



# 2019 FACTS & FIGURES







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# BEFORE STARTING...

This edition of Facts and Figures reflects the situation at the end of 2019, the consequences of the health crisis linked to the Coronavirus are therefore not dealt with in this document

## WHAT'S NEW ?

- EDF's *raison d'être* and business model of EDF
- **Carbon neutrality in 2050:** the Group has adopted an exit target for coal-fired electricity generation by 2030 across all geographical regions
- A description of the first implementations of the 3 CAP 2030 strategic plan projects : **Solar Plan, Storage Plan, Electric Mobility Plan**
- **Strengthening of performance indicators on** Group's six Corporate Social Responsibility Goals
- And an overview of the **Renewables business and its growth prospects**

## Reading suggestions

### Did you know ?

- To help you understand the terms used, you will find a **glossary** at the end of the document
- Moreover, you will find throughout the document some **"Did you know ?"** take away boxes, which enlighten a specific content
- Much more information are available in our URD, which you can download under:

<https://www.edf.fr/en/the-edf-group/dedicated-sections/investors-shareholders/financial-information/regulated-information/reference-documents>

## Navigation suggestions

- To help you navigate through this document, **hypertext links** have been incorporated
- Thus, **a click on the EDF logo** will bring you back to the main table of contents (page 5)
- The name of the chapter can be found at the bottom of each page
- **A click on the name of the chapter** will bring you back to the beginning of this part





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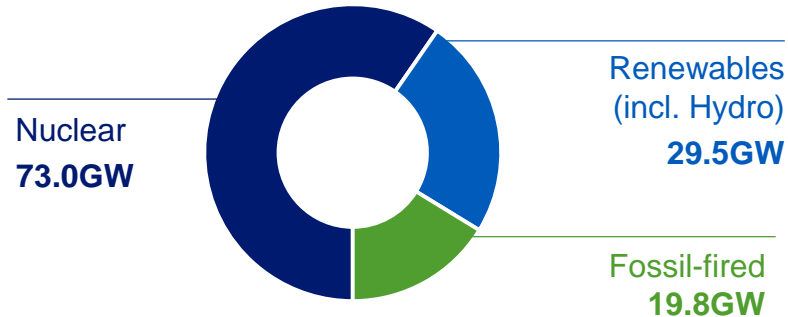
# THE EDF GROUP

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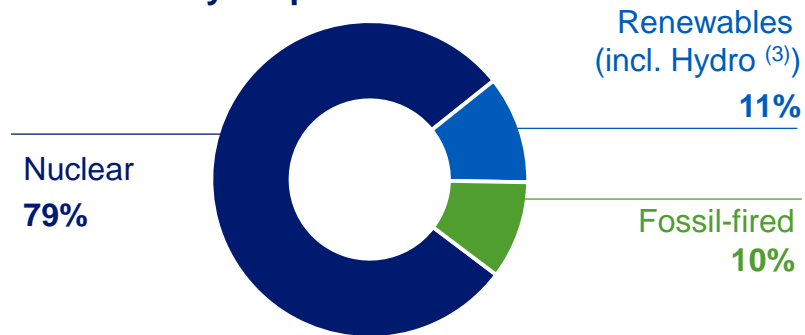
# EDF GROUP 2019 KEY FIGURES

## Operational figures as of end 2019

- **38.9 million customer sites**
- **122.3GW <sup>(1)</sup> installed capacity**



- **557.6TWh electricity output <sup>(2)</sup>**



- **164,727 employees**  
o.w. 63,962 in EDF, 38,754 in Enedis, 14,630 in Framatome, 16,563 in Dalkia and 13,190 in EDF Energy

(1) Consolidated capacities of EDF group  
(2) Output from fully consolidated entities  
(3) Hydro output including pumping

(4) Net income excluding non-recurring items is not defined by IFRS, and is not directly visible in the consolidated income statement. It corresponds to the Group net income excluding non-recurring items, net changes in fair value on Energy and Commodity derivatives, excluding trading activities, net of tax and excluding net change in fair value of debt and equity securities, net of tax  
(5) Sources: rating agencies as of 27/04/2020

## 2019 Financials

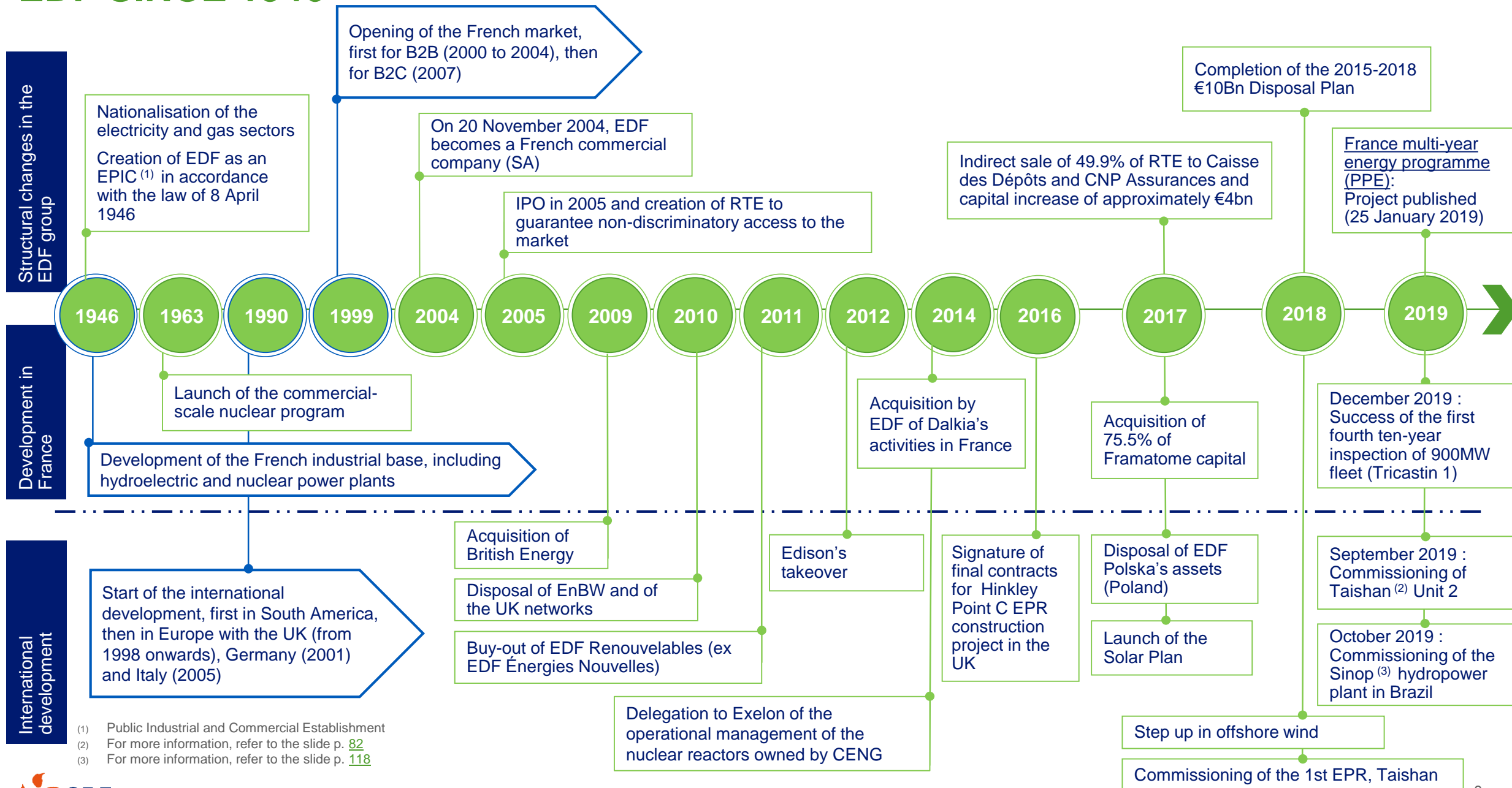
- **Sales: €71.3bn**
- **EBITDA: €16.7bn**
- **Net income excluding non-recurring items <sup>(4)</sup>: €3.9bn**
- **Net investments: €13.9bn**
- **Net financial debt : €41,1bn**
- **Ratings <sup>(5)</sup>: A- negative (S&P) / A3 negative (Moody's) / A- negative (Fitch)**

## Extra-financial ratings

- **CDP** (ex Carbon Disclosure Project) **Climate change**: EDF, member of the "A list" for the 3<sup>rd</sup> time in 2019
- **Sam/DJSI**: score of **80/100** (vs. 79 in 2018), **DJSI World member** for the 4<sup>th</sup> consecutive year
- **Sustainalytics**: score of **86/100** (vs. 83 in 2018), Leader among our peers of Utilities sector for the 3<sup>rd</sup> year
- **FTSE4Good member**: score of **4.7/5** (vs. 4.4/5 in 2018)



# EDF SINCE 1946

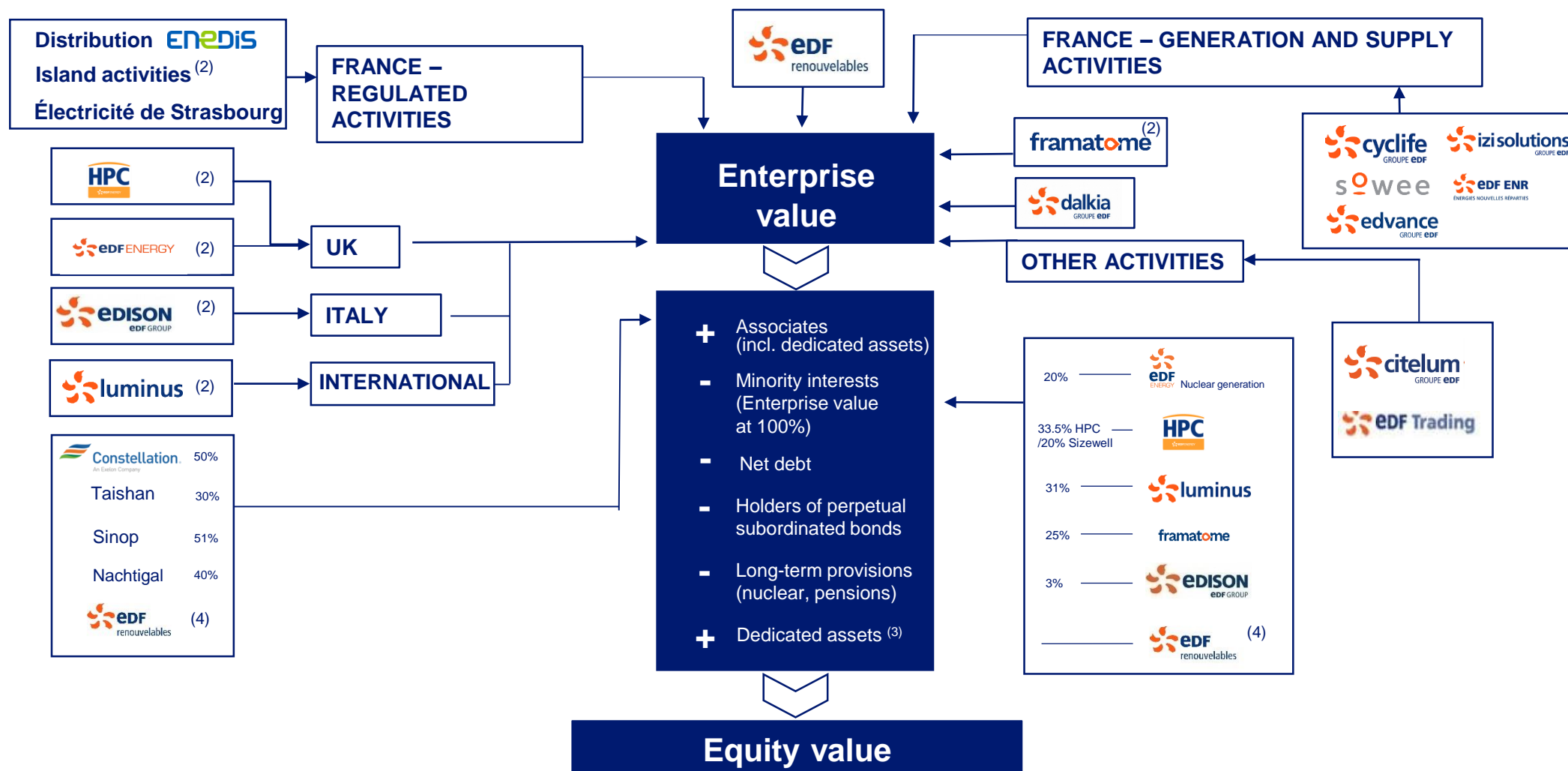


(1) Public Industrial and Commercial Establishment

(2) For more information, refer to the slide p. 82

(3) For more information, refer to the slide p. 118

# EDF GROUP: ORGANISATIONAL CHART (1)



(1) Simplified organisational chart

(2) Shareholdings with significant minority interests

(3) See appendix "Performance of EDF SA's dedicated assets" on [p.245](#)

(4) Companies and shareholdings held at different levels by the EDF Renewables group

# 2019 – 2028 MULTIANNUAL ENERGY PLAN (PPE) FOR FRANCE: STATE OF PLAY

- Publication on 20 January 2020 of the revised draft Decree related to the Multiannual Energy Plan (2019-2023, 2024-2028) and the SNBC<sup>(1)</sup>. Together, they constitute the “French Strategy for Energy and Climate”. They contain several adjustments compared to the first projects submitted for consultation at the beginning of 2019.
- At the end of the ongoing public consultation until 19<sup>th</sup> February, the MEP and SNBC decrees will be published.

Main points in the draft MEP	
Nuclear	<p>14 nuclear reactors to close by 2035 to achieve a 50% share of the electric generation mix, 4 to 6 reactors (including Fessenheim) to be closed by 2028, subject to certain conditions being fulfilled. The draft MEP presents the EDF proposition for the sites potentially concerned. Eventually, It will eventually be up to the government to identify priority sites.</p> <p>Between now and mid-2021: the French government has asked EDF to prepare a file with the nuclear industry by mid-2021 relating to an opportunity on scheduling construction of new plants</p>
Fossil-fired energy	France will close all coal-fired power plants by end-2022. No new all-fossil fuel thermal generation plants will be built
Renewables	<p>Production of 14 to 22TWh of injected biogas in 2028 based on the assumption of a significant cost reduction (€75/MWh in 2023, 60 in 2028)</p> <p>Doubling of installed renewable electricity generation capacity (73GW in 2023, and 100 to 112GW in 2028), including the launch of near 1GW/year of Offshore wind capacity.</p> <p>Increase renewable heat consumption to 25% in 2023 and 40/60 % in 2028 from 2016 figures (155TWh)</p>
Lower consumption of fossil fuels	<p>Target 19% reduction in fossil fuel consumption by 2023 and 34% in 2028 (compared with 2012) ; respectively -10 and -22% for the natural gas</p> <p>Industrial hydrogen: 10% in 2023 and 20 to 40% in 2028 of low-carbon output (renewable or electrolyte)</p> <p>2023: Target of 2.5 million homes renovated, 9.5 million homes heated with wood, 3.4 million housing equivalents connected to a heating network</p> <p>2023: 1.2 million electric passenger cars in circulation (electric and plug-in hybrids) and more than 100,000 public charging points</p>

## Indicative schedule & next steps



(1) Low-carbon national strategy



# BUSINESS MODEL (1/2)

## ASSETS AND RESOURCES - 2019

### Customer proximity

- **33.6** million customers in electricity and **5.3** million customers in gas <sup>(1)</sup>
- Leading brands : EDF, Edison, Luminus, Dalkia
- **47** million customer visits on digital consumption monitoring platforms <sup>(2)</sup>

### A human ambition

- **165,000** employees <sup>(3)</sup>
- **80%** of employees attended a training during the year <sup>(3)</sup>

### An ambitious innovative ecosystem

- EDF Pulse Croissance, a structure dedicated to incubation and support for start-ups, with a financing capacity of some **€60M** in 2019
- More than **2,700** R&D employees <sup>(4)</sup>
- R&D consolidated budget of **€713M** in 2019

### Major industrial assets

- **122.3GW** of electricity generation capacity <sup>(3)</sup>
- An integrated nuclear industry
- EPR technology
- A **33GW** pipeline of renewable wind and solar projects <sup>(3)</sup>
- **1.4** million km of distribution network <sup>(5)</sup>
- **26** million smart meters installed <sup>(3)</sup>
- **340** heating and cooling networks operated by Dalkia

## BUSINESS MODEL



See following slide

## VALUE CREATION - 2019

### For the climate

- A carbon neutrality ambition by 2050 committed **BUSINESS AMBITION FOR 1.5°C**
- Electricity output of **557.6TWh**, **90%** decarbonised <sup>(1)</sup> with emissions of **55g** of CO<sub>2</sub>/kWh <sup>(2)</sup> in 2019
- EDF, a water sharing player: water intensity of **0.87 l/kWh** in 2019 <sup>(3)</sup>



Sustainable Development Goals – United Nations

### For customers

- High customer satisfaction level
- **more than 894,000** struggling customers received energy assistance <sup>(4)</sup>



### For partners and territories

- **~ 100** academic and industrial partnerships
- SMEs account for between **22** and **26%** of EDF and Enedis procurements
- Nearly **213,000** direct and indirect jobs generated <sup>(5)</sup>
- Nearly **90 %** of projects are subject to consultation <sup>(6)</sup>



### For employees

- An employee engagement index of **64%** <sup>(7)</sup>
- Women represent **27.3%** in Management Committees <sup>(8)</sup>
- An average salary equity ratio <sup>(9)</sup> of **6.8**



Sales **€71.3bn**  
EBITDA **€16.7bn**  
Net income **€3.9bn**  
excl. non-recurring items

Sharing added value with our stakeholders

**Suppliers**  
Purchases <sup>(10)</sup>  
**€44bn**  
EDF Group Global CSR Agreement

**States and territories**  
Taxes <sup>(11)</sup>  
**€5.4bn**

**Employees**  
Remuneration <sup>(12)</sup>  
**€14bn**

**Shareholder Dividends**  
Target distribution rate <sup>(13)</sup>  
**45%-50%**

### A solid financial base

- Total consolidated balance sheet: ~ €300 billion
- No. 1 investor among European utilities (€14bn in 2019)

### A strong CSR commitment

- A rating **CDP Climate Change**,
- **No. 2** **SUSTAINALYTICS**
- Nearly €10bn of green & sustainable funding

(1) Consolidated scope. Counted per site  
(2) EDF SA scope excluding French overseas departments and Corsica  
(3) Group scope  
(4) FTEs (full-time equivalent) at Group level  
(5) Enedis distribution network under concession

