UNITED STATES

ELECTRICITY AND HEATING

The United States: towards a bottom-up climate leadership?

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The United States: towards a bottom-up climate leadership?

The American power sector reveals the importance of non-state actors. In June 2017, the federal government announced the exit of the United States from the Paris Agreement, casting strong doubts about the country's ability to continue the newly started decarbonisation of its economy. However, governors, mayors and CEOs of American companies reacted immediately. A few hours after the announcement from Trump's government, an unprecedented coalition of now more than 2700 States, cities and companies joined behind the Paris Agreement under the slogan "We Are Still In". How do these initiatives translate into concrete action at the level of States, cities and companies? Will they be sufficient to ensure a deep decarbonisation pathway of the American power sector? In order to provide answers, we will conduct a three-part analysis of the recent evolution of CO_2 emissions in the United States' electrical sector and the role of different non-state actors.

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1 • THE HUGE CHALLENGE OF DECARBONISING THE AMERICAN ELECTRICAL SYSTEM

The United States' electrical system is a complex generation, transmission and distribution network providing nearly 4000 terawatt-hours of electrical power generated by approximately 7000 power plants (spread over more than a million kilometres of high-voltage transmission lines and more than 10 million kilometres of low-voltage distribution lines) with nearly 160 million residential, commercial and industrial customers.

In a system that has long been based on fossil fuels, a deep decarbonisation pathway leading to zero emissions by 2050 represents a daunting challenge for all stakeholders and requires proactive policies at various levels.

• EMISSIONS FROM THE ELECTRICITY SECTOR CONTINUE TO FALL • The United States remain among the ten most emitting countries per capita on the planet with 15.7tCO_2/person in 2016. Considering the total CO_2 emissions of the energy sector, it is the second largest emitter after China with 5073MtCO_2 in 2017. 34% of this total corresponds to the electrical sector.

After reaching a peak in 2007, CO_2 emissions from public heat and power generation are decreasing, and they are currently at the lowest level since 1990. They decreased by 3.7% in 2017, confirming their downward trend from previous years (Figure 1). This is mainly due to the gradual decline in carbon intensity of the American power mix (CO_2/kilowatt-hour). The partial substitution of coal for natural gas and the increase in the share of non-carbon sources have thus led to a decrease in the carbon intensity of electricity generation.

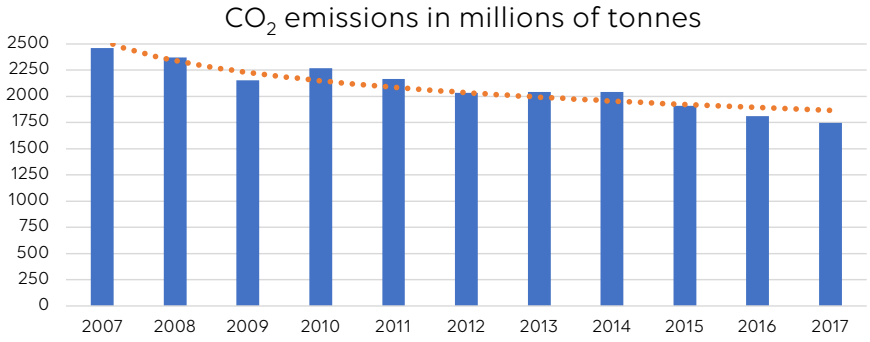

FIGURE 1. CO2 EMISSIONS FROM PUBLIC ELECTRICITY AND HEAT PRODUCTION

Source:: Compiled by the author using data from ENERDATA

Based on the 2018 analysis of the *Energy Information Administration (EIA) named "U.S. Energy-Related Carbon Dioxide Emissions"*, **two fundamental factors have contributed to reducing the carbon intensity of electricity generation since 2005: replacing coal-fired production with combined cycle natural gas production, which consumes less and is more efficient, and deploying renewable energy, in particular wind and solar energy.** According to EIA, the first factor explains 61% of the improvement in carbon intensity while the renewable energies account for the remaining 39%. As for the production of nuclear energy, it practically has not changed between 2005 and 2017.

