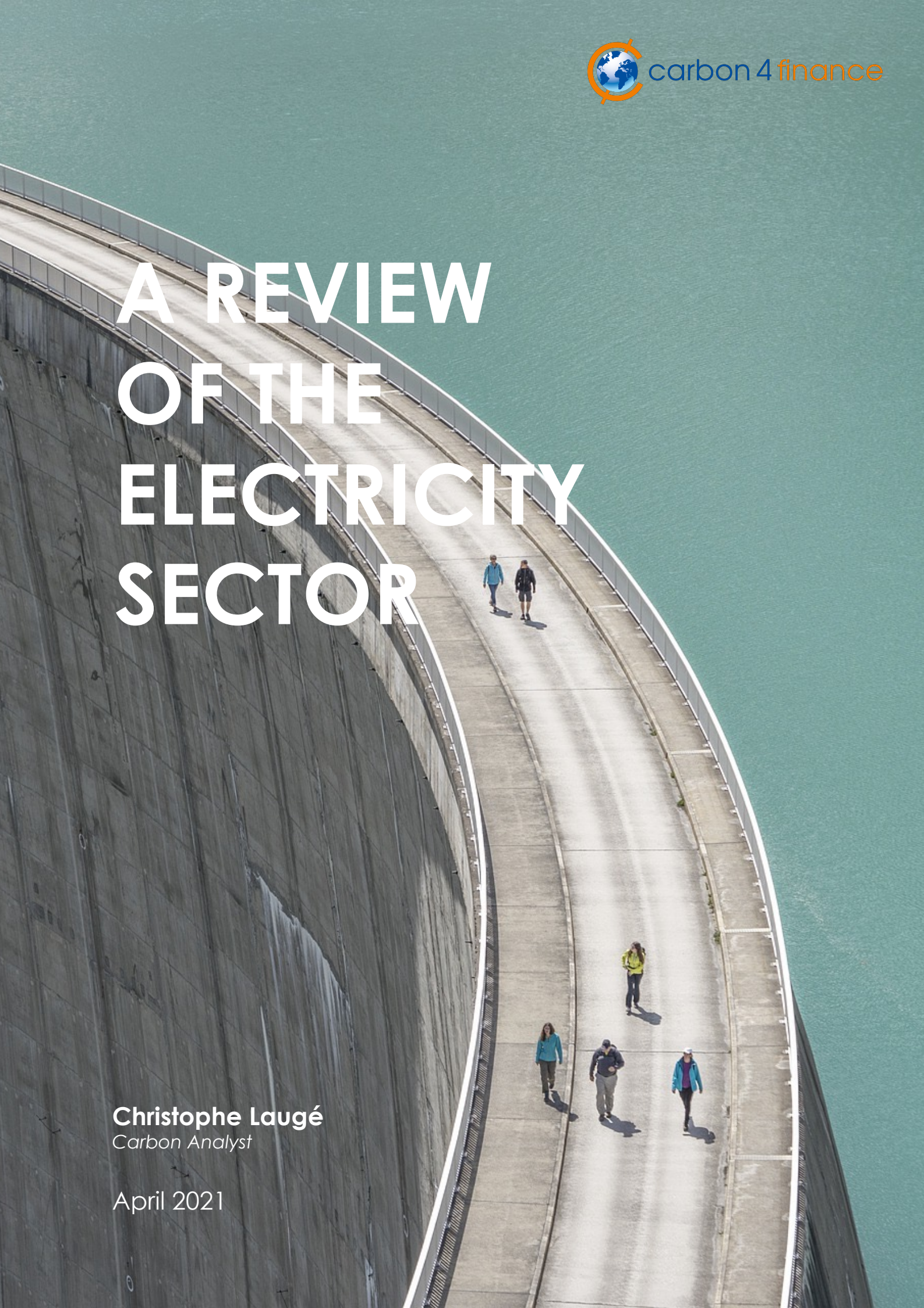
carbon 4 finance

# A REVIEW OF THE ELECTRICITY SECTOR



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# EXECUTIVE SUMMARY.

This report summarises the results of an analysis of around 100 companies in the electricity sector. The analyses were carried out using the Carbon Impact Analytics (CIA) method. The CIA methodology aims to measure the companies' exposure to transition risk, with an overall score based on sectoral indicators and ranging from A+ to E-.

Thanks to the data collected and calculated during this campaign, we established the companies' ranking in the electricity sector according to their degree of exposure. We also looked at their ability to minimise this exposure, and assessed the strategies put in place to see whether they are aligned with the decarbonisation objectives of the global economy.

## Key messages

**A wide range of profiles**

- Among the smallest market capitalisation companies, there are two radically opposed worlds: those still relying mostly on fossil fuels and those moving away from them by favouring low-carbon production sources (many renewable energy pure-players);
- Among the companies with the largest market capitalisation, we find that a majority has a decarbonised profile without being low-carbon energy pure-players.

**A great heterogeneity of the decarbonisation between the different players**

- Some companies have had a sudden realisation in recent years and are now committed solely to low-carbon energy, such as Ørsted and Vattenfall;
- Nevertheless, this realisation is not unanimous and some players in electricity generation continue being heavily exposed to fossil fuels, mainly in America and Asia.

**Decarbonisation efforts must continue**

- In order to achieve the objectives of a 2°C scenario, direct emissions linked to electricity production must be divided by 4 between 2019 and 2040;
- Not only will it be necessary to continue investing in low-carbon electricity generation, but also in electricity transmission and distribution infrastructures and energy storage systems.

This exercise will be repeated annually, the continuity of the CIA methodology will allow for year-on-year comparisons of the results and thus inform future discussions on the effectiveness of the private sector in mitigating their environmental impact.

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# 1 Foreword

Electricity is an industrial and service sector whose purpose is to supply electric energy to an end-user. This process includes several stages: generation (power plants), transmission (high voltage network, which sometimes manages storage systems) and distribution (low voltage network, which sometimes includes storage systems as well) and supply (marketing operations).

Electricity is not freely available in nature, so it must be "produced". Electricity is generated in power plants, which transform so-called primary energy (which is found in nature) into electrical energy. This transformation is achieved by using electric generators driven either by a thermal machine powered by fossil fuels (coal, natural gas or oil), organic fuels (biomass or waste) or nuclear fission; or even directly by mechanical hydroelectric or wind energy. Other sources of electrical energy are also used, such as solar energy (photoelectric effect or thermal concentration) or geothermal energy.

Global electricity production has been increasing steadily since the post-war period (global production was 600 TWh in 1945!).

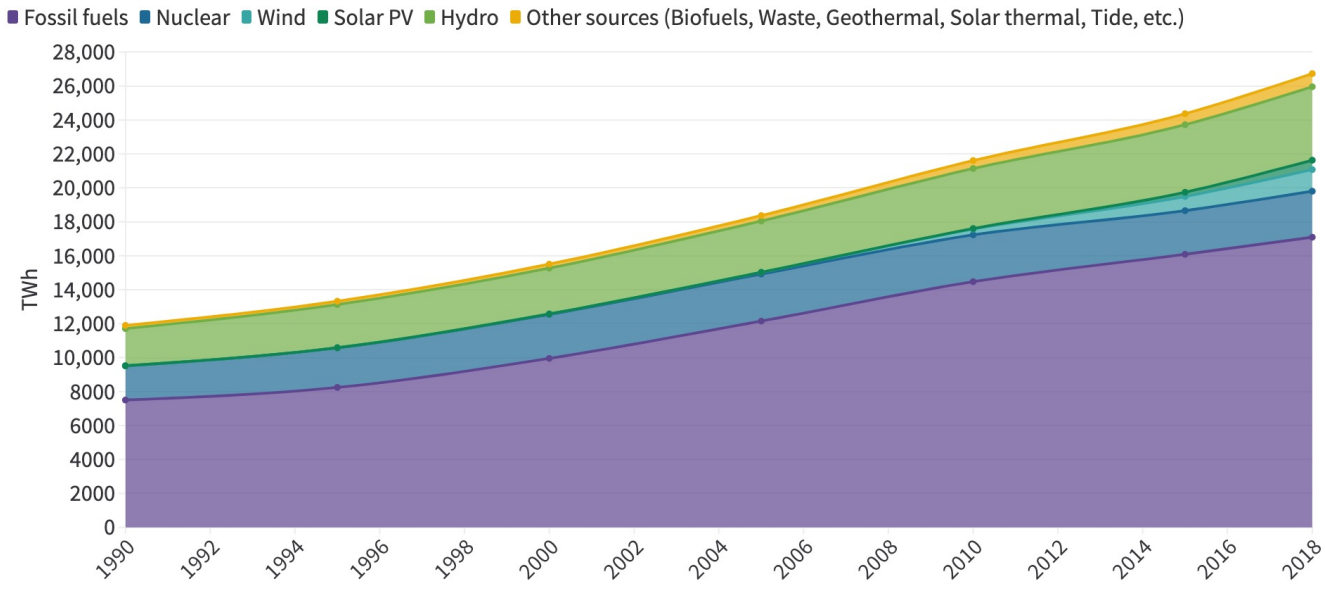



*Figure 1 - Global electricity production between 1990 and 2018*[1]

In 2018, fossil fuels (coal, natural gas and oil) accounted for almost 2/3 of the world's electricity generation (coal makes just under 40% of electricity generation and gas just under 25%, with oil - heavy fuel oil - making up about 5%).