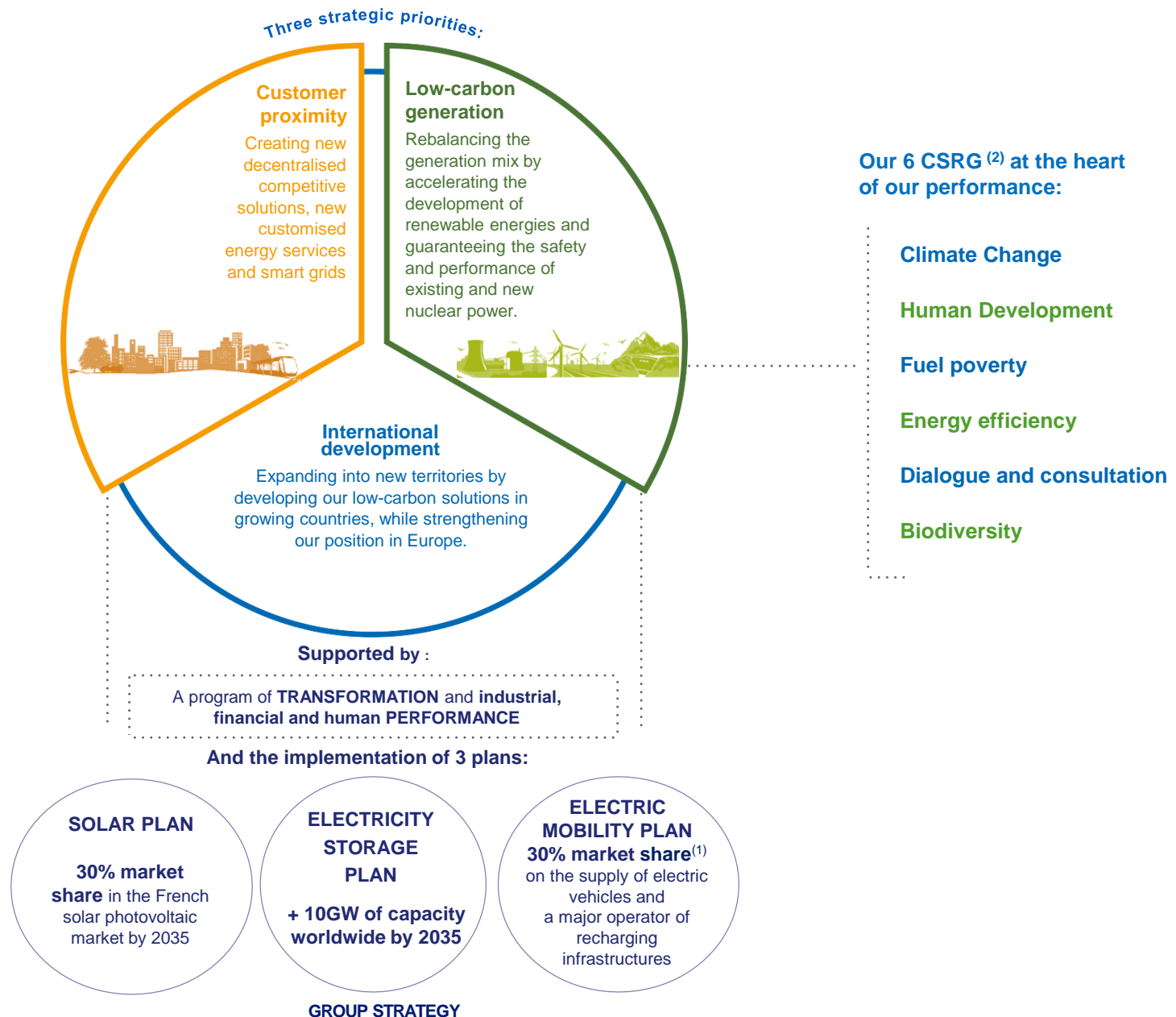
(1) Direct CO2 emissions, excluding life-cycle analysis (LCA) of fuel and generation means.  
(2) CO2 emissions due to heat and electricity generation. Group scope  
(3) Water consumed / electrical generation of fleet. Group scope  
(4) Scope EDF SA + ES  
(5) France excluding Corsica and Overseas. Nuclear DPNT and DIPNN (including EDVANCE) and DTEAM and non-fuel purchases  
(6) In accordance with the Equator Principles - Group Scope  
(7) MyEDF Group internal survey

(8) Group Scope  
(9) EDF SA perimeter - ratio established in accordance with the guidelines published by AFEP  
(10) Consolidated purchases and other external expenses  
(11) Consolidated taxes, including income taxes  
(12) Consolidated personnel expenses  
(13) Rate applied to net income excluding non-recurring items adjusted for the remuneration of hybrid bonds accounted for in equity excl corona virus decision

## BUSINESS MODEL (2/2)

**CAP 2030**

« **Raison d'être** » of EDF  
To build a net zero energy future with electricity and innovative solutions and services, to help save the planet and drive wellbeing and economic development



(1) In France, the United Kingdom, Italy and Belgium.

(2) Corporate social responsibility goals

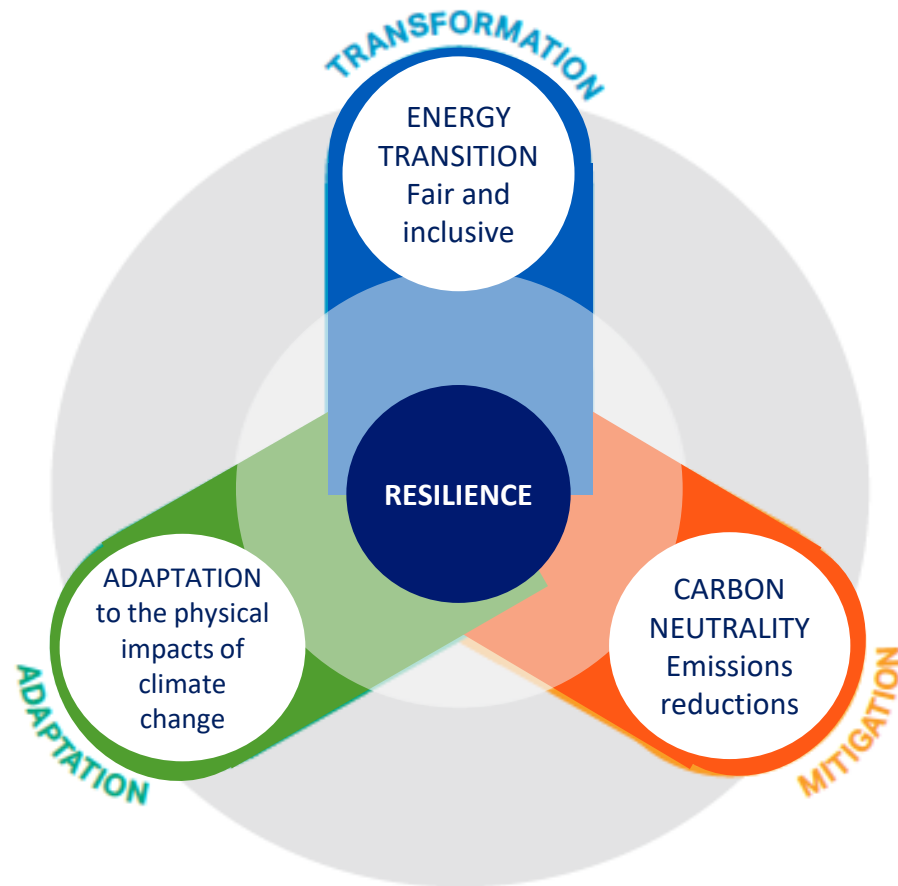


**edf**

FACTS & FIGURES 2019

# EDF'S CLIMATE STRATEGY IS DEFINED AROUND 3 DIMENSIONS

Electrifying uses, innovating,  
helping customers to consume  
more efficiently and fighting energy  
poverty



Make our facilities (new and  
existing) resilient and less sensitive  
to the increase in extreme weather  
events (heat waves, droughts,  
storms, floods, etc.).

Reduce direct greenhouse gas  
emissions to zero or near-zero in  
2050



# NET ZERO: AT THE HEART OF THE RAISON D'ÊTRE



## Carbon neutrality for EDF

=

Close to zero direct emissions

+

Reduction of indirect emissions as significant as possible within the framework of national policies

+

Offsetting residual by compensation through negative-emission projects

## New commitments

A decrease in the Group direct emissions raised from 40 to 50% by 2030 compared with 2017

A commitment to reduce indirect emissions (scope 3)

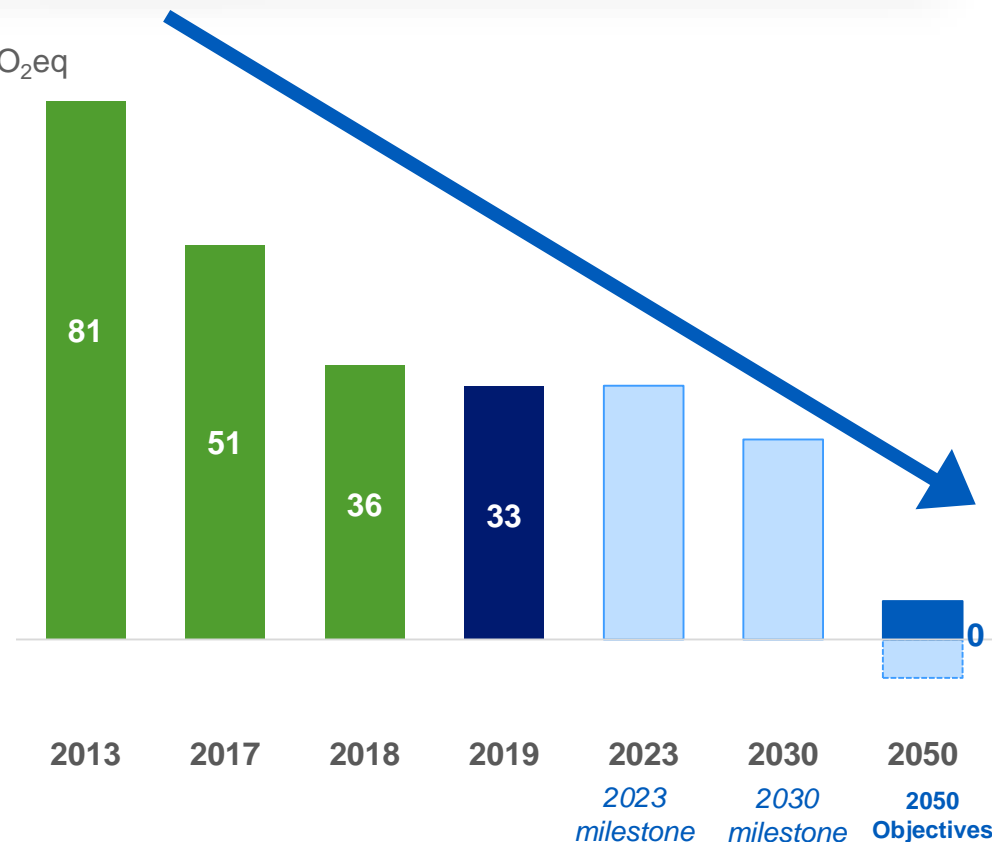
## « Business Ambition for 1.5 degrees »

in 2020 EDF joined this coalition alongside with +200 companies worldwide and is committed to the carbon neutrality in 2050



## DIRECT GREENHOUSE GAS EMISSIONS<sup>(1)</sup> (SCOPE 1)

in MtCO<sub>2</sub>eq



2020 new commitments - Work in progress with SBTi regarding figures' adjustment

(1) Direct GGE emissions, excluding life cycle assessment (LCA) of generation facilities and fuels.

# GROUP INDUSTRIAL PLAN: CAP 2030

## CAP 2030

### 3 priorities

#### CUSTOMER PROXIMITY

To create new, competitive decentralised solutions, new personalised energy services and smart grids

#### LOW-CARBON GENERATION

To rebalance the energy generation mix by accelerating the development of renewable energy and guaranteeing the safety and performance of existing and new-build nuclear facilities

#### INTERNATIONAL DEVELOPMENT

To expand into new geographical areas by developing our low-carbon solutions in growth countries while bolstering our positions in Europe



### 1 transformation programme

ACCOUNTABILITY  
PERFORMANCE




SIMPLIFICATION

DIGITAL INNOVATION

### Driven by human ambition

To build a net zero energy future with electricity and innovative solutions and services, to help save the planet and drive wellbeing and economic development

# CAP 2030: AMBITIOUS OBJECTIVES ON 3 STRATEGIC AXES

<b>CUSTOMER PROXIMITY</b> 	<b>LOW-CARBON GENERATION</b> 	<b>INTERNATIONAL DEVELOPMENT</b> 
<p>Create new, competitive decentralised solutions, new personalised energy services and smart grids</p> <ul style="list-style-type: none"> <li>➤ Deploy <b>new digital services</b> for retail customers</li> <li>➤ Support the <b>development of new uses of electricity</b> (electric vehicles, buildings, etc.)</li> <li>➤ <b>Accelerate R&amp;D</b> on storage, photovoltaics, electric mobility and new networks</li> </ul>	<p>Achieve a new balance for the generation mix by accelerating the development of renewables and guaranteeing the safety and performance of existing and new-build nuclear facilities</p> <ul style="list-style-type: none"> <li>➤ <b>Double the installed capacity of the Group's renewable energy and hydropower fleet:</b> from 28GW in 2014 to 50GW in 2030</li> <li>➤ <b>30% of photovoltaic solar market share in France</b> by 2035</li> <li>➤ <b>Extend the lifespan of the existing French nuclear fleet</b> beyond 40 years</li> <li>➤ <b>Extend the lifespan of the existing British nuclear fleet</b> <sup>(1)</sup></li> <li>➤ <b>Commission up to 10 EPRs</b> by 2030 <sup>(2)</sup></li> </ul>	<p>Expanding into new geographical areas by developing our low-carbon solutions in growth countries while bolstering our positions in Europe</p> <ul style="list-style-type: none"> <li>➤ <b>Triple the Group's international activities</b> by 2030</li> <li>➤ <b>Become the benchmark in 3 to 5 emerging markets</b>, and ensure a significant presence in a dozen countries to support their energy transition</li> <li>➤ Develop <b>energy services</b> activities and <b>engineering services</b> internationally</li> </ul>

<sup>(1)</sup> 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. [100](#)

<sup>(2)</sup> Partially financed by the Group

# THE GROUP EDF

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# 2019 HIGHLIGHTS



CUSTOMERS AND SERVICES: RENEWAL OF OFFERINGS' RANGE AND BUSINESS DEVELOPMENT



ACCELERATION IN THE DEVELOPMENT OF RENEWABLE ENERGIES



PROGRESS OF THE 3 MAJOR PLANS: SOLAR, STORAGE AND ELECTRIC MOBILITY



NUCLEAR: KEY INDUSTRIAL MILESTONES & CONSULTATION ON A NEW REGULATION



INTERNATIONAL: SELECTIVE DEVELOPMENT & PROGRESS ON LARGE HYDROELECTRIC PROJECTS



ENEDIS: A CONSOLIDATED LOCAL FOOTPRINT AND A STRONG ROLL OUT OF LINKY



# CUSTOMERS AND SERVICES: RENEWAL OF OFFERINGS' RANGE AND SALES DEVELOPMENT



## RENEWED AND INNOVATIVE OFFERINGS' RANGE IN FRANCE

- **Estimated France market share of 77.7%** for the B2C segment and 56.9% for the B2B segment
- **Extension of offerings' range:**
  - Launch of “Mes Jours Zen”, an electricity offer adapted to new consumer habits
  - Signature of first long term PPAs for the B2B segment in France (Metro, Société Générale, etc.)
  - “Mon Soleil & Moi”: 10,000 solar installations completed, over 5,000 of which in 2019
- **Success of market offers: more than 550,000 residential electricity customers in France**
- **Over 1.5 million residential gas customers**
- **Hydrogen:** first commercial successes by Hynamics



## GROWTH IN SERVICES

- **Acquisition of Breathe by Dalkia and EDF Energy** (via Imtech): a specialist in energy performance in the UK - revenue of £15m in 2018
- **Renewal or signature of new contracts at Dalkia** (district heating network for Grande Ile in Vaulx-en-Velin and Villeurbanne; energy performance contract at 26 Safran sites)
- **Launch of the services platform “IZI by EDF”** for residential customers and small businesses and integration in 2020 of **MyChauffage** to step up the Group offer on heating equipment and heat pumps

# ACCELERATION IN THE DEVELOPMENT OF RENEWABLE ENERGIES <sup>(1)</sup>



**DOUBLING**  
OF CONSTRUCTION  
START (WIND AND SOLAR)



## STRONG ACHIEVEMENTS IN OFFSHORE WIND

- **OVER 2GW** OF OFFSHORE WIND PROJECTS UNDER DEVELOPMENT OR CONSTRUCTION
- EDF THE **LEADER IN FRANCE**, WINNING 4 OUT OF 7 CALLS FOR TENDER

### OFFSHORE WIND SUCCESS IN FRANCE AND THE UK

- **Saint-Nazaire (480MW)**
  - No. 1 offshore wind farm in France, construction initiated
- **Neart na Gaoithe (UK) (450MW)**
  - Launch of the construction of the offshore wind farm with new Irish partner ESB
- **Dunkerque (~ 600MW)**
  - Call for tender awarded, ahead of 6 other competitors

### AND OFFSHORE WIND DEVELOPMENT PROSPECTS

- **USA:** Atlantic Shore project (**potential of 2GW**)
- **Ireland:** Codling project (**potential of 1GW**)
- **China:** Dongtai IV et V projects (**500MW**)



**PROGRESS IN  
HYDRO POWER**



**COMMISSIONING OF  
LA COCHE NEW  
HYDRO PLANT  
IN FRANCE (240MW)**



**EDF: NEW  
GREEN BOND  
FRAMEWORK**

(1) The EDF group's business development model is based on partnerships. Not all of these projects will necessarily be fully consolidated.

# THE FRENCH SOLAR PLAN

A STRONG ACCELERATION OF SOLAR PV DEVELOPMENTS



TARGET

BE THE LEADER IN FRANCE

ACHIEVE **30%**  
MARKET SHARE BY 2035

► **~ 1GW/Y** TO DEVELOP ON AVERAGE  
BETWEEN 2020 AND 2028 <sup>(1)</sup>



SOLAR PLAN PREPARATION WELL  
UNDER WAY



c.2,000ha  
LAND SECURED

**x7** VS 2017



c.500MWc  
AUTHORISED

**x5** VS 2017



23 projects  
AWARDED BY THE FRENCH  
REGULATOR IN 2019  
FOR 180MWc

**x6** VS 2017



Acquisition  
REALISED IN 2019

PROJECT  
PORTFOLIO  
**c.1GW**

(1) The EDF group's business development model is based on partnerships. Not all of these projects will necessarily be fully consolidated.



# ELECTRICITY STORAGE PLAN <sup>(1)</sup>



## TARGET

**DEVELOP 10GW WORLDWIDE IN NEW  
STORAGE SITES BY 2035**  
IN ADDITION TO THE 5GW OPERATED TODAY



## ACHIEVEMENTS AND PROJECTS

- **0.6GW portfolio of storage projects realised or decided** at end-2019, including:
  - *Noor Midelt in Morocco (Solar hybridisation, concentrated solar and storage of 190MW in the form of heat)*
  - *Big Beau, Arrow Canyon and Maverick 2 (Solar hybridisation+LiOn in the USA) for a total of 150MW*
  - *Inauguration of the first Group hybrid power plant wind+storage (Petit Canal Repowering, Guadeloupe)*
- **Acquisition of storage project developer Pivot Power (UK)** (potential portfolio of **2GW capacity**)
- **Launch of microgrids business**
- **Key innovations:**
  - *Commissioning of **Zinc Air battery demonstrators***
  - *Completion of **testing labs and expertise** on the battery cells of EDF R&D*
  - **€16.9m of investments in start-ups in 2018-2019**

(1) The EDF group's business development model is based on partnerships. Not all of these projects will necessarily be fully consolidated.

# EDF ELECTRIC MOBILITY PLAN <sup>(1)</sup>



## TARGETS

### BE EUROPE'S LEADING E-MOBILITY POWER SUPPLIER IN 2022

IN THE GROUP'S FOUR MAJOR MARKETS: FRANCE, UK, ITALY AND BELGIUM

### NO. 1 SUPPLIER OF ELECTRICITY FOR ELECTRIC VEHICLES

SUPPLY ELECTRICITY FOR 600,000 ELECTRIC VEHICLES IN 2022 (30% MARKET SHARE)

### NO. 1 OPERATOR OF ELECTRIC CHARGING STATION GRID

75,000 STATIONS DEPLOYED AND 250,000 STATIONS AVAILABLE ON AN INTEROPERABILITY BASIS IN EUROPE BY 2022

### EUROPEAN LEADER IN SMART CHARGING

4,000 SMART STATIONS OPERATED IN 2020



## ACHIEVEMENTS AND PROJECTS

- **Supporting EDF's customers and European partners in their transition to electric mobility:**
  - *In the United Kingdom, EDF signed a contract with Royal Mail Group, owner of one of the biggest Europe fleet, for the supply and management of charging infrastructures*
  - *In Italy, Edison signed with the Toyota group a partnership for installing and operating more than 300 charging stations, publicly available*
  - *In France, Izivia signed a partnership with France Europcar Mobility Group for an experiment, offering a charging solution for electric vehicles to the Europcar customers*
- **Creation of DREEV**, a new subsidiary dedicated to smart-charging in Europe
- **"EV100" project: development in line with the target: 8.6% of EDF Group vehicles are electric at end-2019**
- **Acquisition of Pod Point**, leader on the British market in the installation and operation of charging stations, with a total of:
  - *62,000 stations in the UK (position #1 B2C and #2 B2B)*
  - *and 6,600 stations in Norway*
- **Acquisition of PowerFlex** (USA), serving to step up the roll-out of infrastructure combining:
  - *smart charging solutions*
  - *and solar energy production and storage resources in California*

(1) The EDF Electric Mobility Plan supplements specific investments made in this field by Enedis, an independent subsidiary of EDF as defined in the French Energy Code.