Total electricity production decreased slightly between 2005 and 2017. Over this period, electricity generation from fossil fuels decreased by approximately 14% and non-carbon power generation increased by 33%.

The electricity consumption of the United States, which decreased by 2% in 2017, has remained relatively stable over the past decade with only minor variations due to climatic factors. Despite GDP growth of almost 22% between 2005 and 2017, electricity consumption has barely increased by 2.7%, showing the powerful effect of improving energy efficiency. Nevertheless, various forward-looking models (EIA, 2018) show that electricity demand is expected to rise again in the coming years, as the electrification of the economy – including transportation – continues.

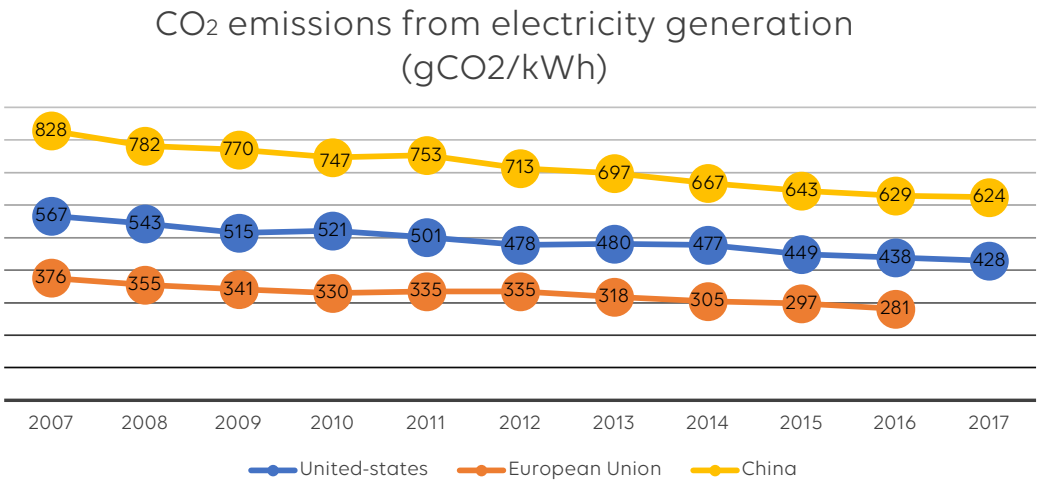

FIGURE 2. CARBON INTENSITY OF THE POWER MIX

Source: Compiled by the author using data from ENERDATA

This reinforces the need for further decarbonisation of electricity generation. Figure 2 above shows the decrease in carbon intensity of the American power mix that, however, still remains well above the average of other developed regions such as the EU and Canada. Will the current political and economic situation of the United States make it possible to continue or even accelerate the decarbonisation of the electrical sector? The change in energy policy proposed by the new conservative government threatens the continuation of decarbonisation; however, many coal plants were closed in the past year.

• THE DECLINE OF COAL CONTINUES THANKS TO THE RISE OF NATURAL GAS AND RENEWABLE ENERGY • Despite the US President's statement that he wants to end the "war on coal", industry experts are planning to continue plant closures. The number of US coal-fired power stations remains huge: according to EIA, a capacity of approximately 246GW was still active in July 2018, but it seems increasingly susceptible to decrease. The shutdowns announced for the 2018-2024 period – a total of 36.7GW – amount to approximately 15% of the current total (Feaster, 2018).
EIA forecasts that natural gas will account for 35% of electricity generation in 2018 and 2019, an increase from 28% five years ago. The share of renewable energy other than hydropower – mainly wind and solar – is also expected to increase to 10% in 2018 and nearly 11% in 2019. On the other hand, the share of coal is expected to fall to 27% in 2019 from 39% in 2014 (Feaster, 2018).

This trend seems to continue in this direction. On the one hand, the level of investment in renewable energy remains strong and costs continue to fall. On the other hand, the increase in domestic gas production is expected to keep a relatively low and stable price in the near future.

