

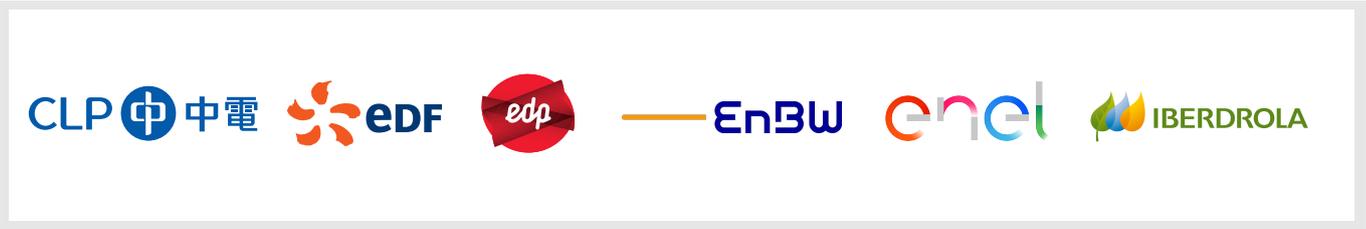
TCFD Electric Utilities Preparer Forum

Disclosure in a time of transition: Climate-related financial disclosure and the opportunity for the electric utilities sector



July 2019

In collaboration with:



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Executive summary

1 Executive summary

Climate change is simultaneously a challenge and an opportunity for the electric utilities sector. Given its historical carbon footprint, climate change presents material risks, requiring a substantial generation mix turnaround. However, at the same time, the confluence of multiple factors presents significant opportunities. Those factors include increases in renewable and low-carbon capacity and the contribution it makes to electricity generation, falling costs of renewable power, development of technologies, new environmental policies and regulatory reforms, many of which are designed to support the energy transition required to achieve the goals of the Paris Agreement.

Electricity, increasingly generated from renewables and low-carbon sources, will play a fundamental role in the decarbonization of the economy and is expected to be advanced economies' largest energy carrier by 2050. This, in turn, will depend on investment in new infrastructure to enable renewable and low-carbon capacity to be integrated into electricity systems and the development of new technologies and customer solutions to ensure electricity security. The electric utilities sector is uniquely placed to participate actively in the transition to the low-carbon economy, addressing the challenges that it presents (particularly around ensuring security of supply and the retirement/phase out of conventional generation assets) and leveraging opportunities as one of the central architects of the low-carbon transition.

The TCFD Electric Utilities Preparer Forum ("the Forum") is a collaboration between CLP, EDF, EDP, EnBW, Enel, Iberdrola and the World Business Council for Sustainable Development (WBCSD). The Forum's aim is to advance the implementation of the recommendations of the Task Force on Climate-related Financial Disclosure (TCFD) by reviewing members' current climate-related financial disclosures, identifying examples of disclosure practice that are consistent with the TCFD's recommendations (which cover four main areas: governance, strategy, risk management and metrics and targets), and considering how disclosures might evolve over the TCFD's "implementation path", which anticipates the development of climate change-related disclosure practices over a three to five year period following the publication of the recommendations in June 2017.

Two years on from the release of the TCFD's recommendations, corporate reporting on climate change is still evolving. The 2019 TCFD Status Report shows that, although companies have made some progress, the pace of implementation is slow and there is scope for further improvement in climate-related financial disclosure practices. In particular, disclosures about the potential financial impact of climate-related issues and the resilience of company strategies under different climate scenarios require more clarity.

The aim of this report is to provide a snapshot, including examples, of how Forum member companies are currently providing effective climate-related financial disclosures. It includes

perspectives from users of climate-related financial disclosures, including investors and other financial market participants who use the information prepared by companies in order to assess and price risk and make decisions about how to allocate financial capital. The report also explores some of the challenges Forum member companies face in responding to the TCFD's recommendations and meeting the expectations of users of climate-related information.

THE MAIN FINDINGS AND THEMES FROM THE REPORT

Governance – With changing energy policies affecting companies across many jurisdictions, climate change is part of the day-to-day reality for the electric utilities industry. Consequently, Forum members are at various stages of embedding climate change into governance systems and strategic and operational decision-making processes. Embedding climate change into governance, operational and strategic systems applies across numerous corporate functions, not just sustainability. The integrated reporting of these processes demonstrates this. Users want to see that boards and management have the appropriate information, skills, experience and incentives to support their ambition as enablers of the transition. Forum members do this by demonstrating how information flows between corporate teams, management and the board and by showing how that information influences business decisions and capital allocation in line with low-carbon strategies.

Strategy – The utilities sector faces risks associated with the physical impacts of climate change, including increasing temperature, changes in rainfall and increases in frequency and severity of extreme weather events (such as hurricanes and wildfires). These can affect generation and network assets as well as customer services and demand. The market and regulatory environment also presents climate-related risks for electric utilities. These include efforts in certain jurisdictions to support the decarbonization of the energy system through targets for renewables, the phasing out of coal generation, energy efficiency, greenhouse gas (GHG) reduction targets and carbon pricing policies.

On the other hand, the sector is well positioned to realize many opportunities associated with the low-carbon transition, especially the coupling of electrification and decarbonization highlighted in transition scenarios. Forum members demonstrate responses to these risks and opportunities by increasingly shifting portfolios to low-carbon generation, strengthening infrastructure, and using financial instruments to support the energy transition. Forum members are diversifying geographically, developing technology and new product offerings, remaining flexible, adaptable and innovating to provide customers with new solutions.

Planning for the future has always been a priority for the sector and companies are using scenario analysis to assess the resilience of their renewed strategies and

their ability to drive the low-carbon transition. However, there are still opportunities for disclosures to develop in this area, particularly with respect to physical risks.

Risk management – For the utilities sector, transition risks are often associated with the link between the regulatory and operating context, the need to balance a range of influences and demands connected to energy security, access and decarbonization. Transition risks can be more volatile than physical risks. This context is of course changing and a risk today could become an opportunity tomorrow – the distinction often being highly policy-dependent.

Physical risks are challenging and companies are already feeling acute and localized impacts. However, companies have not developed their disclosures on physical risks as well as those relating to transition risks. This is because companies expect physical risks to develop over the longer term, they are facility and location specific and assessment of the risk depends on scientific evidence and climate forecasting. Climate risks are closely related to many other types of risk, including those relating to regulation and policies, power demand and market dynamics. Therefore, in order to build a comprehensive picture of the company's exposure to climate risk, disclosures highlight interconnections between climate and other risks.

Metrics and targets – Forum members have been disclosing operational GHG emissions metrics (both absolute and intensity) for years and are increasingly disclosing climate-related financial metrics, as recommended by the TCFD. Forum members have developed a table of illustrative financial and operational metrics covering investments in and returns from generation, as well as non-generation transition enablers that will make the system more flexible and efficient, such as investments in smart networks and customer solutions. It is important that companies disclose both the metric and the associated definitions and scopes in order to allow users to appraise and compare them fairly, pending the development of common standards.

Disclosure challenges still remain for the sector as companies continue efforts to respond to the TCFD recommendations. Variations between business models, size and regulatory environments necessitate the use of different metrics to convey impacts, but can make data comparability difficult to achieve. Some sensitivities exist around companies' ability to publish the forward-looking financial information that users demand, as well as the assumptions behind and outcomes of scenario analyses for which practices and methodologies are still uncertain. Further work along the implementation path will require additional collaborative efforts and additional dialogue and engagement between preparers and users of information.

② Introduction and context



2 Introduction and context

BACKGROUND ON THE TCFD ELECTRIC UTILITIES PREPARER FORUM, ITS MEMBERS AND PURPOSE

Representatives from CLP, EDF, EDP, EnBW, Enel, and Iberdrola – utilities companies of different sizes that operate across different countries and regions with a variety of business models – established the TCFD Electric Utilities Preparer Forum in December 2018. The World Business Council for Sustainable Development (WBCSD) coordinates the Forum's work. Membership of the Forum is restricted to a small, manageable number of utilities companies because of the limited project timeline. Forum members include companies whose senior management have made public statements of support for the TCFD's work and welcomed the initiative to further enhance transparency on climate-related risks and opportunities.

FORUM MEMBERS

Hendrik Rosenthal – CLP
Angus Guthrie – CLP
Alexandre Marty – EDF
Sara Goulartt – EDP
Silvia Osorio – EDP
Lothar Rieth – EnBW
Michael Gebbert – EnBW
Francesca Gostinelli – Enel
Claudio Dicembrino – Enel
Marta Martinez – Iberdrola

The Forum received valuable input from the TCFD Secretariat and a limited group of self-selected users of climate-related financial disclosures, including equity and credit analysts. The purpose of the consultation with users was to seek views on how companies can respond to the four areas of the TCFD's recommendations in such a way as to maximize the usefulness of information for financial market participants. We have synthesized the user perspectives for the purposes of this report and present them anecdotally in the "user perspectives" sections. Readers should recognize the limited nature of the engagement with users.

The Forum's objectives were to review the current state of climate-related financial disclosure and to identify examples of effective practice consistent with the TCFD's recommendations. In addition, the Forum provides a commentary on each of the recommendations and makes proposals about how disclosures may evolve over time. In the commentary, the Forum considers the seven principles of effective disclosure that form part of the TCFD recommendations (Figure 1) to inform its observations about the types of climate-related financial disclosure that are useful and effective.

PURPOSES OF AND AUDIENCES FOR THIS REPORT

This report:

- Reflects the current state of climate-related financial disclosure by highlighting how Forum member companies are implementing the TCFD's recommendations and giving practical examples of effective climate change disclosure;
- Examines particular challenges that the Forum has faced in implementing certain aspects of the TCFD recommendations;
- Provides insight into particular disclosures that demonstrate the role of the sector in enabling the low-carbon transition;
- Considers how reporting might continue to develop in future in line with the TCFD's illustrative implementation path.

Figure 1:
Principles of effective disclosure
TCFD Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures

Principles for Effective Disclosures

- 1 Disclosures should represent relevant information
- 2 Disclosures should be specific and complete
- 3 Disclosures should be clear, balanced, and understandable
- 4 Disclosures should be consistent over time
- 5 Disclosures should be comparable among companies within a sector, industry, or portfolio
- 6 Disclosures should be reliable, verifiable, and objective
- 7 Disclosures should be provided on a timely basis

The audiences for this report include:

- Electric utilities sector companies seeking to enhance their climate-related financial disclosures;
- The TCFD in order to provide input into any further deliberations on how the recommendations could evolve over time;
- Investors and others using climate-related financial disclosures who seek to understand the current state of disclosure practice and the scope for its development over time;
- Organizations the TCFD has identified as making valuable contributions supporting adoption of the recommendations, including stock exchanges, investment consultants, credit rating agencies, and organizations that develop climate-related scenarios so that they can consider what further work is required to support and enhance climate-related financial disclosure;
- Companies from other industries looking to implement the TCFD's recommendations.

CONTEXT: ELECTRIC UTILITIES AND THE ENERGY TRANSITION

Electric utilities have a pivotal role to play in the global energy transition, leading an unprecedented transformation driven by electrification and decarbonization. The transition and development of generation and non-generation activities present great challenges. However, companies that are able to realize and implement opportunities offered by new technologies, infrastructure and customer solutions will create substantial value for their businesses and for wider society, responding to renewed climate-related public interest and consciousness. This introduction provides a summary of some of the key drivers, influences, opportunities and challenges for electric utilities associated with the energy transition and climate change. This report explores these themes through the lens of the TCFD, with key insights and reflections from Forum members. The summary below is not a comprehensive analysis of all factors affecting the electric utilities industry during the low-carbon transition.

DRIVERS & INFLUENCES

Regulation and policy

In the 2015 Paris Agreement, 195 United Nations (UN) member states agreed to strengthen the global response to the threat of climate change by limiting warming this century to well below 2 °C. Countries that have ratified the agreement are now putting in place policies and regulations to address climate change. There are more than 1,500 climate laws and policies worldwide; governments have introduced 106 since the signing of the Paris Agreement.¹ For electric utilities, a range of policy measures influence planning, business development and operations. The European regulatory framework, for example, includes packages relating to market design² and integration, emissions trading,³ renewable energy,⁴ and energy efficiency.⁵ The European Commission also has a long-term strategic vision for a prosperous, modern, competitive and climate-neutral economy by 2050.⁶ Looking beyond the European Union (EU), globally, as of 1 April 2019, governments have implemented or scheduled to implement 57 carbon pricing initiatives: 28 emissions trading systems (ETs), spread across national and subnational jurisdictions, and 29 carbon taxes, primarily implemented on a national level.⁷



Economics of low-carbon technologies

Low-carbon technology cost reductions realized through efficiencies, falling capital costs, competitive auctions and effective management have all strengthened the business case for low-carbon investment. The benchmark levelized cost of electricity (LCOE) per megawatt-hour for onshore wind, solar photovoltaic (PV) and offshore wind has fallen by 49%, 84% and 56% respectively since 2010 and lithium-ion battery storage by 76% since 2012.⁸ Technology evolution and digitalization will bring greater efficiencies and further cost reductions supporting operations and maintenance.⁹

Resilience – flexibility and diversification

Another key driver influencing the sector is the increasing need for system flexibility, responding to technological developments.¹⁰ The system requires greater flexibility as renewable capacity increases, prompting calls for investments in grids, digital infrastructure, energy storage and demand-side management,¹¹ as well as in maintaining a minimum level of dispatchable low-carbon generation capacity.¹²

Given uncertainties associated with the energy transition (e.g., the policy landscape supporting the ratcheting up of Paris Agreement Nationally Determined Contributions (NDCs)), investors are increasingly challenging utilities to diversify their revenue streams,¹³ develop more agile and flexible business models,¹⁴ operate across multiple geographies,¹⁵ use a range of technologies,¹⁶ balance the development and management of generation vs customer solutions and services,¹⁷ and take up the benefits associated with digitalization to support efficiency and the development of new products.¹⁸ Companies that provide relevant solutions, managing the pace, scale and scope of developments, will strengthen their position and role in the market.

BUSINESS OPPORTUNITIES

Electrification, renewables and low-carbon generation

Electricity is the fastest-growing source of final energy demand, with developing economies accounting for the largest share of new demand, driven by economic and population growth.¹⁹ In advanced economies, the electrification of transport, heating and industry also

provides significant opportunities for utilities.²⁰ Electric vehicles, for example, could make up 57% of passenger car sales globally by 2040; electric buses could account for over 80% of municipal bus sales by the same date.²¹ Electrification also dramatically increases the energy efficiency of different uses. According to the International Renewable Energy Agency (IRENA), electricity could become the main energy carrier, growing from a 20% to a 50% share of global final consumption by 2050, with renewable power able to provide the bulk of global power demand.²² Supported by a conducive regulatory and economic context, coupled with strong customer demand evidenced by growth in power purchase agreements (PPAs), hydro, nuclear, wind and solar PV will be significant sources of emission-free electricity.²³ Fossil fuel-based gas (and in the future green and blue gases²⁴), existing and emerging electricity storage forms and demand-side management may also play an important role in enabling the low-carbon transition, balancing the volatility of renewable energy.²⁵



Transmission and distribution

To realize electrification and decarbonization potential and ensure electricity security, the sector requires significant investments in efficient, smart, flexible system infrastructure. Smarter and reinforced transmission and distribution infrastructure will play an important role in integrating new capacity, such as large-scale wind and solar generation assets and smaller decentralized renewable sources, as well as managing congestion and dispatch, interconnections, security of supply and resilience issues.²⁶ Energy service platforms and digitalization also offer business opportunities for utilities, responding to the need for system change.²⁷

Customer and retail solutions

Solutions that support new product and service offerings, commodity retail, demand management, customer experience optimization and the provision of competitive outcomes have become key components of utilities' strategies. Two-way communication enabling monitoring and control of demand through smart meters, for example, helps utilities balance needs.²⁸ Digitalization offers wider benefits,

improving communications, accessibility, progressing advanced machine learning and artificial intelligence to enable higher asset use, improved energy efficiency and customer engagement.²⁹

Supply, legacy asset and adaptation challenges

The need to balance energy security, access and decarbonization through the energy transition³⁰ raises questions and challenges relating to security of supply, viability and the retirement of conventional generation assets. Utilities must develop system capabilities, especially flexibility, in order to maintain a constant balance between electricity supply and demand despite the potential variability and volatility of renewable energy sources. Fossil fuel-based gas (and in the future green and blue gases), as well as nuclear with built-in flexibility, and existing and future energy storage forms, can support the integration of variable renewable electricity generation. These technologies can quickly compensate for dips in solar or wind power supply, rapidly respond to sudden increases in demand and support hydropower when there is insufficient rainfall or pumping or storage capabilities.

Retiring assets and the transition to new sources is a complex process that requires the careful evaluation of regulatory measures, profitability and viability, and close coordination between transmission and generation planners, system and market operators, and state, provincial and regional regulators. Electric utilities are, however, accelerating efforts to retire older fossil-fired generation, meeting planning criteria and identifying operational system changes that must be made.

The physical effects of increasing temperature, changes in rainfall and increases in frequency and severity of extreme weather events (hurricanes and wildfires, etc.)³¹ also present challenges and are increasingly receiving investor attention.³² As a result, utilities are now exploring the effects of, for example, changes in temperatures and potential increases and/or decreases in energy demand; the impacts of extreme events on operations; changes in rainfall and snow levels with a potential increase and/or decrease in hydroelectric generation; changes in solar radiation and wind with a potential increase and/or decrease in solar and wind generation; and changes in cooling water availability with a potential impact on thermal generation.³³



③ Effective disclosure across the four TCFD areas



3 Effective disclosure across the four TCFD areas

This chapter considers each of the TCFD's main recommendations and how Forum member companies are currently responding to them. Each section:

- Summarizes the TCFD's recommendation;
- Provide insights into Forum members' current approach to the TCFD recommendation, including, where possible, the characteristics of disclosures that are particularly useful in response;
- Provides examples of disclosures from Forum members' public disclosures that illustrate possible ways of responding to the recommendation;
- Summarizes users' perspectives on effective disclosure.

PLACEMENT OF TCFD DISCLOSURES

In common with the Oil and Gas Preparer Forum, Electric Utilities Preparer Forum members note that companies take different approaches to the placement of TCFD disclosures across their different reporting documents and channels. Currently, companies choose to present climate-related information in the way that best reflects their approach to reporting, their regulatory context and audit requirements.

As advised by the TCFD, subject to regulatory requirements, companies should seek to provide climate-related financial disclosures in financial filings, maximizing readership with the widest audience. Current placement approaches include integrating climate-related information, using a TCFD "index table" to point readers to useful information (see Figure 2), and creating a separate section devoted to climate-related disclosure.

Figure 2:
EnBW's TCFD-Index table
EnBW Integrated Annual Report 2018

Task Force on Climate-related Financial Disclosures (TCFD)

Issue	Contents	Page reference
Governance	<ul style="list-style-type: none"> > Corporate management > Materiality analysis > Investment guidelines > Climate protection initiatives > Overall assessment by the Group management > Board of Management remuneration 	<ul style="list-style-type: none"> page 56 page 59 f. pages 60 and 88 pages 60 and 73 page 109 page 124 ff.
Strategy	<ul style="list-style-type: none"> > Robustness of business model/ scenario analysis > Strategy, strategic development > Interdependencies > Materiality analysis > Green bonds > General conditions, climate protection > Environment goal dimension: internal control system 	<ul style="list-style-type: none"> page 39 pages 48 and 50 f. page 53 ff. page 59 f. page 85 f. page 73 f. page 117 f.
Risk management	<ul style="list-style-type: none"> > Integrated opportunity and risk management including opportunity and risk map > Environment goal dimension: opportunities and risks 	<ul style="list-style-type: none"> page 114 ff. page 118 ff.
Performance indicators and targets	<ul style="list-style-type: none"> > Sustainability rating > Key performance indicators and long-term targets > Environment goal dimension: key performance indicators and other performance indicators 	<ul style="list-style-type: none"> page 60 page 51 ff. page 101 ff.

GOVERNANCE

TCFD RECOMMENDATION

Disclose the organization's governance of climate-related risks and opportunities.