# NUCLEAR (1/2)



## EXCELLENCE OF THE NUCLEAR SECTOR: LAUNCH OF EXCELL PLAN

- **Enhancement of manufacturing quality**  
(ex: qualification of manufacturing processes beyond the qualification of suppliers)
- **Boosting skills**  
(ex: creation of a university dedicated to nuclear disciplines, specific plan for recruiting and training welders)
- **Strengthening of the governance of major nuclear projects**  
(ex: strategic committee tasked with approving the initial data of the project)



## MAJOR PROJECTS

- **Taishan EPR in China:** commissioning of unit 2 and generation of over 4TWh for unit 2 and 12TWh for unit 1 (on 31/12/2019) since the commissioning
- **Hinkley Point C** <sup>(1)</sup>: “J0” milestone (completion of the safety concrete of nuclear island of unit 1) reached on schedule
- **Flamanville 3** <sup>(2)</sup>:
  - Definition of the scenario on the repair of penetration welds
  - Fuel loading planned for end-2022

(1) See press release of 25 September 2019. Review of costs on completion of the project increased to £21.5bn - £22.5bn in 2015 sterling, excluding interest during the period of construction and excluding currency effects relative to a reference exchange rate of the project of 1 pound sterling = 1.23 euros.

(2) See press release of 9 October 2019. Estimated cost of construction revised to €12.4bn in 2015 euros and excluding interest during the period of construction.

# NUCLEAR (2/2)



## TRICASTIN 1 SUCCESS OF THE FIRST VD4

### Tricastin 1 restart authorised by ASN after 4<sup>th</sup> ten-year visit

- First 4<sup>th</sup> ten-year visit for a 900 MW reactor within the Grand Carénage programme
- Restart after about 7 months: more than 30,000 operations and controls realised and more than 5,000 people mobilised (EDF group and industrial partners)



## TOWARDS NEW REGULATORY FRAMEWORK FOR EXISTING NUCLEAR

### Public consultation launched by the French government on 17 January 2020, on a new regulatory framework for existing nuclear

- Defects of the ARENH highlighted: asymmetry, optionality, lack of a price floor, non-indexation
- The approach is based on the European legal framework: a General Economic Interest Service (SIEG), based on public service obligations
- Designed to establish a balance, safeguarding a market price signal in a corridor of €6 and with a financial mechanism for the netting of flows between the different players



# INTERNATIONAL: SELECTIVE DEVELOPMENT & PROGRESS ON LARGE HYDROELECTRIC PROJECTS <sup>(1)</sup>



## PROGRESS ON LARGE HYDROELECTRIC PROJECTS

- **Commissioning in October 2019 of the Sinop hydroelectric dam** in Brazil (402MW). Electricity sales via PPA over 30 years
- **Start of construction of the Nachtigal run-of-the-river hydropower plant** in Cameroon (420MW). Operational commissioning planned in 2023



## SELECTIVE DEVELOPMENT

- **Engineering assistance of PSPS <sup>(2)</sup> in Dubai and in Israel**
  - Hatta (Dubai): a 250MW project, first PSPS in the United Arab Emirates with DEWA customer and for which EDF is in charge of contributing to feasibility studies, procurement and building monitoring
  - Gilboa (Israel): first PSPS in Israel (300MW), project near end-construction, for which EDF is serving as Project manager support

(1) The EDF group's business development model is based on partnerships. Not all of these projects will necessarily be fully consolidated.

(2) Pumped Storage Power Station.

# ENEDIS: TERRITORIAL ANCHORING CONSOLIDATION AND LINKY PROGRAMME DEPLOYMENT



## TERRITORIAL ANCHORING CONSOLIDATION

- **116 concession contracts renewed in 2019** (or 170 contracts renewed at end-2019) including the localities of Toulouse, Bordeaux, Grenoble and the SIGEIF <sup>(1)</sup> in Île-de-France) for an average period tending toward **30 years**
- Significant achievements supporting **electric mobility in the territories** with more than 150 developed projects in partnership (bus depots, boat charging at wharf, rapid car charging, etc.) and electrification of the Enedis vehicle fleet
- **Crisis management:** 7 mobilisations of the FIRE <sup>(2)</sup> in response to the exceptional climatic events of 2019



## LINKY PROGRAMME DEPLOYMENT

- **7.7 million smart meters installed in the year, bringing the total to 23.4 million at end-2019**
- **2.8 million recurring subscriptions** to the consumption data publication, subscribed by suppliers and third parties



## HIGH-GROWTH IN GRID CONNECTIONS

- **In 2019, more than 30,000 connected renewable facilities** with 900MW of photovoltaic and 1,200MW of wind power plants.
- **Total capacity of the renewable generation fleet connected to the distribution public grid: more than 28GW** with more than 400,000 installations
- Continual momentum of **customers connection (370,000 connections)**

(1) Inter-community commission for power and gas in Île-de-France.

(2) Electricity rapid intervention Force.

# THE GROUP EDF

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# MATERIALITY MATRIX: PRIORITISING COMMITMENTS IN SUSTAINABLE DEVELOPMENT

While considering the views of internal and external stakeholders, the materiality analysis identifies the important sustainability issues likely to have an impact on the Company’s performance, and ranks them according to their potential impact on the Company and its environment <sup>(1)</sup>

The 2017 analysis was updated in 2019 with help from the Sustainable Development Council<sup>(2)</sup> and round tables featuring group managers and experts, the Corporate Responsibility Committee and the members of the Executive Committee

The list of issues was reduced from 35 to 18 “material” issues. Each of the issues identified is precisely described in the URD 2019 (Universal Registration Document). Special attention is paid to issues linked to the six Corporate Social Responsibility Goals.

(1) In accordance with the definition of the principle of materiality, as it appears in Article 225 of the Grenelle 2 Law, the AA 1000 assurance standard, the GRI G4 guidelines, ISO 26000 standard and the IIRC framework on integrated reporting

(2) This concerns a panel of external EDF stakeholders which contributes to challenging Group issues submitted to it.

MATERIALITY MATRIX			
This matrix reflects the 18 most material issues for EDF and its stakeholders			
		Management of radioactive waste and plant decommissioning	Nuclear safety and safety of industrial infrastructures and data
		Action to support energy efficiency	Renewal, extension and performance of the energy mix aimed at decarbonisation
		Creation of value shared with stakeholders, at the service of territories and employment	Performance of offers to end customers (B2B and B2C)
		Sustainable cities, innovation and diversification of solutions	Quality of key project management and responsible investment
		Listening, communication, transparency and dialogue	Adaptation of infrastructure and activity to climate change
		The circular economy and conservation of biodiversity, water air, soils and rare resources	Ethics and the duty of care Company's attractiveness
	Fuel poverty, and access to energy in developing countries  Equal opportunities		
Existence and effectiveness of internal warning systems within the company		Social dialogue	Health and safety of employees and stakeholders



# SIX AMBITIOUS CORPORATE SOCIAL RESPONSIBILITY GOALS SET THE ROADMAP FOR THE GROUP TO DELIVER CAP 2030

- A commitment to change and to working as closely as possible with customers and regions, at the heart of the energy transition and climate issues
- Major and prior commitments, with results reported by the Group<sup>(1)</sup> every year and which are measured by non-financial performance indicators






















<b>CSRG no.1 CLIMATE</b>	➤	The Corporate Responsibility Objective is to go beyond the 2°C path by limiting the Group's direct emissions to 30mt <sup>(2)</sup> in 2030 (scope 1)
<b>CSRG no.6 BIODIVERSITY</b>	➤	To launch a positive approach to biodiversity. Not limited to understanding or reducing the impacts of our activities in the long run but having a positive effect on biodiversity
<b>CSRG no.2 HUMAN DEVELOPMENT</b>	➤	To adopt industrial groups' best practices in terms of human development: health & safety, gender diversity, and social advancement
<b>CSRG no.3 FUEL POVERTY</b>	➤	To offer all vulnerable people information and assistance with energy use and energy benefits
<b>CSRG no.4 POWER EFFICIENCY</b>	➤	Supporting the energy transition of our customers, through tailored offers and more broadly that of all energy consumers through the development of electric mobility, storage solutions and smart grids
<b>CSRG no.5 DIALOGUE &amp; CONSULTATION</b>	➤	To systematically organise a process of transparent and open dialogue and consultation for every new project <sup>(3)</sup> around the world

(1) URD, Chapter 3 – Non-financial performance

(2) A target of less than 30mt is under study to meet with SBTi initiative

(3) New projects involving investments of more than €50 million, entailing a significant impact on regions and the environment

# 18 KPI TO MEASURE OUR CSR PERFORMANCE AND RESPOND TO MATERIALS ISSUES

Corporate responsibility goals	Performance Indicators (KPIs)	Targets	2019	2018	2017	UN SDG <sup>(1)</sup>
<b>CLIMATE</b> CSRG no.1	EDF Group <b>direct greenhouse gas emissions</b> (scope 1) (MtCO <sub>2</sub> eq)	30Mt <sup>(2)</sup> in 2030	<b>33</b>	36	51	 
	Carbon intensity: <b>CO<sub>2</sub> emissions</b> due to heat and electricity generation (gCO <sub>2</sub> /kWh)	-	<b>55</b>	57	82	
	Net installed <b>renewable</b> electrical generation <b>capacities</b> (GW)	50GW in 2030	<b>32</b>	33	32	
<b>BIODIVERSITY</b> CSRG no.6	Level of awareness of the <b>ecological value of the land</b> (%)	-	<b>52%</b>	51%	50%	 
	<b>Water intensity</b> : water consumed / electricity output of the park (l/kWh)	< 1 l/kWh on average for 5 years (2015-2030)	<b>0.87</b>	0.86	0.94	
<b>HUMAN DEVELOPMENT</b> CSRG no.2	<b>Gender balance index</b> : percentage of women in the Management Committees of the Group's entities %	28% in 2023	<b>27.3%</b>	26.3%	-	    
	<b>Overall LTIR</b> (employees and service providers)	< 1.8 in 2020	<b>2.4</b>	-	-	
	Number of <b>fatal accidents</b> linked to business risks (employees and service providers)	0	<b>7</b>	1	7	
	Rate of employees who received <b>training</b> during the year %	75%	<b>80%</b>	83%	84%	
<b>FUEL POVERTY</b> CSRG no.3	Number of <b>Energy assistance</b>	-	<b>894,260</b>	1,302,590	-	   
<b>POWER EFFICIENCY</b> CSRG no.4	Number of Group <b>smart meters</b> installed (millions)	41 in 2021 <sup>(3)</sup>	<b>26</b>	18	10	  
	<b>Electric Vehicles rate</b> in the fleet of light vehicles	100% in 2030	<b>8.6%</b>	< 6.1%	-	
	Number of <b>customer visits</b> on digital consumption monitoring platforms (millions) – Mainland EDF	-	<b>47</b>	28	-	
<b>DIALOGUE &amp; CONSULTATION</b> CSRG no.5	Percentage of projects on which there was <b>consultation in accordance with the Equator Principles</b> (%)	100% in 2030	<b>89.7%</b>	82%	-	    
	Proportion of executives who have completed the <b>anti-corruption training program</b> (%)	100% in 2021	<b>62%</b>	57%	42%	
	Annual rate of <b>procurement from SMEs</b> (%)	22%-26%	<b>22.5%</b>	23.7%	23.5%	
	<b>Number of significant level 2 events on the INES scale</b>	0	<b>3</b>	1	4	
	France: <b>volume of long-lived high and intermediate level solid radioactive waste</b> <sup>(4)</sup> (m <sup>3</sup> )	-	<b>304</b>	315	300	
	UK: <b>volume of low-level radioactive waste generated</b> (m <sup>3</sup> )	-	<b>444</b>	474	453	

- (1) United Nations Sustainable Development Goals  
 (2) A target of less than 30mt to gradually meet with SBTi initiative  
 (2) Target subject to review following COVID-19  
 (3) HMA VL: High & Medium Long Life Activity

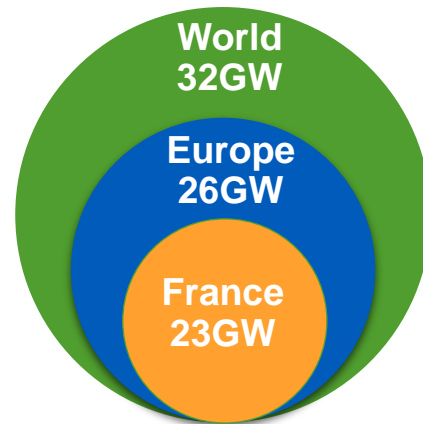
# CO<sub>2</sub> EMISSIONS <sup>(1)</sup> STRUCTURALLY DECLINING

EDF, A COMPANY COMMITTED TO THE ENERGY TRANSITION

## Cap 2030 targets

- Double the net installed renewable capacity of the Group's fleet: from 28GW in 2014 to 50GW in 2030

Net installed renewable capacity of the Group's fleet at the end of 2019 <sup>(2)</sup>:

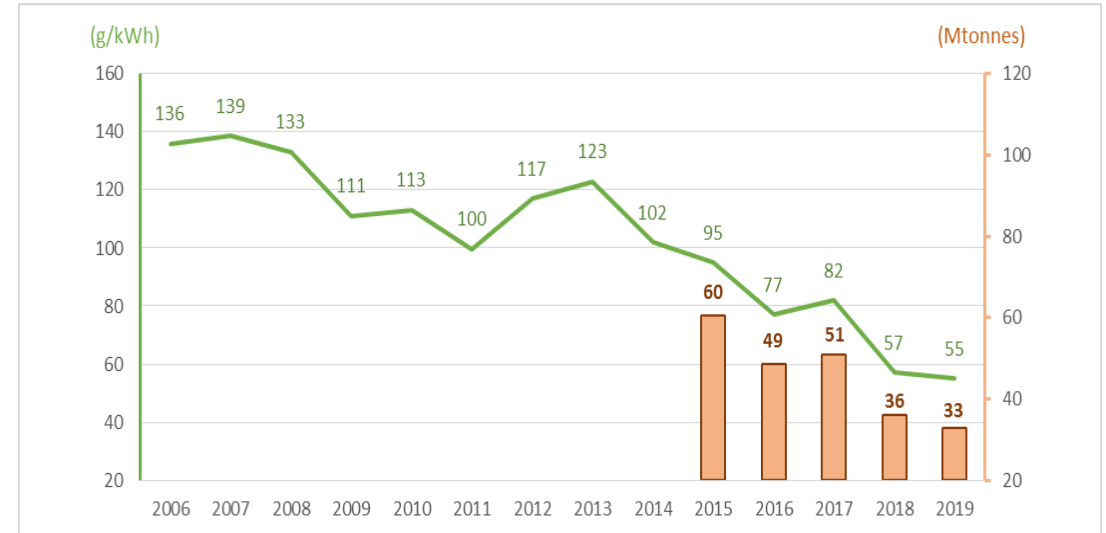


## Commitment 2020

- Move away from coal-fired power generation by 2030 in all geographical areas

## Commitment 2050: carbon neutrality

## Group CO<sub>2</sub> emissions <sup>(1)</sup>



The EDF Group's direct greenhouse gas emissions continued to fall in 2019, in particular through the closure of coal-fired power plants in France and England

<sup>(1)</sup> CO<sub>2</sub> emissions from power and heat generation plants, fully consolidated according to IFRS financial standards, excluding life cycle analysis of means of production and fuels  
<sup>(2)</sup> Consolidated data according to EDF's interest in Group companies, including investments in associates and joint ventures

EDF considers the preservation of biodiversity to be as important as combating climate change. The challenges of carbon neutrality cannot be dissociated from a positive approach to biodiversity (preservation of ecosystems, controlled water management, etc.) that seeks to improve practices and avoid irreversible damage to nature

GETTING TO KNOW OUR LAND BETTER IN ORDER TO IMPROVE  
THE PRESERVATION OF ITS ECOSYSTEM

52%<sup>(1)</sup>...

... The 2019 ratio of knowledge of the ecological quality of the Group's properties. It is the ratio between the surface area of the sites that have been inventoried and the total surface area of the sites

The **land inventories** that were carried out are essential prerequisites **for a better understanding of local biodiversity issues** and the definition of more effective actions for the maintenance and development of ecosystems

	Protected areas/international conventions	Protected areas at national level (IUCN Categories)						
		Ia	Ib	II	III	IV	V	VI
Overall total	67	22	1	61	18	456	178	20

WATER: A LONG-TERM COMMITMENT FOR CONTROLLED  
MANAGEMENT

99%...

... This is the rate in 2019 for the return of water (including sea water) on 44 km³ withdrawn for the cooling of the means of generation. This water is reusable almost immediately



**New 2019 indicator: water intensity**, ratio between water consumed and total electricity production. The target: not to exceed 1 l/kWh on average over 5 consecutive years  
This threshold is very low compared to the sector average, particularly in the United States<sup>(2)</sup>

(1) Performance indicator: assessment of ecological knowledge of the land is the ratio between the surface area of the sites that have been inventoried and the total surface area of the sites  
(2) Intensity between 1.43 and 3.54 l/kWh cf. "Regional water consumption for hydro and thermal electricity generation in the United States" - *Applied Energy* - May 2017

The EDF Group is committed to supporting professional equality between women and men, being a leader in the areas of health and safety, and promoting the development of work-study programmes



## GROUP-WIDE DIVERSITY: 3 COMMITMENTS

28%

of women in the  
**Management Committees** in 2023

28%

of women among leaders and future  
**leaders** in 2030

40%

of **women directors**  
appointed by EDF in 2023

### HEALTH & SAFETY

The Executive Committee undertakes to

Put an end to fatal accidents  
**Reduce** the rate of occurrence of work accidents as of 2020 <sup>(1)</sup>

**Reduce** absenteeism for health and safety reasons<sup>(2)</sup>

### GENDER EQUALITY INDEX

95/100

is the index published by EDF SA for 2019 <sup>(3)</sup>

### SUSTAINABLE MOBILITY AGREEMENT

Signed unanimously in 2019 at Group level in France, this agreement aims to develop work organisations that are more respectful of the environment, health and the well-being of employees, with the goal of becoming a “**low carbon employer**”

### INCLUSION

7,194

**work/study students present** in the Group in 2019

(1) Overall frequency rate (employees and service providers) < 1.8 in 2020, employee frequency rate: < 1.4 in 2020  
(2) < 8 days per employee per year in 2020  
(3) Published in March 2020, after which all Group subsidiaries in France with more than 50 employees have been calculating and publishing this index, which measures the M/F differences in compensation, individual salary increases, promotions, etc.)





## Commitment

Propose information and solutions in terms of energy consumption to assist all sections of the population experiencing difficulties

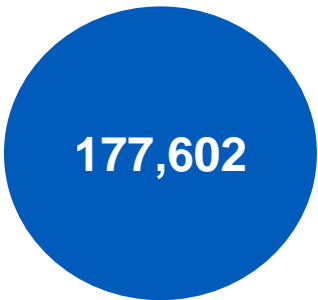


Digital technologies, an additional tool to provide more information and support to those in need. In this respect, EDF is working to improve access to the "Energy Voucher" programme through the digitalisation of the system (39% in 2019)

## Our actions in a few figures (2019)



The number of energy assistance actions provided in France by telephone by the 5,000 customer advisers, to any customers experiencing problems.



The number of calls by social workers processed by the EDF Commerce Solidarity teams in 2019. Nearly 260 EDF experts are dedicated to providing solidarity support to customers.