The age of the plants also becomes a significant factor for the US coal industry. Most of the country's coal-fired power plants were built in the 1960s, 1970s and 1980s, and many of these units are nearing the end of their "normal" end of life. S&P Global's data shows that in 2017, two-thirds of coal shipments went to power plants that were at least 38 years old and nearly 15% went to power plants that were at least 55 years old[1] .

1 - S&P Global, Coal's 'Aging-Out' Problem, Jan. 30, 2018 (coal deliveries from Nov. 1, 2016 to Oct. 31, 2017)

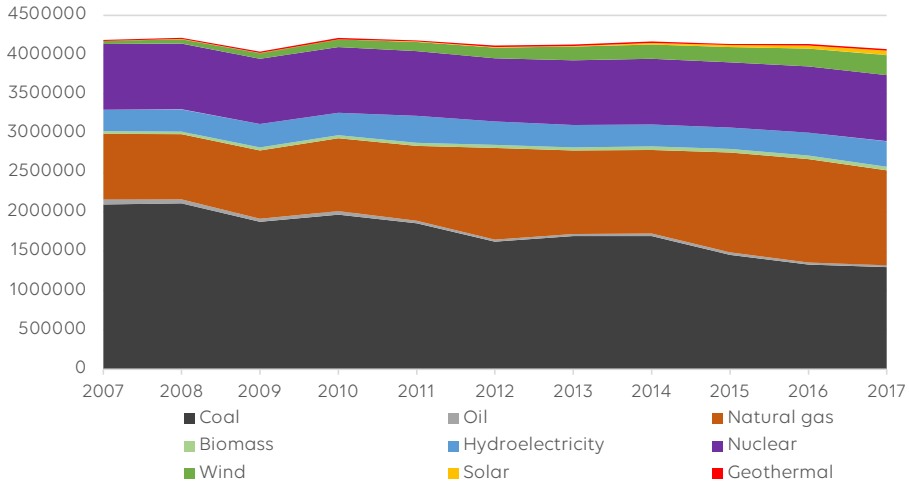

FIGURE 3. ELECTRICITY PRODUCTION PER SOURCE OF ENERGY (GWH/Y)

Source: Compiled by the author using data from ENERDATA

In contrast, much of the US natural gas capacity has been built since 2000, and most wind and solar facilities are less than ten years old[2]. A significant number of new gas, wind and solar power plants come into operation each year while few new coal-fired power plants have been commissioned in the last five years, and few (if any) are likely to be built in the future (Feaster, 2018).

Moreover, coal has serious competitive disadvantages compared to renewable energy and natural gas. In regions of the country where renewable energy and natural gas are abundant, even newer coal plants are closed. For example, power plant no. 5 of Sandow in Texas (600MW, commissioned in 2010) was retired in January 2018, just months after the announcement of its closure (Feaster, 2018).

Gas plants have a technical advantage over coal plants. They can generally respond quickly to fluctuations in demand and increase or decrease their production throughout the day. This allows them to integrate well with wind and solar power to meet the daily demand cycle while remaining economically competitive (Feaster, 2018). In contrast, coal-fired power plants are more efficient when operating continuously. Their operating and maintenance costs increase when they are cycled[3] and stopped for long periods.

In addition to this technical and economic disadvantage, coal-fired power plants are suffering the consequences of heavier regulations principally at the State level and the pressure of various environmental groups such as the Sierra Club.

In March 2018, the private electricity utility First Energy asked the Trump administration to intervene in order to keep coal and nuclear power stations under strain. So far, the government has taken no action to keep power stations open, but the administration was considering using executive power under the national security legislation to stop the wave of closures. However, no formal plan has been submitted.

The American Coalition for Clean Coal Electricity (ACCCE) also predicts that by 2020, at least 26,000MW of coal-fired power plants will be phased out. This association considers most of these closures to be driven by the policies of the Environmental Protection Agency (EPA) imposed under the Obama administration. The ACCCE supported the efforts of the Trump administration to lower EPA regulations and find ways to prevent the closure of coal-fired power plants.

Overall, these trends indicate that the power generation sector has entered a transition that is justified by economic and environmental principles. Coal infrastructure is aging and inflexible; the cost of renewable energy continues to decrease; private electricity utilities adopt decentralised power generation as they modernise their systems; and natural gas offers more flexibility by being less polluting than coal (Feaster, 2018).