The TCFD recommends that companies:

1. Describe the board's oversight of climate-related risks and opportunities;
2. Describe management's role in assessing and managing climate-related risks and opportunities.

FORUM COMMENTARY

Forum members operate mature governance processes, often based on national or global governance codes and frameworks. As they have specifically designed strategies to realize the transition to a low-carbon economy, Forum members are increasingly integrating climate change into governance, strategic, financial and operational decision-making processes.

Where it is clear that companies have already integrated climate considerations into governance processes, disclosures could describe the degree of integration and how companies have specifically modified standard processes to address/manage climate change.

In the case of governance, preparer views on the characteristics of useful information align with those of users and include details that:

1. Illustrate how climate-related information flows between management and board-level decision-makers and describe how key business decisions take climate change considerations into account.

Disclosures should therefore explain how staff keep the supervisory/executive board and relevant board committees abreast of climate-related developments, including regulatory changes in order to adapt decision-making in light of new information. This might involve describing how material climate-related environmental and sustainability information is routinely passed from corporate functions to the board and relevant committees.

In Forum member companies, a variety of corporate teams, including risk, finance, economics and legal, collect and hold climate-related information. This reflects the multidisciplinary nature of climate change monitoring and management that may involve tracking energy policies, carbon prices and regulation, assessing risk and estimating financial impacts of climate change. Disclosures are useful where they explain how teams monitor and manage climate information across corporate functions and pass it to the board and relevant committees in order to inform decision-making.

Forum members typically demonstrate this in disclosures through organigrams that show organizational structure and lines of reporting between the board and management teams (Figures 3-6). Additional details

on governance structure, roles, scope, number of meetings and board agenda items also complement organigrams (Figures 6 and 7).

2. Illustrate the circumstances and way in which the board includes climate change considerations on its agenda and takes it into account in decision-making processes, including those affecting management, business planning, strategy formulation, investments and divestments (Figures 10 and 11).
3. Describe the profile and capabilities of the board, indicating how it supports and maintains the building of these capabilities in order to implement a climate-resilient strategy, including information about capacity building efforts, such as training and expert sessions.
4. Explain whether board- and senior executive-level remuneration is linked to the company's climate change objectives and, if so, how those objectives are tracked and assessed, for example through key performance indicators (KPIs) or metrics disclosed in response to the TCFD's recommendations on metrics and targets. Where remuneration is linked to KPIs and metrics and targets, cross-referencing will make disclosures more understandable and coherent (Figures 8 and 9).
5. Explain shared responsibilities where electric utilities are partly state owned so that investors can understand the decision-making process and allocation of voting rights.

Examples

Figure 3: Enel's governance model to tackle climate change
 Enel Sustainability Report 2018

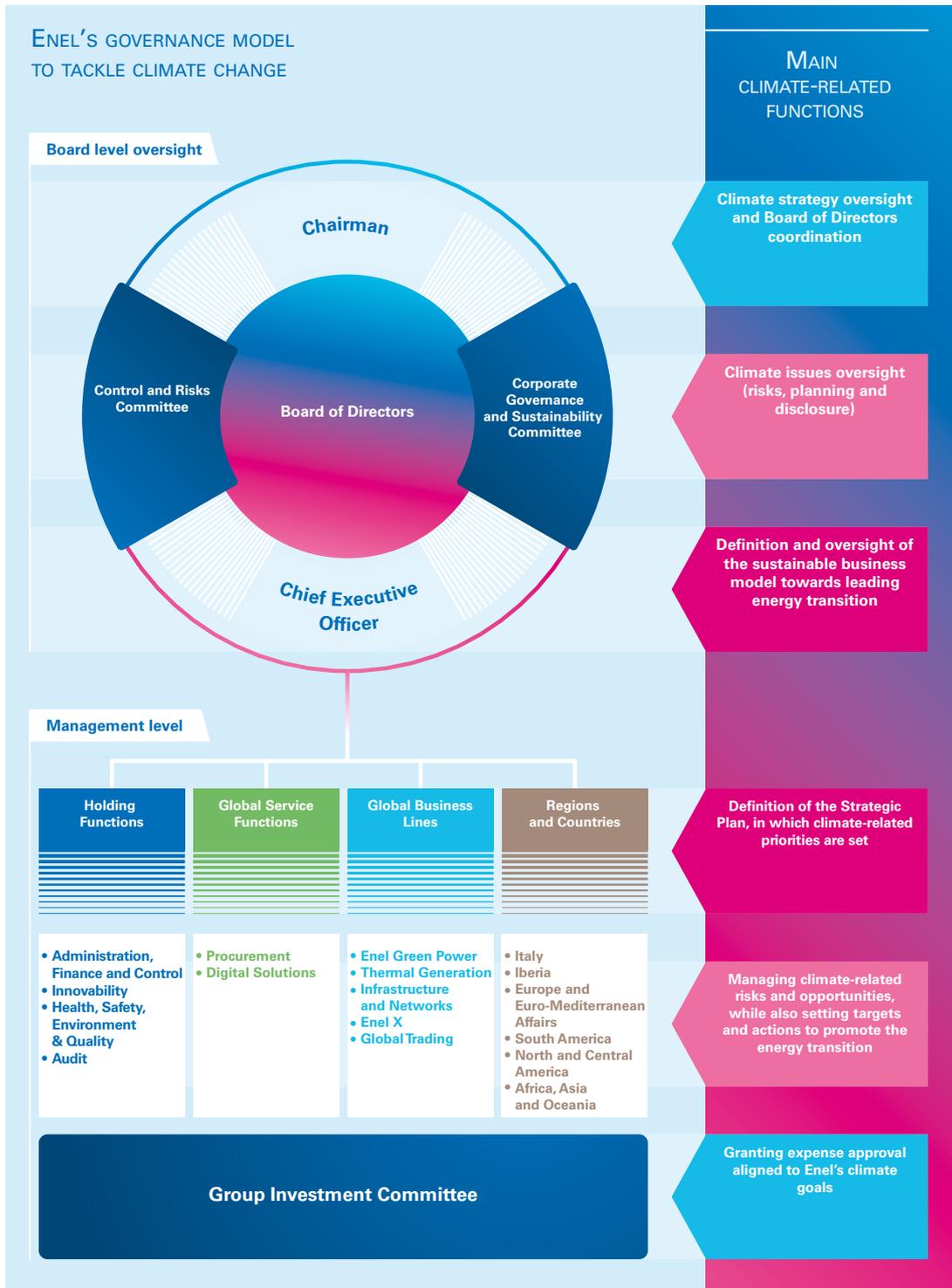
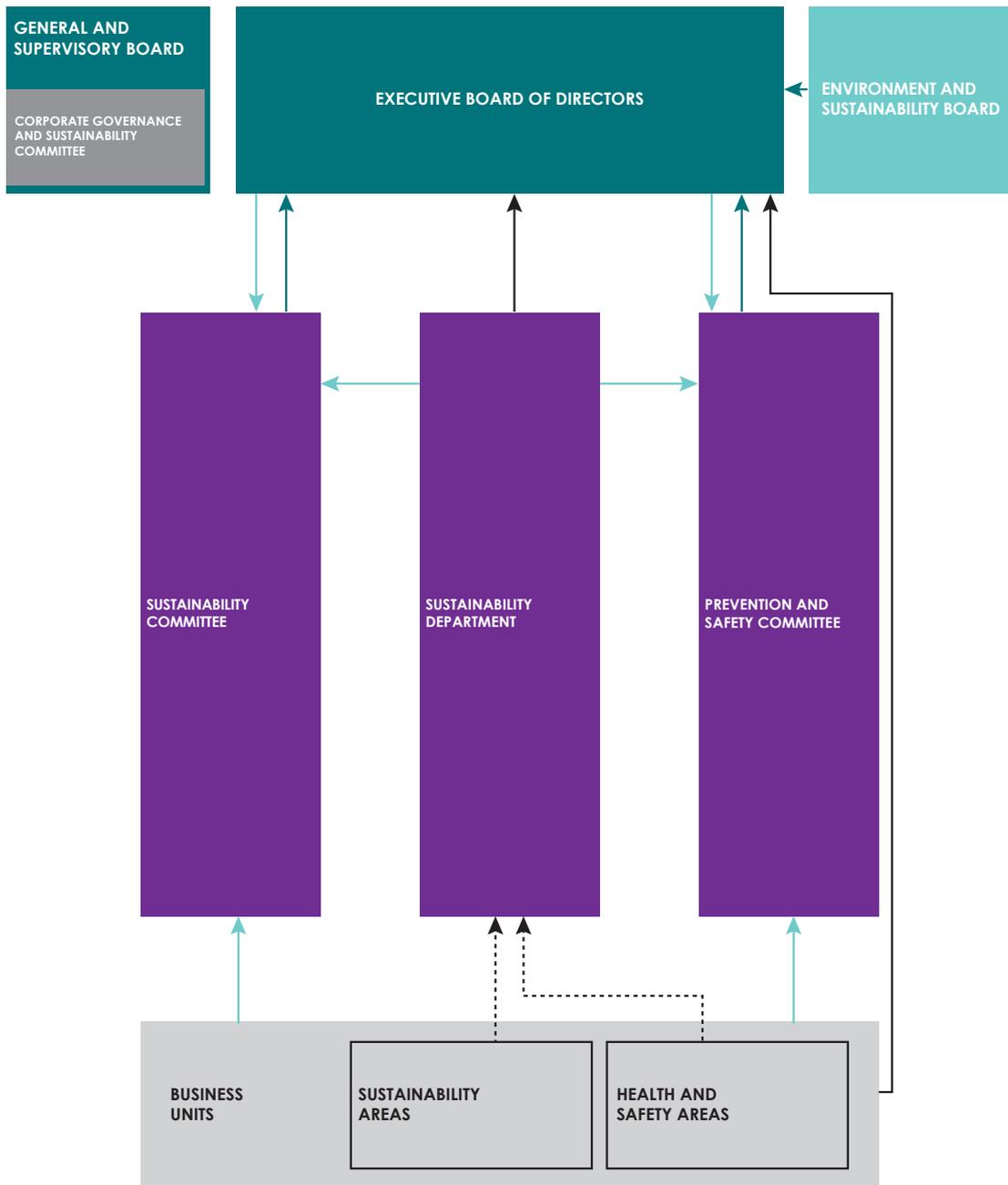


Figure 4: EDP's sustainability governance structure
 EDP Sustainability Report 2018



■ Corporate body ■ Corporate entity ■ Other statutory bodies ■ Central structure ■ Business units
 - Functional reporting/policies and strategies alignment — Hierarchic reporting — Participates — Supports

Figure 5: CLP's sustainability governance structure
[CLP website](#)

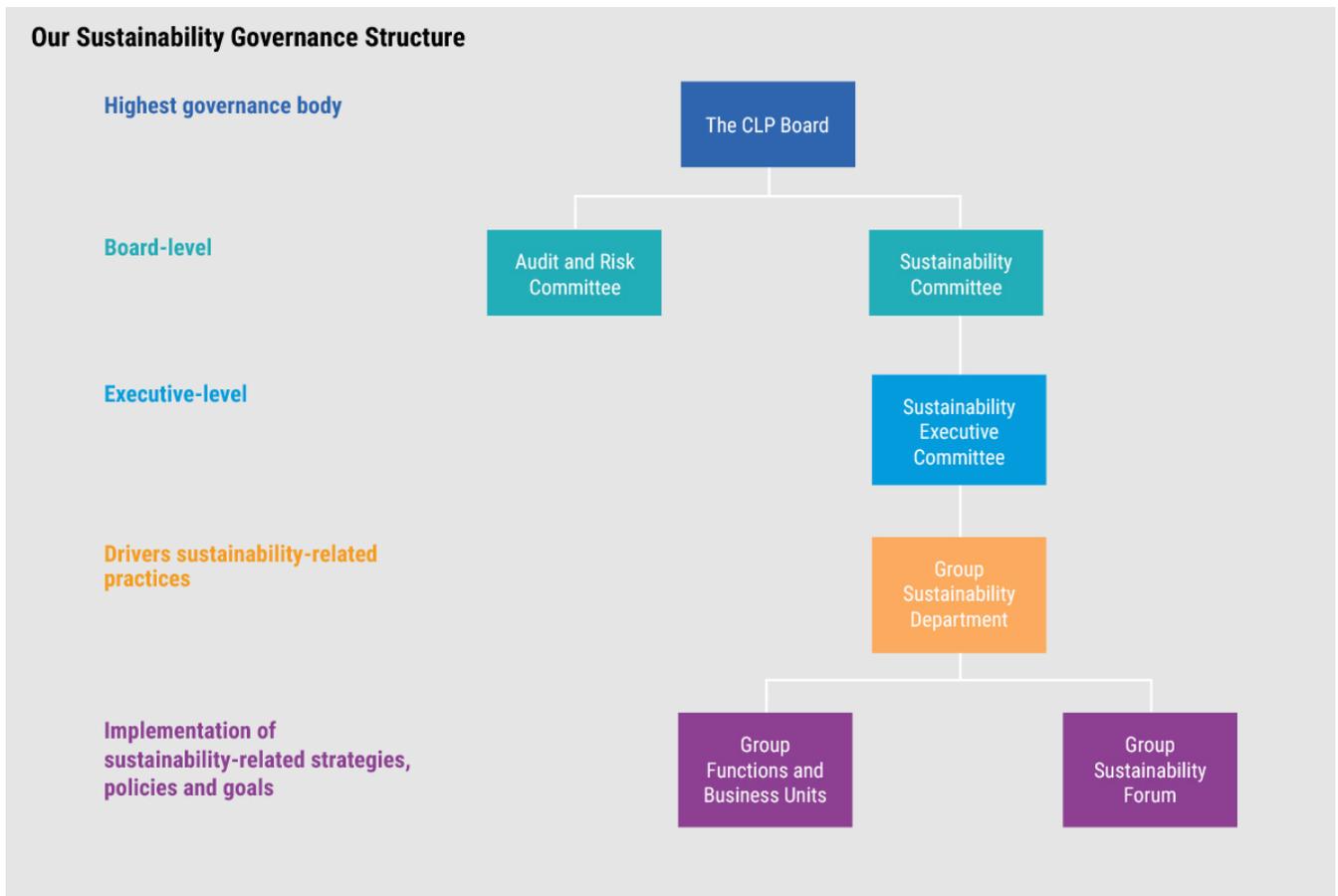


Figure 6: EDF's governance structure for climate-related risks and opportunities
EDF Reference Document 2018

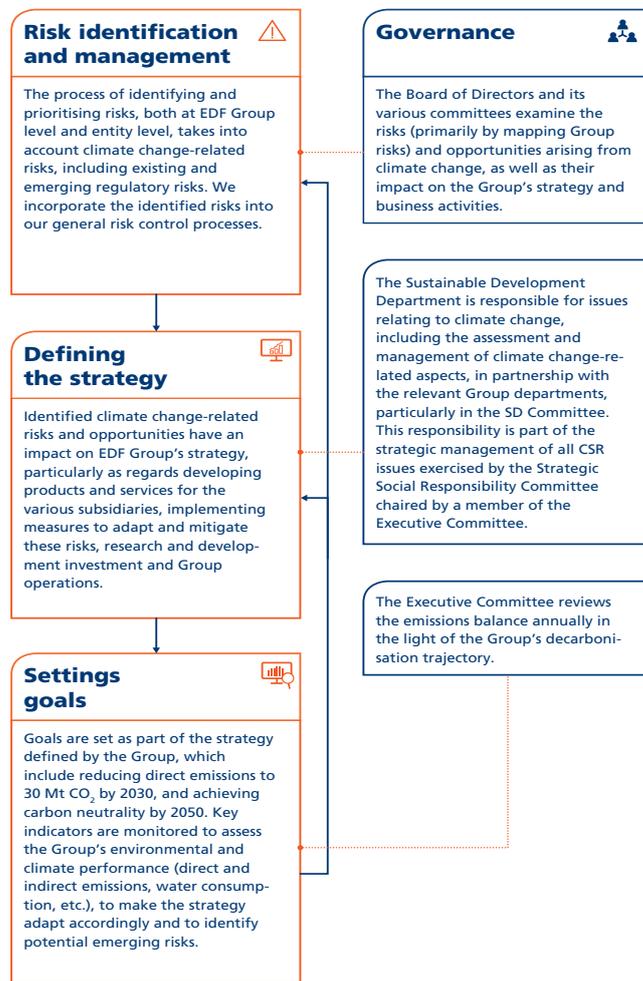


Figure 7: CLP's disclosure of the frequency with which teams inform board committees about climate change issues
CLP Annual Report 2018

Meetings and Attendance

The Committee meets as frequently as required but not less than twice a year and any Committee Member may call a meeting. Between 1 January 2018 and the date of this Report, the Committee met four times (including three times in 2018 and once in 2019). The following table provides an overview of how the Committee spent its time during the period:

	February	2018 August	December	2019 February
Sustainability Reporting / Indices performance	✓		✓	✓
Community investment activities	✓			✓
Climate change and other sustainability risks		✓	✓	✓
Health, Safety, Security and Environment		✓	✓	

Figure 8: Enel's disclosure of employee incentive systems relating to climate change
Enel Annual Report 2018

<p>The company's remuneration policy includes various mechanisms aimed at making progress towards the energy transition, and specifically:</p> <ul style="list-style-type: none"> • a short-term variable component (or MBO) that may include objectives related to the specific function of each manager involved. This may, for example, include objectives tied to the development of renewable energy for managers within the Enel Green Power Global Business Line, or 	<p>related to products and/or services for the energy transition within the Enel X Global Business Line;</p> <ul style="list-style-type: none"> • a long-term variable component that, beginning in 2018, includes a climate-related target for the reduction of CO₂ emissions per kWh_{eq} for the Enel Group over the next three years, which accounts for 10% of total long-term variable remuneration.
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Figure 9: Iberdrola's disclosure of how it integrates climate metrics into executive remuneration policies
Iberdrola Sustainability Report 2018

<p>The Director Remuneration Policy implements, among other things, the structure of the remuneration of the directors for their activities as such and the structure of the executive directors' remuneration for the performance of their executive duties, based on a series of parameters that are in line with the standard remuneration of comparable companies. The reference parameters are contained in the current Director Remuneration Policy and cover economic/</p>	<p>financial, operational and sustainability aspects. Each Annual Remuneration Report specifies the objectives to which the annual variable remuneration of executive directors is tied. The 2017-2019 Strategic Bonus approved by the shareholders at the General Shareholders' Meeting describes the multi-annual remuneration system relating to the achievement of long-term objectives, including the reduction of CO₂ emissions.</p>
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Figure 10: Iberdrola's disclosure of the roles and responsibilities of the board in overseeing climate change
Iberdrola Policy Against Climate Change

<p>The Board of Directors of IBERDROLA, S.A. (the "Company") is vested with responsibility for formulating strategy and approving the corporate policies of the Company, and for organising the internal control systems. It approves this Policy against Climate Change pursuant to the provisions of the Purpose and Values of the Iberdrola group, aware of its commitment to the environment generally and to the fight against climate change particularly.</p> <p>1. PURPOSE Climate change is one of the most important challenges that humanity must face in the 21st century. The use of fossil fuels has caused a considerable increase in greenhouse gas emissions, which have accelerated global warming. The Company and the companies belonging to the group of which the Company is the controlling entity, within the meaning established by law (the "Group"), recognise the seriousness of the threat that such global warming entails, which must be faced in a collective and coordinated manner by governments, multilateral agencies, the private sector and society as a whole. Along these lines, the Company commits to assuming</p>	<p>a position of leadership in the fight against climate change, to promote a corporate culture focused on promoting awareness-raising among all of its stakeholders regarding the magnitude of this challenge and the benefits associated with resolving it, identifying specific actions in the area of mitigation and adaptation. The Company's leadership commitment is consistent with the goals of the Paris Agreement, with goal thirteen of the Sustainable Development Goals (SDGs) approved by the United Nations, and with an ambitious and efficient focus on the process of implementation thereof. The Company thus wishes to contribute actively and decisively to a low-carbon and sustainable future, minimising the environmental impact of all its activities and promoting the adoption of whatever actions are within the Group's reach for such purpose, an effort that must be compatible with social and economic development through the sustainable generation of employment and wealth. This Policy against Climate Change is formalised to articulate and disseminate the Group's commitment with regard to climate change.</p>
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Figure 11: Enel's disclosure of management-level responsibilities related to climate issues
 Enel Annual Report 2018

ENEL'S ORGANIZATIONAL MODEL FOR MANAGING CLIMATE-RELATED ISSUES

Enel has a management team in which climate-related responsibilities have been assigned to specific functions that help guide Enel's leadership in the energy transition. Each area is responsible for managing the climate-related risks and opportunities of relevance to that area:

- **Holding company functions** (i.e. Administration, Finance & Control; Audit; Innovability; and Health, Safety, Environment & Quality) are responsible for analyzing the scenarios and for managing the strategy and financial planning process aimed at promoting renewable energy, the decarbonization of the energy mix, asset digitalization, and the electrification of energy demand;
- **Global service functions** (i.e. Procurement and Digital Solutions) are responsible for implementing sustainability and climate change related criteria in supply chain management and fostering the development of digital solutions to support the implementation of technologies enabling the fight against climate change;
- **Global Business Lines** (i.e. Enel Green Power; Thermal Generation; Trading; Infrastructure & Networks; and Enel X) are responsible for developing activities related to the promotion of renewable energy generation, the optimization of thermal capacity, the digitalization of the electric grid, and the development of enabling solutions in the energy transition and the fight against climate change (e.g. electric mobility, energy efficiency, efficient lighting and heating systems);

- **Regions and Countries** (i.e. Italy, Iberia, Euro-Mediterranean Affairs, South America, North and Central America, Africa, Asia and Oceania) are responsible for promoting decarbonization and guiding the energy transition towards a low-carbon business model within their areas of responsibility. The Europe & Euro-Mediterranean Affairs function is responsible for defining the Group's position on climate change, for low-carbon policies, and for the regulation of international carbon markets within Europe.