Wave 3 of the Energy Company Obligation (ECO), put into place by EDF Energy, entirely aimed at customers in vulnerable economic situations. The goal is to propose solutions to improve energy efficiency.

## SMART METERING

A key link in the energy transition, providing a more detailed analysis of energy consumption

26 million

the number of smart meters installed at the end of 2019 in France, England and India

## DIGITAL

an effective lever to monitor and act on consumption

47 million

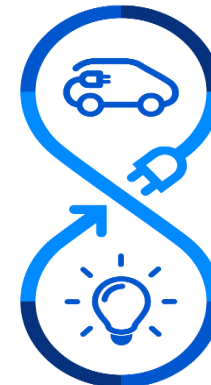
the number of customer consultations in 2019 on digital consumption monitoring platforms



### Promotion of low-carbon uses

The “Mon chauffage Durable” offer makes it possible to replace a fossil fuel boiler with a heat pump or to replace convectors with eco-efficient electric radiators. This offer is part of the “Coup de Pouce Chauffage” programme launched by the French government in January 2019

◀ What's new in 2019 ▶



### Improving the storage potential of vehicles

DREEV is a joint venture between EDF and Nuvve <sup>(1)</sup>. Thanks to V2G (Vehicle-to-Grid) technology, the recharging of electric vehicles helps companies and communities balance their budgets while helping the environment

(1) Nuvve Corporation, a green energy technology company based in San Diego

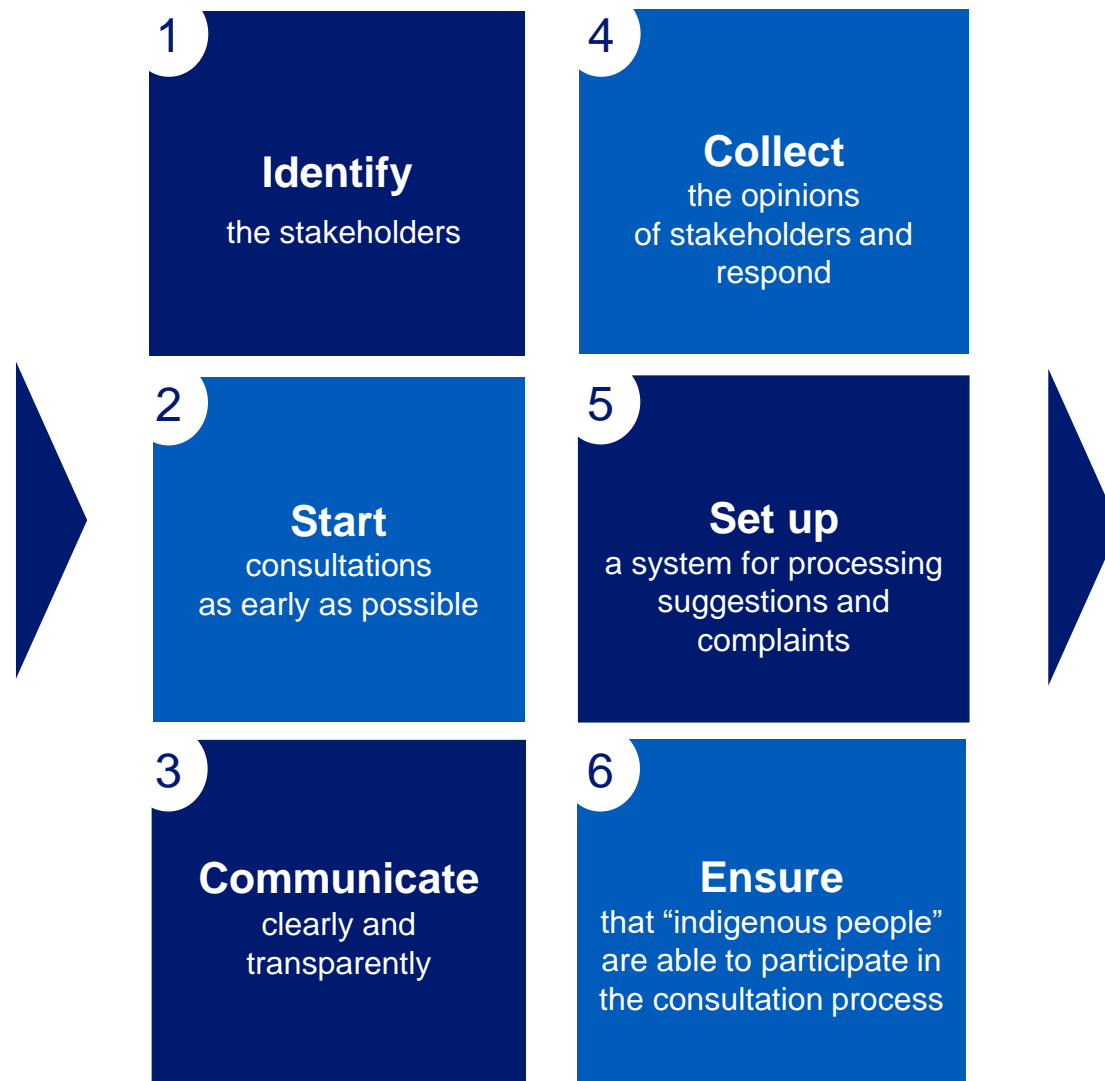
# DIALOGUE AND CONSULTATION ON OUR PROJECTS



## Our Commitment

Systematically organise throughout the world a process of dialogue or consultation for each project costing more than €50 million and having a significant regional or environmental impact

## Stages of consultation according to the Equator principles



## 2019 Results

89,7%

The percentage of the Group's investment projects in 2019 subject to consultation according to the Equator Principles

# NON-FINANCIAL RATINGS (1/2)

Sharp rise in the rating by Sustainalytics (2nd out of 193, inclusion in the top 5 and 1<sup>st</sup> among peers), which triggered the fall in the cost of the impact credit line signed with ING Bank in 2017

Maintaining a high level of performance: member of the DJSI World for the 4<sup>th</sup> consecutive year, member of the “A list” of the CDP (ex Carbon Disclosure Project) Climate change for the 3<sup>rd</sup> time, member of the STOXX ESG Leaders index



**Member of DJSI World**  
**80/100 in 2019**

The average for “Electric Utilities” was 45/100 in 2019.  
Member of the 2020 Sustainability Yearbook, EDF is ranked 10th out of 100 Electric Utilities



**A**

EDF, member of the “A list” of the CDP Climate Change for the 3rd time in 2019



**4.7/5 in 2019**

EDF, the 4<sup>th</sup> largest company in its sector, is one of the 5 nuclear operators worldwide meeting the strict criteria developed and monitored by the FTSE4Good Policy Committee



**86/100 in 2019**

EDF, member of the STOXX ESG Leaders Index 2019, 2nd out of 193 Utilities and 1st among its peers



**73/100 in 2019**

Gold class, EDF in the top 5% of its area of activity and in the top 1% globally



**66/100 in 2018 <sup>(1)</sup>**

EDF, member of all Euronext VigeoEiris indices: World 120, Europe120, Eurozone 120 and France 20 and number 6 amongst 66 Electric & Gas

(1) Most recent rating. Next rating by Euronext VigeoEiris planned in 2020

# NON-FINANCIAL RATINGS (2/2)

## 2019: EDF for the 3<sup>rd</sup> year in CDP Climate Change “A List”

Out of the **8,361** global companies that responded to the CDP in 2019, **only 179** (c. 2% of companies) made the prestigious “**A list**”, including **22 French companies**.

Out of the **273 electric utilities** surveyed by investors, only **10** are members of the **A list CDP Climate Change A List**, including **EDF**.

	2013	2014	2015	2016	2017	2018	2019	Trend
Global performance (D- to A)	B	B	A-	A	A-	A	A	→
Electric Utilities sector average	ND	ND	ND	C	C	C	C	→



“A list” Member award ceremony

This highest rating “A” illustrates in particular the commitment made by the Group in 2018 to reduce greenhouse emissions (scope 1) to less than 30mt in 2030<sup>(1)</sup> and underlines its excellent CO<sub>2</sub> performance<sup>(2)</sup>: 55g/kWh in 2019, while the world average is 485g, and that of the European power sector is 294g. EDF's performance has made a significant positive contribution in terms of avoided emissions.

(1) Target of less than 30Mt is under study to meet with SBTi initiative  
(2) Direct emissions, excluding life cycle analysis of the means of generation and fuels

**CDP**  
DISCLOSURE INSIGHT ACTION

**A LIST**  
**2019**

**CLIMATE**

The CDP is an independent organisation that brings together the world's largest database of greenhouse gas emissions. With the support of 525 investors representing more than \$96,000 billion, and a growing number of companies voluntarily responding to the questionnaire, this is the most widely recognised extra-financial assessments on climate change.

# THE GROUP EDF

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# CAP 2030: EDF PULSE CROISSANCE: EDF GROUP'S START-UP INCUBATOR AND CORPORATE VENTURE (1/3)

## EDF Pulse Croissance

“ *Creating the EDF Group of tomorrow* ”



Through strategic partnerships, equity investments and joint ventures with external start-ups



By investing through 14 venture capital funds (Electranova Capital, etc.)



By offering an incubation and acceleration program for entrepreneurs and projects developed by Group employees

MISSIONS AND MEANS

**€60m**  
**TO INVEST**  
**IN 2019**



Finding new growth drivers for the EDF group



Launching **new offers and new innovative and competitive services** for customers



Creating new activities for the Group

# CAP 2030: EDF PULSE CROISSANCE: EDF GROUP'S START-UP INCUBATOR AND CORPORATE VENTURE (2/3)



2017	<b>NUCLEAR DECOMMISSIONING</b> 6 winners 1 acquisition: CYCLIFE DIGITAL SOLUTIONS
2018	<b>SILVER ECONOMY</b> 3 winners
2018	<b>INHABITANT SERVICES</b> 3 winners 1 acquisition of a stake: ZENPARK
2019	<b>E-HEALTH</b> 125 applications 1 winner

(1) Proof Of Concept

# CAP 2030: EDF PULSE CROISSANCE: EDF GROUP'S START-UP INCUBATOR AND CORPORATE VENTURE (3/3)

“ *Our mission is to explore the energy and digital transition in its multiple dimensions* ”

Michel Vanhaesbroucke,  
Director of EDF Pulse Growth

INVESTMENTS ALREADY MADE BETWEEN SEPTEMBER 2017 AND DECEMBER 2019

SUSTAINABLE  
MANAGEMENT OF  
THE REGIONS



PERFORMANCE  
OF PRODUCTION  
TOOLS



INHABITANT  
SERVICES



DECENTRALISED  
ENERGY SYSTEMS



# R&D TO INNOVATE TODAY AND VENTURE INTO TOMORROW

EDF'S R&D SUPPORTS THE DEPARTMENTS AND SUBSIDIARIES OF THE EDF GROUP ON A DAILY BASIS WITH 2 MISSIONS:

- Improve performance in all activities today
- Prepare for the future by working on breakthrough technologies

R&D also conducts research for clients outside the EDF group through partnerships or orders.

EDF'S R&D COVERS ALL THE BUSINESS AREAS AND ACTIVITIES IN THE ENERGY SECTOR. IN LINE WITH EDF GROUP'S CAP 2030 STRATEGY, ITS RESEARCH FOCUSES ON THREE MAIN PRIORITIES:

- **Electricity transition:** electricity, especially if produced by low-CO<sub>2</sub>-emitting means, will play a major role in decarbonising the end uses of energy. Among these uses, electric mobility and innovative heat production methods are important development levers for EDF
- **Climate transition:** this topic brings together EDF's different electricity generation resources. The EDF Group, a leader in carbon-free energies, aims to ensure that its resources emit as little CO<sub>2</sub> as possible and thereby make a major contribution to the COP 21 and 22 climate objectives
- **The digital and societal transition:** this area is marked by the advent of connected objects and digital tools that have been developed exponentially over the last few years at home and in businesses. This transition cannot be dissociated from a very powerful change in our lifestyles and our behaviours with regard to energy use

## EDF'S R&D IN 2019

- 1,870 employees in France
- 156 PhD students
- 160 teacher-researchers
- 9 research centres:
  - 3 in France
  - 6 internationally (Germany, United Kingdom, China, United States, Singapore and Italy)
- 16 joint laboratories with partners
- + 300 academic and industrial partnerships around the world
- 682 patented innovations protected by 1,933 property titles in France and abroad
- €523 million budget in 2019 (EDF SA)

# R&D: EXPERTISE, TEST FACILITIES, GLOBAL KNOW-HOW

- R&D mobilises its energy experts for the benefit of the EDF group entities and subsidiaries, as well as external customers.  
It relies on more than 70 platforms for testing, measurement and simulation, among **the most modern and effective in the world**, in all areas of the energy sector.
- R&D also provides its customers with expertise in large-scale **digital simulation software and supercomputers**.  
EDF's R&D has a computing capacity of 4 pétaFLOPS, making it one of the largest players in this field.
- R&D also shares its knowledge and expertise through training courses taught by EDF researchers within ITECH.



## R&D AROUND THE WORLD

Located in areas where innovative technologies and business models thrive, the international centres are piloting key projects for the Group on microgrids, hydrogen, offshore wind and mobility solutions.

# R&D INNOVATES TO PREPARE FOR THE FUTURE

## R&D INSIDE: THE CONTRIBUTION OF R&D TO SOME MAJOR ACHIEVEMENTS OF THE EDF GROUP



### ➤ OFFSHORE WIND POWER

Major topic for EDF Renewables in the coming years: research on floating wind power



### ➤ PHOENIX

This energy and material flow optimisation tool has been integrated into the industrial eco-parks project in Dunkirk, which includes a high proportion of renewable energy.



### ➤ VERCORS

This digital containment enclosure has been used with the Technical Department to optimize the installation of a sealing lining on the Belleville 2 reactor containment building



### ➤ AGRI PV

An innovation that responds to the challenges of the solar power plan: complementarity between traditional agricultural activity and a photovoltaic installation



### ➤ SMART CHARGING

R&D supports the DREEV subsidiary in the development of smart charging offers for electric vehicles



### ➤ STORAGE

A study of stationary storage at the West Burton site and the development of a simplified model of the thermal behaviour of batteries.



### ➤ MASERA

Less than one year after its commissioning, the microgrid demonstrator in Singapore is now entering a continuous operation phase after a series of progressive tests



### ➤ SMALL MODULAR REACTOR

After the preliminary design phase, the SMR project is moving on to the preliminary design-summary phase, to become NUWARD



### ➤ EDF CITY PLATFORM in Moscow

Commissioned by EIFER, this tool will help create a leader in intelligent and sustainable cities in Russia



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# COMPOSITION OF THE BOARD OF DIRECTORS AND OF ITS COMMITTEES AS OF 7 MAY 2020

## AUDIT COMMITTEE

- Chaired by a director appointed by the General Shareholders' Meeting
- 2 other directors appointed by the General Shareholders' Meeting <sup>(1)</sup>
- 4 directors elected by the employees

## BOARD OF DIRECTORS

- 11 directors appointed by the General Shareholders' Meeting
  - ✓ 5 on recommendation from the French State
  - ✓ the Chairman and Chief Executive Officer
  - ✓ 5 independent directors
- 6 directors elected by the employees
- 1 Representative of the French state

## CORPORATE RESPONSIBILITY COMMITTEE

- Chaired by an independent director appointed by the General Shareholders' Meeting <sup>(2)</sup>
- 2 other directors appointed by the General Shareholders' Meeting
- 3 directors elected by the employees

## NUCLEAR COMMITMENTS MONITORING COMMITTEE

- Chaired by a director appointed by the General Shareholders' Meeting <sup>(2)</sup>
- 3 other directors appointed by the General Shareholders' Meeting
- 2 directors elected by the employees

## APPOINTMENT, COMPENSATION AND GOVERNANCE COMMITTEE

- Chaired by an independent director appointed by the General Shareholders' Meeting <sup>(2)</sup>
- 1 other director appointed by the General Shareholders' Meeting <sup>(2)</sup>
- 1 Representative of the French State
- 1 director elected by the employees

## STRATEGY COMMITTEE <sup>(3)</sup>

- Chaired by the Chairman and Chief Executive Officer
- 3 other directors appointed by the General Shareholders' Meeting
- 1 Representative of the French State
- 4 directors elected by the employees

(1) These members meet the criteria of both expertise (article L.823-19 of the French Commercial Code) and independence (code AFEP-MEDEF)

(2) This member meets the criteria of independence (code AFEP-MEDEF)

(3) Directors who are not members of the Strategy Committee may attend its meetings

# BOARD OF DIRECTORS MEMBERS AS OF 7 MAY 2020

## DIRECTORS APPOINTED AT THE GENERAL SHAREHOLDERS' MEETING

- |                                      |  |
|--------------------------------------|--|
| ➤ Jean-Bernard LÉVY <sup>(1)</sup>   | ➤ Véronique BEDAGUE-HAMILIUS, appointed on recommendation of the French State <sup>(1)</sup> |
| ➤ Bruno CREMEL <sup>(1)</sup>        | ➤ François DELATTRE, appointed on recommendation of the French State <sup>(2)</sup>          |
| ➤ Colette LEWINER <sup>(2)</sup>     | ➤ Gilles DENOYEL, appointed on recommendation of the French State <sup>(1)</sup>             |
| ➤ Laurence PARISOT <sup>(2)</sup>    | ➤ Marie-Christine LEPETIT, appointed on recommendation of the French State <sup>(2)</sup>    |
| ➤ Claire PEDINI <sup>(1)</sup>       | ➤ Michèle ROUSSEAU, appointed on recommendation of the French State <sup>(2)</sup>           |
| ➤ Philippe PETITCOLIN <sup>(1)</sup> |  |

## DIRECTOR REPRESENTING THE FRENCH STATE

- Martin VIAL <sup>(3)</sup>

## DIRECTORS ELECTED BY THE EMPLOYEES

- |                                   |                                       |
|-----------------------------------|---------------------------------------|
| ➤ Claire BORDENAVE <sup>(4)</sup> | ➤ Marie-Hélène MEYLING <sup>(4)</sup> |
| ➤ Jacky CHORIN <sup>(4)</sup>     | ➤ Vincent RODET <sup>(4)</sup>        |
| ➤ Karine GRANGER <sup>(4)</sup>   | ➤ Christian TAXIL <sup>(4)</sup>      |

## CHARACTERISTICS OF THE BOARD OF DIRECTORS' COMPOSITION

- 41.7% independent qualified directors <sup>(5)</sup>
- 50.0% of women sitting on the Board <sup>(5)</sup>
- Skills and expertise in line with the diversity policy which was adopted by the Board
- Staggered renewal of the directors (4-year term of office)

<sup>(1)</sup> Term of office expiring at the end of the General Meeting called to approve the financial statements for 2022

<sup>(2)</sup> Term of office expiring at the end of the General Meeting called to approve the financial statements for 2020

<sup>(3)</sup> Term of office expiring on 20 November 2022

<sup>(4)</sup> Term of office expiring on 22 November 2023

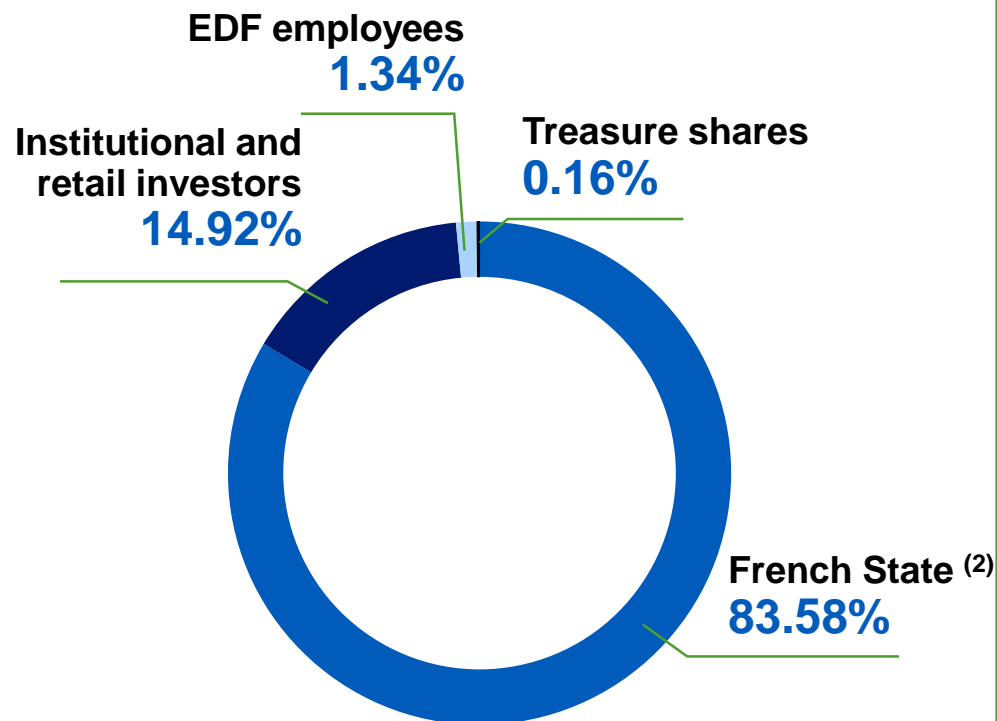
<sup>(5)</sup> Excluding directors that represents the employees