At the same time, a fairly impressive number of innovations continue to emerge, particularly

2 - EIA, "Most coal plants in the United States were built before 1990," Today In Energy, April 17, 2017 3 - C'est-à-dire quand elles fonctionnent à différents niveaux de production tout au long de la journée, ou de façon saisonnière

in the field of electricity storage technology. In this context, some analyses show that if the costs of wind and solar energy and storage continue to fall, renewable energy will soon become more competitive not only in comparison to coal but also to natural gas. This has already been seen in some places such as Western Colorado (Cleantechnica, 2018)

2 • THE MOMENTUM OF CITIES AND STATES IS OPPOSED TO THE WITHDRAWAL OF THE FEDERAL GOVERNMENT

While the federal government is turning its back on climate policies, all the attention is focused on cities, States, businesses, universities and other relevant actors. A recent analysis suggests that if fully implemented, the objectives of registered and quantified non-state actors could approach the commitment made by the United States in the Paris Agreement, leading to a reduction in emissions of 17 to 24% in 2025 compared to 2005 levels. 22 States, 550 cities, and 900 companies in the United States have made climate change commitments, and the 50 States have adopted at least one policy likely to reduce emissions (Climate Action Tracker, 2018).

• A HIGHLY INADEQUATE FEDERAL CLIMATE POLICY • The American climate policy is currently considered highly insufficient to lead the country towards a deep decarbonisation pathway of its economy (Climate Action Tracker, 2018), as it was strongly shaken by the Trump administration in 2018. If the proposed actions become fully implemented, the projections of GHG emissions for the year 2030 could increase up to 400MtCO_2eq compared to the levels projected at the end of 2015. That is almost as much as the total of the emissions of the State of California in 2016. The federal government has proposed to replace the Clean Power Plan (CPP) to freeze vehicle efficiency standards after 2020 and not to apply standards to limit the extremely high emissions of hydrofluorocarbons (HFC). The administration also weakened standards for methane leakage from oil and gas production (Climate Action Tracker, 2018).

The *Clean Power Plan* issued by the Obama administration under the Clean Air Act was aimed at reducing emissions from the electricity sector by 32% by 2030 compared to 2005 levels by setting targets for each individual State. The successful implementation of the CPP would have been an important step in strengthening American climate action. However, in August 2018, the EPA proposed to replace the CPP with the Affordable Clean Energy (ACE) Rule (EIA, 2018) limiting the scope of the plan to reduce greenhouse gas emissions by setting more flexible rules for coal-fired power plants and allowing States to set their own standards (EPA, 2018). This is a significant departure from the CPP, which required all States to meet emission standards and is likely to result in emissions of up to 81MtCO_2eq/yr in 2025 and 212MtCO_2eq/yr in 2030 (Climate Action Tracker, 2018).

The federal government has played a fairly strong role in the diffusion of biofuels, but its role has been much weaker with respect to electric renewable energies. **Renewable electricity in the United States has been largely driven by State incentive policies, among other things, supported by federal tax incentives. In many respects, States as well as local governments and regional organisations have been more ambitious than the federal government.**

• STATES PAVE THE WAY TO RENEWABLE ENERGY AND ENERGY EFFICIENCY • At the sub-national level, 29 States have implemented Renewable Portfolio Standards (RPS) and nine have set voluntary targets (America's Pledge, 2017). Other incentives have also been put in place such as the net billing system or subsidised credits for renewable energy projects. The RPS are fairly flexible policy instruments that require electricity providers to obtain a minimum percentage of their energy from renewable energy sources by a certain date. Each State sets a quota (usually a percentage of renewable energy) and companies choose to fulfil their mandate using a combination of different sources (wind, solar, biomass, geothermal or other renewable sources). Some RPS specify the combination of technologies while others leave it to the market.

The first RPS was established in 1983; however, the majority of States adopted or strengthened their standards after 2000 (IEA/IRENA, 2018). The compulsory quota is usually accompanied by an element of economic flexibility: a system of tradable renewable certificates ("green certificates"). Electricity suppliers fulfil their obligation by producing renewable electricity themselves or by buying surplus certificates from other producers.