Between 1990 and 2018, global electricity generation increased by an average of 2.93% per year. This increase was faster for renewables, which was 3.75% per year. The global electricity mix was composed of about 18.5% renewables (including 18.4% hydro) in 1990 compared to 23% (including 16.2% hydro) in 2018 (excluding geothermal, solar thermal, and biomass).

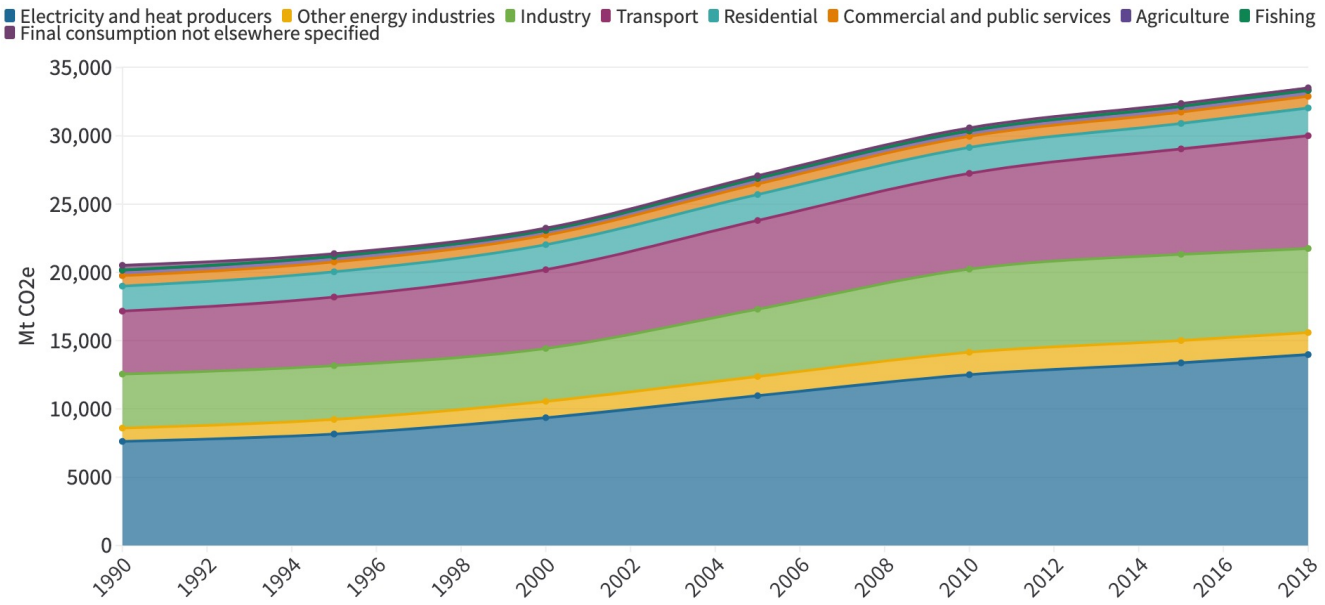



*Figure 2 - Global GHG emissions by industry between 1990 and 2018*

1. IEA (2020), Electricity Information: Overview, IEA, Paris https://www.iea.org/reports/electricity-information-overview

In terms of greenhouse gas (GHG) emissions, electricity generation was responsible for 7.622 Mt $CO_2e$ in 1990 compared to 13.978 Mt $CO_2e$ in 2018, accounting for 37.15% of overall GHG emissions in 1990 and 41.71% in 2018.

On a geographical basis, there is a large difference (more than a factor of 10) in the carbon intensity of electricity generation ($gCO_2e$/kWh) between countries; in France it was approximately 40 $gCO_2e$/kWh in 2019 compared to approximately 720 $gCO_2e$/kWh in India[2]. These differences arise from the wide variety of existing ways of generating electricity, from very low-carbon sources such as renewable energy and nuclear power, to the most carbon-intensive resources (coal and heavy fuel oil), as well as intermediate resources such as natural gas.

The electrification of the energy system seems to be progressing and low-carbon energies are increasing their share in the electricity mix. In order to achieve the objectives of a 2°C scenario, this decarbonisation must continue at a rate of -9.5% per year between 2019 and 2040 in terms of direct emissions.

Nevertheless, the integration of low-carbon production often requires modifications to the electricity network, particularly when the new sources are intermittent or do not have rotating machines (cf. RTE IEA report[3]); generating in turn additional costs, related to the line capacities, additional equipment (storage and frequency control), connection and reinforcement costs: the size of the power lines and transformers, as well as the supply of the reactive energy for the voltage control.

The integration of intermittent low-carbon production (this question does not arise with hydroelectricity or nuclear power) raises other issues[4] for the network: maintaining the reliability and quality of the electricity supply while managing increasingly intermittent flows. Indeed, it is necessary to always adjust the electricity production and consumption at all times, and intermittent renewable energy is a non-controllable source. The network system operator thus plays a role of market facilitator, in particular to bring out new levers such as more flexibility[5] to optimise the electricity system. Historically, the development of renewable energy has been carried out alongside the maintenance or development of controllable sources with a comparable installed power[6]. The more the network is supplied with intermittent energy, the greater the modification required of the network and its management; however, the limit to which it could reach is the subject of intense debate.

In theory, electricity storage and the adaptation of the consumption to production provide an answer to these complexities. Several storage technologies are currently in use: Pumped-Storage Hydroelectricity (PSH) and batteries.

Hydro-pumped storage (the most common storage technology: 99% of the 170 GW of storage available in the world, for a global production capacity of around 7,500 GW) is a technique used in hydroelectric power stations which have the characteristic of being reversible. This technique consists of pumping water from a lower basin - or a river - to an upper basin when there is a surplus of electricity on the grid, and then using it to produce electricity when demand is higher (turbining). However, this technology is limited by geographical constraints.

2. IEA (2020), CO2 Emissions from Fuel Combustion: Overview, IEA, Paris https://www.iea.org/reports/co2-emissions-from-fuel-combustion-overview

3. IEA (2021), Conditions and requirements for the technical feasibility of a power system with a high share of renewables in France towards 2050, IEA, Paris https://www.iea.org/reports/conditions-and-requirements-for-the-technical-feasibility-of-a-power-system-with-a-high-share-of-renewables-in-france-towards-2050

4. https://assets.rte-france.com/prod/public/2021-01/RTE-AIE_synthese%20ENR%20horizon%202050_FR.pdf

5. The flexibility of the sources of the distribution network are numerous and can cover all kinds of technologies, in particular those linked to storage (electric vehicles, hot water tanks, hydrogen storage, etc.). They can also be proposed by consumers or producers, for example a group of individuals who reduce or postpone their consumption in anticipation of a cold peak (voluntary consumption reduction) or a power plant which reduces or increases its production to relieve congestion on the network.

6. This is at least the case in Spain and Germany, with the exception of small, highly interconnected countries (e.g. Denmark) where it is the neighbours who provide the power.

Battery storage has the advantage of offering more versatility than PSHs (few geographical constraints; and it has the possibility of adapting in size and power). However, this technology which enables the supply of large amounts of power on a short time scale, does not yet check all the boxes for a storage system that will be capable of operating from one month to the next, or from one year to the next (see again the RTE IEA report).

# The Power sector campaign

### Points of attention

- The scope of the analysis is limited to the indices monitored by C4F.

- The results presented are limited to the core business (the segment with the largest share of revenues) of a company.

  Examples:
  Enel is a vertically integrated company (breakdown of its revenues: 62% electricity generation, 20% T&D electricity, 11% electricity supply and 7% gas) and its main activity is electricity generation, so in the case of Enel the study below will only focus on electricity generation.