In addition, Enel has established the following two management committees chaired by the CEO, the responsibilities of which include climate-related issues;

- **the Group Investments Committee:** this Committee approves investments related to business development. The Committee is also responsible for ensuring that all investments are fully in line with the Group's commitment to promoting a low-carbon business model and achieving full decarbonization by 2050. The Committee is made up of the heads of Administration, Finance & Control; Innovability; Legal & Corporate Affairs, and Procurement, as well as the regional heads and the heads of the various Business Lines;
- **the Group Risks Committee:** the objective of this Committee is to ensure that the organizational structures involved in managing operating risks are in line with business strategies and objectives, while engaging management in strategic decisions concerning risk policy, management and control.



STRATEGY

The TCFD divides its recommendation on strategy into three parts (A, B and C). The first recommends that companies disclose the climate risks and opportunities identified and the timeframes over which they expect them to materialize. The second recommends that companies describe the impacts of those risks and opportunities, particularly as they affect the organization's businesses, strategy and financial planning.

Finally, the TCFD asks companies to describe the resilience of their organization's strategy, taking into consideration different climate-related scenarios.

This section considers the first two parts of the recommendation together so as to provide a comprehensive picture of the risks and opportunities Forum members have identified as well the associated impacts on strategy, businesses and financial planning.

TCFD RECOMMENDATIONS STRATEGY A AND B

Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy and financial planning where such information is material.

The TCFD recommends that companies:

1. Describe the climate-related risks and opportunities the organization has identified over the short, medium and long term;
2. Describe the impact of climate-related risks and opportunities on the organization's business, strategy and financial planning.

Figure 12: Types of transition and physical climate-related risks
WBCSD CEO Guide to Climate-related Financial Disclosure

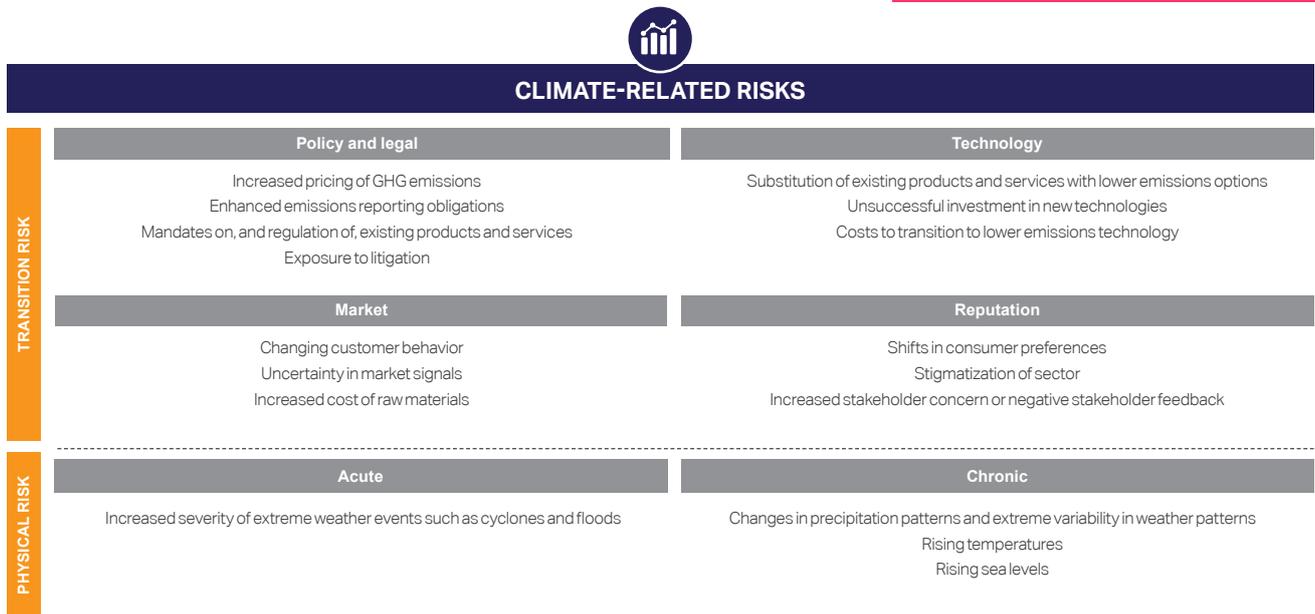
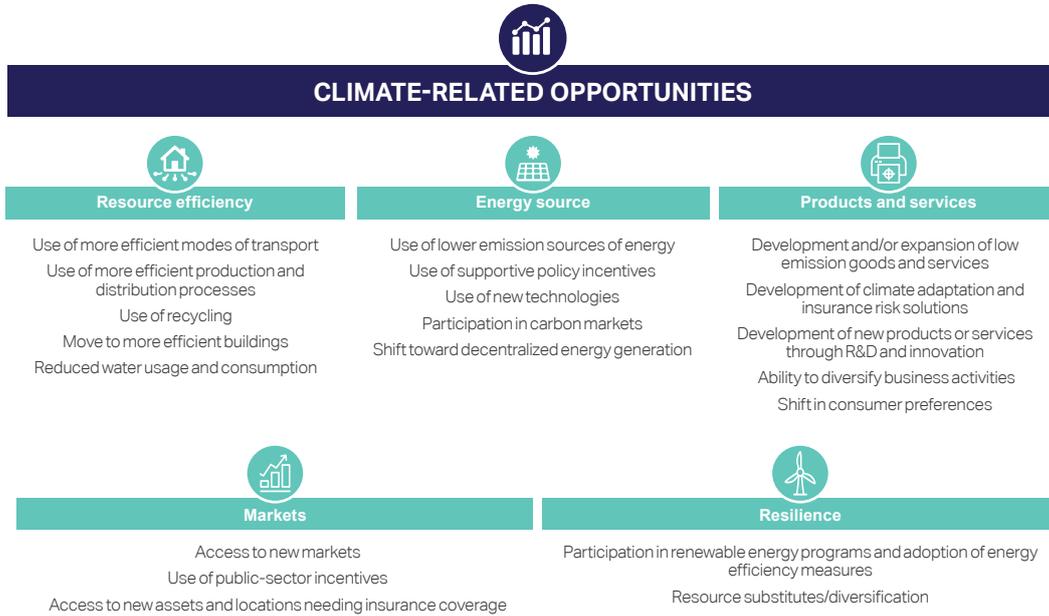


Figure 13: Types of climate-related opportunities
WBCSD CEO Guide to Climate-related Financial Disclosure



FORUM COMMENTARY

Climate-related risks and opportunities for the electric utilities industry

The introduction and context provided in this report describe the transition and physical climate change-related risks and opportunities that potentially affect the electric utilities industry. Table 1 below summarizes some transition risks and opportunities that affect particular business lines within the electric utilities industry, together with the expected impact on businesses, strategy and financial planning.

Table 1: Climate-related transition risks and opportunities facing the electric utilities sector and the expected impact on businesses, strategy and financial planning

UTILITIES BUSINESS LINE	TRANSITION RISKS, OPPORTUNITIES AND IMPACTS	
	Risks and opportunities	Impacts on businesses, strategy and financial planning
Generation	<p>Climate and energy policy changes:</p> <ul style="list-style-type: none"> • Carbon pricing • Limitations on or taxation of carbon emissions • Rising costs of fossil-fueled generation, increasingly displacing it in the merit order³⁴ • Renewable energy incentives • Energy efficiency incentives • E-mobility schemes (including electric vehicle charging regulation) • Insufficient regulatory and policy frameworks to drive deployment of investments and financing • Lack of social acceptance of specific policies (e.g., carbon taxes) <p>Technology advances:</p> <ul style="list-style-type: none"> • Technology cost reduction in renewables and storage • Early phase out of conventional assets leading to stranded assets 	<ul style="list-style-type: none"> • Decarbonization of generation capacity • Investment that shifts the portfolio to renewables and other low-carbon generation technologies, demonstrating alignment with longer-term emissions reduction trends • Development of new services for lower carbon baseload
Distribution	<p>Distribution re-design:</p> <ul style="list-style-type: none"> • Demand for new distribution assets to connect renewable production with demand • A smarter and reinforced distribution grid will play an important role in integrating new capacity for both utility-scale and decentralized sources, for example, decentralized solar PV and flexibility sources, as well as managing congestion and dispatch, security of supply and grid resilience issues. <p>Market design:</p> <ul style="list-style-type: none"> • Risk of inadequate market design to accommodate changing distribution grids, new capacity, decentralization, etc. 	<ul style="list-style-type: none"> • Investments in expanding and upgrading networks to become more efficient, smart and flexible including through management services and digitalization
Customer services	<p>Consumer changes:</p> <ul style="list-style-type: none"> • Changes to consumer demand for green products and services • Opportunity to improve energy efficiency and benefit from associated incentives through consumer engagement • Economy-wide decarbonization requiring a drastic increase in electrification, particularly for heating and transportation • Increased demand for electricity during off-peak times due to more competitive costs of electric vehicles 	<ul style="list-style-type: none"> • Development of new products and services, including home energy audits, energy tracking systems and demand-side management systems that can increase flexibility (e.g., smart meters) • Energy-efficiency measures achieved through consumer engagement and new adaptive product and service offerings • Exploration of new opportunities for electrification and electric mobility • Increasing partnerships with technology experts

The electric utilities industry regards physical risks as longer-term risks, although some are starting to have a material impact in the near term. Table 2 summarizes some physical risks and opportunities that affect electric utilities and gives some strategic response examples.

Table 2: Climate-related physical risks and opportunities facing the electric utilities sector and the strategic response examples

UTILITIES BUSINESS LINE	PHYSICAL	
	Risks and opportunities	Strategic response
Generation	<ul style="list-style-type: none"> • Extreme weather events may impact generation assets • Changing long-term climatic conditions (e.g., wind and solar radiation patterns, temperature) can affect renewable and fossil fuel energy production 	<ul style="list-style-type: none"> • Detailed climate modeling studies to assess vulnerability at a site level basis and identify appropriate mitigation measures (e.g., specific resilience-improvement plans in vulnerable areas) • Decentralizing generation by locating generation facilities closer to populated areas in order to reduce reliance on long transmission lines vulnerable to damage • At a company level, geographic portfolio diversification could reduce exposure to physical risks
Distribution	<ul style="list-style-type: none"> • Extreme weather events may impact distribution networks 	<ul style="list-style-type: none"> • Reinforcing distribution networks to prevent or reduce the damage from extreme weather events • Evolving from “point-to-point” delivery to multi-source, multi-load-center integrated networks • Improving crisis management response and business continuity plans at the operational level • Appropriately insuring sites vulnerable to disruption
Customer services	<ul style="list-style-type: none"> • Seasonal weather trends that affect aggregate power demand across particular geographies 	<ul style="list-style-type: none"> • Managing demand through smart technology-enabled solutions • Using gas, nuclear, storage, pumped hydropower and flexibility solutions to manage and respond to volatility

In current disclosures, Forum members identify risks and opportunities, the timeframes over which they are expected to materialize (typically over the short term (under 3 years), medium term (up to 5 years), and long term (beyond 5 years) and the expected impacts of or actual business responses to those risks and opportunities (Figures 14-16).

In practice, Forum members have already developed strategic responses to the expected impacts of the risks and opportunities identified. Forum members reflect the impacts of the risks and

opportunities in strategic choices, activities and plans, which fall into three main categories:

1. Innovation and opportunity maximization, including the development of new electricity products, consumer solutions, and leveraging digital leadership (Figures 17, 18, 19, 21, 22 and 24);
2. Risk management, including analysis of external risk, management of energy demand and development of the skills needed for the transition (Figure 22);

3. Investment and divestment activity to support strategic response, including evidence of investment in renewable development, use of financing instruments such as bonds to support carbon reductions and energy efficiency, financial planning implications, etc. (Figures 24-32).

USER PERSPECTIVES

Transition risk

Disclosures in response to the TCFD's strategy A and B recommendations are useful where they:

- Explain the company's understanding of how the policy landscape is changing, potential implications (connected to contracts, subsidies, etc.) and how they manage uncertainty and prepare internally for potential regulatory reforms.
- Identify the markets and jurisdictions that particular risks and opportunities are most likely to affect and provide information at the asset level, such as the total capacity of assets and individual plants.
- Explain the way in which the company defines short-, medium- and long-term risks and opportunities. The information is useful, for example, when assessing the timeframe of investments in new technologies or the expected lifetime of current assets (considering their resilience to technological advancement, policies and regulation, and changing market and consumer behavior).
- Detail, where possible, any quantitative information on changes to capital expenditures (CAPEX), operational expenditures (OPEX) and revenue as a result of actual or anticipated policy changes.
- Explain the potential impacts associated with the risks and opportunities identified, including the impacts on the company's businesses, strategy and financial plans and how those impacts manifest in decisions, plans or actions.

Physical risk

For many users, assessing companies' longer-term resilience to physical risks is beyond their normal investment horizons. However, they are interested in understanding the following:

- Granular information about the geographical spread of assets, even at subnational levels. Geographical diversification diminishes physical risks associated with one geography.
- The impact of changing conditions on operations, particularly in geographies where those changes drive the uptake of new technologies.
- In regards to generation, the impact of water availability on power plants, both in terms of flood risk and the availability of cooling water.
- The extent of the impacts of extreme weather disruption already taking place.
- The impact of climate change and chronic changes in weather on demand patterns. How changes in demand might impact volatility and the trend for energy and how this translates into fluctuations in earnings (e.g., whether the changes are systemic or whether they can expect reversals).

Examples

Figure 14: CLP's disclosure of its climate-related risks over short-, medium- and long-term time horizons
CLP Sustainability Report 2018

Risks and Opportunities

Short term (0-1 year)	Medium term (1-5 years)	Medium to long term (5+ years)
<p>Physical risks from extreme weather events (also see the section below)</p> <p>Securing the skills and capability required to implement our climate strategy</p> <p>New products and services to help our communities decarbonise</p> <p>Technologies to enhance the performance of our renewable assets</p>	<p>New regulatory requirements in relation to climate change</p> <p>Transitioning to low-carbon energy in Hong Kong to meet the Government's decarbonisation targets</p> <p>Energy management solutions to enhance efficiency at a systemic level, for instance in building smart cities</p>	<p>Potential stranded fossil fuel assets</p> <p>Growing our non-carbon portfolio to reach our Climate Vision 2050 targets</p>

The Risk Management Report in the Annual Report further outlines how climate-related risks have been integrated in CLP's Risk Management Process.

Figure 15: Iberdrola's disclosures on climate-related opportunities
Iberdrola Sustainability Report 2018

Finally, although they represent an enormous challenge, climate change and the necessary transition towards decarbonisation of the energy model are also an opportunity compatible with growth and profitability for the company. Iberdrola has undergone a profound transition in this regard over the last two decades, clearly anticipating the energy transition to face the challenges of climate change and the need for clean electricity. Today, the group is perfectly positioned to take advantage of the following opportunities, among others, thanks to its leadership in renewable energy, smart grids, storage and digitalization, and its commitment to the transition towards a low-carbon and climate-resistant economy:

- **Investment opportunities and improved competitive advantage.** Legislative and regulatory changes encouraging decarbonisation through greater electrification, the development of renewable energy and the integration thereof into the electricity system through smart grids and backup capacity, technological innovation, etc.
- **New services and markets.** Demand for new energy services and products related to the energy transition (e.g. electric mobility, demand-side management, smart grids, energy storage, etc.).
- **Advantages in the acquisition of financing.** Growing pressure on the financial sector and capital markets, which favours those companies with an ambitious decarbonisation strategy, low exposure to assets linked to climate change and good positioning on the sustainability and transparency indexes.
- **Strengthening of corporate reputation.** Result of a leadership position in the energy transition.
- **Sustainable creation of value.** Maximisation of the social dividend for all Stakeholders.

Figure 16: Enel's description of short-, medium- and long-term transition risks
Enel Annual Report 2018

As for the **risks and opportunities associated with transition variables**, and based on the various scenarios mentioned above in combination with the various factors involved in the identification of risks (e.g. the competitive landscape, the long-term outlook for the industry, materiality analyses, etc.), we analyzed the trends in the following drivers and related potential risks and opportunities: (i) prioritizing the phenomena of greatest relevance in terms of climate change; (ii) distinguishing between the short term (less than 3 years), medium term (3-5 years), and long term (beyond 5 years); and (iii) connecting these drivers to the TCFD recommendations for the classification of risks and opportunities.

Short-term risks and opportunities and strategic actions of mitigation and adaptation:

- **introduction of laws and regulations** for getting through the transition and the Paris Agreement introducing stricter emission limits and/or altering the generation mix not driven by price signals;
- **increasing focus within the financial community on ESG issues** with potential future benefits in terms of the availability of capital, which is also tied to financial sustainability, and of new products and markets (e.g. green or other sustainable bonds);

Medium-term risks and opportunities and strategic actions of mitigation and adaptation:

- **technological maturity and full competitiveness of renewable energy**, both large-scale and small-scale, with positive effects on return on investment.
- use of **more efficient means of transport** from the point of view of climate change, particularly with regard to the development of **electric vehicles and recharging infrastructures**;
- **development and/or expansion** of (new) assets (e.g. storage) and/or low-carbon services (e.g. Energy-as-a-Service) in response to technological progress and shifts in investment from the supply side to the demand side of energy in order to move beyond the Paris Agreement with benefits in terms of new revenue opportunities;
- **use of low-carbon sources of energy as the mainstream segment of the energy mix** in countries with opportunities to develop renewable resources and with flexibility in their electricity and energy systems with positive impacts in terms of return on investment and new business opportunities;
- **increase in the level of competition and convergence of opportunities**

Long-term risks and opportunities and strategic actions of mitigation and adaptation:

- **from diverse fields** with opportunities to access new markets, services and/or partnerships or for the entry of new players into the energy industry;
- **regulatory changes with a view to integrating new digital and renewable technologies and to driving infrastructure resilience** with potential benefits in terms of introducing new mechanisms of remuneration tied to environmental performance and innovation.
- **uncertainty and volatility in business drivers** (e.g. macroeconomics, energy, climate, etc.) that are **growing and persistent as new paradigms**, with effects on price indicators, on the cost of raw materials and technologies, on the value of assets, and on reputation;
- **gradual increase in the decentralization of the energy and electricity industries with a shift towards distributed technologies and resources**, which leads to new business and investment opportunities with a focus on the customer and on the needs of infrastructures.