States have the power to individually dictate environmental protection policies, and this past year, many have strengthened some climate and energy standards. In recent months, State congresses have proposed hundreds of bills on clean energy production, reduction of GHG emissions, and regulations and measures for the protection of the environment. Many are also looking for ways to tax carbon emissions, encourage solar energy installations and demand general advancements in renewable energy technology (Green Gazette, 2017).

The scientific organisation Union of Concerned Scientists (UCS) recently proposed and applied a method that examines the evolution of clean energies across the country. By examining 12 parameters including the creation of clean energy jobs, the progress of renewable energy, and the reduction of power plant pollution, the report identifies the States that are making the most progress towards a sustainable future.

The UCS analysis clearly identifies leaders among the 50 US States:

• **California** paves the way for clean energy. The Golden State leads in the adoption of electric vehicles and is in the top five on six other indicators: residential solar capacity per household, energy savings, clean energy jobs, standard targets for renewable energy, the ability of companies to buy renewable energy and the targets for reducing carbon emissions (see Text box 1 below).

• **Vermont**, in second place, is the State that ranks first in terms of jobs in the clean energy sector and in its targets for reducing carbon emissions. It is also among the first in terms of energy savings, adopting electric vehicles and energy efficiency policies.

• **Massachusetts**, in third place, has the strongest energy efficiency regulation and ranks among the top five in terms of residential solar capacity per household, energy savings, clean energy jobs and emission reduction targets.

However, other bills oppose the transition to clean energy. Proposed legislation could put an end to the net billing system for "prosumers" (who produce and consume their own energy) of solar energy, which are gaining popularity in Indiana and Missouri. Wyoming lawmakers have considered penalising large-scale wind and solar producers. Most importantly, many States do not have laws to achieve their GHG reduction targets.

It also seems important to stress that some States that are less favourable to climate action and fossil fuel issues, such as Texas, are making remarkable progress in the field of renewable energies. If California is the champion of solar energy, then Texas in the champion of wind energy. This southern State has one of the most open and competitive electricity markets in the country and currently has the largest installed capacity of wind energy in the United States, with 22GW. Due to its low marginal cost, this type of energy has priority over the Texas electricity system, and in some months, it has already supplied a quarter of the electricity consumed in the State. For example, other more expensive sources of production such as coal are being pushed out of the market.

Despite a few exceptions, it is clear that it is the States more than the federal government that lead the decarbonisation of the electricity sector through two main principles: promoting renewable energy and improving energy efficiency.

The State of California: A sustainable energy policy.

California has adopted an aggressive programme to promote renewable energy. The centrepiece of the programme is the Renewable Portfolio Standard system introduced in 2002, which requires an increase in the percentage of State electricity sales from renewable sources each year (Ballotpedia, 2018). This percentage should reach 33% by 2020 and 50% by

2030. Other statutory tools to support this effort include a feed-in tariff for small-scale renewable electricity producers. In addition, the government introduced a net metering system in 1996 that allows customers who produce their own renewable electricity to sell a portion to the grid.

California also has the most ambitious legislation on climate change in the country. The 2006 Global Warming Solutions Act (known as AB 32) requires the State to reduce its GHG emissions to 1990 levels by 2020. AB 32 assigns the California Air Resources Board (CARB) the task of choosing the statutory and policy tools to achieve this target. CARB has chosen to implement a cap-and-trade programme. The programme caps all GHG emissions and then reduces the overall emissions limit annually until the 2020 target is achieved. In 2014, California tied its cap-and-trade system to Quebec's cap-and-trade system, creating a broader emissions trading market that should help reduce the costs (Dernbach, 2018).

In 2016, the California parliament passed a law setting a 40% GHG emissions reduction target relative to 1990 levels by 2030, leading to the need to adapt the cap-and-trade system to satisfy the new target.