  Engie (breakdown of its revenues: 46% in electricity generation, 10% in electricity supply and 44% in gas), its main activity is also electricity generation, so the study will only present the results of that specific activity.

  Edison International (breakdown of its revenues: 14% in electricity generation, 72% in electricity T&D, 14% in electricity supply), its main activity is electricity T&D, so the study will only focus on electricity T&D.

- It is therefore a sectoral study, which does not aim to compare the companies with each other, but rather compares the homogeneous sectors of these companies.

# 2 Methodological overview

A sector score is composed of **3 sub-scores**:

- **A past performance score**, which captures the company's GHG emissions reduction momentum over the last 5 years;

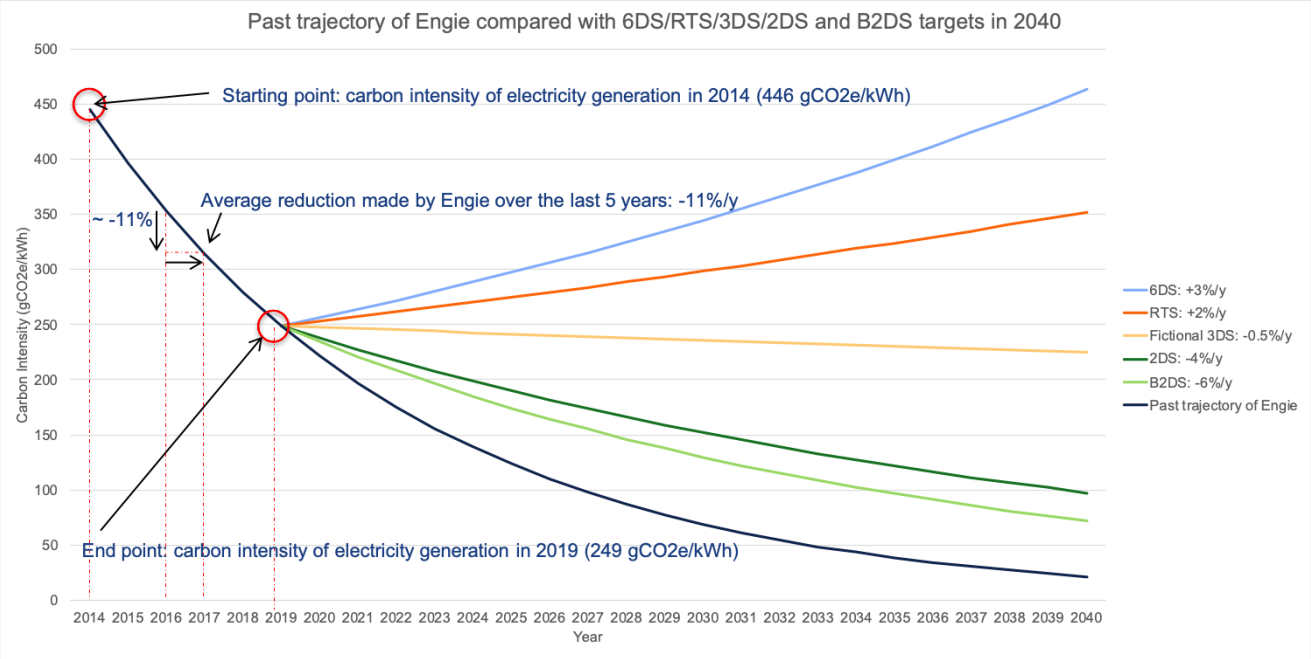
- **A current performance score**, which compares the company's current performance with the sector as a whole (this score is relative to the sector as a whole and it is adjusted after the sectoral campaign, enabling the comparison on a similar basis);

- **A future performance score**, which measures the extent to which the transition risk is considered in the company's strategy, based on 5 criteria:
  - The measures taken by the actor and its positioning on the market;
  - Transitional investments;
  - Scope 1&2 emissions reduction targets;
  - Scope 3 emissions reduction targets;
  - Governance of energy and climate issues (the existence of internal structures dedicated to energy and climate issues, the presence of training for employees on energy and climate topics and the implementation of incentives for members of the organisation to reduce their carbon footprint).

## 2.1 The case of electricity generation

In the case of electricity generation:

- The past performance score is measured by the reduction rate of the electricity generation's carbon intensity ($gCO_2e/kWh$) over the last 5 years and is compared with what is required in the ETP scenarios (B2DS, 2DS, RTS) between the year of analysis and 2040. This reduction rate is then expressed in temperature (below is an explanation with an example and a graph to better understand the attribution of this score). The past performance score makes up 20% of the electricity generation's sector score.




In this graph the reduction of the carbon intensity of Engie's electricity generation activities has been plotted over the last 5 years, from 446 $gCO_2e/kWh$ in 2014 to 249 $gCO_2e/kWh$ in 2019 (dark blue portion of the curve), which corresponds to an average reduction of 11% per year. In order to obtain the past performance score, this annual reduction rate is compared with the various reduction rates that Engie would need to achieve in order to meet the carbon intensity targets set by the different 6DS/RTS/etc. scenarios set for 2040. In Engie's case, the reduction achieved so far is higher than that of its specific B2DS scenario.

- The current performance score is measured by the carbon intensity of the electricity generation ($gCO_2e/kWh$) during the year of analysis (note: it is relative to the sector, see above). It makes up 40% of the electricity generation's sector score.

- The future performance score represents the company's willingness to reduce emissions, divest from fossil fuel power plants, develop more low-carbon power generation units (all sources with EFs below 100 $gCO_2e/kWh$ across Scope 1&2&3 are considered as low-carbon) and set targets for reducing the carbon intensity of electricity generation ($gCO_2e/kWh$). It makes up 40% of electricity generation's sector score.

## 2.2 The case of electricity transmission and distribution

In the case of electricity transmission and distribution:

- For the past performance score, we focus on reduced emissions. If a company has managed to improve its efficiency over the last 5 years, then it will result in reduced emissions. In the case of an electricity transmission and distribution company, the carbon efficiency is measured by the company's ability to reduce its grid losses. These reduced emissions are used to calculate the CIR (Carbon Impact Ratio) associated with the T&D activity, which is the ratio of the reduced emissions over the induced emissions. The CIR value will then be used to determine the past performance score. The higher the CIR, the better the past performance score (the largest gain was achieved by Consolidated Edison, with a CIR of 0.35, see the paragraph below for more details). The past performance rating represents 30% of the electricity T&D's sector rating.

- The current performance score is measured in terms of grid losses of the electricity network (reminder: the current performance rating is relative to the whole sector, see above). It represents 40% of the electricity T&D's sector rating.

- The future performance score is measured by the company's willingness to contribute to controlling energy demand (through the development of technologies that allow peak shaving or the installation of smart meters) and to define its reduction targets for the network losses and sulphur hexafluoride (SF6) leaks - in Europe the losses are around 6 kg SF6/TWh for a distribution network and 60 kg SF6/TWh for a transmission network. The future performance rating represents 30% of the electricity transmission and distribution's sector score.

# 3 Results

## 3.1 Our sample

### The electric power sector as a whole

There are 626 companies in the electric power industry, **of which 84** are covered by C4F. These 84 companies represent **78% of the total market capitalisation** of this industry. The 20 largest capitalisations in the sector are covered – except for PG&E (due to its financial instability, as it is a company in bankruptcy).