# EDF GROUP EXECUTIVE COMMITTEE AS OF 7 MAY 2020

- **Jean-Bernard LÉVY** Chairman and Chief Executive Officer (CEO)
- **Marc BENAYOUN** Group Senior Executive Vice President in charge of Customers, Services and Territories. He also oversees Edison and the Group's gas business
- **Bruno BENSASSON** Group Senior Executive Vice President in charge of Renewable Energies.
- **Béatrice BUFFON** Group Senior Executive Vice President in charge of the International Division
- **Christophe CARVAL** Group Senior Executive Vice President in charge of Group Human Resources
- **Xavier GIRRE** Group Senior Executive Vice President in charge of Group Finance
- **Véronique LACOUR** Group Senior Executive Vice President in charge of Change Management and Operational Efficiency
- **Cédric LEWANDOWSKI** Group Senior Executive Vice President in charge of Nuclear and Thermal business
- **Alexandre PERRA** Group Senior Executive Vice President in charge of Innovation, Corporate Social Responsibility and Strategy
- **Simone ROSSI** Group Senior Executive Vice President, CEO of EDF Energy
- **Pierre TODOROV** Group Senior Executive Vice President and Group General Secretary
- **Xavier URSAT** Group Senior Executive Vice President in charge of Engineering and New Nuclear Projects
- **Paul-Marie DUBEE** Senior Executive Vice President in charge of Executive Coordination and Government Relations, is also discharging clerical duties for the Executive Committee

# EDF: SHAREHOLDING STRUCTURE AS OF 31/12/2019<sup>(1)</sup>

## SHARE CAPITAL AS OF 31/12/2019



**By law, the French State must hold at least 70% of EDF's share capital**

## SHARES INFORMATION AS OF 31/12/2019

	Shares
Number of shares	3,103,621,086
Number of shares outstanding	3,103,621,086
Number of treasure shares	4,882,938
French security identification no. (ISIN code)	FR0010242511
Main index	CAC Next 20, Euro Stoxx Utilities, Stoxx Europe 600 Utilities, Euronext 100
Listing	Paris (Euronext Paris)

- Pursuant to article L 225-123 of the French Commercial Code, as amended by the Act n°2014-384 of 29/03/2014, the so-called “**Loi Florange**”, all fully-paid shares that have been held in registered form for at least 2 years in the name of the same shareholder will automatically entitle their holder to double voting right. These provisions have taken effect on 3 April 2016. As of 31 December 2019, the French State held 83.58% <sup>(2)</sup> of EDF's share capital and 88.89% <sup>(2)</sup> of EDF's voting rights.

<sup>(1)</sup> On January 15, 2018, the French State entered into a share allotment agreement with EPIC Bpifrance, whereby it allotted 389,349,361 EDF shares, representing at 31 December 2019, 12.55% of the share capital and 7.44% of the voting rights. They will act together and will have to consult each other before every Shareholders' Meeting of EDF. The EPIC Bpifrance has undertaken not to transfer the securities, to put them back as collateral or otherwise to dispose of them

<sup>(2)</sup> Including Epic Bpifrance

# EDF: A LISTED COMPANY MAJORITY OWNED BY THE FRENCH STATE

## EDF STATE-OWNED COMPANY: LEGAL AND CONTRACTUAL FRAMEWORK

- EDF's chairman and CEO is appointed by decree of the President of France on recommendation of the Board of Directors
- In accordance with article 13 of the French Constitution, EDF's Chairman is appointed based on the candidates' interviews and the opinion of the relevant committees of the French National Assembly and Senate
- The Board of Directors can be composed of 3 to 18 members, including members appointed by the Shareholders' Meeting<sup>(1)</sup>, a State representative<sup>(2)</sup>, and one-third of employees' representative elected in accordance with the provision of the Act of 26 July 1983
- Some decision related to financials, investments, acquisitions and disposals, or related to the compensation of executive officers must be subject to specific authorisation procedures (the Order of 20 August 2014 and the Decree of 9 August 1953 )
- The company is subject to controls by different authorities: State Inspector, *Cour des Comptes* (Government Audit Body), Finance Inspection
- The French State Shareholdings Agency (APE) represents the State as a shareholder

(1) If need be upon recommendation from the State, in accordance with article 6 of the Order of 20 August 2014

(2) Appointed by the Minister of Economy amongst State agents, in accordance with article 4 of the Order of 20 August 2014

(3) In accordance with the independence criteria indicated by the AFEP-MEDEF code.

(4) Committee Of Sponsoring Organizations of the Treadway Commission

## EDF LISTED COMPANY: CORPORATE GOVERNANCE

- EDF has to abide by listed companies laws and specific standards of a public sector entity
- Internal rules of its Board of Directors are similar to those of other listed companies
- EDF adheres to the consolidated AFEP- MEDEF Code which is the corporate governance code to which the company refers, in accordance with the French commercial code, subject to the specific laws and regulations applicable to EDF
- EDF is subject to the rules relative to the balanced representation of women and men on Boards of Directors and has to respect the proportion of members of the Board of each sex of not less than 40%, excluding directors that represent the employees (Commercial Code and executive order of 20 August 2014). In accordance with AFEP-MEDEF Code, the EDF Board must include a third of independent qualified members <sup>(3)</sup>. The appointments of directors proposed to the General Meeting are in line with the diversity policy applicable to Board members (French Commercial Code).
- The Board of Directors has created five dedicated committees to review and prepare certain projects before their submission to the Board of Directors
- The Appointments, Compensation and Governance Committee reports annually on the functioning of the Board of Directors and proposes areas for improvement. Furthermore, every 3 years, this evaluation is conducted by a specialist external consultant under the supervision of the Committee
- EDF is compliant with internal control procedures COSO<sup>(4)</sup>



# EDF'S INTERACTION WITH THE FRENCH STATE SHAREHOLDING AGENCY (APE)

- The French State Shareholding Agency (APE) is a national department controlled by the Minister of Economy and Finance. It performs the function of the State shareholder by safeguarding the State's patrimonial interests and the management of its investments. As such, it proposes and implements the decisions and policies of the French State with the related ministries
- Its main objectives consist of:
  - Reviewing the strategy and financial health of the company
  - Representing the French Government as a shareholder
  - Facilitate relationship between the company and the French Government
- As a result, the APE has expressed the following requirements to public sector enterprises. They have to:
  - Designate points of contact persons for the APE
  - Prepare a scorecard reporting for the APE on the main financial and qualitative data
  - Organise regular meetings, at least once a year to present the company's strategy and financial performance
  - Inform the APE of any investment operation, or any specific audit mission

# OTHER REGULATORY BODIES WITH AN IMPACT ON EDF'S ACTIVITIES

## THE FRENCH NUCLEAR SAFETY AUTHORITY (ASN)

**The ASN helps monitor nuclear safety and radiation protection and informs the public in these areas. Its activity is focused on several main missions:**

- Regulation through the submitting of opinions to the French government on draft decrees and ministerial orders, and by the regulatory decisions of a technical nature that it adopts
- The individual authorisations it grants for the operation of the plants, in particular the authorisations for restarting after the reactor stoppages
- The control of the installations that it carries out through the on-site regulatory inspections, scheduled or unannounced (with an average of 650 INB inspections per year, and 656 in 2018), in particular on the occasion of periodic reviews of compliance and re-evaluation security, mandatory for the continuation of the operation of the plant

## THE CRE (FRENCH ENERGY REGULATION COMMISSION)

**The CRE ensures the proper functioning of the electricity and gas markets for the end-customers in compliance with the energy policy. The regulation fields include:**

- Energy networks
  - Access to regulated networks and their operation and development
  - Independence of network operators
- Energy markets
  - Monitor deals on energy and CO<sub>2</sub> markets
  - Monitor retail markets (for instance, making proposals for regulated tariffs' evolution)
- Regulated tariffs
  - As per the provisions of the French Energy Code, the CRE henceforth is in charge of proposing the evolutions of all the regulated electricity sale tariffs

# OTHER CONTROL PROCEDURES INVOLVING EDF

- EDF may be subject to State audit procedures, in particular through economic and financial evaluation assessment and through verifications by the French General Finance Inspectorate (Inspection Générale des Finances)
- The company's accounts and management, and where applicable, those of its directly-held majority subsidiaries are under the control of the Cour des comptes (National Audit Court). Thus have been published on the Cour des comptes website:
  - The report on EDF's international strategy
  - The report on the management of the Électricité de Strasbourg group
  - The summary proceedings on working hours in the Group's main entities
  - The summary proceedings with the Minister for the Ecological and Inclusive Transition and to the Minister of Economy and Finance on the assessment of the implementation of Regulated Access to Historic Nuclear Power (ARENH)
  - The annual public report 2019, Volume II, on the wage policy at EDF SA
- EDF must also undergo the audit procedures performed by the French Parliament



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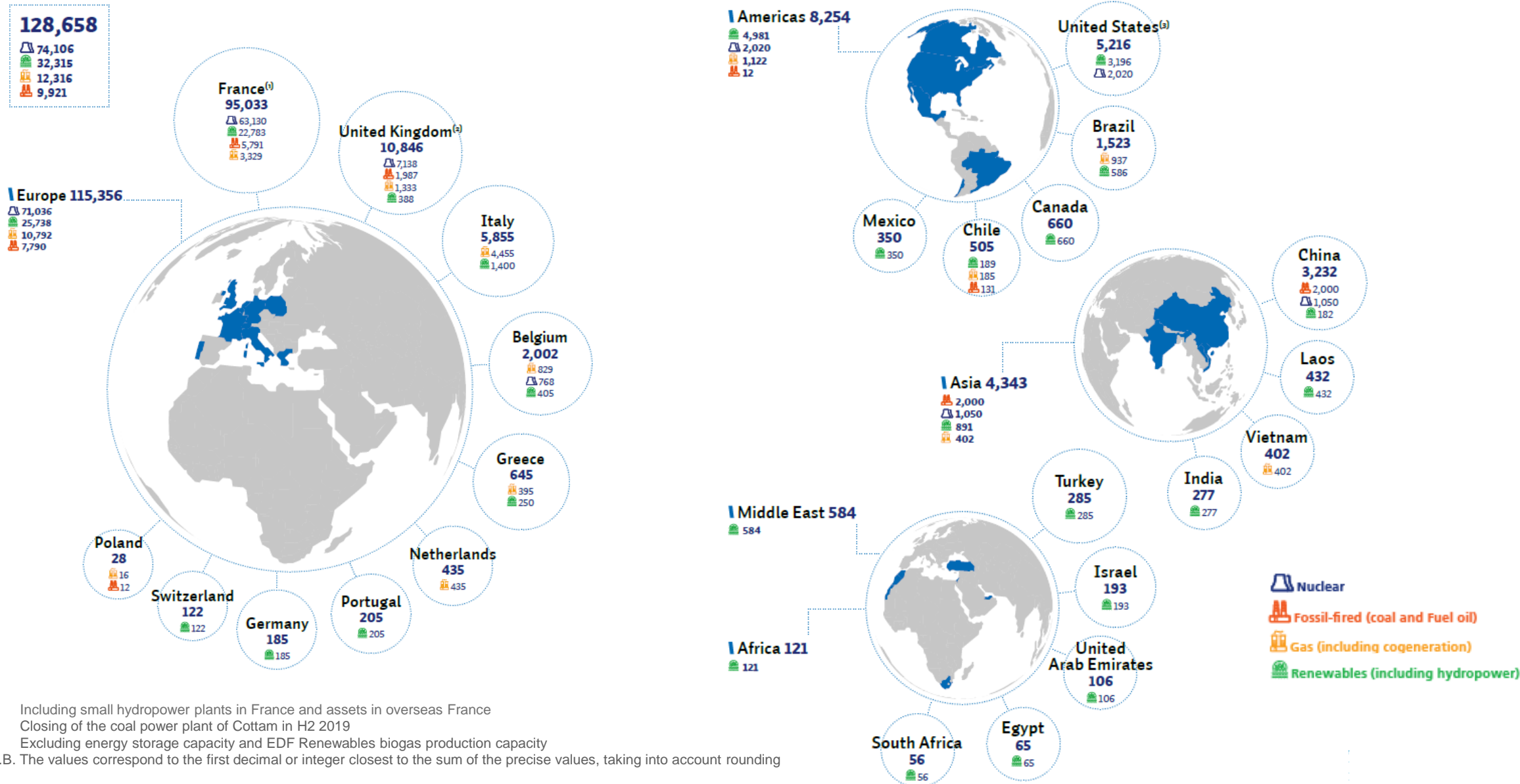
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# EDF GROUP'S NET INSTALLED CAPACITY\* BY COUNTRY IN 2019

\* Net capacity according to EDF's percentage ownership in Group companies, including associates and joint ventures.



# ELECTRICITY OUTPUT AS OF 31 DECEMBER 2019

## Output from fully consolidated entities

(in TWh)	2018		2019	
Nuclear	457.8	78.4%	437.6	78.5%
Hydro <sup>(1)</sup>	51.6	8.8%	44.2	7.9%
ENR	17.2	2.9%	18.3	3.3%
Gas	44.1	7.6%	49.0	8.8%
Fioul oil	4.7	0.8%	5.1	0.9%
Coal	8.6	1.5%	3.4	0.6%
<b>Group</b>	<b>584.0</b>	<b>100%</b>	<b>557.6</b>	<b>100%</b>

NB: The values correspond to the expression to the first decimal or integer closest to the sum of the precise values, taking into account rounding

(1) Hydro output after deductions of pumped volumes is 44.3TWh in 2018 and 37.9TWh in 2019



# FRANCE – COUNTRY PROFILE

## KEY POINTS

- EDF is active on the whole electricity value chain, from generation to sales and optimisation/trading. The activities can be split into:
  - **Unregulated activities:** generation and supply, optimisation and trading
  - **Regulated activities,** with **RTE**<sup>(1)(2)</sup> (transmission) and **Enedis**<sup>(2)</sup> (distribution). EDF's activities in Corsica and the French overseas departments and municipalities are managed by the **Island Energy Services (SEI)**, **Island Electric Production (PEI)** and are regulated, as well as the activities of the subsidiary **ÉS** (Électricité de Strasbourg)<sup>(3)</sup>
- EDF owns the largest nuclear fleet worldwide, o/w 58 operating plants in France
- RTE<sup>(1)</sup> and Enedis are subsidiaries of EDF but are operationally independent (legal unbundling), within the meaning of the provisions of the French Energy Code
- EDF also plays a holding role through the 100% control of **EDF Renewables**<sup>(4)</sup> and **EDF International** (which controls the greater part of EDF stakes in international subsidiaries) as well as interests in various companies, including:
  - **EDEV** (o/w, Électricité de Strasbourg, Citelum, etc.)
  - **Dalkia** (energy services provider)
  - **EDF Trading** (market operator for the Group)
  - **Framatome** (supplier in the nuclear industry), see the p. [76](#)

## INSTALLED CAPACITY AND OUTPUT IN 2019

CAPACITY	MW	%
Nuclear	63,130	70
Hydro <sup>(1)</sup>	20,089	22
ENR excl. hydro	1,994	2
Thermal <sup>(2)</sup>	5,525	6
<b>Total <sup>(3)</sup></b>	<b>90,738</b>	<b>100</b>

(1) Excl. Corsica and the French overseas department, i.e. 439MW in 2019

(2) Excl. Corsica and the French overseas department, i.e. 1,621MW in 2019

(3) Tidal capacity of 240MW excluded

OUTPUT	TWh	%
Nuclear	379.5	88
Hydro <sup>(1)(2)</sup>	39.7	9
ENR excl. hydro	2.9	1
Thermal <sup>(3)</sup>	9.8	2
<b>Total</b>	<b>431.9</b>	<b>100</b>

(1) Excl. Corsica and the French overseas department, i.e. 1.2TWh in 2019

(2) Output including pumped volumes: the electricity consumption needed for the operation of STEPs amounted 6.3TWh in 2019, resulting in total output after deduction of pumped volumes of 33.4TWh. Including generation from the tidal power on the Rance river of 0.5TWh

(3) Excl. Corsica and the French overseas department, i.e. 4.6TWh in 2019

EBITDA 2019 of the France Segments excl ENR	€bn
Unregulated (Generation & supply)	<b>7,615</b>
Regulated	<b>5,101</b>

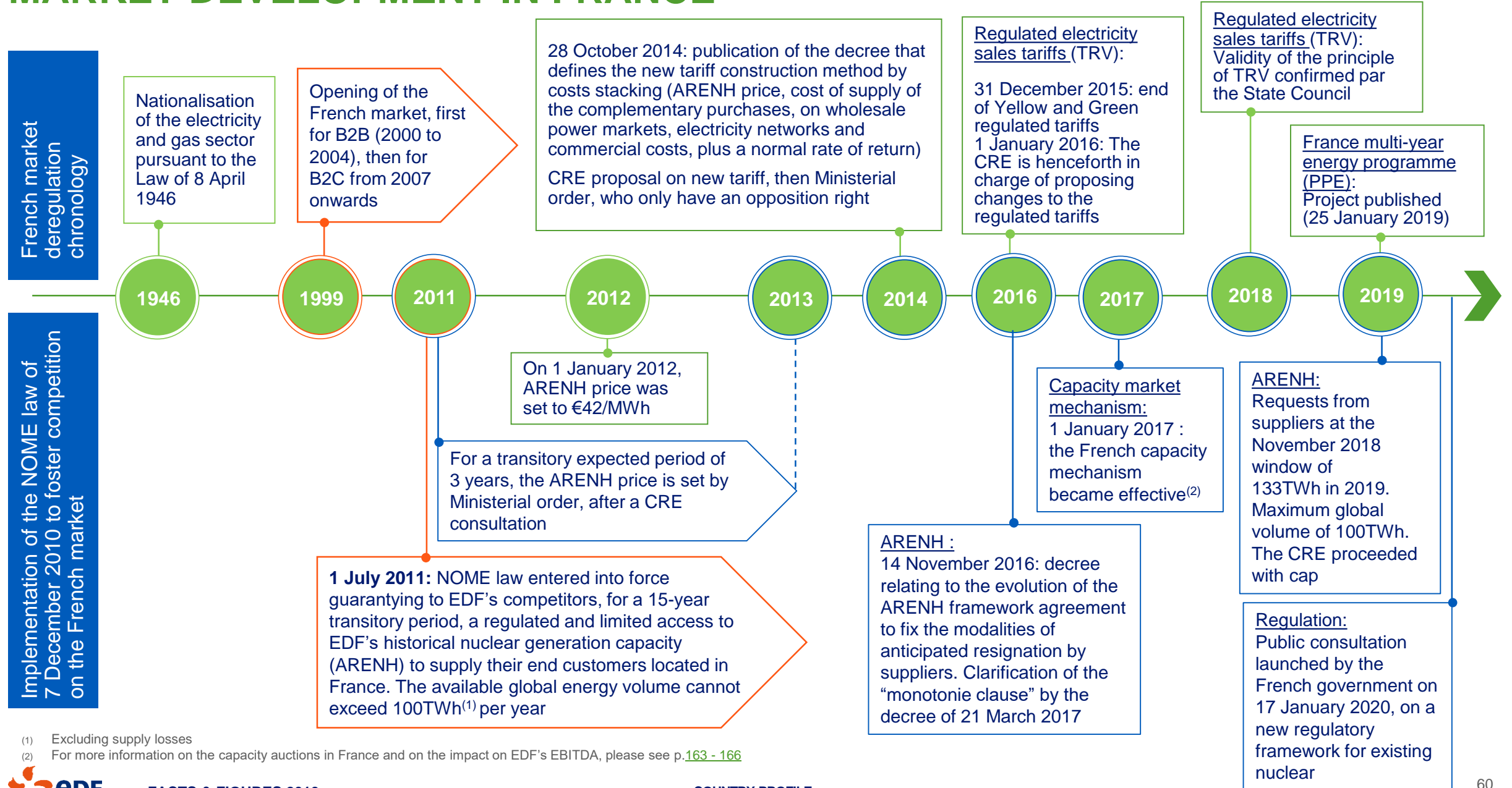
(1) RTE is consolidated by the equity method via the CTE holding company

(2) Subsidiaries managed with complete independence, within the meaning of the provisions of the French Energy Code

(3) For more information on the ÉS activities, please see the p. [150](#)

(4) For more information on the Renewables activities including EDF Renewables, please see the p. [109](#)

# MARKET DEVELOPMENT IN FRANCE



# UNITED KINGDOM – COUNTRY PROFILE

## KEY POINTS

### Main entity:

EDF Energy, one of the UK's largest energy companies and the largest producer of low carbon electricity.