Figure 17: EDF's strategic plan focusing on low-carbon transition opportunities and geographical diversification
EDF Group's Facts & Figures 2018

CAP 2030: AMBITIOUS OBJECTIVES ON 3 STRATEGIC AXES



⁽¹⁾ Since the acquisition of British Energy by EDF, the operating life of the RAG plants has been extended by 8 years on average. For more information, see p. 80
⁽²⁾ Partially financed by the Group

Figure 18: EDP's disclosures around how climate issues have impacted products and services
EDP Sustainability Report 2018

INNOVATING IN THE CLIENT'S SERVICE

In 2018, EDP continued to focus on innovating its commercial offer, launching new products and services and promoting intelligent, efficient energy management solutions. Around 151 million euros of revenues were generated only in energy efficiency services, representing an increase of 13% compared to 2017 (page 142).

In addition to its energy supply, EDP has a wide range of solutions (www.edp.pt, www.edpenergia.es, energia.edp.com.br) in geographical areas where its marketing/trading activity is present, of note being its more recent products and services and/or those that are noteworthy through contributing to a more sustainable use of resources:

SOLAR ENERGY

Savings simulation and installation of solar photovoltaic systems in a self-consumption scheme adapted to customers and local characteristics

ELECTRICAL MOBILITY

Support, advice and availability of in-home and out-of-home charging solutions available in the three geographical areas where EDP is present.

ENERGY EFFICIENCY

More efficient equipment and lighting such as LED lamps, high performance motors, electronic speed drives and heat pumps. Advisory services and energy audits.

In the Iberian Peninsula business sector, EDP has supported the implementation of integrated energy efficiency services through the Save to Compete programme, which identifies measures to reduce energy consumption, promoting its implementation and costing through the savings generated. The results are posted online and can be viewed on the Save to Compete website (edp.pt> corporate> reduzir fatura> save to compete).

EDP also supports energy saving measures, programmes and projects, in addition to those products and services that make up its business portfolio.

In Portugal, of note is the participation in the Plan for the Promotion of Electricity Efficiency Consumption - PPEC, promoted by the Energy Services Regulatory Authority, which encourages the implementation of measures to adopt consumption habits and more efficient equipment by consumers in the different market segments - Residential, Trade and Services and Industry and Agriculture. For the call for tenders the implementation period of which took place during the 2017-2018 biennium, the EDP Group approved 19 measures (3 more than in the previous call for tender), which represented 67% of the available funding. It is estimated that the implementation of these measures will allow an approximate saving of 1.2 TWh and a reduction of 430 thousand tonnes of CO₂, taking into account the working life of the equipment.

27 M€ AND 270 GWh

OF ACCUMULATED SAVINGS WITH SAVE2COMPETE SINCE ITS LAUNCH

In Brazil, EDP invested R\$ 30.28 million in energy efficiency initiatives in 2018, which led to energy savings of 9.6 GWh/year in São Paulo and 7.4 GWh/year in Espírito Santo. Funds are invested in accordance with legislation for the Brazilian electricity sector, which determines that the distributors annually apply 0.4% of net operating revenue into energy efficiency programmes (EEP) and 0.1% into the National Electricity Conservation Programme (PROCEL).

For example, in 2018, the Solidarity Efficiency project benefited more than 25,500 residential customers. 114,000 inefficient lamps were replaced with LED bulbs. This is expected to save 4.4 GWh/year, equivalent to the average consumption of approximately 3 thousand families/year.

Figure 19: EnBW's disclosures regarding digital leadership and the preparation of its business model to future transformation/transition
EnBW Integrated Annual Report 2018

Leadership: The digital energy industry is characterised by a high level of complexity. In order to be able to react and lead appropriately in this environment, new skills are required. The leadership development activities at EnBW concentrate on the themes of managing the business, developing new products, leading people, methodological excellence and self-management as part of the "Digital Leadership" programme. Special importance is being given here to the improvement of cross departmental cooperation and the formation of effective leadership coalitions, which are also supported by the increased use of agreements on team targets. The "Next Level Leadership" initiative has grown out of the "Digital Leadership" programme: After receiving fundamental guidance on what behaviour and skills are helpful in an increasingly dynamic and less predictable world, employees in leadership positions are provided with advice and offered individual learning experiences. A group of digital pioneers is, for example, being provided with an opportunity to learn about specific digital technologies and business models. In addition, change projects can be mentored through internal and external advice given on the job. For this, we use modern learning formats that enable participants to directly experience contemporary leadership at work. The aim is to realise the digital transformation of the Group more quickly and effectively.

Figure 20: EDF identify external market pressures with the potential to affect group strategy
EDF Reference Document 2018

The fight against climate change, by curbing greenhouse gas emissions, has entered a crucial phase with a view to limiting global warming to +2°C.

Given that energy accounts for most CO₂ emissions worldwide, it is crucial to gradually reduce the use of fossil fuels as energy sources in order to meet the climate target. To this end, the two major levers of actions are: lowering energy consumption by developing energy efficiency solutions and increasing the use of carbon-free energy sources, i.e. renewable energies - thermal (wood, biomass) or electric (hydro, photovoltaic or wind) - and nuclear energy.

Today, electricity accounts for only about 20% of energy consumed worldwide. Thus, uses currently covered by fossil fuels must be replaced by carbon-free energy solutions, first and foremost electric power solutions. Given that electric power solutions are very often seen by consumers as being synonymous with energy efficiency, they contribute to the joint objective of reducing energy consumption and moving away from fossil fuels for transport, buildings and industry: heat pumps as a replacement for fuel-oil or gas boilers, electric vehicles as replacement for combustion-powered vehicles.

With the Clean Energy and Climate Change Packages, the European Union has set itself ambitious goals for 2020 and 2030.

France's focus is on the fight against climate change. It has reaffirmed its goal through its Climate Plan which aims to achieve carbon neutrality by 2050.

In this respect, France – which already has low carbon intensity electrical facilities – is a step ahead of its major European neighbours. This low carbon and competitive mix must be preserved in the long term, drawing on the complementary relationship between renewable and nuclear energy.

However, the current business models of electricity producers are under pressure due to the market and European regulatory context, although significant investments are still required to maintain existing assets, and in the longer term, to renew generation facilities:

- commodity prices (oil, gas, coal) are highly volatile and are expected to remain so in spite of the abundance of carbon and the growth of shale gas production. They remain very sensitive to geopolitical tensions, changes in economic growth, adverse climatic and technical conditions;
- the price of CO₂ is directly dependent on the applicable regulations. In Europe, the emissions quota system currently in place does not ensure a minimum CO₂ price;
- the electricity market price depends directly on the above factors and impacts

the breakeven point of electricity generation plants;

- when commodities and CO₂ prices are low, the market price for electricity goes down, even more so as demand for electricity in Europe is sluggish. For example, over the first eight months of 2018, demand in EDF's four main European markets increased by 1% compared with 2017. Moreover, significant subsidised production capacities are connected to the network due to energy transition policies, thereby also impacting prices;
- since 2016, commodities prices have increased, allowing the market price for electricity in France for the year N+1 to cross the €50/MWh mark in 2018, for the first time since 2013;
- however, there is no guarantee that any of these parameters will remain at the current level, as evidenced for example by the sharp fluctuations in the price of European CO₂ emissions licences, which fluctuated between €7/t and €25/t in 2018.

Figure 21: Enel explain their collaborative approach to sustainable innovation that supports strategic priorities
Enel Sustainability Report 2018

THE OPEN INNOVABILITY ECOSYSTEM

Enel operates through an Open Innovability model, where the solutions, as well as being innovative, guarantee long-term sustainability for Enel's business and for the communities in which the Company operates. It is an ecosystem based on sharing, which allows you to face challenges by connecting all are as of the Company with startups, industrial partners, small and medium-sized enterprises, research centers, universities and solver ecosystems, through crowdsourcing platforms.

Enel has **91 active innovation partnership agreements**, including 8 global agreements which cross over several Business Lines. In addition to Enel's traditional activity fields, such as conventional generation and renewables, they have promoted the development of new e-mobility, microgrid, energy efficiency and industrial IoT solutions. The network of hubs where startups have the opportunity to test their solutions with the support of Enel's structures and knowledge, was expanded during 2018. There are **6 Innovation Hubs** (Silicon Valley, Tel Aviv, Madrid, Moscow, Santiago de Chile and Rio de Janeiro) and **3 Innovation Hub & Labs** (Catania, Pisa and Milan). 28 bootcamps and scouting activities dedicated to specific technologies of interest to the Group were organized through the Innovation Hubs in 2018.

Innovation activities are managed, in compliance with current regulations and with the Enel Compliance Programs, by the Innovability Function in collaboration with the various Holding Functions and Business Lines in all the countries in which the Group operates. There are dedicated structures on an individual Business Line level, in order to facilitate the development and dissemination of innovative solutions. A three-year innovation plan is defined each year to support the Group's strategic priorities. To be defined as innovative an idea must be sustainable, replicable and satisfy one or more specific needs. The plan is submitted for approval by the Group Innovation Committee which is chaired by the CEO and shared with the top management. Each Business Line then puts all the activities in place that are instrumental in achieving the specific targets, using all the Open Innovation tools, such as the relationships with startups, sellers and academic partners, the involvement of internal innovation communities to explore frontier solutions, the development of patents and corporate entrepreneurship, the strengthening of internal creativity and internal and external crowdsourcing initiatives. The innovation process is monitored by specific indicators, which take into account the number of innovative opportunities generated and how they are processed during all phases.

Innovation priorities for the three-year period 2019-2021 include: new digital solutions for the business, internal processes and customer management; automation of plant construction, management and maintenance phases; development of new products, innovative services and new technologies for energy production; innovation in management and customer interaction; in situ safety operations; sustainable management of water resources and other natural resources.



Figure 22: CLP's approach to demand-side management
[CLP website](#)

<p>MANAGEMENT APPROACH</p> <p>As part of our continuous efforts to drive towards a greener future, CLP is stepping up our Demand Side Management (DSM) measures.</p> <p>Through closer customer engagement, the application of new technology and increased customer awareness of energy consumption, DSM aims to achieve energy efficiency by reducing customers' peak electricity demand. Energy management offers mutual benefits to our customers and our business. For customers, the bills can be reduced, and for power companies, new investment in electricity infrastructure can be deferred.</p> <p>Our Customer Service Quality Policy also commits us to support our customers to use our products and services more efficiently and effectively.</p>	<p>GOALS AND TARGETS</p> <p>In Hong Kong, under the Scheme of Control Agreement (SCA), which ended in September 2018, we were incentivised with an extra 0.01 percent return on our fixed assets if we met the energy efficiency and conservation target of achieving no less than 150 energy audits for commercial and industrial customers and an extra 0.01 percent for saving at least 12 GWh of electricity consumption per year. These targets will be quadrupled under the new SCA effective from October 2018, and the incentive will be raised to approximately 0.1 percent upon achievement of the new energy saving targets and 0.04 percent for the new energy audit target.</p> <p>STRATEGY AND PROCEDURES</p> <p>Drawing on our expertise in the power industry, we encourage our residential and business customers and the community at large to use energy more efficiently and</p>	<p>to change their behaviour so that they can save more energy and help to create a better environment.</p> <p>Our four-pronged approach to changing people's habits and helping them reduce their energy consumption is designed to:</p> <ul style="list-style-type: none"> • Educate the public; • Provide customers with information and energy-saving tips; • Equip customers with tools and technical support; and • Support enablers to make greater energy efficiency possible.
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Figure 23: Iberdrola's disclosures of its new customer products and services designed to enable the low-carbon transition
[Iberdrola website](#)



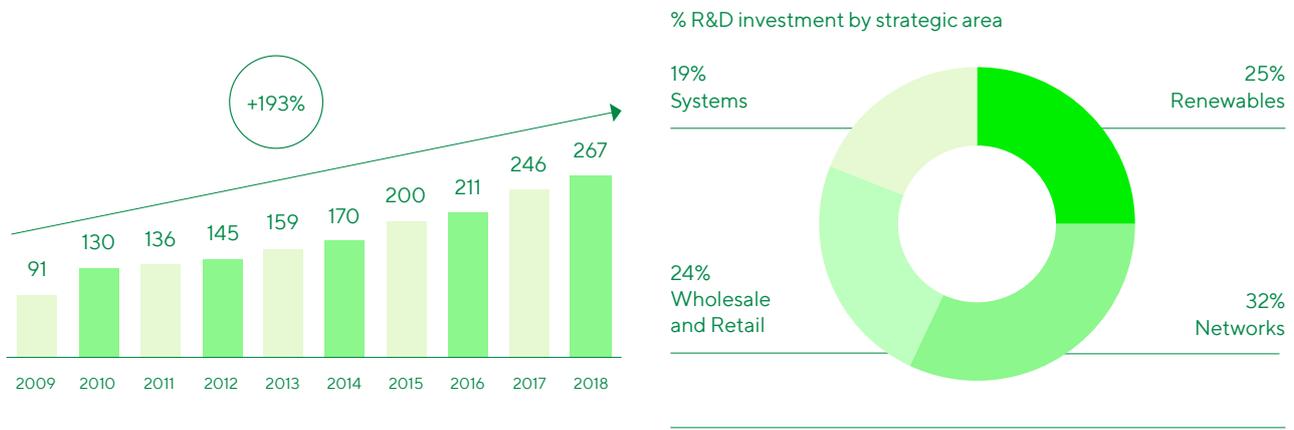
Pioneers in digitisation

CONTINUOUS INNOVATION IN PRODUCTS AND SERVICES

-  **Energy Wallet**
Purchase of green energy packages
-  **Planes a Tu Medida**
Only electric utility that offers hourly rates
-  **Smart Solar**
Distributed generation and storage
-  **Smart Home and Smart Meter**
Responsible use of energy
-  **NYSEG Smart Solutions**
Online store with energy efficient products
-  **PowerUp and Elektro Fácil**
Apps for managing consumption
-  **Smart Mobility**
Specific solutions and rates for electric vehicles

Figure 24: Iberdrola's disclosures on investments in R&D and key focus areas
Iberdrola Integrated Report 2018

Investments in R&D (€M)



Highlight the value of the company's intangible assets

Main R&D research projects

- Renewable energy**
 - As to the improved efficiency of assets, *ROMEO* and *ASPA* seek to develop new models and tools for the early detection of failures based on AI/big data techniques. The *Renewables Digital Evolution Plan (2018-2022)* has also been launched.
 - Avangrid Renewables has passed the process of being registered as a *Balancing Authority*, with responsibility for the real-time balancing of production and demand.
 - In offshore wind, the *Wikingen* offshore wind farm was inaugurated and construction of *East Anglia One* offshore wind farm has started in the United Kingdom.
- Smart grids**
 - The *ALOIS* project has commenced to develop a system for control and protection of feeders in distribution networks for stable and sustainable island operation.
 - LAYCA* seeks to develop a system for locating breakdowns and identifying failures in medium-voltage networks. *Quality Innovation Award* received in the Basque Country.
 - Also noteworthy are the *Star+* and *Bidelek 4.0* projects, to continue pushing the digital transformation of the electricity grid and to improve the efficiency thereof.
- Clean generation**
 - Includes the *OCTAVE* project for the design of technologies for the diagnosis and control of the combustion process to make our plants more flexible.
 - OFF-GAS*, *RESHAND* and *FILTRABRIS*, which are part of Iberdrola's Supplier Innovation Programme, are oriented toward operational efficiency and nuclear safety.
- Customers**
 - Energy Wallet*, a pioneering product that allows the purchase of 6-, 12- or 24-month green energy packages knowing the final price. They can be used at different addresses and allow for real-time management from one's mobile phone.
 - In the United Kingdom, there is *PowerUp*, which allows for the purchase of gas or electricity in packages up to 180 days in advance at a pre-established price.
 - Smart Mobility*, a comprehensive solution that includes the acquisition of a charging point, installation and warranty, operation by means of an *app*, and a personalised supply contract.

Innoday 2018, we are committed to innovation and young talent

On 23 May, the company's international campus hosted the *Innoday 2018* symposium, a meeting space to disseminate *innovative* initiatives that transform the energy sector, encourage the transfer of knowledge and attract young talent.

Innoday 2018 was based around two pillars:

- The presentation of the Iberdrola group's Universities Programme.
- The innovation fair: 25 exhibitors showed emblematic projects relating to energy in the areas of the group's business as well as that of its partners.

Youth who participated in the start-up initiatives of the Universities Programme were also involved, with the winners of the challenges earning an award.

Figure 25: CLP's Climate Action Finance Framework
[CLP website](#)

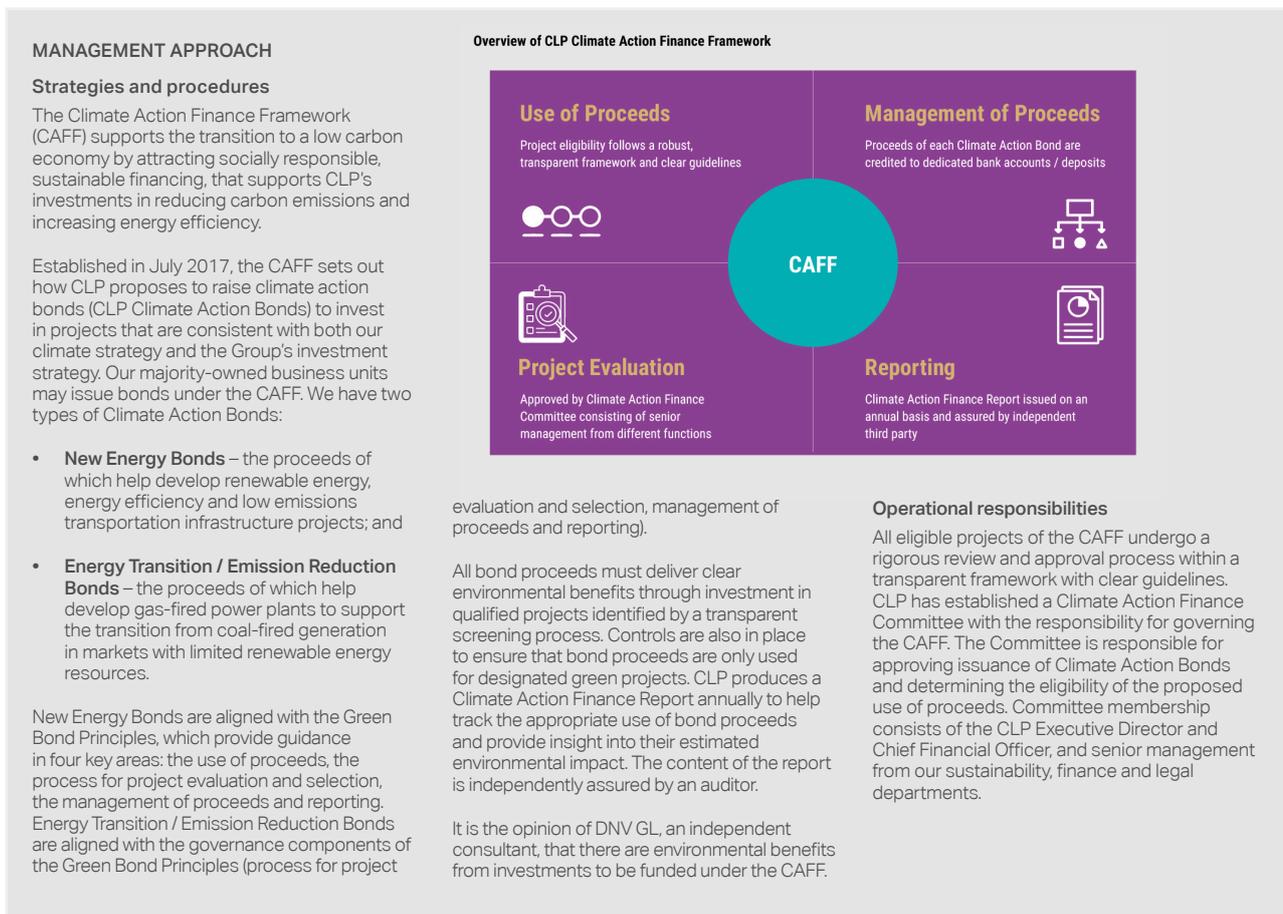


Figure 26: EnBW's forecasted expenditure into renewables
 EnBW Integrated Annual Report 2018

Total investment 2019–2021
 in %

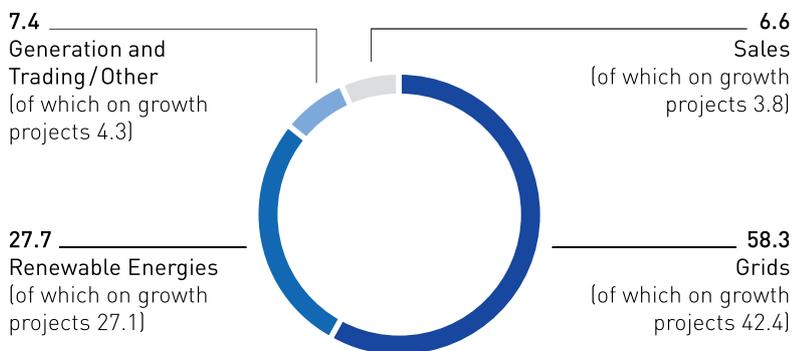


Figure 27: EnBW's portfolio transformation in line with the EnBW Strategy 2020
EnBW Capital Markets Day 2018 Presentation



Figure 28: EDF's green bond renewables development
EDF Reference Document 2018

Allocation of proceeds at 31 December 2018:

	Funds raised	Funds allocated to Eligible Projects	Number of Green Bond funded projects	Share of investment financed via Green Bonds funds
Green Bond no. 1 – November 2013	€1.4 billion	€1.4 billion	13 ⁽¹⁾	59%
Green Bond no. 2 – October 2015	\$1.25 billion	\$1.25 billion	7 ^(1,2)	58%
Green Bond no. 3 – October 2016	€1.75 billion	€1,188 million	6 ⁽²⁾	65%
		EDF Renewables: €764 million	6 ⁽²⁾	
		EDF Hydro: €424 million	411 operations	100% ⁽³⁾

(1) Including the Roosevelt Project, financed by Green Bonds 1 and 2.