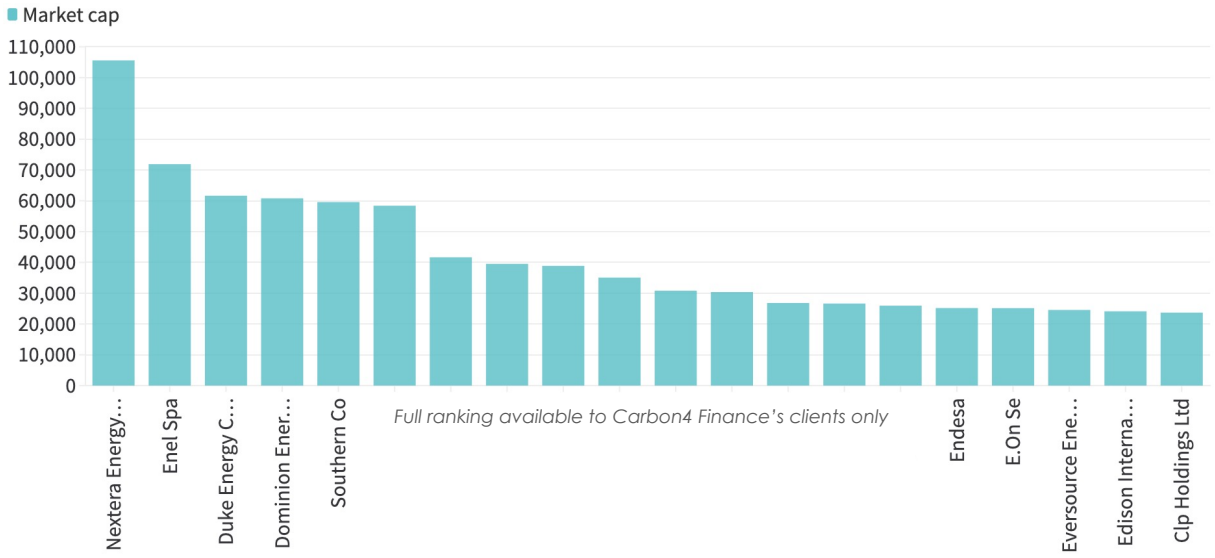



*Figure 3 - The 20 largest companies in the electricity sector, by market capitalisation (as of 31/12/2019 in millions or euros)*

## 3.2 Ranking of the companies with the highest greenhouse gas emissions

### The electric power sector as a whole

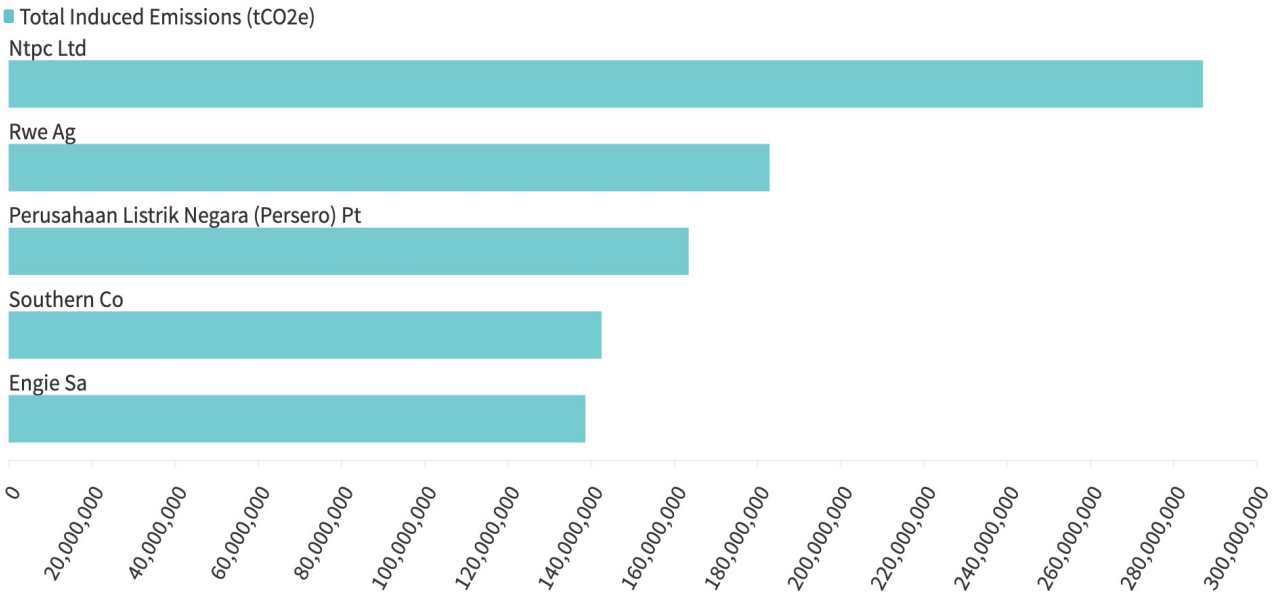



*Figure 4 - The 5 most emitting companies in the Power sector, Scope 1&2&3 ($tCO_2e$)*

In terms of induced emissions, National Thermal Power Corporation Limited (NTPC Ltd), one of India's leading electricity and gas generation and distribution companies, is the largest emitter (of all Scope 1&2&3 emissions). At 287 million $tCO_2e$, its emissions account for nearly 9% of the global electricity sector's total emissions (Scope 1&2&3), with a total electricity production of over 245 TWh in 2019.

Of the total Scope 1&2&3 emissions in the sample, the 37 highest emitters alone account for more than 80% of the emissions.

# 3.3 A focus on electricity generation

## A- Companies committed to decarbonisation: reducing the carbon intensity of their electricity production


*Figure 5 - The carbon intensity reduction (% $gCO_2e/kWh$) of the electricity generation over the last 5 years*

### The Ørsted and Vattenfall cases

According to company data, **Ørsted** has achieved the largest reduction in the carbon intensity of its electricity generation over the last 5 years, from 374 $gCO_2e/kWh$ in 2014 to 65 $gCO_2e/kWh$ in 2019, equivalent to **an annual reduction of almost 30%.** Indeed, Ørsted (formerly Dong Energy) was mainly a coal operator until 2008 when it revamped its strategy and began to invest heavily in renewables, particularly in offshore wind farms, converting their coal plants to biomass. Ørsted also divested from its oil and gas business in 2017, production formerly used within the group for electricity generation.

Similarly, **Vattenfall** has achieved a very significant reduction in the carbon intensity of its electricity generation over the past 5 years, from 421 $gCO_2e/kWh$ in 2014 to 126 $gCO_2e/kWh$ in 2019, the equivalent to **an annual reduction of 21%.** This reduction is mainly due to the sale of its fossil fuel and coal activities in 2016 (which were partly used internally by the group, such as Ørsted with its oil and gas activities). Today the low carbon intensity of Vattenfall's electricity production is largely attributable to nuclear power generation (more than 40% of its total production), but the company remains significantly exposed to fossil fuels (24% of total production, of which 16% is gas and 8% coal).

## B- The reduction by region

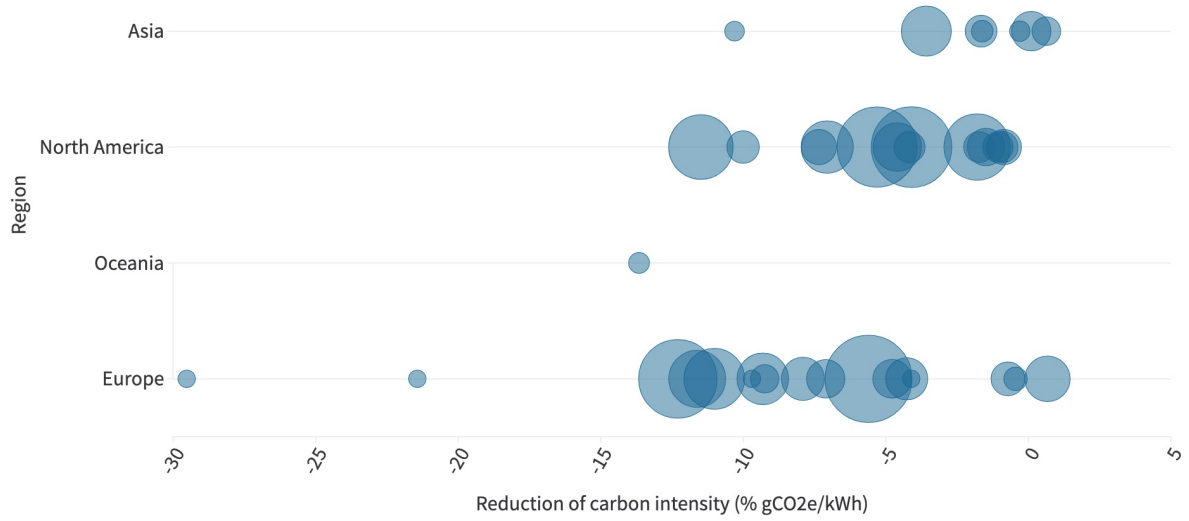



*Figure 6 - The carbon intensity reduction of electricity generation (% $gCO_2e/kWh$) by region*

n this graph we have plotted the annual reduction of the electricity generation companies' carbon intensity by region. Overall, North American and European companies have embarked on a GHG mitigation strategy. Among the large market capitalisation (larger bubble size), the reduction is slightly greater for the European companies than for the American ones. In Asia, the reduction remains insignificant.

## C- The current energy mix

The carbon intensity of the electricity generation ($gCO_2e/kWh$) allows us to compare the exposure to transition risk between the different players.