The cap-and-trade programme is only part of California's overall plan to achieve the "technologically achievable" and "cost-effective" emission reductions that AB 32 requires. California also limits the carbon intensity of new long-term power supply contracts so that the supplier cannot produce more than a combined cycle natural gas power plant that emits approximately half of the emissions from a coal plan.

TEXT BOX 1

• INCREASINGLY COMMITTED CITIES • Many US cities have made a public commitment to reduce carbon emissions and combat climate change through initiatives such as the Covenant of Mayors, We Are Still In, or by developing their own climate action plans.

At least 80 US cities, under the coordination of the influential progressive NGO Sierra Club, have committed to achieving 100% renewable electricity production in the coming decades. In the United States, six cities – **Aspen, Burlington, Georgetown, Greensburg, Rock Port and Kodiak Island** – have already achieved their targets. These six cities now generate 100% of the energy used in their communities from clean, non-polluting and renewable sources.

As American cities join the quest for clean and sustainable energy, some are struggling against private electricity utilities that are sometimes resistant to change. Others have a municipal electricity utility or collaborate with their suppliers to move towards cleaner energy sources. As a result, some communities are separating themselves from these investor-owned businesses, joining forces to get their own energy sources through **Community Choice Aggregation (CCA)** programmes.

CCAs allow communities to bypass investor-owned electricity providers by joining together to buy their own wholesale energy and gain greater control over their energy options as a result. Thanks to CCA, decisions regarding electricity supply, tariffs and incentives are made at the local level. The 18 operational CCAs in California already represent many regions and cities in the State, and another nine are expected to be launched in the near future (Sierra Club, 2018). This is the case of **Santa Barbara** among others, which is in the process of creating a CCA in partnership with other neighbouring municipalities. This Californian city is committed to achieving at least 50% renewable electricity for the entire city by 2030. Further north, **San Francisco** and **San Jose** pioneered the creation of CCA, each with a target of 100% renewable energy over a decade ago.

In August 2017, the Orlando (Florida) city council unanimously passed a resolution to ensure the transition to 100% clean energy in municipal operations by 2030 and in the entire city by 2050. Led by Mayor Buddy Dyer – a strong supporter of the Sierra Club 100% clean energy movement – the Orlando resolution was supported by a broad and diverse coalition of local organisations including the League of Women Voters, IDEAS for Us and NAACP, as well as the Sierra Club. The coalition is currently working to secure the commitment to close the last two coal-fired power companies from the city's utility and replace them with renewable sources.

A 100% clean energy target is ambitious for all cities, but perhaps even more so for a long-standing coal industry capital like **St. Louis** (Missouri), home to two of the largest coal companies in the country. However, following the withdrawal of the Trump administration from the Paris Agreement, Lewis Reed – Chairman of the St. Louis council – urged his city to take charge of its future. In October 2017, the St. Louis council unanimously approved the commitment to switch to 100% clean and renewable energy by 2035. Its supporters have a long-term vision for the city focused on creating green jobs, clean air and a better quality of life for all residents. The city has set a deadline in December 2018 for developing its Clean Energy Transition Programme and has gathered a committee of stakeholders to this end.

These are a few examples of the many commitments made by US cities in 2017 and 2018. A follow-up of these commitments will make it possible to define their implementation and their real impact in the decarbonisation pathways of these cities.

3 • THE ROLE OF BUSINESSES AND CITIZENS' INITIATIVES

Just as in other countries, the electricity markets in the United States are in turmoil. Traditional businesses in the sector, whether private, public or mixed, face a dual threat. On the one hand, we see the arrival of new players from other economic sectors, often world giants. On the other hand, the large number of innovations in power generation and storage technologies enables increasingly decentralised production in which consumers and new forms of organisation play a more important role.

• COMPANIES INTEGRATE THE CLIMATE DIMENSION INTO THEIR STRATEGIES • As part of the **Global Climate Action Summit** held in September 2018 in San Francisco, 21 leading companies submitted the ***Step Up Declaration***. It is a new alliance dedicated to harnessing the power of emerging technologies and the fourth industrial revolution to help reduce GHG emissions in all economic sectors and ensure a positive climate change for 2020. Collectively, these organisations cover a wide range of sectors that can significantly reduce GHG emissions in buildings, data centres, the finance sector, telecommunications, transportation, etc. They include the following companies: Akamai Technologies, Arm, Autodesk, Bloomberg, BT, Cisco Systems, Ericsson, HP, Hewlett Packard Enterprise, Lyft, Nokia, Salesforce, Supermicro, Symantec, Tech Mahindra, Uber, Vigilent, VMware, WeWork, Workday and Zoox.