(2) Including the Red Pine Project, financed by Green Bonds 2 and 3.

(3) Share of total investments financed by EDF, including half of the investment in the Romanche-Gavet project.

At 31 December 2018 the following Eligible Projects had been chosen by EDF Renewables for financing under the first three Green Bonds issued in November 2013 (GB1), October 2015 (GB2) and October 2016 (GB3):

Project	Type and Capacity	Location	Year come into service	Financing GB1/GB2
CID Solar	PV Solar, 27MWp	US (California)	In service	GB1
Cottonwood	PV Solar, 33MWp	US (California)	In service	GB1
Catalan wind farm	Onshore wind, 96MW	France (Pyrénées-Orientales)	In service	GB1
Heartland	Biogas, 20MW	US (Colorado)	In service	GB1
Hereford	Onshore wind, 200MW	US (Texas)	In service	GB1
La Mitis	Onshore wind, 25MW	Canada (Quebec)	In service	GB1
Le Granit	Onshore wind, 25MW	Canada (Quebec)	In service	GB1
Longhorn North	Onshore wind, 200MW	US (Texas)	In service	GB1
Pilot Hill	Onshore wind, 175MW	US (Illinois)	In service	GB1
Rivière du Moulin	Onshore wind, 350MW	Canada (Quebec)	In service	GB1
Spinning Spur 2	Onshore wind, 161MW	US (Texas)	In service	GB1
Spinning Spur 3	Onshore wind, 194MW	US (Texas)	In service	GB1
Roosevelt	Onshore wind, 250MW	US (New Mexico)	In service	GB1 and GB2
Great Western	Onshore wind, 225MW	US (Oklahoma)	In service	GB2
Kelly Creek	Onshore wind, 184MW	US (Illinois)	In service	GB2
Salt Fork	Onshore wind, 174MW	US (Texas)	In service	GB2
Slate Creek	Onshore wind, 150MW	US (Texas)	In service	GB2
Tyler Bluff	Onshore wind, 126MW	US (Texas)	In service	GB2
Red Pine	Onshore wind, 200MW	US (Minnesota)	In service	GB2 and GB3
Bluemex Power 1	PV Solar, 120MWp	Mexico (Sonora)	In service	GB3
Copenhagen Wind Farm	Onshore wind, 80MW	US (New York)	In service	GB3
Nicolas Riou	Onshore wind, 112MW	Canada (Quebec)	In service	GB3
Rock Falls	Onshore wind, 154MW	US (Oklahoma)	In service	GB3
Stoneray Power Partners	Onshore wind, 100MW	US (Minnesota)	In service	GB3

Figure 29: EDP's innovation and technology research
EDP Sustainability Report 2018

SUPPORT FOR ENTREPRENEURSHIP

One of the focuses that has proved critical for the development and introduction of innovative technologies in the various EDP business units has been the support provided to entrepreneurship through EDP Starter. With activity in Portugal, Spain and Brazil, EDP Starter offers the best start-ups in the sector the opportunity to participate in acceleration programmes, hackathons and conferences in order to develop pilots and possibly invest. 2018 was also marked by EDP's presence at the Web Summit, and participation in the global start-up acceleration programme, Free Electrons.

**EDP Starter 2018: 700+ applications;
34 Countries; 33 startups; 23 PoCs;
44 Mentors; € 500,000 in PoCs**

Investment targets:

- EDP Ventures \$GPS: €40M
- EDP Cleantech FCR: €25M
- EDP Ventures Brasil: R\$30M

DEVELOPMENT OF INNOVATIVE TECHNOLOGIES

EDP focuses on five areas of innovation and technological research, of note being some of the ongoing projects:

CLEAN ENERGY

It aims to boost the renewable energy business (onshore and offshore wind, solar and hydro)

- **Floating photovoltaic** - development of the pilot project for the installation of a floating photovoltaic platform and roll-out study with greater capacity in the Alqueva reservoir in Portugal.
- **WindFloat Atlantic** - Development of the pre-commercial phase of a floating offshore wind farm using WindFloat technology. The project will be located 20 km from Viana do Castelo, with 3 to 4 units and a total installed capacity of 25 MW.

INTELLIGENT NETWORKS

Development of solutions that enable the smart management of electrical networks. **InteGrid** - a project co-funded by the European Commission with the aim of promoting the demonstration of smart grids, storage and integration of renewable energies, enabling the interactive participation of grid users and providing for the interoperability of different market and interconnection solutions for different stakeholders.

- **Gridcure** - SaaS (Software as a Service) platform for predictive analytics for electrical utilities, which uses data to optimize power strategy and improve smart grid operations.

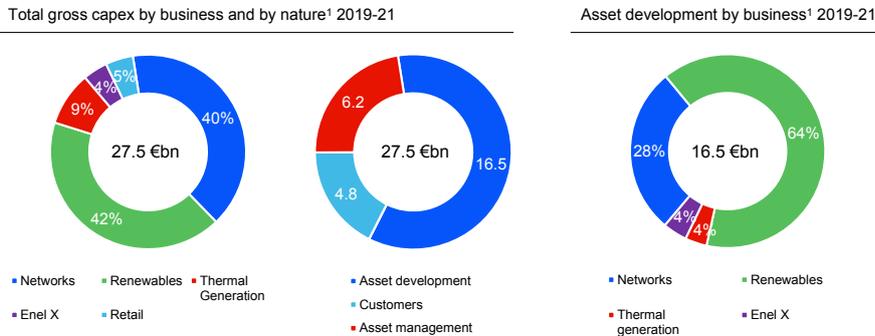
CUSTOMER-FOCUSED SOLUTIONS

Promoting the improvement of energy efficiency through offering low carbon products and services and increasing electrification through competitive prices

- **Sharing Cities** - a European project seeking to share integrated energy solutions to promote energy efficiency, in three cities (London, Milan and Lisbon). The development of an ongoing Sustainable Energy Management System (SEMS) in the head office building of the Lisbon municipality, which will allow the grouping and management of energy consumption information for the building (general and controllable loads), photovoltaic production and consumption of electric vehicles.
- **Chatbot EDP** - development by the start-up winner of the EDP Starter Acceleration Programme Spain 2017, of a chatbot available on the EDP Carrefour Plan website, which allows customers, through artificial intelligence, to contract services related to the EDP-Carrefour offerings.
- **Energymate** - IT application developed in collaboration with the Asturian start-up Energintel, which provides customers with natural language information about their electricity consumption.

Figure 30: Enel's financial disclosures on future capital expenditure in renewable energy 2019-2021
 Enel Capital Markets Day Presentation 2018

Asset development supports our growth ambitions

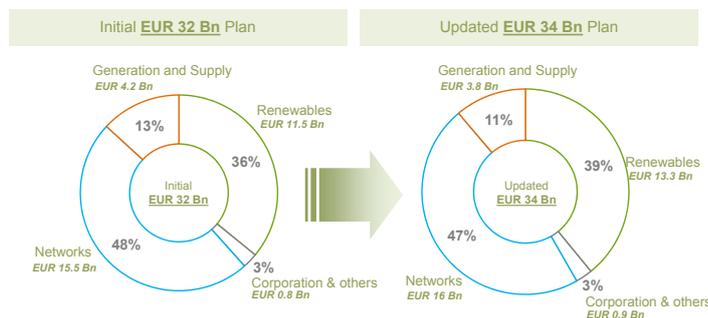


1. Includes 1.6 €bn BSO capex

Figure 31: Iberdrola's investment plans 2018-22
 Iberdrola Capital Markets Day Presentation 2018

Investments 2018 – 2022: investments by business

Increasing the investments in regulated or long-term contracted activities, up to 86%...



...due to new opportunities in Renewables or Networks in most of geographies

Figure 32: EnBW's strategic outlook with accompanying financial planning
 EnBW Strategic Outlook 2013-2020



1 Investments and disinvestments which are part of the strategic measures are in addition to the approved PR1315 budget and maintenance capex in existing business (figures, accumulated and rounded, from 2013-2020)

TCFD RECOMMENDATION STRATEGY C

1. Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.

FORUM COMMENTARY

Forum members believe that capitalizing on the opportunities identified in response to the TCFD's Strategy A and B recommendations is the most effective way to demonstrate the transformation of business models and consequently resilience in a low-carbon future. Forum members therefore conduct scenario analysis not only to evaluate risk and strategic resilience, but also to guide current plans and investments in anticipation of a range of different situations and in order to capitalize on opportunities that enable the transition.

Forum members consider a range of scenarios from those indicative of a 1.5-2°C outcome to scenarios that anticipate 3-4°C of warming in order to assess the commercial implications of, and strategic resilience to, transition and physical risks respectively. Forum members use public reference scenarios, adopting specific parameters and assumptions, namely from the International Energy Agency's (IEA) Sustainable Development Scenario (SDS), New Policies Scenario (NPS) and the Intergovernmental



Panel on Climate Change (IPCC) Representative Concentration Pathway (RCP) 8.5, 4.5 and 2.6 (in line with the 2°C Paris Agreement) (Figures 33-35).

Using scenario analysis to demonstrate resilience in the face of **transition risks**:

Forum members typically conduct scenario analysis based on analyses of risks identified in response to the TCFD's Strategy A and B recommendations and the strategic implications of key parameters. Forum members commonly use the following parameters as inputs when conducting scenario analysis:

- **Investment in renewables and low-carbon generation capacity**, mainly due to technology improvements and price reductions;
- **Electrification of the energy mix and demand evolution**, increasing decarbonisation enables other sectors to reduce their carbon intensity;
- **Penetration of electric vehicles (EVs)**, as these solutions become more competitive for several transport segments;
- **End-use changes**, such as increased electrification of heating systems;
- **Network challenges and investment needs**, as a consequence of end-use changes, leading to infrastructure redesign and complexity, as well as the need for smarter systems to accommodate a higher share of renewables, EVs, higher consumption, and new business models requiring higher flexibility needs;
- **Carbon pricing**, driving switching from fossil fuel-based generation to low-carbon where it is more efficient;

- **Other policies**, such as increasing energy efficiency requirements;
- **Demand response**;
- **Technological development**, for example the adoption of distributed storage, due to battery price reductions or CC(U)S required in markets where other technologies may not be sufficient to achieve a 2°C scenario.

Using scenario analysis to demonstrate resilience in the face of **physical risks**:

Organizations are still developing techniques for applying scenario analysis to assess strategic resilience against physical risks and therefore disclosures on the subject are relatively sparse. However, physical risks are material for both thermal and renewable generation and for transmission and distribution infrastructure. Wind and precipitation patterns affect the reliability of renewable assets and thermal generators rely on the availability of water for cooling purposes. Similarly, networks (transmission and distribution) and energy markets are vulnerable to disruption from extreme weather events and changes in climatic conditions.

Physical risks and the way in which they might affect strategic resilience over time can be highly specific to location and facility. Forum members are beginning to undertake specific, detailed studies and climatic analysis across the geographies in which they operate to identify the level of exposure and vulnerability of assets and operations. This analysis involves comparing historical climate data against long-term forecasts. Variables such as wind, temperature and precipitation patterns are then typically used to understand potential impacts of chronic physical risk on different business segments and assets.

This can be combined with analysis of extreme weather events (acute physical risk), specifically the changing frequency and intensity over time in different geographies and regions.

This analysis informs the assessment of risks at an asset level and forms the basis for estimates of potential financial impacts (e.g., costs associated with power outages, repairs and income from additional heating/cooling days). Analyses of future resilience against physical risk can also account for company-specific mitigation and adaptive measures.

Disclosure of the key findings of such analyses gives users an understanding of geographical risk distribution, adaptive actions employed and levels of diversification and decentralization to hedge against physical risks.

Disclosures on strategic resilience based on scenario analysis

At present, the outputs from scenario analyses are largely qualitative and tend to focus on resilience against transition risk.

Outputs from scenario analysis depend on assumptions made about the parameters used to conduct the analysis, the values given to them and the period over which Forum members conducted the scenario analysis, all of which are subject to change in light of new information and sector developments.

Over time, Forum members expect disclosures about strategic resilience to develop so that:

- Information about strategic resilience focuses more on the specifics of individual companies, their context, business lines and customer solutions, in addition to the general view about the electric utilities industry's role in the transition.

- Quantitative information complements qualitative information (as appropriate, given commercial and market sensitivities).
- Public scenarios are supplemented with information from other sources that, for example, anticipate more ambitious deployment of decarbonized technologies or more specific contextual information related to jurisdictions in which companies operate. This will ensure that scenario analyses optimize strategic decisions and are specifically relevant to the company's own views on how the transition might unfold. Supplementary sources can originate from within companies, particularly where they provide deeper insight than public scenario developers on issues such as demand growth or technological costs.

USER PERSPECTIVES

The use of scenario analyses:

Users encourage disclosure of forward-looking information from companies that reflects the way in which management is monitoring and responding to future trends and their potential impacts.

Disclosures about strategic resilience based on scenario analyses are most useful when:

- Companies are transparent about inputs, parameters and assumptions used (e.g., carbon price) and the processes followed.
- They include an indication of how trends and developments are likely to affect the business model, strategy and finances of companies.
- Resilience is tested against a range of scenarios including a

1.5-2 °C scenario.

- They provide insight (as far as commercial sensitivity allows) into how the company expects key performance metrics to change under different scenarios; for example, how the allocation of investments might change under different scenarios or how generation mixes might change along with corresponding investment needs.

Assessing resilience: Users assess a company's strategic outlook and business model resiliency by examining evidence of diversification, innovation, flexibility and business model adaptation in response to future trends and opportunities associated with the transition to a low-carbon economy. Indicators that show that companies have integrated transition trends and opportunities into business models include disclosures covering:

new product lines and customer solutions; changes in the generation mix; the development of transmission and distribution networks; changes in technology; and changes in customer base, behavior and demand.

To assess the coherence between the current business model and the strategic outlook, users scrutinize the investments associated with identified transition opportunities and examine evidence of the assumptions and parameters that inform diversification and innovation plans. Users also look for disclosures about the capacity of companies to adapt their business models in response to external factors; as well as evidence for how companies are managing legacy assets in terms of divestment and restructuring. Users also value information about contracts, including the proportion of long-term vs short-term contracts and the nature of power purchase agreements (PPAs).

Examples

Figure 33: EnBW scenario analysis – scenario selection

EnBW Integrated Annual Report 2018

<p>In order to evaluate the robustness of our business model against the backdrop of social efforts to limit climate change and achieve the two-degree target, the following scenarios are used:</p> <ul style="list-style-type: none"> • The Energiewende continues to progress on its current path with a focus on the expansion of renewable energies in the electricity sector • Rigorous alignment towards climate protection in the context of the efforts 	<p>being made worldwide to achieve the ambitious climate protection targets</p> <ul style="list-style-type: none"> • Slower reorganisation of the energy system against the background of weaker economic growth below the long-term potential • The Energiewende is confined in an international environment that is oriented toward strong economic growth, also in conventional industrial sectors
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Figure 34: Iberdrola's selected scenarios

Iberdrola Sustainability Report 2018

<p>STRATEGY</p> <p>Climate change is a key element for defining the company's strategy. Iberdrola treats it not only as a risk factor, but also as an opportunity for growth through mitigation and adjustment activities during the transition towards a low-carbon economy.</p> <p>Iberdrola's strategy is aligned with the objectives of the Paris Agreement, given that the company has been integrating the fight against climate change into its strategy since the early 2000s, clearly committing to decarbonisation of the energy model through renewable energy, storage and smart grids, together with the commitment to achieve the SDGs.</p> <p>In 2018 Scottish Power sold its 2,566 MW of thermal generation, making it the first vertically integrated company in the United Kingdom with 100 % renewable wind power generation facilities.</p> <p>Iberdrola has chosen four climate scenarios on which it is performing the analysis of potential impacts on its business model:</p> <ul style="list-style-type: none"> • Two transition scenarios that for Iberdrola represent potential paths towards a low-carbon economy. They are based on plausible projects prepared by a third party, the International Energy Agency: <ul style="list-style-type: none"> ◦ Sustainable Development Scenario (SDS): this scenario assumes achievement of the climate change 	<p>goals agreed to in Paris (<2°C), improvement in air quality and universal access to electricity in accordance with the UN SDGs.</p> <ul style="list-style-type: none"> ◦ New Policies Scenario (NPS): a scenario based on the World Energy Outlook, which includes current and announced energy policies (e.g. nationally determined commitments, or NDCs, from the Paris Agreement). <p>There has been a comparative analysis of these two scenarios allowing for conclusions to be extracted by business and geographic area regarding the level of resiliency of Iberdrola's strategy with respect to climate change in the short and medium term. Continuity of the Outlook 2018-2022 has been assumed, with a qualitative transfer thereof through 2030.</p> <p>The result of the analysis indicates that, thanks to the company's strategy and positioning in renewable energy, divestment from oil and coal plants, and smart grids, its business model is sufficient to face both scenarios.</p> <p>It is important to note that, over the long term, Iberdrola's goal to achieve carbon neutrality by 2050 (which the company already set in 2009) is more ambitious than the goals sought under the NPS scenario and is aligned with the SDS.</p> <ul style="list-style-type: none"> • Two physical scenarios, based on the IPCC Fifth Assessment Report, to 	<p>diagnose the range of impacts:</p> <ul style="list-style-type: none"> ◦ Representative Concentration Pathway 8.5 (RCP 8.5) of the Intergovernmental Panel on Climate Change (IPCC): the most unfavourable case of the physical risks that the company might face corresponds to a 3.7°C increase in average global temperature during the 2081-2100 period. ◦ Representative Concentration Pathway 4.5 (RCP 4.5) of the Intergovernmental Panel on Climate Change (IPCC): stabilisation scenario, taking account of the efforts being made and to be made at the international level to reduce greenhouse gas emissions. <p>Taking into account that adjustment to the physical risks arising from climate change is a major issue for a sector as strategic as electricity, Iberdrola has analysed the principal climate threats to which the electricity sector might be exposed under these two scenarios in the various jurisdictions and for the different technologies in the short, medium and long term.</p>
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Figure 35: Enel's disclosure on its strategic planning and use of scenario analysis
Enel Annual Report 2018

		2015	2018	2021
Renewables	Renewable capacity (% of total)	41%	46%	55%
CO₂	CO ₂ emissions (kg/kWh _{eq})	0.409	0.369	0.345
Grid customers	Millions	61	73	75
Retail free-market customers	Millions	17	22	36
New businesses	Gross margin (billions of euro)	-	0.5	0.9
Simplification	Group earnings to total earnings (%)	64%	72%	71%
Cash generation	FFO - Gross investment (billions of euro)	1.8	2.5	4.4
Remuneration of shareholders	Dividend per share (€)	0.16	0.28	0.36⁽¹⁾

(1) Guaranteed minimum dividend (floor).