Below is a graph representing the carbon intensity of electricity generation ($gCO_2e/kWh$) on the x-axis, the production volumes (MWh) on the y-axis and the size of the bubbles is proportional to the market capitalisation. The colours are correlated with the current performance rating of the electricity generation.

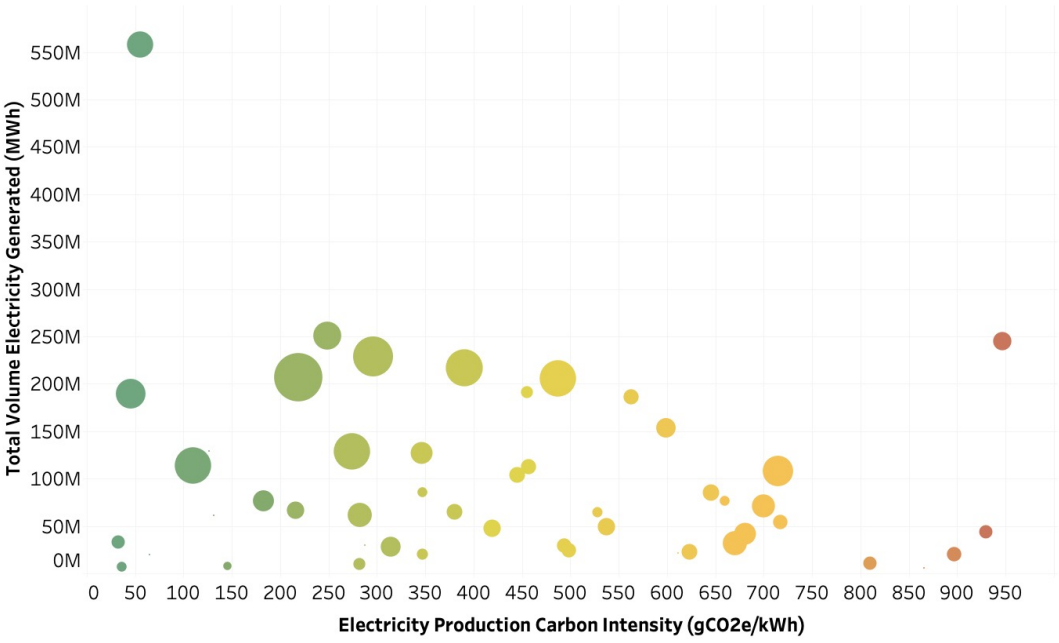



*Figure 7 - The carbon intensity of the companies' electricity generation ($gCO_2e/kWh$)*

Our observations from the graph:

- Among the smallest market capitalisation, there are two radically different profiles, which fall either side of 400 $gCO_2e/kWh$. Two schools of thought stand out: those still relying heavily on fossil fuels, and those shifting away from them relatively quickly (with many pure players in renewable energy);
- Among the companies with the largest market capitalisation, we find a wide variety of profiles, the majority being decarbonised companies (we note that EDF is in a peculiar position, as it has a low stock market value given its high production and low emissions per kWh);
- Overall, the profiles are diverse, particularly among the smaller market capitalisation, some of which are still very dependent on fossil fuels.

## D- Energy mix by region

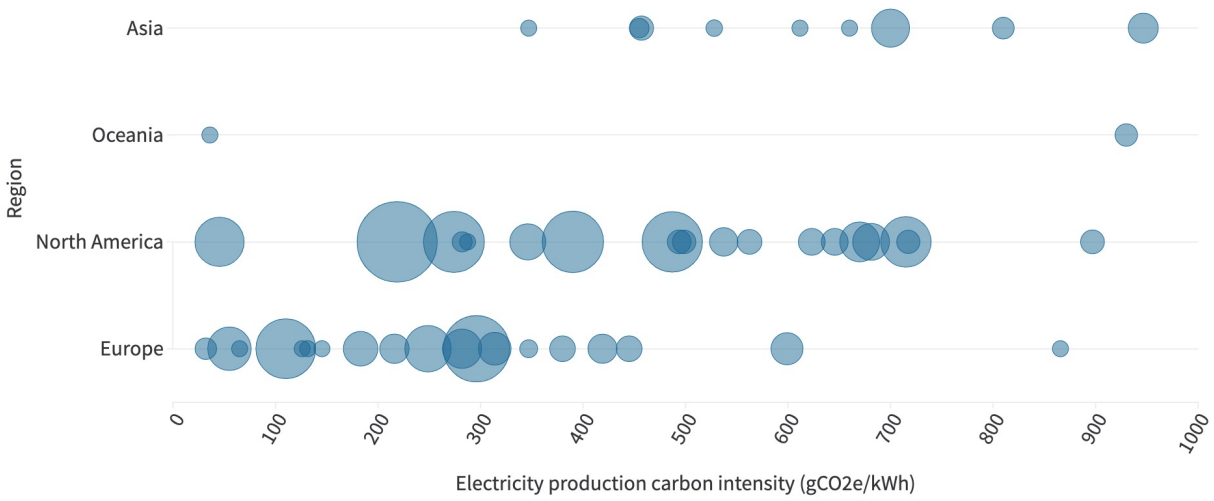



*Figure 8 - The carbon intensities of the electricity generation ($gCO_2e/kWh$) by region*

In this graph we see that European power producers have a much lower carbon intensity than their American and Asian counterparts, both among large and small market capitalisations (bubble size).

Does this mean that European electricity generation companies have better anticipated the energy transition? The first decarbonised energy source in Europe remains nuclear, followed by hydropower. Neither of these was implemented for climate mitigation purposes, but rather because of the scarcity of coal on the ground, forcing them to turn to gas, nuclear power, and hydroelectricity. It is therefore mainly due to historical reasons which explain this relatively good performance.

## E- Which plans are the electricity generating companies coming up with?

Taking all the qualitative criteria together, the following 5 actors have the highest qualitative score.

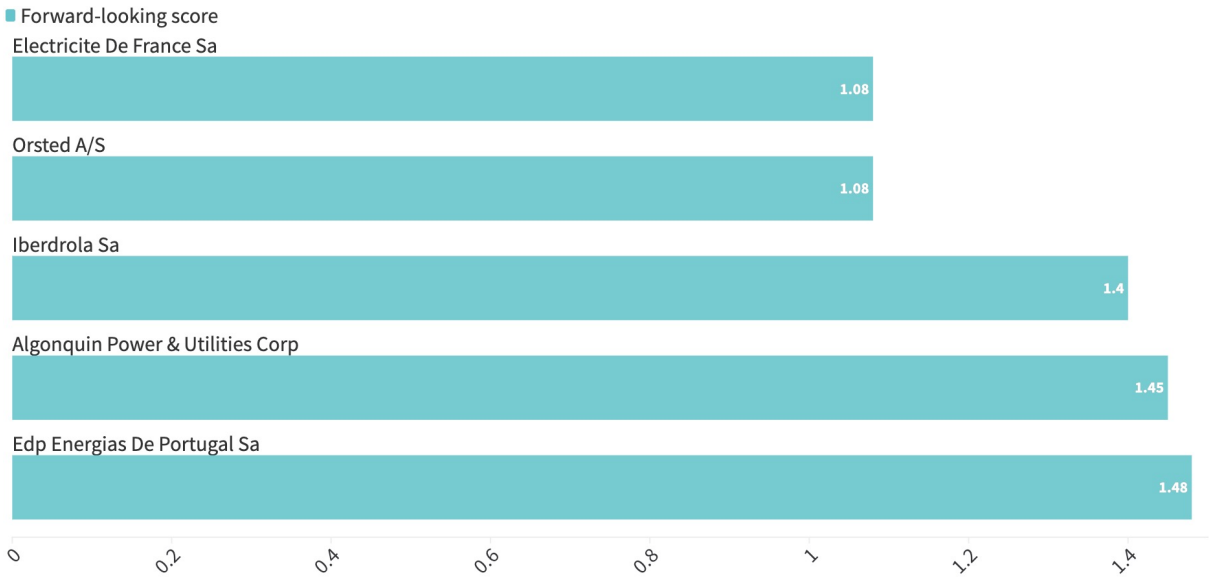



*Figure 9 - The top 5 qualitative scores for the electricity generation sector*

As a general observation, companies receiving a good qualitative score are those whose decarbonisation is already well underway, therefore further seeking to strengthen their position as drivers of this transition.