The Step Up Declaration was developed with the leadership of Salesforce, a leading California-based cloud computing company. The Declaration focuses on the transformative power of the fourth industrial revolution, which comprises artificial intelligence, cloud computing and the Internet of Things.

Are the oil giants joining the transition?

European oil companies have started to invest heavily in renewable energy – for example, solar energy at Total or off-shore wind at the Norwegian company Statoil, which has recently changed its name to Equinor. However, American oil companies are currently far less active. One of the provided reasons is the even lower profitability of renewable energy projects compared to oil and gas projects.

Nevertheless, American oil giants are taking a few steps towards non-carbon energies. ExxonMobil is interested in biofuels and is devoting a growing portion of its R&D budget to alternative energy sources[4]. This company invests approximately $1 billion per year into basic and applied research on low-carbon technologies. This oil supergiant is particularly focused on synthetic biology.

It hopes to prove the commercial feasibility of deploying genetically modified algae in large open-air operations capable of producing the equivalent of 10,000 barrels of renewable crude oil per day from sunlight and industrial CO_2. If the company's trial succeeds, this modular design could evolve to much higher levels. ExxonMobil is also developing genetically modified microbes together with the country's largest biodiesel producer Renewable Energy Group, which could produce biodiesel from residual biomass (i.e. without the use of food crops such as maize). Other projects include fuel cells that capture and consume CO_2 to produce electricity and new technologies for the manufacture of plastics emitting 50% less CO_2[5].

Chevron holds interests in solar, wind and geothermal generation facilities that can power approximately 113,000 US households each year. This seems modest, but it represents the first steps of a possible renewable energy development strategy for this company with a strong presence on the west coast of the United States. Chevron has also invested in next-generation renewable fuels with little success, but it still sees a bright future for renewable diesel. The company has tested various mixing ratios (with low-oil diesel) of 6 to 20% for some terminals in California.

TEXT BOX 2

With respect to electricity generation, private electric utilities provide 38.7% of the total production in the United States, other producers account for 39.9% of the total production, municipal utilities 10%, federal agencies 6.4% and electric cooperatives 5% (Klass, 2017).

Some of these companies are making progress in their decarbonisation efforts. This is the case of NRG Energy, an American company producing and distributing energy present in 11 States. Starting in 2009, NRG launched an initiative to become a green energy producer in the United States and began investing in clean energy projects. These include onshore and offshore wind energy, solar thermal energy, PV solar installations and the conversion of some of their traditional coal-fired power plants to biomass. At the end of 2010, NRG launched the "EVgo" network – one of the first networks of charging stations for electric cars. The company had set itself a target of halving its total emissions by 2030 compared to 2014 levels. It has already managed to reduce its emissions by almost 20 million tonnes, meaning that the target will be achieved well before 2030. **Climate action has helped NRG bring innovative solutions to the market, meet customers' current needs, and anticipate their future needs while making the company stronger and more efficient.** It also attracts and retains the best talent in the industry and provides excellent returns for shareholders, said one of the company's leaders (Greenbiz, 2018).

APPLE and TESLA enter the energy market

A number of established companies with a recognised brand in various sectors appear to be ready to compete in electric markets that have for long been dominated by traditional energy companies.

Among these new arrivals is Apple, who has quietly created a subsidiary called Apple Energy LLC and has applied to the Federal Energy Regulatory Commission (FERC) for a licence to sell electricity directly to retail consumers.