STRATEGIC PLANNING, VALUE CREATION, AND CLIMATE CHANGE

Enel is committed to adopt a strategy based on meeting the objectives of the Paris Agreement (COP21). By way of strategic planning and risk management integrated with sustainability and climate-related issues, the Enel Group has created sustainable value over the long term. Over the last four years (2015-2018), the Group has increased profitability while achieving objectives related to decarbonization, digitalization, and customer service. The Group's Strategic and Business Plan 2019-2021 (the Plan) calls for continuing along this virtuous path based on a long-term view and the achievement of a series of predetermined objectives.

The Group's commitment can also be seen in the objectives pursued in relation to the United Nations' Sustainable Development Goals (SDGs), specifically: inclusive and equitable quality education (SDG 4); access to clean, affordable energy (SDG 7); inclusive and sustainable economic growth (SDG 8); industry, innovation, and infrastructure (SDG 9); and sustainable cities and communities (SDG 11). Enel is working to achieve the full decarbonization of electricity generation by 2050, in line with the objectives of the Paris Agreement and with the science-based targets, while also helping to achieve the United Nations' SDG 13.

Our model of value creation is based on a long-term vision that aims to take advantage of opportunities in the energy transition in three main areas: (i) the decarbonization of our generation capacity (increase of about 11.6 GW in the Group's renewables capacity and decrease of about 7 GW in thermal capacity by 2021 compared with 2018); (ii) infra-structure development (+10% of electricity distributed over the distribution network in 2021 compared with 2018; 3.4 million lamps by 2021; some 455,000 public and private electric vehicle recharging points by 2021) and new customer services (9.9 GW of demand response by 2021; 173 MW of distributed storage installed per year by 2021) at the service of electrification and urbanization; and (iii) the digitalization of assets, customers, and human capital (€5.4 billion in investment for the period 2019-2021).

CLIMATE-CHANGE REFERENCE SCENARIOS

The Group develops financial and macroeconomic scenarios over the short, medium and long term to support both business and strategic planning and the investment evaluation process. This makes use of economic and statistical models progressively integrated with climate-related data by introducing projections related to physical and transition scenarios in order to have a broad and consistent view of the landscape both in countries in which the Group has a presence and in those of potential interest. Forecasts of the main variables are constantly compared against the most authoritative international sources.

The Group has taken two physical scenarios representing two distinct, extreme pathways of concentrations of greenhouse gases (GHGs) developed by the Intergovernmental Panel on Climate Change (IPCC) in order to include the most extreme pathways of those that are plausible:

- **Representative Concentration Pathway 2.6 (RCP 2.6):** a climate-change scenario consistent with limiting global warming to below 2°C by 2100 (mean of +1°C over the period 2081-2100 based on the IPCC Fifth Assessment Report);
- **Representative Concentration Pathway 8.5 (RCP 8.5):** a business-as-usual scenario that represents the most pessimistic forecast of containing GHGs, resulting in a mean temperature increase of 3.7°C over the period 2081-2100.

In order to study the effects of climate change and related transition scenarios, the Group has entered into a collaboration with the International Centre for Theoretical Physics (ICTP) concerning the geographical downscaling of global climate scenarios. Downscaling enables detailed forecasts at a greater resolution so as to track the business impact of a series of relevant variables, such as temperature, rain levels, snow levels, solar radiation, and wind. This approach produces a model that integrates climate change with the other country-level variables, starting with the countries of greatest relevance to the Group and then extending out to global coverage. Integration of the scenario analyses with climate-related variables will result in an increasingly important tool supporting informed strategy and operating decisions.

The initial results of the scenario analysis and climate data have shown that significant, chronic changes will take place gradually over the coming decades.

Changes compared with historical trends will be gradual, with limited effects in both scenarios until 2050, but with more extreme, chronic effects under RCP 8.5 from 2050 to 2100 compared with historical trends and RCP 2.6. Studies of Europe and South America have pointed to a general increase in temperature with a greater impact in southern Europe and in Central and South America and of particular intensity by 2100. In these areas, rainfall levels could significantly decline after 2050 under RCP 8.5 forecasts, but could increase in northern Europe (e.g. Scandinavia). Differences in solar radiation patterns, on the other hand, could be more significant beginning in 2100 in the regions most exposed to a significant reduction in rainfall, whereas wind patterns could experience less homogeneous variations.

Regarding the **transition scenario definition**, the Group refers to the leading international sources, such as the **International Energy Agency** (WEO Sustainable Development Scenario; WEO Current Policies Scenario; ETP 2017 2°C Scenario 2DS; Beyond 2°C Scenario B2DS), the **International Renewable Energy Agency** (Reference case, Remap case), and **Bloomberg New Energy Finance** (BNEF New Energy Outlook). This approach enables Enel to associate a series of assumptions and variables to the potential climate-related scenarios, including pathways to develop a scenario consistent with the Paris Agreement (COP21). The transition scenario include variables such as demand for energy and services or assumptions about electrification, the use of electric vehicles, and the prices of commodities and CO₂. In order to reach this objective, a sharp reduction in emissions from power generation, high renewable energy source penetration, and the use of effective policy mechanisms and measures with regard to carbon pricing are expected. Within this landscape, we are also expecting an increase in energy efficiency, and in the electrification of industrial and residential consumption as well as in the transport industry. This transition towards lower carbon emissions and efficiency in the use of energy could lead to a gradual uncoupling of economic growth and the consumption of resources and, consequently, to lower demand and lower prices for fossil fuels.

RISK MANAGEMENT

TCFD RECOMMENDATION

Disclose how the organization identifies, assesses and manages climate-related risks.

The TCFD recommends that companies:

1. Describe the organization's processes for identifying and assessing climate-related risks;
2. Describe the organization's processes for managing climate-related risks;
3. Describe how the organization integrates the processes for identifying, assessing and managing climate-related risks into its overall risk management.

FORUM COMMENTARY

Forum members disclose the type and impacts of climate-related risks identified in response to the TCFD's Strategy A and B recommendations. The recommendation on risk management focuses on eliciting information about the processes companies have in place for identifying, assessing and managing risks (Figures 36-43).

Where a company has a widely-accepted company risk management process, for example as specified by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), and has integrated climate change risk into that process, disclosures

are useful when they describe the degree of integration and if/how the company has specifically modified risk management processes to address/manage climate change.

In the case of risk management, preparer and user views on the characteristics of useful information are aligned. Even where the process for identifying, assessing and managing risk is clear, disclosures should:

- Confirm that the company has integrated climate change considerations into overall risk management processes;
- Explain whether any particular adaptations are required to the risk management process to take account of the fact that climate change can often form one part of, or contribute to, other risks. In particular, the highly interconnected nature of climate risk means that it is best monitored in combination with macro-economic, regulatory and investment factors;
- Explain (where appropriate) the interconnections between climate and other risks in order to build an overall picture of the company's exposure to risk;
- Explain (where appropriate) the way in which regulated assets are exposed to or protected from risk, for example where future tariff reviews could impact potential costs and

CAPEX commitments driven by climate change;

- Describe how the company uses risk management processes to monitor the potential for assets to become stranded in response to policy and regulatory risks and technological advances;
- Explain how the company applies risk management processes to physical risks that might be more uncertain than other risks. In particular, whether the process:
 - Is applied to particular facilities and locations;
 - Relies on or references modeling processes and resolution requirements in response to high levels of uncertainty;
 - Takes account of efforts to improve the physical resilience of assets, such as operational experience, diversification of assets, and the capacity to deploy additional resilience measures within the time horizon or lifespan of the asset, (i.e.: replacement of assets, technology improvements, and development of weather forecasting capabilities).



Examples

Figure 36: Enel's approach to identifying, assessing and managing risks and opportunities
Enel Annual Report 2018

<p>IDENTIFYING RISKS AND OPPORTUNITIES</p> <p>The identification of risks and opportunities within the Group's business and strategic planning process is de-signed to manage short-term (less than 3 years), the medium-term outlook (3-5 years), and the revision of long-term ambitions (beyond 5 years).</p> <p>Medium- and long-term planning starts with a strategic assessment of the external landscape and climate-related issues, which involves the following activities:</p> <ul style="list-style-type: none"> • macroeconomic, energy and climate scenario analysis - a series of global and local analyses and forecasts to identify the main macroeconomic, climate and energy-related drivers over the short, medium and long-term horizon; • competitive landscape analysis - a set of analyses to compare financial and operating performance as well as environmental, social and governance (ESG) performance of competitors and players of other sectors in order to monitor, guide and support the Group's competitive advantage and leadership position; • Industry view - an overview of the macro-trends affecting the business environment and impacting an assessment of the Group business through an extensive internal and external collaborative approach; • strategic dialogue - an ongoing process of engaging the Board of Directors, management, and employees in the definition of strategies. This process ensures that there is agreement as to the Group's priorities; • analysis of ESG risks - analysis to identify the potential ESG risks to which the Group may be exposed, due to geographical 	<p>distribution and operations; it is conducted based on an analysis of external studies such as the World Economic Forum's Global Risk Report, studies by leading ESG investment analysts, and internal studies such as materiality analyses or due diligence concerning human rights;</p> <ul style="list-style-type: none"> • ESG landscape analysis and materiality assessment - Enel conducts ESG and materiality analyses using an approach that takes account of the guidelines based on numerous international standards (e.g. Global Reporting Initiative, UN Global Compact, SDG Compass, etc.) with the goal of identifying and assessing priorities for stakeholders and correlating them with the Group's strategy. <p>ASSESSING RISKS AND OPPORTUNITIES</p> <p>Enel is committed to setting up and structuring periodical monitoring and assessment processes of risks and opportunities associated both with physical variables trends, related to acute and chronic climate-related events, and with transition scenarios related to changes in the socio-economic landscape and in laws and regulations concerning the fight against climate change.</p> <p>For the ex ante assessment of risk levels, a Plan risk analysis, including exposure to climate-related factors, will be presented each year to the Control and Risk Committee. With regard to ex post monitoring, the various risk factors, including the main climate-related variables that could have an impact on the Group's objectives and operations, will be periodically evaluated and revised. These activities will be undertaken starting from 2019, while at the operational level there are already processes in place to monitor the risk of damage to assets and infrastructures</p>	<p>caused by climate-related extreme events or natural disaster, as well as the consequent risk of prolonged unavailability of such assets.</p> <p>MANAGING RISKS AND OPPORTUNITIES</p> <p>Consistently with the Strategic Plan, the Business Lines submit investment proposals for approval to the relevant Investments Committees, composed of Business Line senior management. Moreover, the Group Investments Committee approves investments above a certain threshold or concerning particularly innovative projects.</p> <p>The Investments Committee approval is based on a joint assessment of both return and risk aspects. The risk assessment includes a quantitative analysis of economic, financial and operational risk factors and a qualitative analysis of all risk categories in order to determine the potential impact on the investment return and the appropriate mitigation efforts. The units responsible for developing each project identify the specific factors that could influence the expected return on investment, including certain environmental and climate-related risks (e.g. an increase in the frequency of extreme environmental and climate-related events and changes in national laws and regulations regarding the fight against climate change). The Group is committed to further developing the investment analysis framework to explicitly include an assessment of each project contribution to the improvement of the Group's climate resilience.</p>
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Figure 37: EnBW's climate risk identification processes
EnBW Integrated Annual Report 2018

Climate protection: Risks generally exist in the area of environmental protection due to the operation of power generation and transmission plants and the possible consequences for the air, water, soil and ozone layer. The importance of climate protection is taken into account in, amongst other things, the key performance indicator CO₂ intensity.

EnBW counters these risks using, amongst other things, an environmental management system certified according to DIN ISO 14001, which has been established at key subsidiaries. EnBW takes the safety of the population and the protection of the environment very seriously. In this context, risks also exist due to external circumstances, such as extreme weather conditions. These risks are countered by EnBW using an emergency and crisis management system that has been implemented throughout the Group and includes comprehensive organisational and procedural measures. EnBW ensures that the risks posed by crisis and emergency situations are mitigated quickly, effectively and with a coordinated approach through the use of regular crisis management exercises and other measures. Through its diverse range of activities in the areas of environmental, nature and species protection, EnBW also utilises the opportunity – beyond its core activities – to make a substantial contribution to improving environmental protection. Thanks to the positive public perception of these activities, they can also have a positive impact on our key performance indicator Reputation Index.

At the same time, EnBW also faces potential risks due to the ongoing process of climate change. For example, more frequent extreme weather conditions leading to highly fluctuating water levels or limits being placed on emissions locally could have an especially negative impact on the operation of power plants and thus the security of supply (electricity grids). The operation of hydropower plants can be restricted by both a lack of or also an abundance of water. The output from thermal power plants that must be cooled could possibly be impacted by temperature limits on discharged water. Increasing volatility in the availability of wind, water and sun presents challenges in terms of planning certainty for the operation of power plants and the sale of volumes of electricity. For this reason, the top opportunity/top risk wind fluctuations has been reported since the Integrated Annual Report 2016, although these opportunities/ risks have no material effect on non-financial issues. In addition, there is uncertainty due to increasing environmental restrictions for the realisation of projects for sustainable energy generation and for the operation of power plants. These risks are managed and mitigated in internal processes using targeted control measures.

Alongside changes in physical climate parameters and other developments relating to or governed by environmental factors, regulatory guidelines and changes in the market also flow into the risk evaluation process. However, there are also opportunities such as changing customer needs and an increasing demand for climate-friendly products such as e-mobility. These opportunities and risks are regularly and systematically identified Group-wide. The first recommendations from the Task Force on Climate-related Financial Disclosures (TCFD) have been implemented and are communicated in the report on opportunities and risks. Building on the revision of the risk map in 2016, special focus will be placed on sustainability aspects – especially climate protection targets – and they will be anchored more deeply in the risk evaluation process in future.

Figure 38: CLP's risk management framework
[CLP website](#)

MANAGEMENT APPROACH

Effective risk management that takes into account the need to balance risk and opportunity is critical to the long-term growth and sustainability of our business.

Risk Management Framework

Risk is inherent in our operations and the markets in which we operate. We aim to identify risks early so that they can be understood, managed, mitigated, transferred or avoided. This demands a proactive approach to risk management.

CLP's risk management framework comprises four key elements:

- 1) Risk management philosophy;
- 2) Risk appetite;
- 3) Risk governance structure; and
- 4) Risk management process.

CLP's overall risk management process is overseen by the Board through the Audit & Risk Committee. We recognise that risk management is the responsibility of everyone within the Group. As a consequence, risk management is integrated into our company-wide business and decision-making processes. This includes strategy formulation, business development, business planning, capital allocation, investment decisions, internal control and day-to-day operations.

CLP's risk management objectives are two-tiered:

1. Strategic

At a strategic level, CLP focuses on the identification and management of the material financial and non-financial risks associated with the pursuit of our strategic and business objectives. In pursuing growth opportunities, we aim to optimise risk and return decisions as defined and quantified through a diligent and independent review process.

2. Operational

At an operational level, CLP aims to identify, analyse, evaluate and mitigate all operational hazards and risks. We do this in order to create a safe, healthy, efficient and environmentally-friendly workplace for its employees and contractors. Other considerations include ensuring public safety and health, minimising environmental impact, and securing asset integrity and adequate insurance.

Emerging Risks

CLP recognises that global trends have a significant impact on our operating environment. These trends are responsible for significant political, economic, social, environmental and technological changes, which have crucial implications for our strategic execution and operational performance. We recently conducted a megatrend analysis to identify the ESG topics most material to CLP. Following a review of dozens of prospective megatrends, the following five material topics were identified.

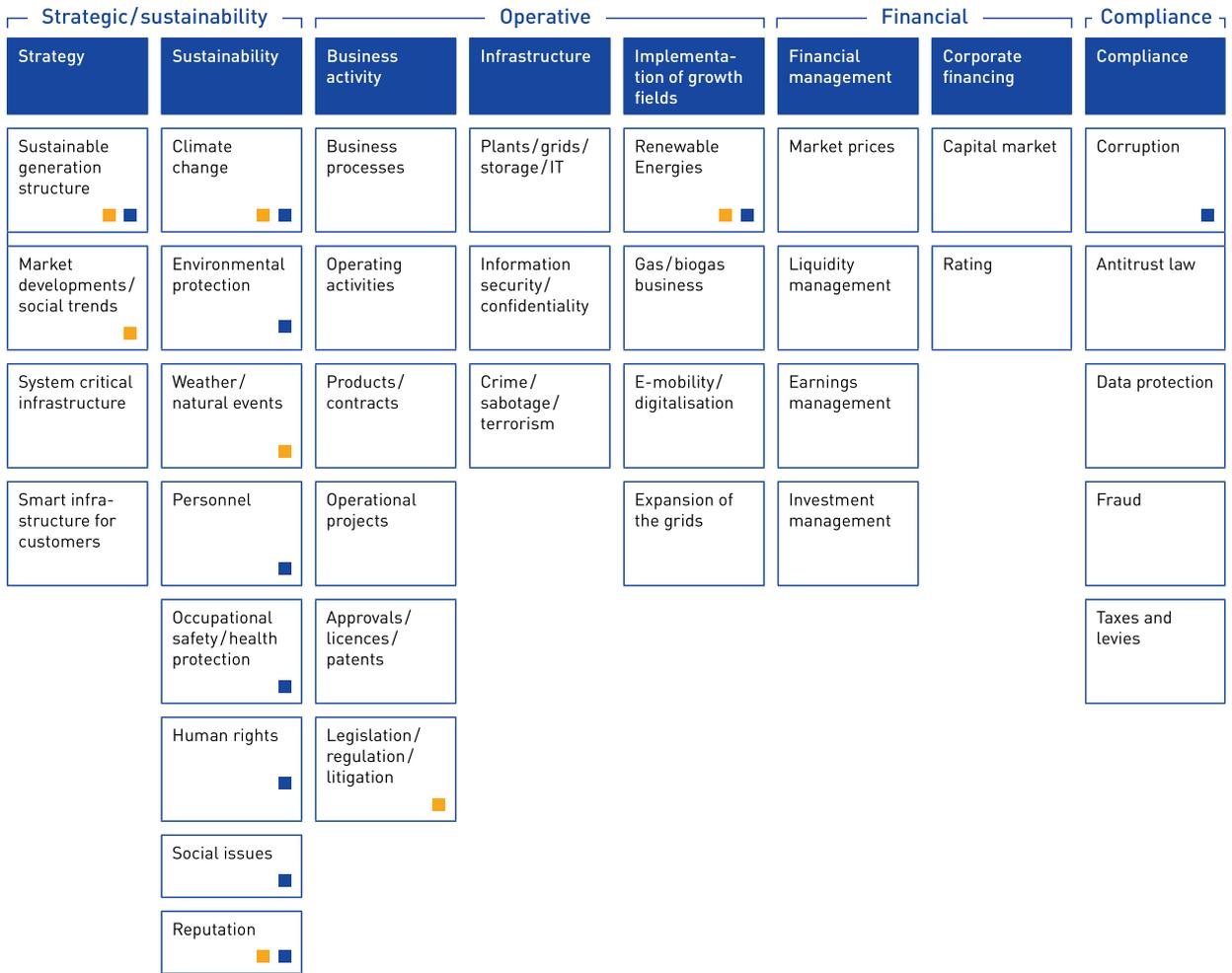
- Increased expectations of business purpose
- Climate change and mitigation
- Technology as enabler and disruptor
- Risks to cyber security and data privacy
- Ever-changing operating environments require an agile, inclusive and sustainable workforce

Going forward, we will continue to strengthen the integration of ESG risks into our risk management framework and processes, including how we consolidate and assess climate-related risks at the Group level.