These companies are seeking to generate an increasingly larger share of their revenues from low-carbon energy. More concretely, they are investing heavily in low-carbon energy (mainly wind and solar), but also divesting from their fossil fuel assets (mainly thermal power plants). Below is a comparative table of the strategies put in place by the best performing players.

| Company | Strategy | *Horizon* | *Low-carbon investments* | *Targets* |
|---|---|---|---|---|
| EDF | - Disposing all its coal plants by 2026<br>- Extending the life of its nuclear power plants<br>- Increasing its solar capacity (1 GW/year until 2028)<br>- 10 GW of additional storage capacity by 2035 | *2023 - 2035* | *97% (monetary)* | *Maintaining the level of its carbon intensity at 55 gCO2e/kWh* |
| Ørsted | - Expanding its share of electricity generated from low-carbon sources (mainly offshore wind), reaching 99% in capacity by 2025 | *2023 - 2032* | *95% (monetary)* | *Carbon intensity (gCO2e/kWh): - 98% 2006 - 2025* |
| IBERDROLA | - Investment programme of B EUR 32 between 2019 and 2022 integrating renewables into its network<br>- Expanding its wind and solar farms | *2022 - 2030* | *95% (capacity)* | *Carbon intensity (gCO2e/kWh): -50% 2007 - 2030* |
| ALGONQUIN Power & Utilities Corp. | - Closing coal-fired generation plants (eg. Asbury Power Plant)<br>- Reaching 75% of electricity generated from renewables by 2023<br>- Add 2,000 MW of renewables between 2019-2023 | *2023* | *100% (capacity)* | *Carbon intensity (gCO2e/kWh): -32% 2017 - 2023* |
| edp | - Expanding its wind and solar farms<br>- Disposing of coal-fired power plants | *2025 - 2030* | *93% (monetary)* | *Carbon intensity (gCO2e/kWh): - 90% 2005 - 2030* |

These announcements certainly seem achievable for those companies whose energy transition has been underway for some years (or even forever). Affordability is not an impediment anymore for the other players which have not yet make it to the top 5, since the cost of renewables has dropped considerably over the last decade[7].

7. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Power_Generation_Costs_2019.pdf

## F- Sector score

The sector score ranks companies according to their past performance, current positioning and future ambitions. Below are the rankings for the electricity producers.

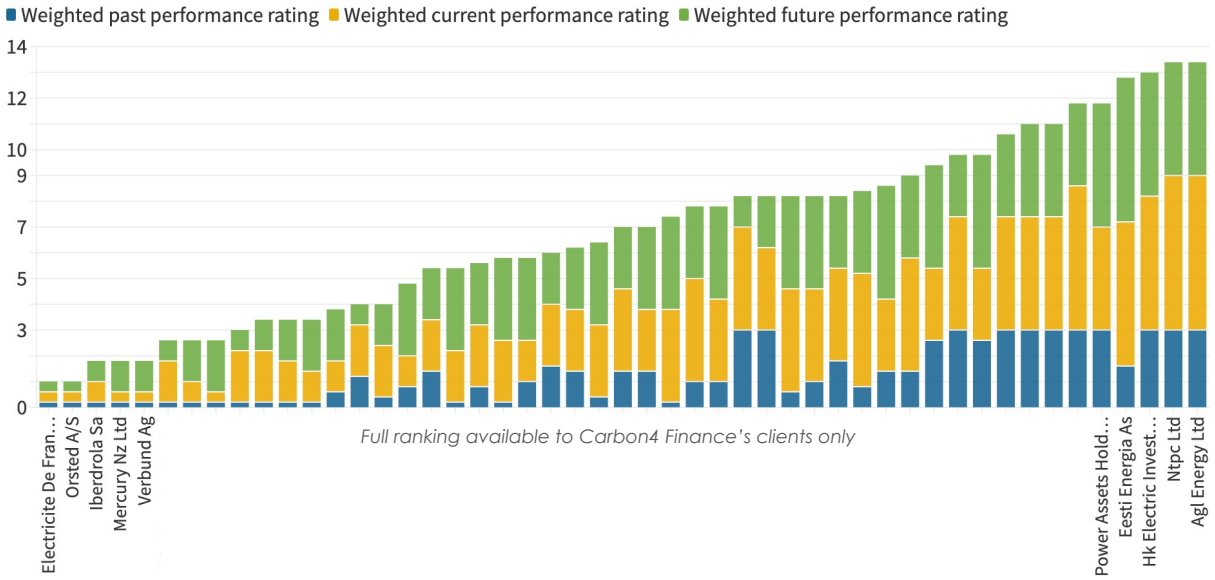



*Figure 10 - The ranking of electricity generation companies*

A high score (close to 15) indicates that the company is heavily reliant on coal and that it has little or no commitment to decarbonisation; while a low score (close to 1) indicates a low exposure to transition risk.

### TOP 3

| Rank | Company | Comments | *Past performance rating* | *Current performance rating* | *Future performance rating* | *Sectoral rating* |
|---|---|---|---|---|---|---|
| #1 | EDF | EDF reaches the top of the ranking because:<br>- It has significantly reduced the carbon intensity ($gCO_2e/kWh$) of its electricity production (-12% on average per year over the last 5 years)<br>- The current carbon intensity of its electricity production has a value of 55 $gCO_2e/kWh$ (in 2019)<br>- EDF also stands out for a strategy that addresses the challenge of adaptation and mitigation (objective of extending the life of its nuclear power plants and increasing the share of low-carbon energies in the mix, notably by being the leader in solar energy in France by 2035 and by continuing its investments in nuclear power) | *1* | *1* | *1* | ***1*** |
| #2 | Ørsted | Orsted reaches the second place in the ranking because:<br>- Historically the company was exclusively a producer of fossil energy (coal/oil) but over the last 3 years the company has opted for a completely different strategy by investing significantly in renewable energies (especially offshore wind power) and by selling its thermal power assets, this allowed the company to reduce its carbon intensity by almost 30% over the last five years<br>- The current carbon intensity of its electricity production decreased to 65 $gCO_2e/kWh$ (in 2019)<br>- Orsted intends to continue the development of offshore wind projects and to covert its thermal power plants from coal to biomass | *1* | *1* | *1* | ***1*** |
| #3 | IBERDROLA | Iberdrola reaches the third place in the ranking because:<br>- It has also been able reduce the carbon intensity of its electricity production around 50% over the last 5 years<br>- Though almost 20% of the electricity produced by the company still relies on gas (and is responsible for over 50% of the company's GHG emissions), which leads to a carbon intensity of around 150 $gCO_2e/kWh$ | *1* | *2* | *2* | ***1.8*** |

## A focus on Mercury Energy: is there a limitation to the methodology?

Mercury Energy, a New Zealand company, was formed from the break-up of Mighty River Power into three state-owned electricity generation companies (Mercury Energy, Genesis Energy and Meridian Energy) in 1998. Mercury Energy took over the ownership and operation of the eight hydroelectric plants on the Waikato River and inherited two oil-fired plants (ready for decommissioning), while Genesis Energy took over the ownership of all the other thermal plants. Mercury Energy has since acquired one geothermal plant and commissioned another. With its renewable generation units (hydro and geothermal), the company has reached fifth place in the ranking.

This demerger took place more than 20 years ago, so the past performance rating of Mercury Energy has not been impacted. If this split had been less than 5 years ago, how would Mercury's past performance rating have been calculated? Should the company's energy mix before the split be considered? If so, should it still be granted the best past performance rating, given that it would have significantly 'reduced' the carbon intensity of its electricity generation? A very similar and more recent case is the separation of RWE from its subsidiary Innogy.