### 3 principal activities:

- 1. Customers and services:** managing power and gas supply and customer service activities for residential and business customers (5.0 million residential customer accounts at the end 2019).
- 2. Generation:** 15 reactors on 8 nuclear power stations <sup>(1)</sup>, 1 coal-fired power station <sup>(2)</sup> (with open-cycle gas turbine (OCG)) and 1 gas-fired power station. Renewable energy generation from wind farms by EDF Renewables (JV EDF Energy and EDF Renewables Group)
- 3. Nuclear New Build:** Construction of Hinkley Point C (3.2GW) EPR power plant project and development of Sizewell C (3.2GW) EPR power plant project in partnership with China General Nuclear Power Corporation ("CGN"), as well as developing proposals for a new nuclear station Bradwell B, a UK HPR1000 ("Hualong") by CGN

### Strategy:

- Transition to a lower-carbon economy through the generation of safe, reliable and affordable low-carbon electricity and fight against climate change in five areas: serving customers; generating electricity; building new nuclear; providing energy and technical services; and renewables.
- EDF Energy is shifting focus from service efficiency to delivering outstanding customer experience and also developing new services and revenue streams by moving beyond supply, in response to market opportunities in flexibility, smart energy products and electrification of the economy.
- In Generation, EDF Energy seeks to create value through continued operational excellence of existing assets and by developing a portfolio of new investments, leading the revival of Nuclear New Build in the UK and extending the lifetime of existing nuclear plants, when safe and commercially viable.

## 2019 supply market share

Electricity supply: ~45TWh ~15 % <sup>(3)</sup>

Domestic Gas supply: ~29TWh ~10 % <sup>(3)</sup>

## 2019 key figures

EBITDA 2019 of the segment UK: €772m

	Capacity (GW)	Output (TWh)
Nuclear <sup>(1)</sup>	8.9	51.0
ENR	0.4	2.0
Gas	1.3 <sup>(4)</sup>	6.2
Fossil-fired excl. gas <sup>(5)</sup>	2.0	2.5
<b>Total</b>	<b>12.5</b>	<b>61.7</b>

## Did you know ?

**EDF Energy Blue Lab** applies the benefits of a start-up to help accelerate innovation for customers.

**Dalkia and EDF Energy** have created a JV to help businesses explore and develop solutions that deliver energy, carbon and cost savings

**EDF Energy** advances its low-carbon strategy with the acquisition of **Pod Point**, an EV charge point specialist, and **Pivot power**, company specialising in battery electricity storage and the deployment of private electricity grids for EV charging infrastructures.

(1) Including Centrica's 20% stake

(2) Cottam coal-fired power plant was closed in September 2019 after more than 50 years of being in service

(3) UK Gas and Electricity supply is as per BEIS data

(4) Including 1MW of Barkantine CHP

(5) Coal capacity represents transmission entry capacity. Net power including biomass

# ITALY – COUNTRY PROFILE

## KEY POINTS

The Italian gas and electricity markets are strategic for EDF due firstly to their major significance in Europe, secondly to their connection to the French markets and the key position in the Mediterranean basin



- **Edison:** The Group owns 97.446% of Edison's share capital. The company is a major player <sup>(1)</sup> in the Italian energy market, active in the production of power from renewable sources and gas, in gas midstream activities (supply of natural gas mainly through long term contracts, storage and distribution), in the sale of electricity, gas as well as energy and environmental services to the final market. Edison is engaged in strengthening its profile as a responsible energy operator in support of the energy transition, focusing on the generation from renewable sources, the responsible use of natural gas and the renewed boost to energy efficiency activities
- **Key strategic priorities:**
  - **Electricity generation:** increase power generation from renewable sources, mainly PV solar and wind. Thanks to the acquisition of EDF EN Italia in 2019 and the completion of 165MW wind farms by E2i Energie Speciali <sup>(2)</sup>, Edison became the second wind power operator in Italy with 922MW. In order to complement the growth in renewables and ensure the security of power supply, in 2019 Edison announced the construction of two latest-generation combined cycle power plants, with high efficiency and low environmental impact, in Marghera Levante (780MW) and Presenzano (760MW)
  - **Customers and services:** strengthen the positioning on the Italian market through the development of innovative low carbon energy services <sup>(3)</sup> targeted to industrial, tertiary and public administration segments and the combined offer of power and gas as well as of value-added services to B2B and B2C customers.
  - **Gas activities:** optimize the Group's natural gas portfolio ensuring flexible, competitive and diversified supply. Strengthen the leadership in innovative uses of gas for the benefit of the decarbonisation of the transport sector (small scale LNG) and develop new gas import infrastructures for Italy and Southern Europe <sup>(4)</sup>

In order to support the sustainable repositioning, in July 2019 Edison announced the decision to exit hydrocarbons exploration and production activities <sup>(5)</sup>. The closing of the sale is expected in 2020

## 2019 GROUP KEY FIGURES IN ITALY

	Capacity <sup>(a)</sup> (MW)	Output <sup>(a)(1)</sup> (TWh)
Thermal	4,640	16.6
Hydro	1,020	3.2
Other renewable	1,012	1.6
<b>Total</b>	<b>6,672</b>	<b>21.4</b>

a. Incl. Generation and energy efficiency services

**Generation fleet** in Italy is made up of **93** hydropower plants, **14** thermal power plants, **46** wind farms and **64** photovoltaic power plants

2019 EBITDA in Italy: €578m <sup>(6)</sup>

### 20.0Gm<sup>3</sup> of gas sold to end customers

*O/w 13% to the residential sector, 25% to the industrial sector and 33% for thermoelectric uses (including Edison's own internal needs)*

**14.7Gm<sup>3</sup> of natural gas imports** by Edison, i.e. 21% of the country's natural gas imports

**1.5 million sales contracts** of power, gas and energy services

(1) According to the 2019 ARERA report based on 2018 data Edison is the 3rd largest producer at national level (the 2019 data will be available in mid-2020). Edison's net electricity output in Italy in 2019 represents ~8% of net Italian electricity generation

(2) 30% Edison and 70% owned by the fund F2i; 100% of the energy generated by E2i is transferred to Edison, which uses it for integrated management of its production portfolio

(3) For more information on energy efficiency activities, see p.179

(4) For more information about the Group's gas infrastructure, see p.191

(5) Excluding Algerian E&P assets that will be owned by Edison and will possibly be resold in the future

(6) EBITDA for Edison's E&P business is presented at the bottom of P&L in discontinued operations

# BELGIUM AND NETHERLANDS – AREA PROFILE

## Key points

- **The Benelux region** includes important interfaces with the Franco-German electric power plate, and plans for new connections to Germany and Great Britain are under consideration. The Benelux is also an important node in the European gas market due to its numerous import and transit infrastructures
- **Main entities:**
  - **Luminus**
    - ❑ EDF majority shareholder (**68.63%**), through EDF Belgium.
    - ❑ 2<sup>nd</sup> largest player in the Belgian energy market with 10% of the national generation capacity. Total electricity output of **7.1 TWh** in 2019.
    - ❑ Present in renewable energies through 7 hydropower plants.
    - ❑ Leader in wind power with **52 onshore wind farms**, the group built 27 wind turbines with an additional capacity of 81.8MW in 2019, for a total of **438.5MW**
    - ❑ Owning 10.2% (**417MW**) of the nuclear power plants Tihange 2 and 3, and Doel 3 and 4, Luminus also has **100MW** of drawing rights on the French Chooz B nuclear power plant.
    - ❑ The company has 2,000 employees, including the recently acquired subsidiaries
    - ❑ On the B2B market, Acquisitions of Censatech, Studieburo De Klerck and ERVAC, strengthening the Luminus position in energy services
  - **EDF Belgium:** wholly-owned by EDF, it holds 50% of the Tihange 1 nuclear plant, or 481MW, representing 2% of Belgian generation capacity. The life span of this power plant has been extended to 2025
  - **Sloe Centrale B.V. (Netherlands):** Thanks to its very high technical performance, the Sloe power plant has been called upon to operate nearly **5,000 hours by the end of September 2019** since the beginning of the year, with a service factor of more than 68%, 15 points higher than the average calculated over the last two years

## 2019 key figures

Pays	Company	Main activities	Technical data
Belgium	EDF Belgium	Electricity generation	<b>Nuclear installed capacity: 481MW</b>
Belgium	Luminus	Electricity generation Electricity and gas sales	<b>Installed capacity: 2,129MW</b> 18% gas market share in Belgium <b>Delivery points: ~1.7 million</b>
Netherlands	Sloe Centrale B.V.	Electricity generation	<b>Installed capacity CCGT: 870MW</b>

In 2019, EBITDA in Belgium amounted to €206 million  
(Luminus: €158m, EDF Belgium €48m)



**In 2020, Luminus was awarded the Top Employers in Belgium for the 8<sup>th</sup> consecutive year**

## Did you know ?

Luminus owns **52 onshore wind farms** with a total of 189 turbines in Wallonia and Flanders.

By the end of 2023, the company aims to reach **774MW**, making Luminus the leading wind energy company in Belgium



# NORTH AMERICA – AREA PROFILE

## Electricity

- **In North America the group has:**
  - More than 9.8GW of installed and under construction gross capacity
  - Around 52GW of capacity managed on behalf of third parties through O&M (operation and maintenance) or optimization services contracts
- **Activities in North America:**
  - **Renewable energies:** EDF Renewables holds 3.8GW of net capacity (3.5GW in wind, 0.3GW in solar) and 2.2GW in construction, mainly located in the USA, and close to 11GW managed for own account or third parties
  - **Trading:** EDF Trading operates in the Northern American markets for electricity (including financial transmission rights) and gas. EDF Trading activities also include trading of RECs <sup>(1)</sup>, biogas, carbon emissions and credits and weather derivatives
  - **Nuclear:** EDF Inc. has 49.99% stake in **CENG** which operates 5 nuclear reactors with Exelon, with a global capacity of 4,272MW. The NYPSC <sup>(2)</sup> has established that Ginna and Nine Mile Point nuclear facilities are eligible for the ZEC programme <sup>(3)</sup>. This programme of credits was created in order to preserve the low-carbon nuclear generation installations, which comply with the criteria determined by the NYPSC.  
**Framatome** also helps supply electricity to 36 million North American households

## Energy supply

- **Commercialization of gas and electricity:** EDF Trading, through its subsidiary EDF Energy Services, is part of the Top 5 suppliers to non-residential customers in North America, offering all environmental products, natural gas and electricity

## Energy services

- **Renewables:** EDF Renewables manages about 11GW through operation and maintenance contracts on its own or on behalf of third parties
- **Trading:** EDF Energy Services (100% subsidiary of EDF Trading North America) provides management and optimization services for thermal, wind, PV and hydro power generators
- **Local management of energy and energy efficiency:** through Dalkia, a 100% subsidiary of the EDF Group, with 505 employees

## R&D

- **EDF Innovation Lab:** located in Silicon Valley, this R&D and Innovation team partners with local Universities and Utilities on Distributed resources integration and Future of energy markets. It has also identified Powerflex, electric vehicle charger operator, then acquired by EDF Renewables

## Did you know ?

In 2019, **Citelum**, an EDF subsidiary specializing in street lighting, carried out a survey of outdoor and indoor lighting at 14 marinas along the east coast, from New Jersey to Florida for Safe Harbor Marinas

(1) Renewable Energy Certificate

(2) NYPSC: New York Public Service Commission

(3) Zero emission credit



# MAP OF EDF GROUP NORTH AMERICAN OPERATIONS

The EDF group has operations in 42 out of 50 states and in 5 out of 10 Canadian provinces

## EDF present subsidiaries

- EDF Inc
- DK Energy US

- EDF Renewables Energy
- EDF Renewables Canada
- EDF Renewables Mexico
- EDF Renewables Energy Services

- EDF Trading North America
- EDF Energy Services

- TIRU
- Citelum



**EDF Renewable Energy**  
★ HQ - ● Other offices  
USA: 856 employees

**EDF Renewables Canada**



**Citelum North America**  
★ HQ - ● Other offices  
USA: 36 employees



**EDF Trading North America**  
**EDF Energy Services**

★ HQ ● Other offices  
USA: 418 employees



**DK Energy US**  
★ HQ  
USA: 178 employees  
**Groom Energy**  
■ HQ ● Other offices  
**TIRU (HQ in La Défense)**  
● Montreal site  
Canada: 270 employees



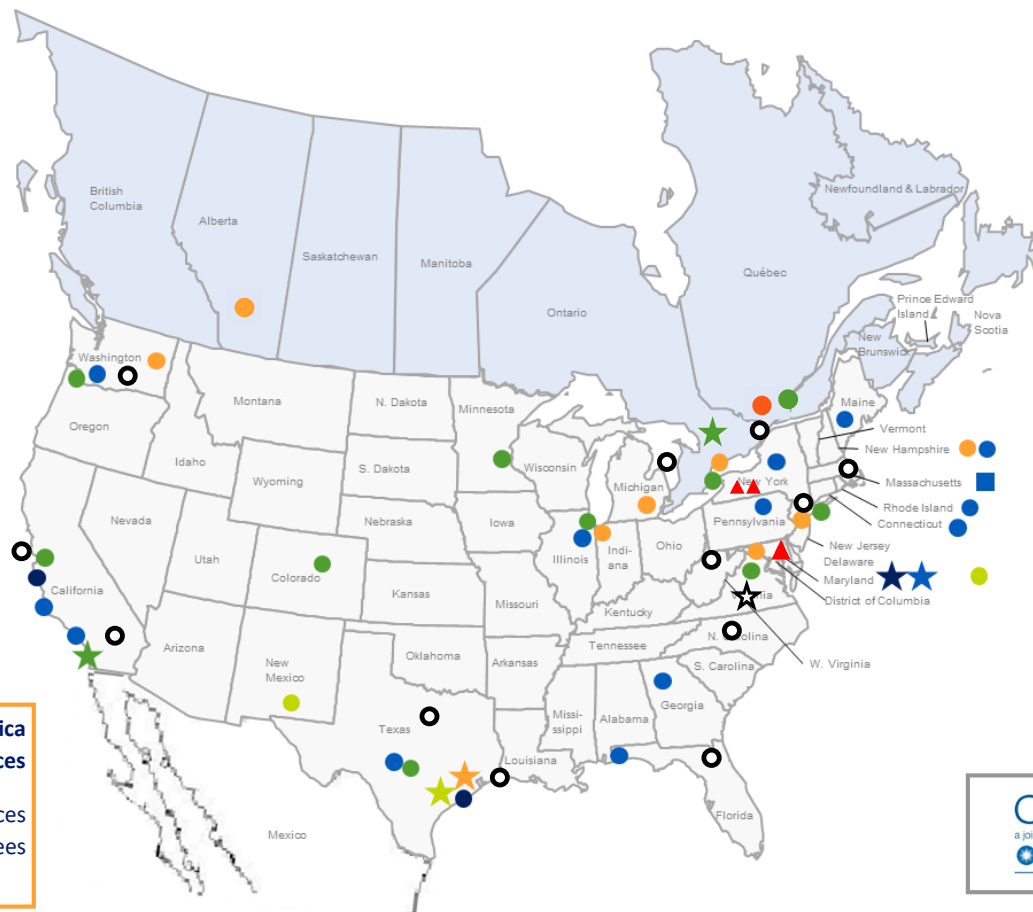
**EDF Inc.**  
★ HQ ● Other offices  
USA: 30 employees\*  
*\*Does not include CENG staff*



**Constellation Energy Nuclear Group**  
▲ Nuclear plant  
USA : 2,315 employees



**Framatome**  
★ HQ ● Other offices  
USA : 2,100 employees



# LATIN AMERICA – AREA PROFILE

## Brazil

- **EDF Norte Fluminense** (*EDF NF*)
  - The Group owns 100% of **EDF Norte Fuminense**, which has built and operates a CCG<sup>(1)</sup> with an installed capacity of **826MW**
  - EDF NF owns **51%** of the **Sinop Energy Company** (SEC), which is responsible for the construction and operation of the Sinop hydroelectric facility (**402MW**) commissioned in 2019 (see slide p. [118](#))
- **EDF Renewables:** (100% subsidiary of EDF) has been present in Brazil since 2015, with a net capacity of 182MW in wind power (Ventos da Bahia), and 199MW in solar power (ex: Pirapora II) as well as 344MW in wind power under construction
- EDF is also present in Brazil through the activities of **Edison** (Iberitermo (50% stake) subsidiary which operates a CCG of 226MW) and those of **Citelum** (subsidiary 100% owned by EDF dedicated to public lighting). Citelum, which renewed its contracts in São Francisco do Conde, Caixias and Goiânia, is from 2019 supporting the city of Valinhos in its projects and has won a new contract in Imperatriz



Solar plant of Pirapora

## Chile

- In partnership with AME (Andes Mining Energy), the group subsidiary **EDF Andes** <sup>(2)</sup> acquired **750MW** of flexible generation capacity (**gas and peak**) in 2018 to support the development of its renewable activity in Chile by compensating for fluctuations in wind and solar generation. This acquisition complements the “gas to power” strategy in place since 2014, combining the construction, operation and maintenance of an approximately 600MW CCGT with a FSRU-type <sup>(3)</sup> offshore LNG storage and regasification infrastructure
- **EDF Renewables** is present in Chile with 3 assets: the solar power stations of **Bolero (146MWp gross)** and **Santiago (115MWp gross)** and the wind farm of **Cabo Leones 1 (115MW gross)**
- **Citelum** is present in Chile on the public lighting market. In 2019, Citelum won public lighting renovation and maintenance contracts in 5 new municipalities. Citelum also added to the number of its artistic lighting projects, with the illumination of the Sculpture Park of Providencia and the Pontifical Catholic University of Chile in Santiago



Solar plant of Bolero (Atacama's desert)