Figure 39: EDP's disclosures on the management of climate-related risks
EDP Sustainability Report 2018

RISK	RISK TYPE	MAIN IMPACTS AND MITIGATION
PHYSICAL RISKS	Acute , with an impact on the increasing frequency and severity of extreme events, such as heat waves, droughts, floods, storms, forest fires.	Increasing the frequency and severity of extreme events, according to the IPCC scenarios, could disrupt production and distribution activities, as well as increase the operational and capital cost of recovering from damage to distribution and generation network assets. As mitigation strategies, EDP has a comprehensive insurance plan and has been reinforcing business continuity and crisis management plans, thereby minimizing impact to business and third parties.
	Chronic , related to longer-term changes in climate patterns, for example, increase in mean temperature and average level of oceans, and changes in precipitation patterns.	A structural decrease in precipitation, compounded by a potential increase in competitive uses of water, will affect hydroelectric production. IPCC scenario 8.5 is particularly worrisome for the Iberian Peninsula business, and may represent a decrease of 10% in average annual precipitation levels, directly impacting hydro productivity. To mitigate this risk, EDP has a strategy of diversification by technology, geographical area and by business area. Years such as 2017, representing a very dry year (HPI = 0.47), where the impact of the hydrological risk in the Iberian Peninsula was around €300M, may be more common, with the structural reduction of precipitation levels.
TRANSITION RISKS	Regulatory actions on concerted government actions for the adoption of climate mitigation and adaptation strategies, e.g. changes in schemes supporting renewable energies	One of the potential climate regulatory risks identified is related to the change in the regulatory framework regarding generation from renewable sources, with a potential financial impact for EDP. Risk is mitigated through an active strategy of diversification across technologies and geographical areas (see opportunities), asset maturity, as well as through rigorous monitoring of government policy and regulation.
	Technological , regarding the adoption of new technologies requiring greater investment by organizations.	In a fast-paced sector where the current system will be disrupted, the emergence of new, more efficient technologies will require higher levels of investment. The risk of failure to monitor or delay the adoption of new technologies may jeopardize the future. EDP tracks market trends, the study of still-maturing technologies throughout the value chain and has a clear Innovation policy focused on the main trends in the sector (page 42).
	Market , resulting from changes in market dynamics, due to the influence, e.g., of changes in customer behaviour and changes in market fundamentals.	Demand is expected to reduce due to improved energy efficiency. This is driven by a change in consumption patterns (via regulation or change in behaviour), with a potential negative impact on supplier revenues. The medium-term risk in the compliance scenario for the European Energy Efficiency Directive may lead to a 1.5% annual reduction in consumption in the Iberian Peninsula. This risk is positively offset by the current recognition of electrification as a key solution to the decarbonization of the economy, accelerating the reinforcement of the supply of energy services, as described in the opportunities table.
	Reputational , referring to the increase in stakeholder concern and the influence of public opinion.	The electricity sector has traditionally been seen as a net contributor to Climate Change. In a paradigm shift, the Group is strengthening its renewable portfolio, which will surpass 75% by 2020. At the same time, it is recognized for its excellent performance in the various sustainability indexes of which it is part, demonstrating its sustainability and providing evidence of measures and strategies which have been adopted.

Figure 40: EnBW's risk map, with a special focus on TCFD-related information
 EnBW Integrated Annual Report 2018



■ Task Force on Climate-related Financial Disclosures (TCFD) ■ Corporate social responsibility (CSR)



Figure 41: EDF's categorization and prioritization of climate-related risks
EDF Reference Document 2018

Risk categories	Summary of the main risks specific to the Group	Importance
Regulation of the energy markets, section 2.1.1	■ 1A - Evolution of public energy policies and market regulation, including the Multiannual Energy Programme (<i>PPE or programmation pluriannuelle de l'énergie</i>) in France	+
	■ 1B - Evolution of the regulatory framework and tariff regulation	+
	■ 1C - Evolution of the regulatory framework for concessions (hydropower field or public distribution) ***	+
	■ 1D - Insufficient compensation for missions of general interest*	
	■ 1E - Increased cost caused by energy savings certificates*	
Competitive and general context, section 2.1.2	■ 2A - Increased competition in energy markets	+
	■ 2B - Exposure to wholesale energy and capacity market prices	+
	■ 2C - Environment unfavourable to the Group's low-carbon transition solutions	+
	■ 2D- Exposure to the physical effects of climate change	+
	■ 2E - Increased risks of malicious attack, including cyber attacks	+
	■ 2F - Blackout risk	+
	■ 2G - Major crisis	
	■ 2H - Impact of Brexit	
Transformation of the Group, section 2.1.3	■ 3A - Group strategy implementation in line with the defined objectives	+
	■ 3B - Adaptation and development of skills according to the Group's evolution, division requirements and new working methods	+
	■ 3C - Ability to ensure the Group's long-term social and financial commitments (pensions and other employee benefits)	
Operational performance of the Group, section 2.1.4	■ 4A - Management of large and complex industrial projects (including nuclear)	+
	■ 4B - Control of operational and financial performance	+
	■ 4C - Operational continuity of supply chains and contractual relationships with customers and suppliers	+
	■ 4D - Exposure to financial risks (liquidity, exchange rates, interest rates, discount rates)	+
	■ 4E - Occupational safety or health violations	+
	■ 4F- Ethics or Compliance Violations	+
	■ 4G - Industrial safety and impact on environmental heritage including biodiversity	
Nuclear activities of the Group, section 2.1.5	■ 5A - Nuclear safety in operation, exercise of nuclear civil liability**	+
	■ 5B - Safely extending operating life while controlling costs and deadlines** (<i>Grand Carénage</i> in France*)	+
	■ 5C - Management of the final processing of radioactive waste, the decommissioning of reactors and the ability to fulfil the corresponding commitments**	+
	■ 5D - In addition to factor 4-A, additional regulatory, industrial and financial factors are taken into account for EPR projects	+
	■ 5E - In addition to factor 4-B, consideration of fuel cycle management**	

Main scope of exposure, France, Europe and International, with specific notes

* France

** France and United Kingdom

***France and Italy

Figure 42: Iberdrola's identification and management of risks
Iberdrola Sustainability Report 2018

Risk management:

As regards the process for identifying the risk of climate change, Iberdrola's Board of Directors and senior management are committed to identifying and evaluating the risks of the group: a) Ex ante: the risk tolerance levels are reviewed and approved annually through risk policies and limits that establish the qualitative and quantitative risk appetite at the level of the group and at each of the principal businesses and corporate functions; b) Ex post: at least one quarterly supervision of major risks and threats and the different exposures of the group, as well as compliance with the risk policies, limits and approved indicators.

Climate change covers various risks, which to a large extent are not new risks for Iberdrola.

Pursuant to the General Risk Control and Management Policy, risks relating to climate change are included in the catalogue of threats. Within the group, the identification, analysis and management thereof is approached with a multi-departmental focus, in which there is cooperation between corporate as well as business functions with the participation of the highest management levels of the group. Regular review procedures are established for this purpose.

The group's control and risk management system considers and monitors the risks arising from climate change, which can be grouped into:

- Physical: potential material impacts on facilities.

- Transitional: associated with the process of global decarbonisation, including regulatory changes, market prices, technologies, reputation.
- Other: like risks in the supply chain and social phenomena.

Based on the estimates of the impacts and Iberdrola's mitigating elements, it is not expected that the climate change risks evaluated will have a catastrophic or permanent impact on the group's consolidated figures analysed to 2040, which are globally resistant. In any case, the opportunities arising for the company from the decarbonisation of the global economy are greater than the risks.

Figure 43: EDF's strategy for physical and transition risk mitigation
EDF Reference Document 2018

ADAPTING TO CLIMATE CHANGE

Climate change has direct impacts on the physical conditions for performing the Group's activities, and indirect impacts as well (changes in energy demand, disturbances in the competitive environment). Since 2010, the EDF group has been implementing a climate change adaptation strategy which aims to reduce or avoid the harmful effects of these impacts, while preserving their benefits.

This strategy concerns physical and transition risks. It involves:

- assessing the current and future impacts of climate change on existing facilities and business activities;
- adapting the installations concerned to make them less sensitive to climatic conditions and increase their resilience to extreme changes and situations;

- taking into consideration assumptions of changes in weather conditions in the facilities' design;
- adapting the Group's solutions, internal operations and know-how in light of climate change.

EDF's R&D Department has methods and tools to model the impacts of climate change, propose solutions to alleviate these impacts and anticipate the direction in which energy systems might evolve:

- a "Climate Department" was set-up, tasked with producing prospective data that allows identifying the physical risks of climate change;
- a research programme was initiated on the robustness of nuclear and thermal power plant heat sinks in operation.

It includes results obtained from assessments of water availability in the French watersheds concerned;

- other research projects aiming to anticipate the developments of the energy systems, and discover the constraints which they will face, the disruptive factors.

Adapting to the physical effects of climate change mainly concerns structures with a long life cycle: nuclear and thermal power plants, hydropower dams, hydrocarbon platforms at sea. As wind and solar power plants are intended to be operated for a shorter period (approximately 20 years), they are relatively unaffected, especially as they are lightweight facilities with easy-to-replace equipment.



METRICS AND TARGETS

TCFD RECOMMENDATION

Disclose metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

The TCFD recommends that companies:

1. Disclose the metrics the organization uses to assess climate-related risks and opportunities in line with its strategy and risk management process;
2. Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and any related risk;
3. Describe the targets the organization uses to manage climate-related risks and opportunities and performance against targets.

FORUM COMMENTARY

Forum members commonly disclose **operational metrics** to show performance and progress against climate-related targets, including GHG emissions reductions. Commonly reported metrics include absolute Scope 1, 2 and 3 GHG emissions, carbon intensity and low-carbon energy generation capacity (Figures 44, 46, 47, 48, 49, 50, 51, 52). Forum members also use operational metrics to illustrate efficiencies and progress in new areas such as customer engagement or digitalization.

In light of the opportunities presented by the low-carbon transition for the sector, a company's absolute GHG emissions may rise in the short to medium term as growth, geographical diversification and demand for electricity outpaces efficiency improvements and

changes in generation mix. Emissions can also be volatile due to weather variability (e.g., emissions increasing due to drought or inadequate wind resources for a specific year or changing demand due to more heating or cooling needs). Utility companies can partly manage weather variability through geographical diversification. Given the potential volatility of absolute GHG emissions measures, emissions intensity metrics support an understanding of GHG emissions trends particularly in a period of growth. Therefore, it is useful for utilities companies to disclose both intensity and absolute metrics.

Forum members present **financial metrics** primarily to demonstrate investments in different business areas enabling the low-carbon transition, showing that investment choices are aligned with strategies. Forum members most commonly report investments in R&D, generation, technology and networks (Figures 24, 26, 30, 31, 44, 45, 47, 52). Forum members also provide cost savings and earnings connected to different business lines and segments. In some cases, the information required for these metrics is in the financial statements or other conventional financial disclosures on capital allocation plans or R&D spending, although it may not necessarily have a specific climate-related label. Disclosures highlighting expenditure connected to operations and maintenance can also give an indication of broader efforts to support the low-carbon transition.

Metrics that reflect strategy and long-term ambitions are useful for demonstrating and tracking progress against the company's intentions and direction. Disclosures about project pipelines and other investments give an indication of plans beyond five years and the extent to which the company is aligning with future

trends and integrating innovation into its business model. Disclosures about medium- and long-term targets are useful when they include descriptions outlining how companies will reach targets (e.g., through changes in generation mix, efficiency improvements). However, longer-term views of the generation mix and business model will depend on assumptions about how the industry, market and regulatory environment will evolve and companies will need to update them as the portfolio changes.

Choice of metrics and comparability: Forum members support efforts to categorize, structure and define activity that relates to the transition, for example, investments in generation, transmission and distribution, infrastructure and customer solutions. This area needs further work; but it is also important that companies choose suitable metrics so that disclosures appropriately reflect individual business models (for example, R&D strategies focused on open innovation models and/or partnership models), company size and geographical scope. It is therefore important that companies explain in their disclosures why they have used particular metrics, the scope applied and how they define the terms relevant to an understanding of the metric. Forum members highlighted the work of the European Commission's technical expert group on sustainable finance in relation to the development of a classification system for environmentally sustainable economic activities as a relevant development seeking to support comparability.

Table 3 outlines illustrative metrics collated through the Forum's discussions, including with certain investors. At present, a number of these metrics do not have universally agreed definitions and

companies choosing to disclose these metrics should explain how they define metrics and associated terminology according to their business reporting.

As climate-related disclosures evolve over time, there will be opportunities to support greater comparability, for example by standardizing categorizations of

transition enabling activities. Further work could also involve connecting emission reductions and emission intensity to a full range of technologies and activities to give a complete picture of how companies are managing the transition.

Table 3: Illustrative metrics for electric utilities sector responses to the TCFD recommendations – collated by Forum members

KPIS	UNITS	COMMENTS
Total CO ₂ e (carbon dioxide equivalent) emissions (Scope 1)	Tons CO ₂ e	
CO ₂ e emissions intensity (Scope 1)	Tons CO ₂ e/MWh	Companies should provide a comprehensible (and meaningful) description of the methodologies, scope and approach used to calculate or estimate the metrics.
Total CO ₂ e emissions (Scope 2)	Tons CO ₂ e	
Total CO ₂ e emissions (Scope 3)	Tons CO ₂ e	
Renewable capacity	GW - % & total	
Renewable generation	GWh – % & total	Companies usually report on the breakdown of each energy source – wind, solar, hydro (as each has specific characteristics and combined with the geographic breakdown will also give a sense of diversification).
Renewable CAPEX	% & total (local currency)	
Renewable EBITDA	% & total (local currency)	A number of variables can influence earnings, including economic cycle, weather, pricing, market dynamics and commodity prices. Details on how companies define EBITDA can differ (e.g., inclusion of non-recurrent flows, gains on disposals).
Low-carbon capacity	GW - % & total	
Low-carbon generation	GWh – % & total	Companies may choose to separate components or constituents. Companies may also consider disclosing these metrics in a way that aligns with their business reporting segments. According to the International Energy Agency, low-carbon includes technologies that produce low – or zero – greenhouse gas emissions while operating. This includes nuclear, fossil-fuel plants fitted with carbon capture and storage, and renewable-based generation technologies.
Low-carbon generation CAPEX	% & total (local currency)	
Low-carbon generation EBITDA	% & total (local currency)	
Natural gas capacity	GW - % & total	
Natural gas generation	GWh – % & total	Renewables include bio-gas. Companies may also consider disclosing these metrics in a way that aligns with their business reporting segments.
Natural gas CAPEX	% & total (local currency)	
Natural gas EBITDA	% & total (local currency)	A number of variables can influence earnings, including economic cycle, weather, pricing, market dynamics and commodity prices. Details on how companies define EBITDA can differ (e.g., inclusion of non-recurrent flows, gains on disposal). Renewables include bio-gas. Companies may also consider disclosing these metrics in a way that aligns with their business reporting segments.
Non-generation transition enablers CAPEX & EBITDA	% & total (local currency)	Companies will need to clarify the scope and definitions associated with this transition enablers category. It could include EV infrastructure, customer solutions (e.g., smart meters, energy services), smart networks (e.g., demand forecasting, automation and analytics), transmission and distribution infrastructure and storage. Companies may also consider disclosing these metrics in a way that aligns with their business reporting segments.
Non-generation transition enablers	Number	Companies will need to clarify the scope and definitions associated with this category. It could include number of EV charging points (public/private – owned, managed, financed), number of smart meters (% & total), number of customer solutions sales, etc.

USER PERSPECTIVES

Investors and other users have expressed interest in understanding the financial implications of the energy transition on electric utilities, likely effects on profitability and cash flows driven by climate adaptation and climate mitigation. In particular, investors are interested in:

The current business model and financial plans

Users look to assess a utility company's level of preparedness for the low-carbon transition from a financial perspective, looking in particular at the following financial indicators:

1. Metrics that give an understanding of the current business model and where it generates value
 - An indication of the proportion of low-carbon generation vs. total generation (with clear definitions of low-carbon)
 - The proportion of profit generated by low-carbon business, for example, how much profit the company makes from fossil fuel vs. low-carbon
 - How commercial value is made from different business lines, such as customer vs generation

2. Financial metrics that give an indication of the future business model

- Financial planning, including capital allocation plans, R&D to support the low-carbon transition, anticipated changes in EBITDA from low-carbon business development, investments in non-generation activities

3. Geographical information so that users can assess

- Where the company is making a profit geographically and assess cost competitiveness
- Alignment of business with country-specific low-carbon policies and risks associated with unexpected changes in government policies
- Physical climate risks affecting assets and energy demand

Mitigation targets and plans for achievement

1. Users want to assess progress on long-term decarbonization targets over time and how these targets align with the utility's overall strategy. The most useful disclosures include:
2. The scope of the targets, baseline, timelines and how the company takes previous mitigation efforts into account

3. How carbon intensity and/or absolute targets contribute to planned carbon neutrality and Paris targets

4. How carbon intensity and absolute GHG emissions reduction targets are relevant to future plans (for example, whether the targets relate to the utility company's own operations or as an enabler for carbon reduction in the value chain) and how intensity and absolute can be reconciled (where absolute GHG emissions continue to rise)

5. How divestments and acquisitions affect and adjust targets

6. Significant milestones for long-term goals

7. Plans and components for the achievement of targets over time, including:

- Interim targets and the expected relative contributions from offsetting, electrification, efficiency gains, changes in the energy mix, etc., understood as being subject to adjustment over time
- What the trajectory towards targets means in terms of investment, R&D and capital expenditure

Examples

Figure 44: Enel's climate-related metrics disclosure
Enel Annual Report 2018

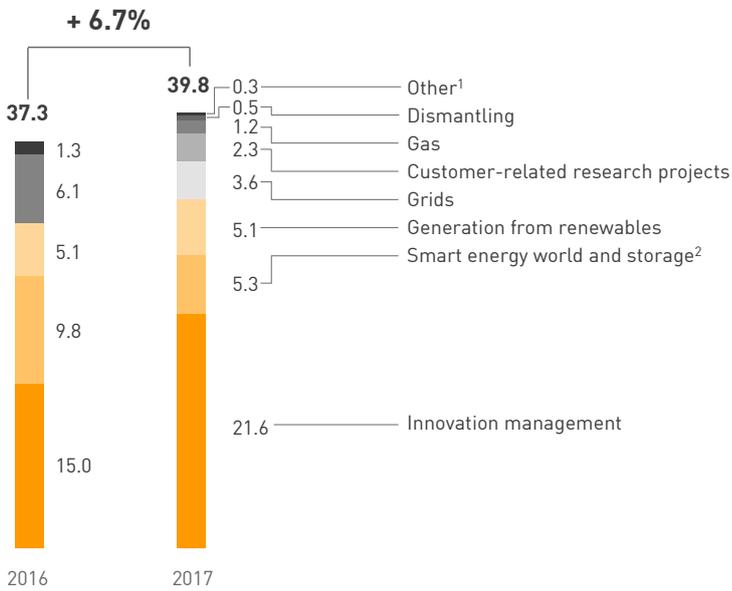
Main climate change indicators

	2018	2017	Change	
Net renewable production (% of total)	39.5	32.7	6.8	-
Emission free production (% of total)	49.1	43.3	5.8	-
ISO 14001-certified net efficient capacity (% of total)	98.5	99.0	(0.5)	-0.01%
Average thermal generation yield (%) ⁽¹⁾	40.1	40.7	(0.6)	-
Specific emissions of CO ₂ from net production (kg CO ₂ /kWh _{eq}) ⁽²⁾	0.369	0.411	(0.042)	-10.2%
Specific water requirement for total production (l/kWh _{eq}) ⁽³⁾	0.38	0.44	(0.06)	-13.6%
Drawings of water in water-stressed areas (%) ⁽⁴⁾	12	9	3	-
Generation with water consumption in water-stressed areas (%) ⁽⁴⁾	8	8	-	-
Direct greenhouse gas emissions - Scope 1 (million/t)	94.80	105.51	(10.71)	-10.2%
Indirect greenhouse gas emissions - Scope 2 (million/t _{eq}) ⁽⁵⁾	1.09	1.19	(0.10)	-8.4%
Other indirect greenhouse gas emissions - Scope 3 (million/t _{eq}) ⁽⁵⁾	6.78	7.14	(0.36)	-5.1%
Total direct consumption of fuel (Mtoe)	37.0	41.3	(4.3)	-10.4%
Reference price of CO ₂ (€)	13.0	5.3	7.7	-
EBITDA from low-carbon products, services and technologies (billions of euro) ⁽⁶⁾	14.5	13.4	1.1	8.2%
CAPEX for low-carbon products, services and technologies (billions of euro) ⁽⁶⁾	7.5	7.6	(0.1)	-1.3%
Ratio of capex for low-carbon products, services and technologies to total (%) ⁽⁶⁾	89.0	88.9	0.1	-