## TOP 3 TAIL END

| Rank | Company | Comments | *Past performance rating* | *Current performance rating* | *Future performance rating* | *Sectoral rating* |
|---|---|---|---|---|---|---|
| Third to last | 港燈 HK Electric | Third to last in the ranking is HK Electric Investments, a company highly exposed to coal (70% of total electricity production) leading to a carbon intensity of around 810 gCO2e/kWh. The company is aware of its climate impact, but invests in gas-fired power plants and not in low-carbon energy sources (<100 gCO2e/kWh). | *15* | *13* | *12* | ***13*** |
| Second to last | एनटीपीसी NTPC | Second to last is NTPC Ltd, one of the main producer and distributor of electricity and gas in India, a company that is also highly exposed to coal (about 93% of total electricity production), which leads to a carbon intensity of about 950 gCO2e/kWh. Nevertheless, the company is aware of the energy-climate issues and is beginning to integrate a decarbonation strategy. | *15* | *15* | *11* | ***13.4*** |
| Last | AGL | At the very bottom of the ranking is AGL Energy, an Australian company with a high exposure to coal (more than 60% of total electricity production) which leads to a carbon intensity of around 930 gCO2e/kWh. Also due to a lack of transparency, it is difficult to assess the strategy for adapting to climate risks, or for reducing its carbon footprint. | *15* | *15* | *11* | ***13.4*** |

# 3.4 A focus on electricity transmission and distribution

## A- Companies which successfully reduced their emissions

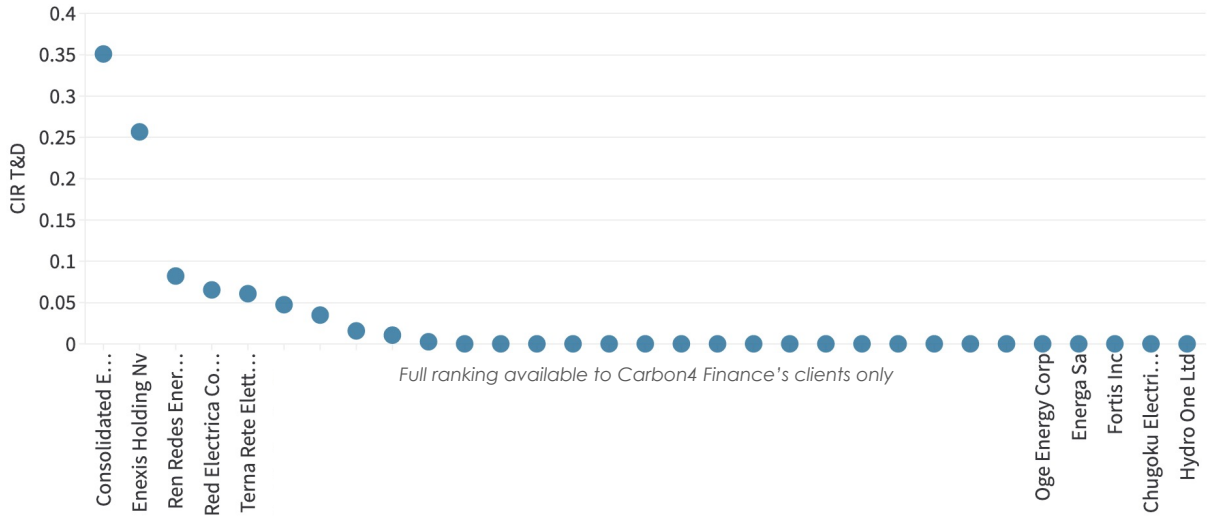



*Figure 11 - T&D CIR of companies*

The CIR (Carbon Impact Ratio) represents the ratio between the reduced emissions and the induced emissions. It measures the capacity of a player to reduce its GHG emissions compared to the emissions generated by its activity, allowing to position the company against its peers.

### Focus on Consolidated Edison

Since 1996 Consolidated Edison has managed to reduce its SF6 leakage by 97% (sulfur hexafluoride SF6 is a gas with 22,000 times the warming potential of carbon dioxide). In order to do this, the company has resorted to major research programmes and a team dedicated to replacing the faulty equipment (with a continuous monitoring the emissions from all the equipment). Consolidated Edison is looking for alternatives to SF6, including the development of electrical equipment (circuit breakers/switches) with no requirements for SF6.

### Limitations of the methodology

A large proportion of the companies involved in electricity transmission and distribution have not reduced their emissions over the last 5 years. It may be difficult for this sector to reduce its emissions further as some players have already very low network losses.

## B- Current performance

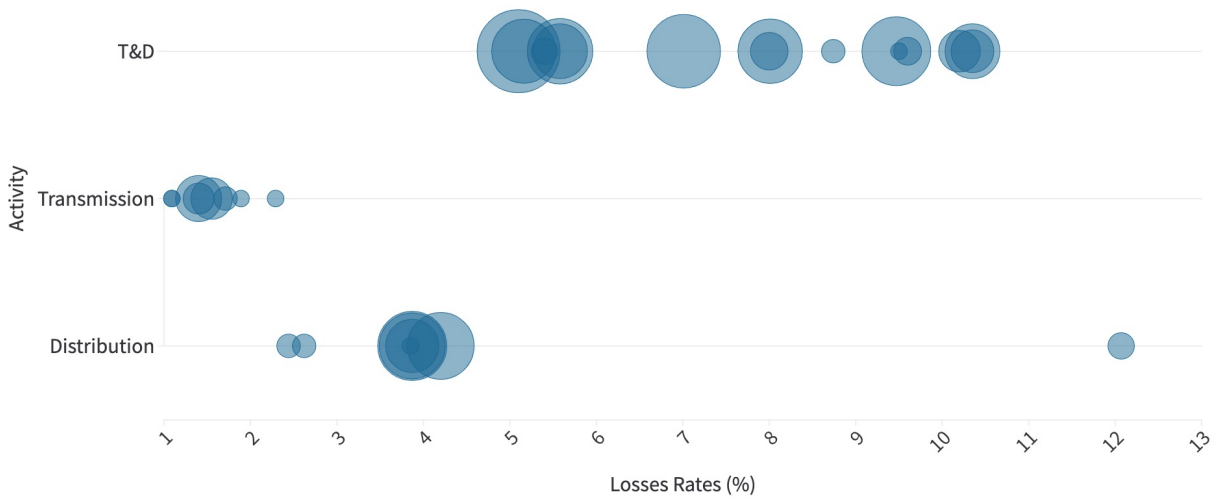



*Figure 12 – Grid losses by network type*

Companies with a larger market capitalisation (proportional to the bubble size) have networks whose performance is in the middle range when it is a player that is only involved in transmission or distribution. However, if the company is involved in both transmission and distribution then the performance is much more heterogeneous.

## C- Future performance

Taking the qualitative criteria into consideration, the following 5 players receive the highest qualitative score.

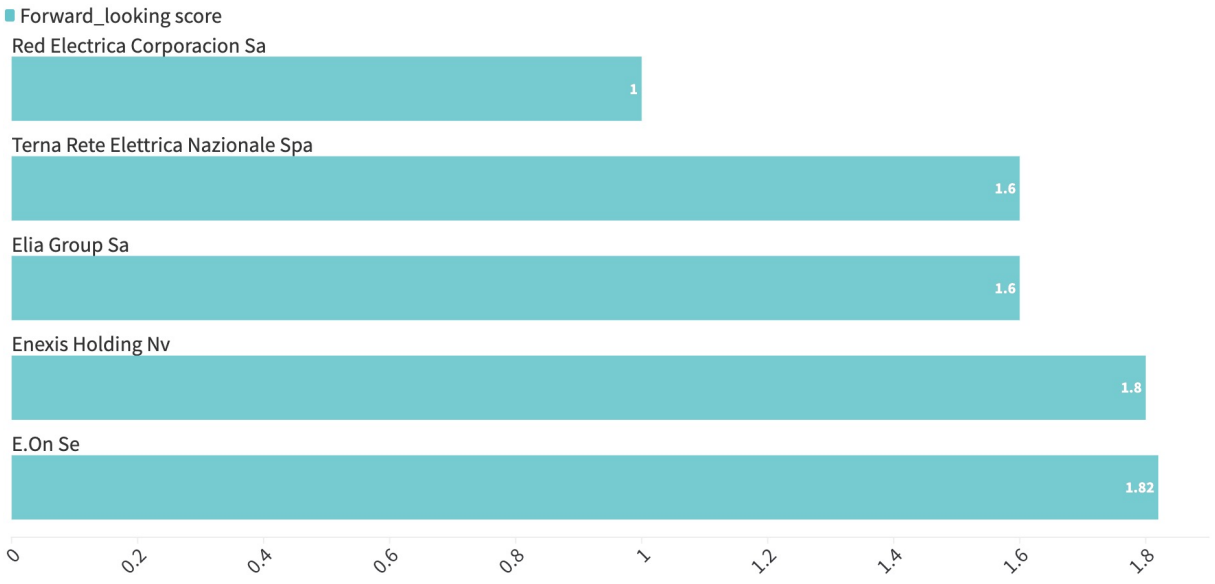



*Figure 13 - The top 5 qualitative scores for the electricity transmission and distribution sector*

Let's take a closer look at the top players' different strategies.