<sup>(1)</sup> Combined cycle gas plant

<sup>(2)</sup> Formerly known as EDF Chile

<sup>(3)</sup> Floating Storage Regasification Unit

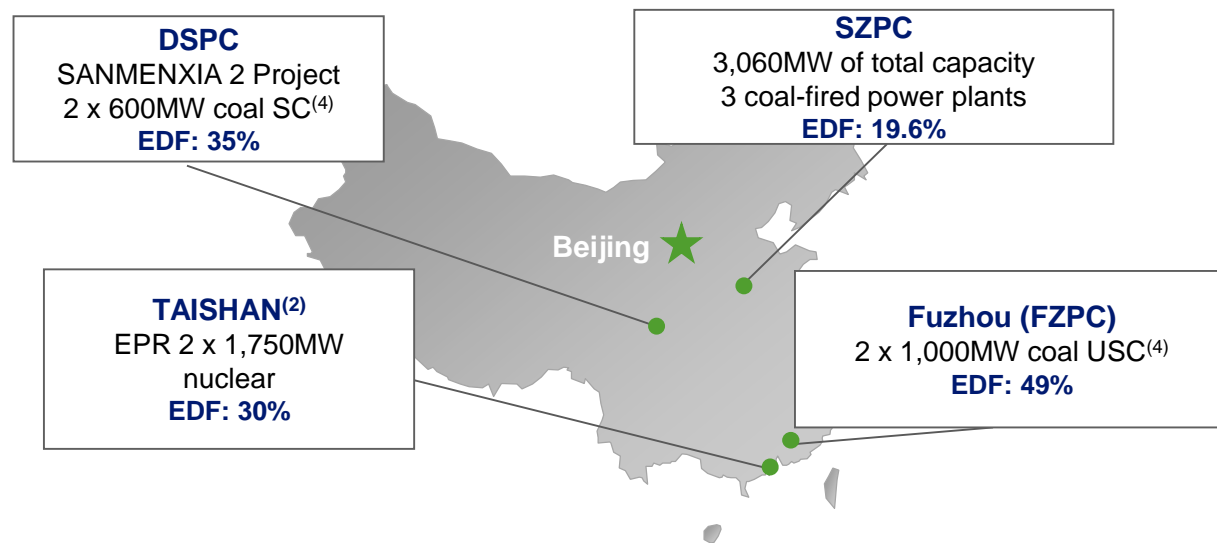
# CHINA – COUNTRY PROFILE

## Key points

- The EDF group is one of the largest foreign investors in the electricity sector in China, with interests in nuclear, renewable and thermal power plants for a **total net capacity of 3,650MW<sup>(1)</sup>**
- As the first foreign company to invest in a project to build and operate a **nuclear power plant** in China, EDF owns 30% of **Taishan (TNPJVC)**, which aims to finance, build, commission and operate two EPR nuclear reactors<sup>(2)</sup>. Unit 1 was the first EPR in the world to enter commercial service on 13 December 2018 and the Unit 2 was commissioned on 7 September 2019
- EDF operates since 2016, a **heating network** that supplies homes over an area of 8 million m<sup>2</sup> in the city of Sanmenxia (Henan). In the nearby town of Lingbao, EDF operates a 35MW biomass **cogeneration power plant** which supply heating and electricity. On the tropical island of Hainan the Group has started in Sanya to build a cooling network for the air conditioning of hotels located in a tourist area
- **EDF Renewables** acquired in 2016 a majority share (80%) in UPC Asia Wind Management (AWM), which develops and builds **wind power** projects in China. In 2018, EDF Renewables diversified its activities in distributed solar power by creating a joint venture with ACC to develop **solar roofing solutions** for industrial customers. Its net installed capacity amounts to 103MW in wind and 79MW in solar power, and 135MW are under construction - mostly in wind power. In offshore wind energy, EDF Renewables is building the Dongtai IV (302MW) and Dongtai V (200MW) wind farms in partnership with China Energy Investment.
- EDF owns 49% of FZPC, a joint-venture with a subsidiary of Datang, which built and operates the “ultra-supercritical” **coal-fired power plant** of **Fuzhou**. This technology ensures better performance (~44% for Fuzhou) and a limited environmental impact. The first unit was commissioned in late 2015 and the second in April 2016

(1) Data in proportion to EDF's equity  
(2) For more information on the Taishan 1&2 EPR project, see p. [82](#)

## Thermal and nuclear generation capacity



## Partnership with CGN

- On 29 September 2016, **EDF and CGN** signed the final contracts for the Hinkley Point C power plant project<sup>(3)</sup>. EDF's stake in Hinkley Point C is 66.5% and CGN's is 33.5%. An agreement covering the development of the UK HPR1000 (Hualong One) technology at Bradwell, United Kingdom was also signed at that time. In addition, EDF is working with CGN to advance a project similar to Hinkley Point C, a 3.2GW EPR construction project at Sizewell

(3) For more information on the Hinkley Point C EPR project, see p. [80](#)  
(4) SC = “supercritical” technology, USC = “ultra-supercritical” technology

## Did you know?

EDF led the design, construction and commissioning of the Daya Bay nuclear power plant (2 x 1,000MW) and assisted the Chinese group CGN in the construction of the Ling Ao power plant (4 x 1,000MW). Today, EDF provides support to the CGN group in the operation of its entire fleet

# SOUTHEAST AND SOUTHERN ASIA – AREA PROFILE

## India

- In **March 2018**, the EDF group and the Indian energy company NPCIL<sup>(1)</sup> signed an industrial agreement for the construction of 6 EPRs on the Jaitapur site in India. With a total power of about **10GW**, **Jaitapur** will be **the largest nuclear project in the world**<sup>(2)</sup>
- **Citelum**, an EDF subsidiary specialised in street lighting, is also present in India where it manages **180,000** luminous points in the city of Ahmedabad and renovate the lighting points of Noida, on behalf of Tata Projects Ltd
- A **roll-out Smart Meters project** signed in 2018 and officially launched in March 2019 with EESL 3 for 5 millions Smart Meters, and with NDMC for 75,000 Smart Meters. EDF International Networks is now present in India
- **Wind and solar power sectors:** At the end of 2019, the Group's **installed renewables power (excl. Hydro) capacity is 276MW net** with a consequent portfolio of projects under developments (716MW of PPA signed in solar and 300MW wind power)

## Vietnam

- In **2019**, EDF owns **56.25%** of Mekong Energy Company (MECO), the company that owns Phu My 2.2, a combined cycle plant with a capacity of **715MW**. The other shareholders are TEPCO (JERA) and SGM2 (Sumitomo). This is the 1st IPP project<sup>(3)</sup> dedicated exclusively to foreign investment in Vietnam. The BOT contract (Build, Operate, Transfer) has a duration of 20 years. In 2005, EDF completed the turnkey delivery of the plant, which MECO now operates
- The **Son My 1** project concerns the construction and operation of a regasified LNG (liquefied natural gas) combined cycle plant with optimised environmental performance of approximately **2,250MW**, scheduled to be commissioned in 2024. In March 2018, the EDF group was appointed leader of the consortium (**37.5%**) to study the project alongside the Vietnamese partner Pacific Corporation (**25%**) and two Japanese partners, Sojitz Corporation (18.75%) and Kyushu Electric Power Co (18.75%)

## Myanmar

- The **Shweli 3** project concerns the construction and operation of an hydroelectric dam of ~ **671MW**, scheduled to be commissioned in 2025. The EDF Group has been appointed lead contractor of the consortium (with a 32,5% stake), responsible for developing the project alongside two private-sector partners, one from Myanmar (Birman Ayeyar Hinthar Holdings Co. Ltd, 10%) plus a Japanese partner (Marubeni Corporation, 32,5%) together with the Ministry of Electricity and Energy (MOEE, 25%), a Burmese state entity

## Laos

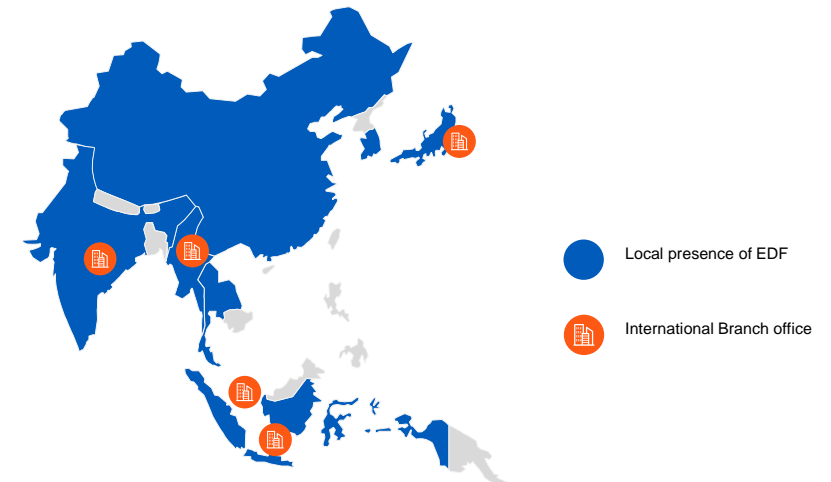
- **At the end of 2019**, the Group **owns 40% of Nam Theun 2 Power Company** (NTPC), which owns the Nam Theun 2 Hydropower Complex (**1,070MW installed capacity**). Built by EDF under a turnkey contract, the other shareholders are the Thai company EGCO<sup>(4)</sup> (35%) and the Laotian society LHSE<sup>(5)</sup> (25%). NTPC company operates the power plant on a 25-year concession contract concluded with the government of Laos
- A project to develop an hybrid floating solar farm with a capacity of 240 MWp on the Nam Theun 2 hydroelectric dam reservoir was launched in 2019

## Indonesia

- In 2019, EDF continues its development strategy, focusing on mini grids, targeting remote islands areas (various MoU have been signed)

## R&D

- EDF Lab. Based in Singapore, deployed its *microgrid* offer throughout Southeast Asia following the inauguration of the **microgrid demonstrator "MASERA"** in partnership with local universities



(1) Nuclear Power Corporation of India Ltd.  
 (2) See press release 10/03/2018  
 (3) Independent power plant

(4) Electricity Generating Public Company Ltd.  
 (5) Lao Holding State Enterprise



# AFRICA – AREA PROFILE

The Group wishes to develop on the continent of Africa by assisting countries with high-energy demand, on a selective basis appropriate to each geographical region, and by building sustainable and multi-industry partnerships. EDF is also intensifying its action in the supply of competitive off-grid energy.

## South Africa

- Since 2007, EDF has a subsidiary in Johannesburg, focused on reviving the South African nuclear program
- **Wind energy sector:** Since 2011, EDF Renewables has been developing in the wind energy market and operates three wind farms with a gross capacity of **111MW** through its 94%-owned EDF Renewables South Africa subsidiary. The construction of a 35MW new wind farm started in 2019
- In December 2018, EDF acquired **30%** of GIBB POWER, a subsidiary of the South African group GIBB Engineering and Architecture, in order to increase its activity in thermal engineering, hydraulics, transportation and distribution services<sup>(1)</sup>. The company started its activity in 2019

## Morocco

- **Solar energy sector:** In 2019, the EDF Renewables – Masdar - Green Of Africa consortium successfully bid for the first place of the **Noor Midelt 1** solar project in Morocco, using a hybrid solar-storage technology that is a world first. This hybrid solar project with installed capacity of **800MW** innovatively combines two technologies: concentrated solar power (CSP) and photovoltaic solar power. Construction works are scheduled to start in 2020
- **Wind energy sector:** EDF-RE (60%), in partnership with Mitsui&Co (40%), is developing the **Taza** wind farm (150 MW project, with a 1<sup>st</sup> phase of **87 MW**). The PPA was signed at the end of 2019. Construction works are scheduled for the 1<sup>st</sup> semester of 2020

## Egypt

- **Solar energy sector:** In 2019, EDF Renewables commissioned the **Benban plants** with **130 MWp** in partnership with Elsewedy Electric. EDF Renewables also took a strategic share in the Egyptian company **KarmSolar** to tackle the private PPAs and micro-grid market

## Cameroon

- EDF has started the construction works on the **Nachtigal** hydroelectric dam (**420MW**), and will operate it through its 40% stake in Nachtigal Hydro Power Company (NHPC) alongside IFC, the State of Cameroon, Africa50 and STOA
- In November 2019, EDF and the State of Cameroon signed a Development Agreement for a second hydroelectric dam, on the Sanaga river, on the site of Kikot, with capacity of about 450MW

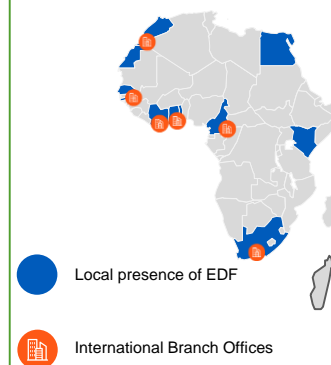
<sup>(1)</sup> See press release of 8 October 2018

## Ivory Coast

- In partnership with SIFCA, the Ivorian agro-industrial group and Meridiam, EDF is developing the "**Biovéa**" biomass plant project (2 x 23 MW). The concession agreement was signed between EDF, its stakeholders and the Government of Ivory Coast

## Off-Grid

- EDF has fifteen years of experience in the field of "**Off-Grid**" (decentralized energy). In addition to the historical activities of KES in South Africa (company created in 2002 and 50 % owned by EDF) and ERA (Senegal), the Group partners with innovative start-ups to provide energy and services to a rural clientele **in South Africa, Côte d'Ivoire, Ghana, Senegal, Kenya and Togo**.
- Such services enable **500 000 people** to light and power their low-consumption household appliances or also to be equipped by solar-powered water pumps and thereby significantly improve their crop yields.
- EDF aims to **multiply this figure by 4** over the next 3 years



## Did you know?

At the end of 2019, EDF rewarded the winners of the **EDF Pulse Africa** Awards, accompanying committed innovators for energy development. Pulse Africa 2019 attracted 536 projects from 26 African countries. The 1st Prize, was awarded to LIFI LED, which is developing a product offering an access to Internet, electricity and educational content at the very same time

# MIDDLE EAST– AREA PROFILE

## United Arab Emirates

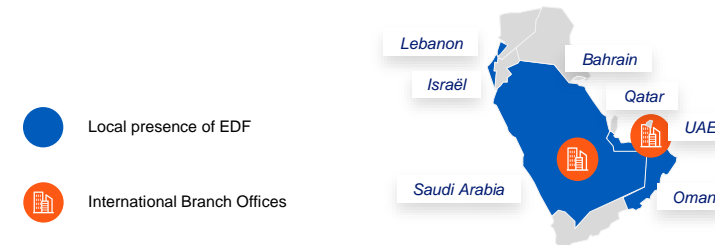
- EDF Renewables joined forces with the Masdar-led consortium to develop the “**DEWA III**” project, representing the third phase (800MWac) of one of the world's most powerful solar fleet projects, the Mohammed bin Rashid Al Maktoum solar plant, in partnership with Dubai Electricity and Water Authority (DEWA) near Dubai. The first two units (for a total of 500MWac) were commissioned in 2018 and 2019 respectively. The last unit is scheduled to be commissioned in 2020
- In addition, EDF operates a project supporting the contracting authority of a 250MW pumping station dam, planned to be developed in the Hatta mountains in the Emirate of Dubai, for DEWA

## Saudi Arabia

- In 2019, EDF Renewables gained a foothold in Saudi Arabia by winning, in consortium with Masdar, the call for tender for the Dumat Al Jandal wind project. With an installed capacity of 416MW, this wind farm will be the first in Saudi Arabia and the most powerful in the Middle East. The construction of the fleet started in the summer of 2019

## Israel

- Since 2010, EDF Renewables has owned a subsidiary in Israel which has established itself as the leading local player in solar energy, with ~300MWp of gross installed capacity, ~150MW under construction, another ~100MW won in calls for tender to be built by 2021, and several dozen additional projects under development. EDF Renewables Israel signed its first 2 agreements in Israel for the supply of solar electricity to private industrial customers
- The subsidiary is also active in the fields of electricity storage, wind power and wave energy. EDF Renewables Israel was selected in 2019 by the Israeli Ministry of the Environment to set up and run the Israeli Innovation Lab in the field of renewable energies and sustainable development







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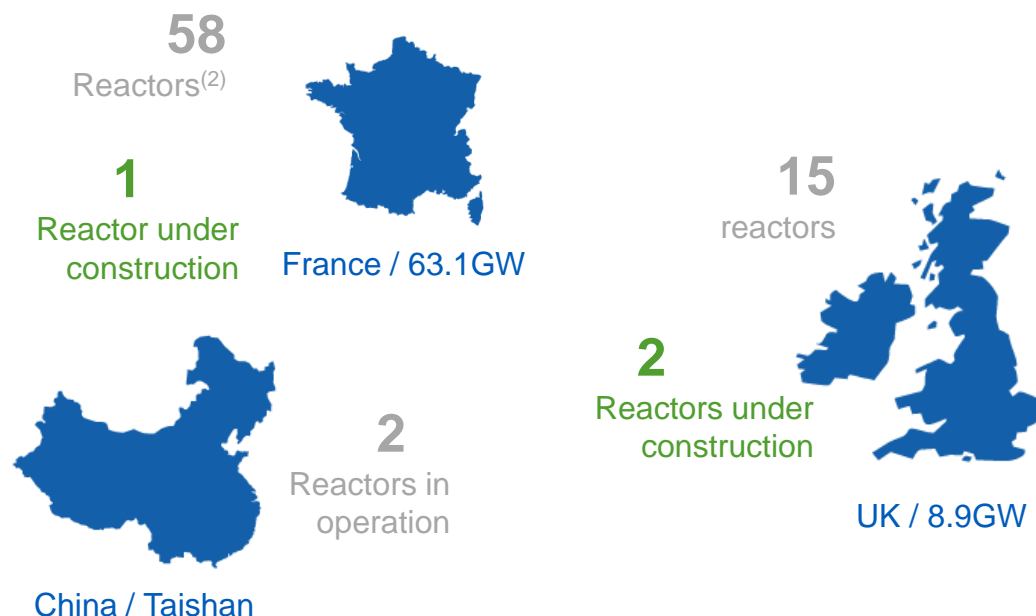
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# EDF GROUP MAIN BUSINESSES

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# EDF: UNIQUE EXPERTISE AND KNOW-HOW IN THE NUCLEAR INDUSTRY

## EDF, THE WORLD'S LEADING NUCLEAR OPERATOR<sup>(1)</sup>



- **To operate the existing nuclear fleet beyond 40 years**, and building the success of Tricastin 1 - the first reactor to successfully pass its fourth ten-year inspection (VD4) to extend its operating life, EDF plans to invest €45 billion<sup>(3)</sup> over the period 2014-2025, as part of the “**Grand Carénage**” programme
- The pooling of EDF and Framatome engineering teams in a joint subsidiary **Edvance**<sup>(4)</sup>, are the major milestones in the re-engineering of the French nuclear sector, for **new projects in France and abroad**
- EDF and its subsidiary Cyclife have won their first contracts on the international markets of **nuclear decommissioning and waste treatment**<sup>(5)</sup>.