- (1) Percentages calculated using new method that does not include oil and gas plants in Italy that are in the process of decommissioning or are marginal among thermal plants. The figures also do not consider consumption and generation for co-generation at Russian thermal plants. The average generation yield is calculated on the basis of the number of plants and weighted by output.
- (2) Specific emissions are calculated as total emissions from simple thermal generation and co-generation of electricity and heat as a ratio of total renewables generation, nuclear generation, simple thermal generation and co-generation of electricity and heat (including the contribution of heat in MWh equivalent).
- (3) Following the adoption of the new GRI 303, from this year the value previously indicated as specific consumption is now indicated as specific requirement. Requirement is the total quantity of water drawn, including the reuse of waste water, necessary for the operation of a generation plant. The specific requirement for total production is calculated as total water consumption by simple thermal generation and co-generation of electricity and heat and nuclear generation as a ratio of total simple thermal generation and co-generation of electricity and heat (including the contribution of heat in MWh equivalent), renewable generation and nuclear generation. The value does not include water drawn for use in open-cycle cooling, which is then returned to the original water source. For 2018, the value of the water requirement changed as a result of a change in the accounting criteria adopted in the nuclear sector, where cooling water returned to the recipient body of water is no longer included, as already done for all plants that adopt an "open-cycle" cooling system. Under the recalculated system, in 2017, total water drawn for generation processes amounted to 112.2 million cubic meters.
- (4) The World Resources Institute (WRI) has defined "water-stressed area" as an area in which annual per capita water availability is less than 1,700 m³.
- (5) Scope 2 emissions: indirect CO₂ emissions for 2018 due to the consumption of electricity for electricity distribution, transport of fuel, coal mining, facilities management and electricity purchased from the grid by hydroelectric plants are estimated as the product of electricity consumption and the respective weighted coefficients of specific emissions for the entire generation mix of the countries in which the Enel Group operates (Source: Enerdata - <https://www.enerdata.net/>). Following a change in methodology, the figure for 2018 also includes electricity purchased from the grid for pumping at hydroelectric plants. The share of emissions connected with grid losses for electricity consumed has been included in Scope 3 emissions rather than Scope 2 as previously. The figure for 2017 has been recalculated. Scope 3 emissions: indirect CO₂ emissions for 2018 due to the marine transport of coal are estimated on the basis of the amount transported (equal to 69.5% of total coal used), considering Panamax ships with a tonnage of 67,600 tons travelling an average distance of 700 nautical miles over 22 days of steaming, using 35 tons of fuel oil per day, with an emissions coefficient of 3.2 kg of CO₂ for each liter of oil burned, including three days for unloading with a consumption of 5 tons of fuel oil. Indirect emissions of CO₂ from rail transport of coal are estimated on the basis of the amount transported (equal to 30.5% of coal used), considering trains with a tonnage of 1,100 tons travelling an average distance of 1,400 km with a consumption of 6.9 kWh/t for each 100 km of transport and the average emissions coefficient of Enel in the world. Indirect CO₂ emissions from the transport of consumables, fuel oil, diesel, solid biomass, refuse-derived fuel (RDF) and waste are estimated on the basis of the amount of raw materials transported, considering trucks with a tonnage of 28 tons travelling an average distance (out and back) of 75 km, using 1 liter of diesel for each 3 km travelled with an emissions coefficient of 3 kg of CO₂ for each liter of diesel burned. The figure is an approximate estimate of fugitive methane (CH₄) emissions of the coal imported and used by the Enel Group for thermal generation. The figure does not include emissions from the transport of lignite. The figures for 2017 have been restated following the adoption of a new methodological approach. The share of emissions connected with grid losses for electricity consumed has been included in Scope 3 emissions rather than Scope 2 as previously.
- (6) "Low-carbon products, services and technologies" include the Business Lines of Enel Green Power, Infrastructure and Networks, Enel X and Sales (80%, excluding gas).

Figure 45: EnBW's R&D expenditure
EnBW Investor Factbook 2018

Expenditure on research, development and innovation
in € m



¹ Also includes conventional generation
² Includes, e.g. electromobility and hydrogen

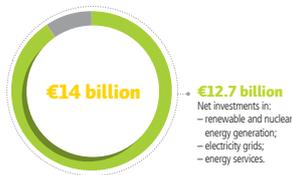
Figure 46: Iberdrola's installed capacity of renewables
Iberdrola Sustainability Report 2018

Iberdrola total	Renewables	61,754	50,747	56,443
	Onshore wind	36,605	33,878	32,162
	Offshore wind	1,642	821	728
	Hydroelectric	22,416	15,321	22,597
	Mini-hydro	670	394	686
	Solar and others	421	333	270
	Nuclear	23,536	23,254	24,381
	Combined cycle	50,654	54,053	50,892
	Cogeneration	8,016	6,853	6,947
	Coal	1,637	2,642	3,803
	Total	145,597	137,549	142,466

Figure 47: EDF's disclosures on low-carbon indicators
EDF 2018 Performance

Over 90% of the Group's net investments contribute to reducing the energy system's carbon intensity...

Total net investments (excluding Group asset disposal plan) in billions of euros



...financed partly by disposals, which help to reduce the Group's carbon footprint.

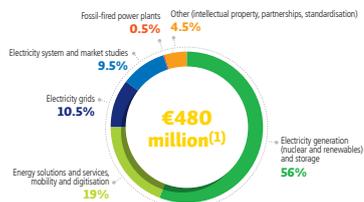
Performance plan: debt reduction and strategic refocusing, with €10 billion⁽¹⁾ in disposals between 2015 and 2018

Non-controlled assets	€4.3 billion
CO ₂ intensive businesses and non-core markets	€1.6 billion
Gas infrastructure assets	€1.7 billion
Real estate assets	€1.6 billion
Other	€0.8 billion

Over €3 billion in disposals of carbon intensive assets between 2017 and 2018

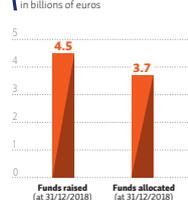
⁽¹⁾ Net debt reduction impact.

95% of EDF's research and development budget in France dedicated to decarbonising and transitioning energy systems.



Innovative financing instruments.

Four Green Bond issues since 2013



Financing of:
- 25 wind and solar projects worldwide.
- Over 400 programmes to renew, upgrade and develop existing hydropower facilities in France.

Financing capacity of €30 million a year in startups with EDF Pulse Croissance

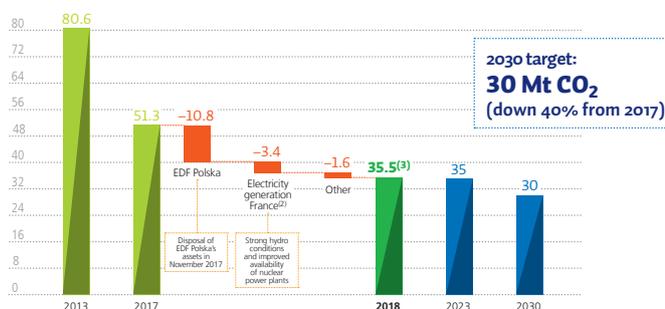
Four areas of focus

Sustainable management of regions	Performance of generation tools
Decentralised energy systems	Services to the home

⁽¹⁾ The amount of 480 million corresponds to the operating expenditure (research activities) of EDF R&D, including financial instruments and capital expenditure.

Figure 48: EDF's scope 1, 2 and 3 emissions disclosures
EDF 2018 Performance

EDF group low-carbon strategy
Total direct CO₂ emissions⁽¹⁾ - in Mt CO₂



Assessment of EDF group greenhouse gas emissions in 2018
in Mt CO₂ equivalent



⁽¹⁾ Direct emissions excluding the life cycle analysis of generating plants and fuel.
⁽²⁾ Including SEI and PEI emissions in non-interconnected regions (mainly islands).
⁽³⁾ The 35.5 Mt CO₂ shown in the 2018 registration document (March 2019) includes, for some minor emission sources, an estimate based on the Group scope and data at the end of 2017. The actual value (35.7 Mt CO₂) reflects the change in scope between 2017 and 2018, in particular the integration of Franatome.

Figure 49: EnBW's Environment KPIs and targets
EnBW Integrated Annual Report 2018

Goal dimension	Goal	Key performance indicator	2018	Target in 2020	
Environment	Expand renewable energies (RE)	Installed output of RE in GW and the share of the generation capacity accounted for by RE in %	3.7/27.9	5.0/>40	The share of the generation capacity accounted for by renewable energies has doubled compared with 2012. Onshore and offshore wind power and hydropower are at the forefront of this development.
	Climate protection	CO ₂ intensity in g/kWh	553	-15% to -20%	EnBW actively contributes to climate protection by successively reducing the CO ₂ intensity of its own generation of electricity (excluding nuclear power) by 15% to 20% by 2020 compared to 606 g/kWh in the reference year 2015.

Figure 50: Iberdrola's scope 1, 2 and 3 emissions disclosures
Iberdrola Sustainability Report 2018

Inventory of Greenhouse Gas Emissions (GHGs)

Iberdrola's inventory of emissions is calculated using the emissions set forth in disclosures 305-1, 305-2 and 305-3. In April 2018, for the ninth consecutive year, Aenor verified Iberdrola's greenhouse gas emissions inventory, covering the direct and indirect emissions from all activities, pursuant to the UNE ISO 14064-1:2006 standard.

Set forth below is the inventory (as of the date of approval of this report) to be submitted for verification in 2019 pursuant to the *Greenhouse Gas Protocol* of the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI).

CO ₂ equivalent emissions to be verified in 2019 (t)	Spain	United Kingdom	United States	Brazil	Mexico	Total
Scope 1: Direct emissions	4,958,842	2,242,114	1,202,792	1,310,724	14,930,626	24,645,098
Scope 2: Indirect emissions	1,081,958	532,699	377,332	486,073	1,773	2,479,834
Scope 3: Other indirect emissions	1,581,743 ⁶¹	3,343,814	9,101,788	4,473,919	2,872,670	21,373,934

Updated information is available in the [Greenhouse Gas \(GHG\) Inventory](#) on the corporate website.

Figure 51: CLP's targets as part of its Climate Vision 2050
CLP Sustainability Report 2018

Tightening CLP's clean energy and decarbonisation targets over time

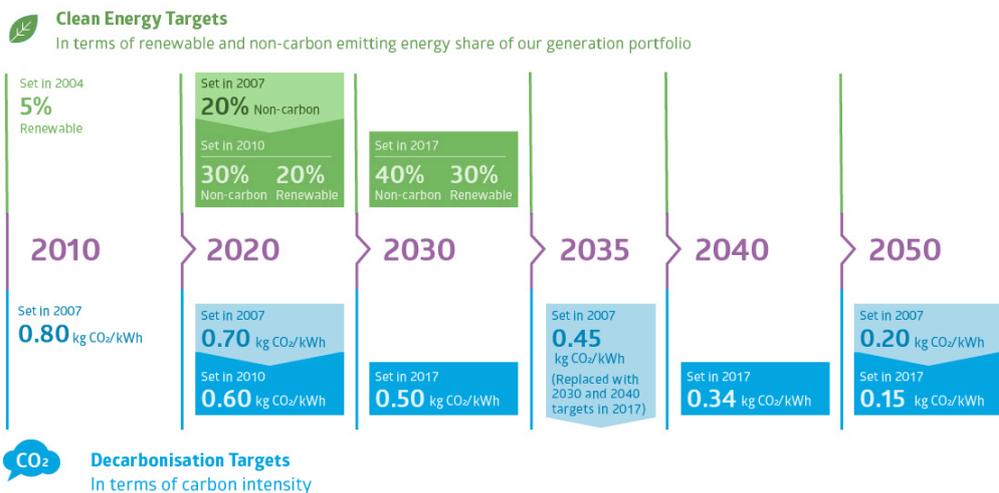
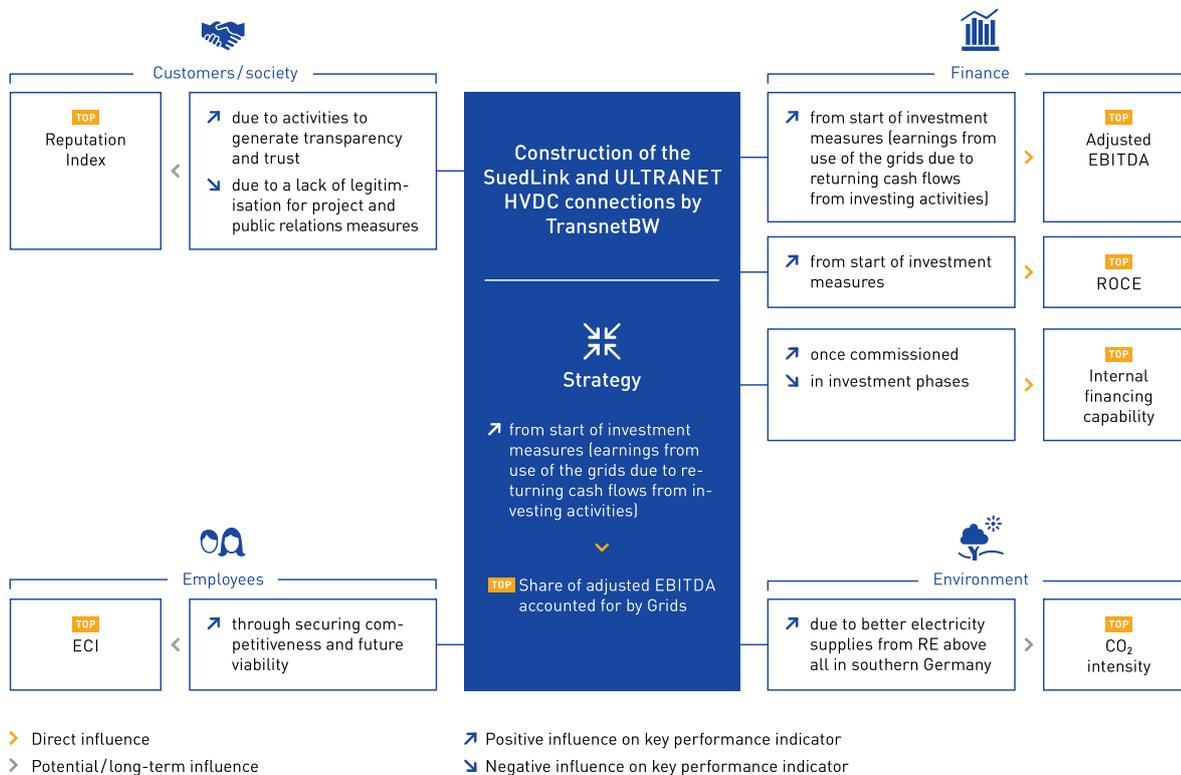


Figure 52: EDP's climate-related financial targets
EDP Sustainability Report 2018

		TARGET 2020	STATUS 2018	OBSERVATIONS
GENERATE ECONOMIC VALUE INVESTING IN DECARBONIZATION	▪ Renewable capacity	▪ ~76%	▪ 74%	  
	▪ Investment in I&D+I (aggregate)	▪ €200M	▪ €211M	
	▪ Smart meters (Iberia)	▪ 90%	▪ 38%	
	▪ Saved Energy (aggregate)	▪ 1 TWh	▪ 1 TWh	

Figure 53: EnBW interdependencies between key performance indicators
EnBW Integrated Annual Report 2018

Interdependencies between key performance indicators using the construction of HVDC connections as an example



4

Conclusion

4 Conclusion

Electric utilities hold a unique system architect role, developing and connecting generation, aggregation, transmission, distribution and demand management. The position and integrated nature of many utility companies means they have a deep understanding of key challenges and opportunities associated with the energy transition, including decarbonization, electrification and technological development.

There is increasing evidence of effective disclosure practices in the electric utilities sector, as demonstrated throughout this report. Forum members are embedding climate change into strategic decision-making and risk management processes, and responding to the TCFD's recommendations with disclosures that demonstrate how they are increasingly shifting strategies and portfolios to renewable energies, diversifying geographically, and developing new technology and product offerings. Operational and financial metrics that demonstrate the size of investments in these areas, progress against targets and views on business model development potential and future resilience support these descriptions.

Practical steps that companies can take now to enhance their disclosures include:

- **Financial focus:** Companies may enhance their disclosures by focusing more on the financial implications of and response to climate change. This could include investments, acquisitions and divestments that support the low-carbon transition, actual or expected earnings, efficiencies and development/management costs.
- **Coherence between strategy and activities:** Providing comprehensive explanations about how the company has designed its strategy and particular activities to support a coherent approach to the low-carbon transition. For example, electric utility companies might explain how investments in and returns from low-carbon generation are complemented by non-generation "transition-enabling" activities supporting flexibility, resilience and efficiency.
- **Clarity about the basis on which information is prepared and the scope of disclosure:** Improving descriptions of the methodologies, calculations, terminology and definitions used for the purposes of preparing and communicating climate-related information, including the extent to which businesses and the value chain are within scope of the reported information.

- **Labeling and organizing information:** This potential enhancement involves reviewing and identifying existing disclosures or internal information sources that the company could use to respond to the TCFD's recommendations. In some cases, information already held or disclosed by companies simply needs labelling or cross referencing to highlight its relevance to climate-related risks and opportunities. For electric utilities this could include highlighting the role of infrastructure, digitalization and customer solutions as low-carbon transition enablers.

Through Forum member discussions and dialogue with users, a number of other opportunities to enhance disclosure have been identified, as the sector continues along the TCFD implementation pathway. The opportunities concerned reflect some of the "fundamental principles for effective disclosure" listed in Appendix 3 to the TCFD's Final Report, including:

- **Comparability:** More work can be done to achieve standardization in climate-related financial information. Although some elements, including metrics, narrative, scenario analysis, etc. are not currently standardized, disclosures should nevertheless contain sufficient information about the basis on which the company has prepared information to facilitate a degree of comparability among utilities by users.

- **Balance:** The TCFD's third Effective Disclosure Principle says that "disclosures should be sufficiently granular to inform sophisticated users" and contain "balanced narrative explanations [so that] risks and opportunities [are] portrayed in a manner that is free from bias". Where it helps users to evaluate a company's risks, opportunities, performance and prospects, companies should consider breaking down climate-related financial disclosures across different technologies, business segments and types of activity, provided that the more granular detail does not distort an understanding of the consolidated group position.

- **Forward looking information:** The TCFD encourages disclosure of both historical and future-oriented information. There is scope to develop disclosures about strategic resilience based on scenario analysis, including disclosure of the assumptions and parameters used in the analysis and selected quantitative information to complement the narrative on strategic resilience.
- **Dialogue:** The role of utilities is changing and expanding, new business opportunities are emerging and companies are exploring new ways of working. As the energy transition continues at pace the relationship, knowledge and understanding shared between preparers and users of information must be developed.

Forum members' strategies and disclosures provide clear evidence of concerted efforts to respond to the energy transition and the TCFD recommendations. Given the critical role of the sector and the size of the challenge and opportunity, it is imperative that these efforts continue and develop. This will provide investors with the relevant information basis for decisions aligned with the aims and ambition of the Paris Agreement.

More effective climate-related financial disclosure can also attract employees who share the company's climate ambitions, catalyze solutions by sharing information, and demonstrate to society how the electric utility industry contributes to a resilient low-carbon future.



5 Appendix

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