| Company | Strategy | Horizon | Targets |
|---|---|---|---|
| RED ELÉCTRICA DE ESPAÑA | - Red will benefit from the will of the Spanish state to integrate low carbon – renewable in the present case – sources in the grid<br>- Red intends to expand its network in order to facilitate interconnection of electrical grids<br>- Red is promoting electric mobility | *2018 - 2022* | *SF6 leakage rates: below 4kg/TWh transported*<br>*Reduce by 40% Scope 1&2 emissions per MWh transported by 2030 compared to 2015 figures* |
| Terna | - Terna will benefit from the will of the Italian government to integrate more renewable sources into the grid (35% of the electricity transported by Terna was already from renewable sources in 2019)<br>- Terna also plans to boost smart solutions | *2020 - 2024* | *Keep grid losses rates below 2%* |
| elia | - Elia will benefit from the will of the Belgium government to increase the share of renewables into its grid and to support electricity storage and hydrogen storage projects<br>- Elia aspires to run an SF6-free grid | *Not specified* | *SF6 leakage rates: below 0.25% (kg leaked/kg used)* |
| ENEXIS | - Enexis will benefit from the Dutch government to increase the share of renewables into its grid (mainly wind and solar farms)<br>- Enexis aims to reduce its GHG emissions by 95% by 2050 compared to 2018 levels<br>- Enexis is also extending the use of smart meters | *2030 - 2050* | *Reduce grid losses (no quantified target)*<br>*Use of internal CO2 prices* |
| e·on | - E.ON will benefit from the German government to integrate more renewables into its grid while preparing for Germany's phase out of coal by 2022 | *2030* | *Keep grid losses rates below 4%* |

The main challenges for the electricity transmission and distribution sector include integrating low-carbon energy into the networks, developing energy demand management technologies and keeping network losses and SF6 leakage to adequate levels.

## D- Sector score

Below is the ranking of the electricity transmission and distribution companies covering their past performance, current positioning and future ambitions:

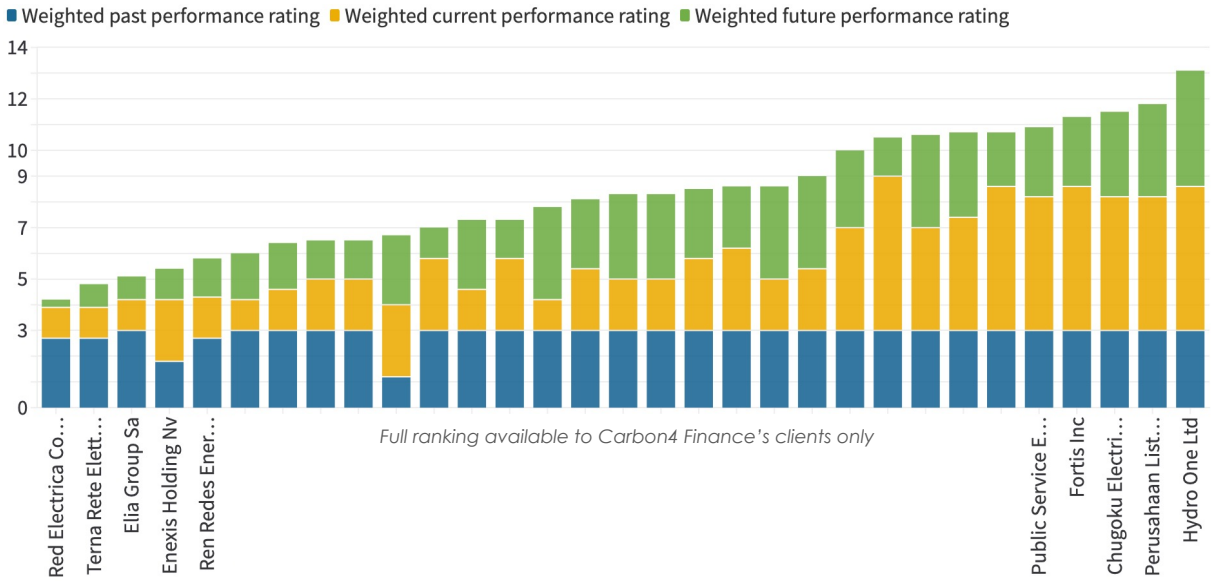



*Figure 14 – Ranking of electricity transmission and distribution companies*

A low score (close to 1) reflects low loss rates as well as an effort to reduce network loss rates, a willingness to expand the transmission and distribution network and to integrate renewable sources of energy.

## TOP 3

| Rank | Company | Comments | *Past performance rating* | *Current performance rating* | *Future performance rating* | *Sectoral rating* |
|---|---|---|---|---|---|---|
| 1 | RED ELÉCTRICA DE ESPAÑA | Red reaches the top of the ranking because:<br>- It has slightly reduced its leakage rate of SF6<br>- Its network losses are very low (around 1.5%)<br>- It will also benefit from the will of the Spanish state to integrate low carbon sources into its grid | *9* | *3* | *1* | ***4,2*** |
| 2 | Terna | Terna reaches the second place in the ranking because:<br>- It has slightly reduced its grid losses rates and SF6 leakages<br>- Its network losses are very low (around 1.4%)<br>- It will benefit from the will of the Italian government to integrate more renewable sources into its grid | *9* | *3* | *3* | ***4,8*** |
| 3 | elia | Elia reaches the third place in the ranking because:<br>- Its grid losses are very low (less than 1.5%)<br>- Elia will benefit from the will of the Belgium government to increase the share of renewables into its grid<br>- Elia aspires to run a SF6-free grid | *10* | *3* | *3* | ***5,1*** |

## TOP 3 TAIL END

| Rank | Company | Comments | *Past performance rating* | *Current performance rating* | *Future performance rating* | *Sectoral rating* |
|---|---|---|---|---|---|---|
| Third to last | Energia | Third to last in the ranking is Chugoku, a Japanese company that does not show awareness of its impact on climate change, it will not connect its grid to low carbon generation sources to replace fossil sources. | *10* | *13* | *11* | ***11,5*** |
| Second to last | PLN | Second to last is Perusahaan (PLN), one of the main producers and distributors of electricity in Indonesia, with grid losses that are rather high (9.5%). PLN shows little interest in connecting its grid to low carbon generation sources and it does not seek to reduce its grid losses nor its SF6 leakages. | *10* | *13* | *12* | ***11,8*** |
| Last | hydro One | At the very bottom of the ranking is Hydro One, a Canadian company, with grid losses that are rather high (10.3%). Hydro One will not connect its grid to low carbon generation sources and it is willing to reduce its SF6 leakages but has not set any quantified targets. | *10* | *14* | *15* | ***13,1*** |

# CONCLUSION.

The decarbonisation of the electric power industry has irrevocably begun; a large number of players are committed to the production of low-carbon electricity and some are even pure-players in renewable energy (i.e. producing the entirety of their electricity from renewable sources: biomass, wind, geothermal, hydroelectricity, concentrated solar power or solar PV).

However, this trend is not homogeneous as some companies remain heavily exposed to fossil fuels with no concrete plan to switch to low-carbon energy.

Finally, it appears that the largest players have decarbonised profiles but are not pure players in low-carbon energy.

# Glossaire

| Abbreviation | Meaning |
|---|---|
| **$gCO_2e$** | Grams of carbon dioxide equivalent |
| **GW** | Gigawatt |
| **kWh** | Kilowatt-hour |
| **Mt** | Megatonne |
| **MW** | Megawatt |
| **MWh** | Megawatt-hour |
| **$tCO_2e$** | Tonne of carbone dioxyde equivalent |
| **TWh** | Terawatt-hour |
| **2DS** | Scenario 2DS – Pathway to limit global warming to 2°C by 2060 |
| **IEA** | International Energy Agency |
| **B2DS** | Scenario "beyond 2DS" - Pathway to limit global warming to 2°C by 2060 |
| **REV** | Revenues |
| **ETP** | Energy Technology Perspectives |
| **GHG** | Greenhouse gas |
| **RTS** | « Reference Technologies Scenario », considered as the usiness-as-usual scenario |
| **SF6** | Sulfur hexafluoride |


Created in 2016 and based in Paris, Carbon4 Finance brings the Carbone 4 consultancy expertise to the financial sector, which since 2007 has been providing carbon accounting, scenario analysis and consultancy services in all economic sectors.

Carbon4 Finance offers a comprehensive set of climate data solutions covering both physical risk (the CRIS methodology: Climate Risk Impact Screening) and transition risk (the CIA methodology: Carbon Impact Analytics). These proven methodologies allow financial organisations to measure the carbon footprint of their portfolio, assess their alignment with a 2°C compatible scenario and measure the level of risk arising from climate change events.

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