lennox International and Trane Technologies both produce air conditioning equipment such as heating, ventilation, air conditioning and refrigeration.

## Circular economy and recycling

In order to achieve climate neutrality by 2050, the circular economy will be vital. We will need to increase recycling, which should reduce cumulative CO<sub>2</sub> emissions by 2.77 gigatons over the next 30 years, saving \$70 billion. Companies offering waste management systems or sustainable packaging should therefore benefit from strong secular growth.

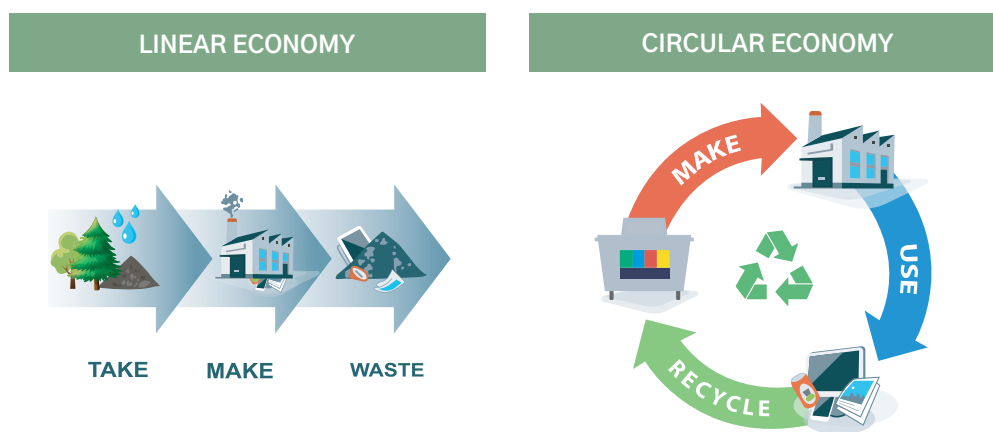
As urbanization intensifies, more and more people are exchanging rural life for the city. Today, about 4 billion people live in cities. By 2050, according to Hannah Ritchie and Max Roser, this figure should rise to 7 billion, primarily spurred by growth in emerging markets.

Urbanization is accompanied by a growing stream of waste. The amount of waste has already increased by 1000% in the past 100 years, and experts assume that it will double again by 2025. The world population's increasing prosperity and overconsumption are the culprits. Households are responsible for about half of all waste. In developed countries, paper, plastic, glass and metal account for half of all garbage. That means that these materials have a lot of recycling potential.

An OECD study concluded that more than 50% of the greenhouse gas emissions of several countries come from materials, including consumption and raw materials. To reduce these emissions, we must fully commit to a circular economy. The aim is to shrink the mountain of waste and reuse materials as raw materials for new products, reducing the impact on the environment.

The circular economy clearly has many advantages. It reduces waste, increases the efficiency of the source materials used, contributes to a more competitive economy on the long term and creates many jobs.

In the coming decades, substantial investments will have to be made in waste management systems and sustainable packaging. Innovation certainly plays an important role at an industrial level. Governments should make it a primary goal to invest in new recycling technologies. For example, according to Paul Hawken, recycled paper alone could reduce CO<sub>2</sub> emissions by 0.9 gigatons over the next 30 years because it emits 25% less CO<sub>2</sub> than traditional paper.



<https://www.towardszerowaste.gov.sg/>

There are still a lot of opportunities, especially with regard to industrial and household waste. Using new materials and raw materials to replace old products and dumping waste weighs on our climate. If we succeed in increasing the percentage of waste that is recycled from 50% to 65% in the coming years, then according to Paul Hawken, **CO<sub>2</sub> emissions could be reduced by no less than 2.77 gigatons, saving \$71.1 billion over the next 30 years.**

There are many companies that make the circular economy possible, ranging from efficient waste management systems to those involved in recycling itself.

For example, the Norwegian company Tomra is active in the development, production, sale and maintenance of recycling and sorting systems. Tomra is the market leader in machines for efficient collection of used glass and plastic bottles ('empties'). It also offers advanced sorting machines that ensure that less food is wasted.

## Circular economy and recycling CONTINUED

Companies such as Waste Management, Biffa, Republic Services and Daiseki, among others, offer various types of waste management systems that collect, transport and/or recycle waste efficiently. This limits environmental problems and risks to public health.

Finally, many companies are also involved in sustainable packaging, which allows food to be stored longer and minimizes the impact on the environment. The list of companies active in sustainable packaging includes Ball (aluminum packaging, a more sustainable alternative compared to plastic), Smurfit Kappa (cardboard), the Swedish company BillerudKorsnäs (paper and cardboard packaging), the British DS Smith (cardboard packaging), Austria's Mayr-Melnhof (cardboard) and the Finnish company Huhtamäki (food and beverage packaging).

### Food and agriculture

Today, agriculture and forestry activities generate 24% of greenhouse gas emissions worldwide. Reducing waste and shifting diets, along with better agricultural practices, will help us take the pressure off ecosystems and meet the increasing demands for food worldwide. Eating lower on the food chain and making sure that all food that is grown is consumed will lower farming inputs, limit land clearing and reduce associated emissions.

Better agricultural practices can help us reduce emissions from crops and pastures, including methane generated by growing rice and raising ruminants, nitrous oxide emitted from manure and overusing fertilizers, and carbon dioxide released by disturbing soils. Farming and forestry practices can also aid in carbon capture because many of the same techniques that prevent land-based emissions also enhance carbon sinks and improve food security and agricultural resistance to climate change.

Agriculture is also highly sensitive to water availability, which is threatened by climate change. Crops and livestock have an enormous water footprint, especially animal products like meat, dairy and eggs, which consume more water than fruit, vegetables and beans. The more meat, dairy and processed food we consume as individuals, the more water we use. Shifting to more plant-based diets can help us reduce this pressure on water availability.

## Conclusion

Today, we are standing at a tipping point regarding climate challenges. Multiple inflection points are happening now: governments are recognizing the importance, technological innovation offers solutions, costs of renewable energy are decreasing dramatically, and the average citizen is becoming more aware of our environment.


Besides this good news, we are still lagging on our global climate goals. Countries and governments will need to invest billions of dollars into green opportunities. In this whitepaper, multiple climate solutions were discussed. It is important to note that we only discussed the main solutions in this paper. There are a lot of interesting technologies and techniques that weren't discussed like carbon capture and storage (CCS), tropical forest restoration, alternative cement, managed grazing, and so on. All solutions available must be implemented in order to achieve our ambitious climate goals. Renewable energy needs to become our main energy source, electric vehicles will become the standard, ships will use green hydrogen as a fuel, we will live in a circular economy and buildings will become net zero.

With this knowledge in hand, Econopolis wants to benefit from this strong secular growth trend by identifying investment opportunities within this segment. By doing this, we aim to achieve financial returns while doing good.



**Interested to learn how Econopolis tackles  
climate change in its investing activities?**

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