According to specialised press, Apple's strategy is due to several reasons (Sioshansi, 2017). First, Apple uses 93% of renewable energies in all its activities and its target is to quickly reach 100%. The company has contracts with solar

4 - tps://www.eniday.com/en/sparks_en/oil-majors-invest-renewable-energy/
5 - https://www.fool.com/investing/2018/06/04/big-oil-is-investing-billions-in-renewable-energy.aspx

developers around the world for a capacity of 521MW, making it one of the world's largest consumers of solar energy. In addition, it invests in net-zero energy buildings including its new headquarters in Cupertino, California.
Second, the company is in a position to generate surplus renewable energy most of the time, especially on cool, sunny days in the spring when there is no air conditioning. The surplus energy can be resold to the grid at wholesale prices, or even better, to other customers at current retail rates, which tend to be two to three times higher.
Third, some analysts speculate on the possibility of Apple resuming its plans for developing electric cars – an area in which it has been working quietly for some time. Having excess renewable energy to power electric vehicle batteries can open up new markets at a time when the mobile phone market appears to be saturated.
Finally, it counts on the value of its Apple brand. Its customers seem likely to buy any goods or services that boast the famous logo including electricity, especially if it is 100% renewable.
In mid-November 2016, Tesla shareholders at a special meeting approved the acquisition of SolarCity for $2.6 billion. This means that Tesla can move forward with the integrated solar roof and residential battery system announced in October 2016. The company predicted that the cost of solar electricity with storage via batteries will be lower than electricity retail rates in many places. If the company succeeds in combining the two products, it can use the same tools to shake the automotive and electrical industries by bringing together electric mobility, PV solar panels and storage. Affluent customers who can afford a high-end electric vehicle may wish to produce some of their electricity on their roof, and may want to store some of it in batteries for later use (Sioshansi, 2017).

TEXT BOX 3

• THE ENERGY DEMOCRACY MOVEMENT • Energy democracy is both a new concept and an emerging social movement that links the change in energy infrastructure to the possibilities of profound political, economic and social change. The term continues to spread in the context of climate justice struggles, driven by unions, academic communities and political parties. This concept is increasingly used in the United States to demand and justify the integration of policies linking social justice and economic equity to transitions to renewable energy (Burke & Stephens, 2017).
Energy democracy is born of citizen movements that fight against climate and economic crises, resist the expansion of fossil fuels, and seek a transition to renewable energies. Since 2012, various groups[6] and organisations in the United States and Europe have explicitly adopted the term "energy democracy" as the central theme of the energy and climate change discourse. In 2012 in the United States, the Cornell University's Global Labour Institute hosted an international round table of trade unionists who used energy democracy to discuss the struggle for the energy transition, which gave rise to a new organisation – the Trade Unions for Energy Democracy.

This transition path is characterised by a strong presence of actors who have lost confidence in existing governance systems, by the emergence of new guiding principles, beliefs and practices, the coexistence of multiple innovations and widespread experimentation, and a shift to more local or regional systems and decentralised technologies and management structures. These include energy co-ops, Community Choice Aggregation programmes (see 2.3 above), net metering systems and Community Benefit Agreements (Burke & Stephens, 2017).

6 - Community Power Network, Local Clean Energy Alliance, Trade Unions for Energy Democracy, Institute for Local Self Reliance, Center for Social Inclusion, Climate Justice Alliance, Rosa Luxemburg Foundation, Alternative Information and Development Centre, Public Services International, Emerald Cities Collaborative, Energy Democracy Alliance of New York, entre autres.

CONCLUSION

An analysis of the registered and quantified commitments of sub-national and non-state actors in the United States (America's Pledge, 2018; Climate Action Tracker, 2018) suggests that if implemented, these commitments could lead to a reduction in emissions of 17 to 24% in 2025 compared to 2005 levels.

While the federal government has significantly changed its climate policy – including the decision to leave the Paris Agreement –, the US climate leadership remains alive and well. It is a new kind of bottom-up leadership driven by the conviction of citizens, the leadership of cities and States as well as driven by the innovation capacity of its companies, making it possible not only to take concrete action now but also to lay the foundations for a future partnership with the federal government. In the coming years, the continuation of the decrease in CO_2 emissions from the American power sector will tell whether the dynamics of the Federated States will be stronger than the federal desire to revive coal contrary to recent economic developments.

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