<sup>(1)</sup> AIEA (Agence Internationale de l'Énergie Atomique), Nuclear power reactors in the world, 2017 edition

<sup>(2)</sup> As of 31/12/2019. Shutdown of the 2 Fessenheim reactors respectively on February 22<sup>th</sup> 2020 and June 30<sup>th</sup> 2020

<sup>(3)</sup> In 2013 euros (or €48 billions in current euros)

<sup>(4)</sup> Edvance, bringing together EDF's and AREVA NP's engineering expertise around the nuclear island

<sup>(5)</sup> Please refer to the press releases published by EDF on 6 February and 21 February 2018

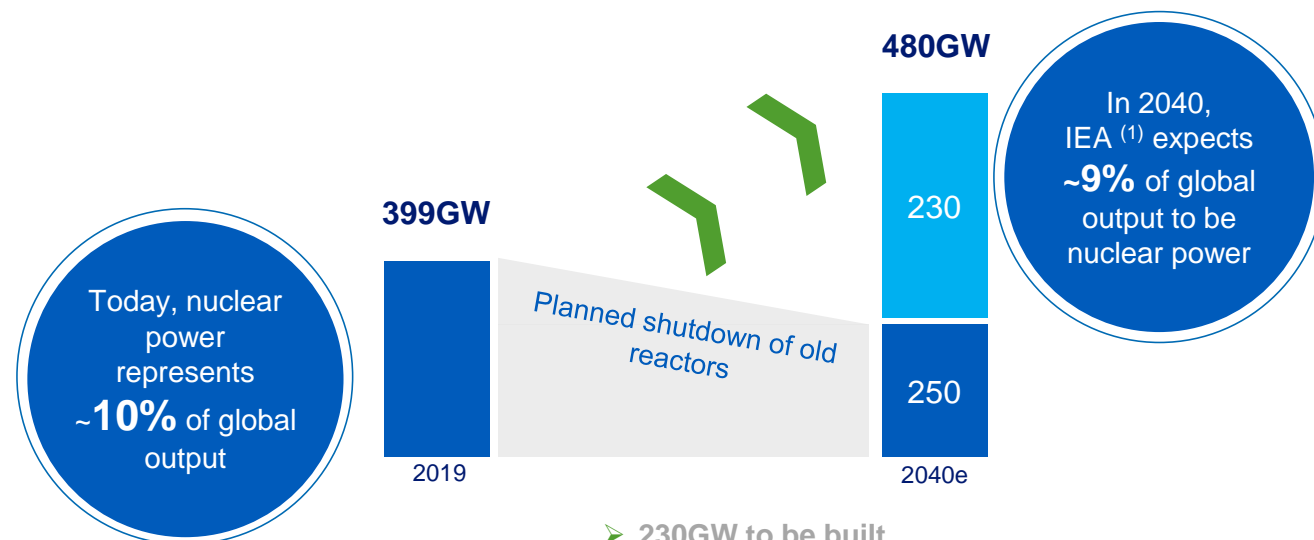
## EDF, GLOBAL EXPERTISE

**EDF manages the entire lifecycle of nuclear generation facilities: design, operation and decommissioning**

- **EDF is the world's leading nuclear operator** <sup>(1)</sup> with a standardised nuclear fleet of 58 reactors <sup>(2)</sup> in France and 15 reactors in Great Britain
- EDF is investing **to continue the operation, safely**, of its reactors beyond 40 years, a guarantee of the competitiveness of electricity generation in France
- **Construction of EPR-type reactors** throughout the world (France, China, Great Britain) and development of an optimised version of the EPR (EPR 2) for the renewal of the French nuclear fleet by 2030
- EDF is present in the French and international markets for the **decommissioning** of nuclear power plants and **radioactive waste treatment** facilities

# UNIQUE POSITIONING IN NUCLEAR NEW-BUILD

## WORLD NUCLEAR CAPACITY EXPECTED TO EXPAND OVER THE NEXT QUARTER CENTURY

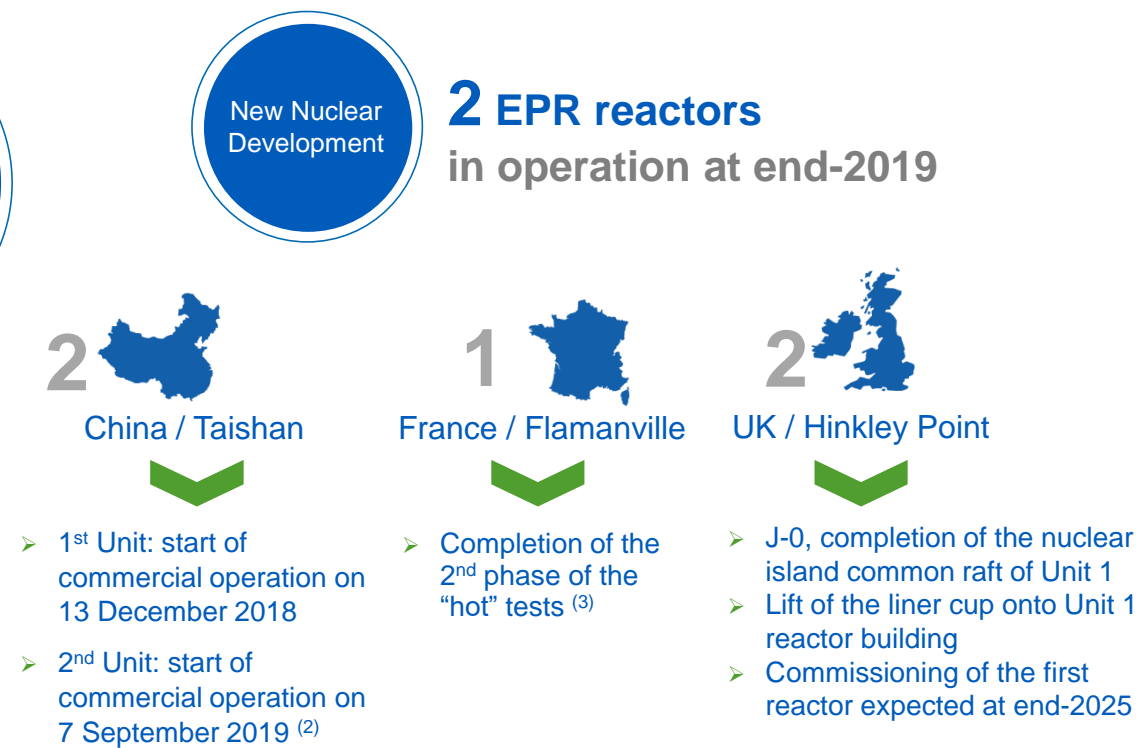


- 230GW to be built
- 149GW to be decommissioned

- The world's primary energy demand is expected to grow by 25% by 2040. This period will be marked by a accelerated growth of the electric share of energy consumption: +60% by 2040. The electricity share in the world's final energy consumption is expected to reach 24% in 2040, compared to 19% in 2018 <sup>(1)</sup>
- The share of nuclear power in global output is to stay relatively stable between 2019 and 2040, at 9%

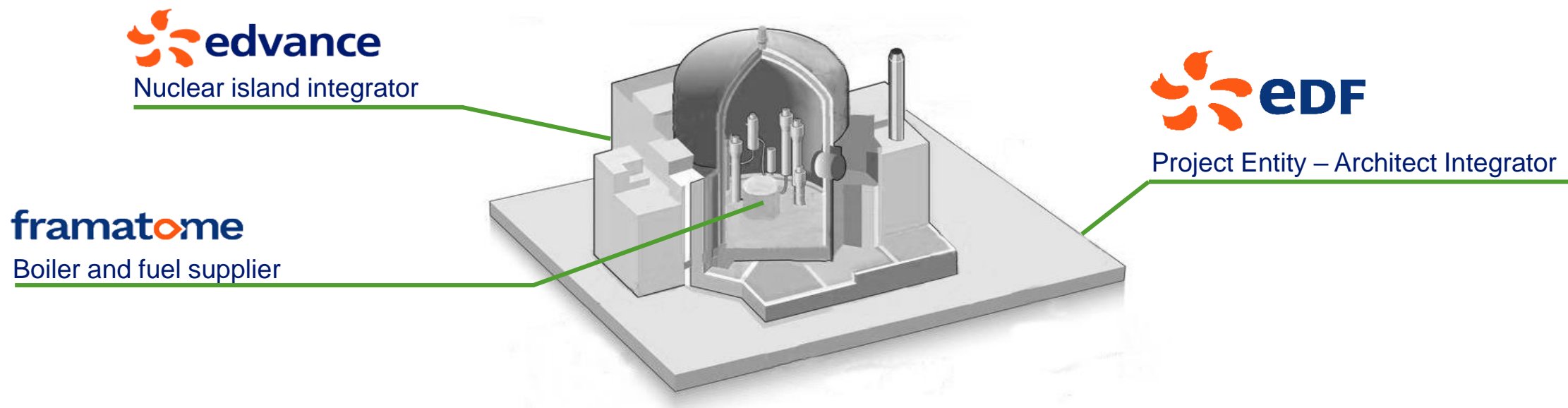
(1) International Energy Agency's reference scenario  
 (2) Please refer to EDF's press release of 6 September 2019  
 (3) Please refer to EDF's press release of 9 October 2019  
 (4) Please refer to EDF's press release of 29 September 2016  
 (5) Please refer to EDF's press release of 10 March 2018

## UNIQUE POSITIONING ON GLOBAL NEW NUCLEAR BUILD GROWTH



- In 2016, EDF also signed two other agreements with CGN concerning studies on two nuclear construction projects in the UK, Sizewell C and Bradwell B <sup>(4)</sup>
- In 2018, EDF and the Indian company NPCIL signed an Industrial Way Forward Agreement for the construction by NPCIL of six EPRs at the Jaitapur site in India <sup>(5)</sup>. On December 14, 2018, EDF submitted a complete and packaged technical and commercial offer

# NEW NUCLEAR: AN INTEGRATED CHANNEL FOR CONQUERING NEW MARKETS



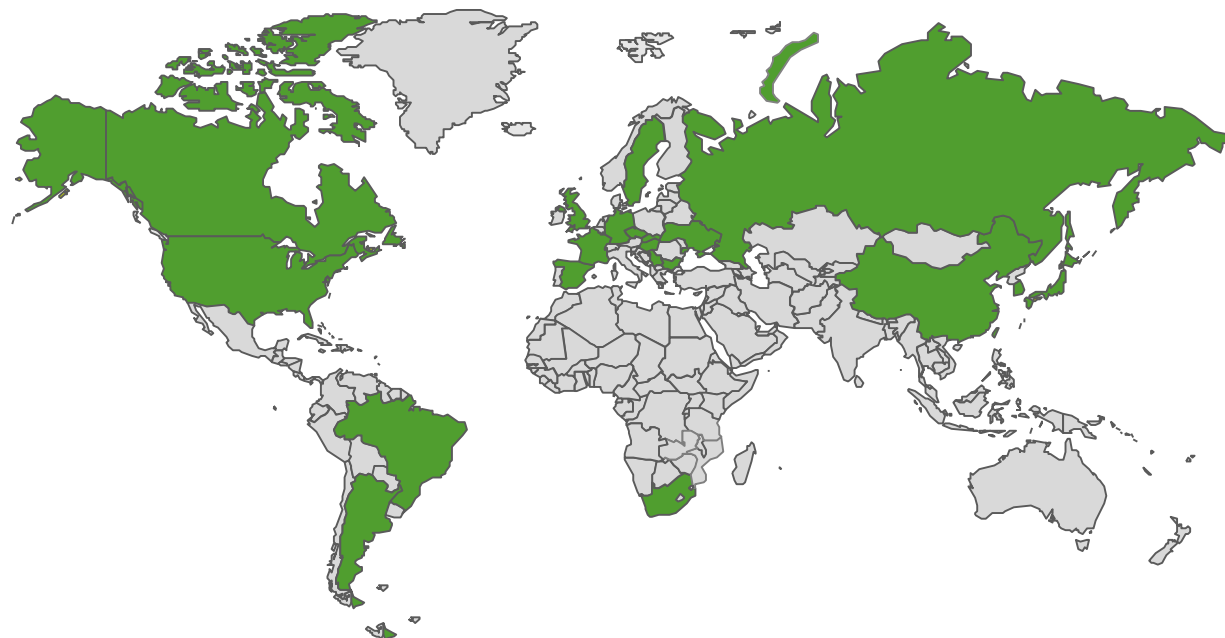
- **EDF Group (EDF SA, Framatome, Edvance) drives the French nuclear sector with the following goals:**
- Make project delivery and management more effective by harnessing each company's core strengths and the synergies expected from Framatome's integration into EDF group and the pooling of the EDF and Framatome engineering teams as part of the joint subsidiary Edvance
  - Enhance the competitiveness and appeal of our technologies and services through complementary expertises
  - Provide development opportunities for the French nuclear sector by ensuring ever greater engineering and business expertise in integrated projects

A promising market and active projects on every continent



# FRAMATOME, A MAJOR INTERNATIONAL PLAYER IN THE NUCLEAR INDUSTRY

## An international presence



€3.4bn  
in sales <sup>(1)</sup>

€12bn  
backlog <sup>(1)</sup>

56  
Sites in  
18  
countries <sup>(1)</sup>

14,000  
employees <sup>(1)</sup>

<sup>(1)</sup> Data at the end of 2019

## Benchmark supplier in the nuclear industry

- Designer and supplier of nuclear steam supply system and nuclear equipment, services, fuel and control systems for high levels of safety and performance
- 5 business areas
  - **Installed base:** products and services for the maintenance, modernization and life extension of existing nuclear reactors, those under construction and those being dismantled
  - **Fuel:** development, design, licensing and manufacturing of fuel assemblies and components for power reactors (PWR, VVER, BWR) and research reactors. Development of zirconium products.
  - **Projects and Component Manufacturing:** project management and construction of new boiler and replacement component projects including the manufacturing of heavy and mobile nuclear island components
  - **Instrumentation & Control:** Design and manufacture of instrumentation and control solutions for the safety of the nuclear boiler
  - **Engineering and Design Authority:** Development, design and licensing of boilers and associated services



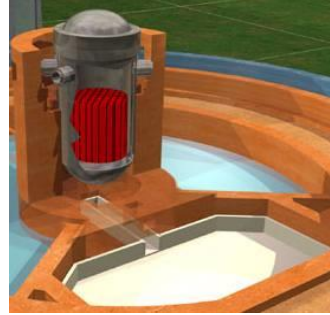
# EPR, A SAFE AND HIGH-PERFORMING REACTOR



Double-wall containment building with a shell able to resist to an airplane crash



4 independent safeguard systems



Core catcher in case of an accident



## ➤ Safety

- Accident probability reduction (factor 10)
- External hazard protection (shell able to resist an airplane crash)
- Evolutionary design (core catcher)

## ➤ Performance

- Annual generation boosted of 36%
- Efficiency improvement (+3pts)
- Increased availability (91%)

## ➤ Radioprotection

- At least 40% cut in collective annual exposure

## ➤ Environment

- Very important reduction in radioactive waste and gaseous and liquid discharges

# FLAMANVILLE 3 EPR (1,650MW)

## PROJECT HISTORY

- Construction progress:
  - ✓ Main civil engineering work completed
  - ✓ More than 98% of electromechanical assembly completed, the remaining activity is being carried out as the system performance tests are undertaken.
  - ✓ 79% completion of building finish work <sup>(1)</sup>
- System performance tests:
  - ✓ From 22 February 2019 to 22 March 2019: 1st phase of the “hot” tests with more than 95% of the test criteria testing compliant.
  - ✓ From 21 September 2019 to 17 February 2020: 2nd phase of the “hot” tests, enabling the facility to be tested under normal operating conditions



## UPDATING OF SECONDARY CIRCUIT WELDS

In a letter dated 19 June 2019, the Nuclear Safety Authority (ASN) asked EDF to repair the eight containment penetration welds for the Flamanville EPR, not compliant with the “break preclusion” principle. Within this framework, EDF has assessed three repair scenarios.

This work resulted in discussions with the ASN, who sent EDF a letter on 4 October concerning the technical feasibility of these three scenarios.

The penetration weld rework scenario preferred by EDF is the use of remote-controlled robots, designed to conduct high precision operations inside the pipings concerned. This technology has been developed for nuclear power plants in operation and shall be qualified for penetration weld rework. The aim is to qualify this scenario with validation by the ASN by the end of 2020, the date on which EDF will be able to initiate the repair works. The second scenario, based on extraction and realignment works in the Safeguard Auxiliary Buildings, is kept at this stage as a fall-back solution.

The technical examination of the process of realignment of the welds on the main secondary system with quality deviations or not in compliance with the “break preclusion” principle requirements defined by EDF is being continued in order to start welding activities as soon as possible (see the significant incident report of 30 November 2017 on the correction application of “high quality” requirements).

## SCHEDULE AND COST <sup>(2)</sup>

The provisional schedule for the implementation of the preferred penetration weld repair scenario, if the target for validation by the ASN is complied with, results in the date of fuel loading at the end of 2022 and the reassessment of the construction cost to €12.4 billion <sup>(3)</sup>, representing an increase of €1.5 billion. These additional costs will be recorded mainly as other income and expenses <sup>(4)</sup> and not as CAPEX.

A new application to amend the Flamanville 3 construction authorisation decree, to extend the deadline, was filed by EDF on 23 July 2019. Subsequent to this application, the construction authorisation decree has been amended on 25 March 2020 with a new deadline extended until 2024

<sup>(1)</sup> Finishing work aimed at bringing the facility up to a high quality standard (cleanliness, paint, weather stripping), in accordance with the standard of an operating nuclear power plant.

<sup>(2)</sup> See press release of 9 October 2019.

<sup>(3)</sup> In 2015 euros, excluding interim interest.

<sup>(4)</sup> IAS 16 paragraph 22 on abnormal costs incurred in connection with assets constructed by the company. These costs will affect the years 2020, 2021 and 2022 with an impact of €0.4bn on the 2020 Group share of net income, with no impact on net income excluding non-recurring operations

# HINKLEY POINT C: PROJECT OVERVIEW

<b>Location</b>	Bridgwater, Somerset, UK
<b>Technology</b>	Two UK EPR reactors
<b>Capacity</b>	3.2GW (2 x 1.6GW)
<b>Operating life</b>	60 years+
<b>Responsible Designer</b>	EDF
<b>Main contractors</b>	Framatome, GE, Bouygues/Laing O'Rourke, Alliance of Cavendish Nuclear/Balfour Beatty/Altrad/NG Bailey and Doosan Babcock
<b>Contract for difference</b>	CfD strike price fixed over 35 years: £ <sub>2012</sub> 92.50/MWh or £ <sub>2012</sub> 89.50/MWh if a positive FID is taken for Sizewell C (indexed to British inflation)
<b>Investors' participation</b>	EDF Energy: 66.5% ; CGN: 33.5%
<b>Economic benefits</b>	25,000 jobs on site during construction, with potentially up to 8,000 people on site at peak construction – 4,500 jobs in France





# HINKLEY POINT C

All 4 main goals set for 2019 on Unit 1 were achieved

## PROGRESS ON THE HINKLEY POINT C PROJECT <sup>(1)</sup>

The project's completion cost is estimated at between £21.5 and 22.5 billion in 2015 sterling<sup>(2)</sup>, an increase of £1.9 to 2.9 billion<sup>(3)</sup> compared to the previous estimates, reflecting mainly challenging ground conditions and extra costs needed to implement the completed functional design; the range depends on the effectiveness of action plans, namely those to be delivered in partnership with contractors.

Commissioning of Unit 1 remains scheduled end-2025. Risk of COD delay of Units 1 and 2 has increased: it had already been estimated respectively at 15 and 9 months. Materialisation of this risk would entail an additional cost of around £0.7 billion

## 4 KEY TARGETS FOR 2020 HAVE BEEN DEFINED:

- Q1 – First safety-related pipework installed
- Q2 – J-0 milestone for Unit 2
- Q3 – Unit 1 Feedwater Tank Manufacturing complete
- Q4 – Reactor building Internal Structure Design complete



Lifting of the 170 tonne liner cup and installation onto the Unit 1 reactor building

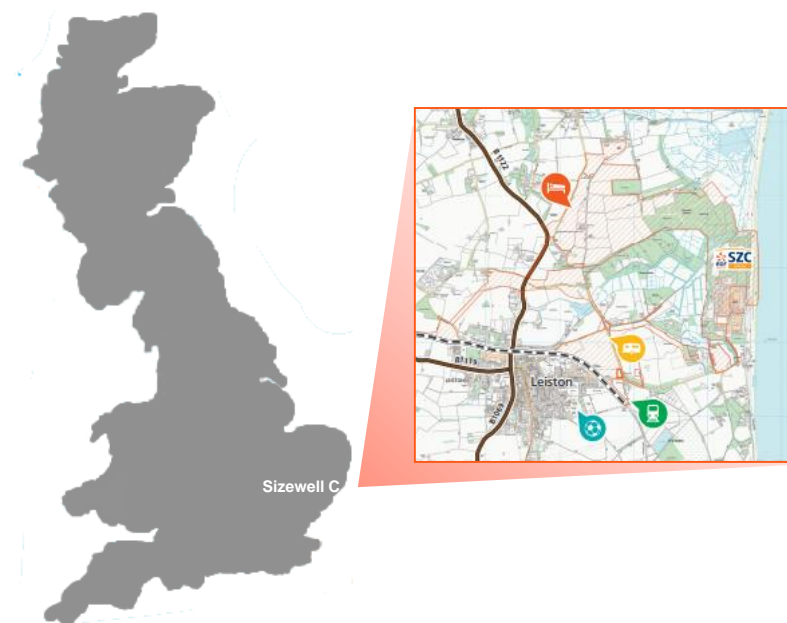
<sup>(1)</sup> Please refer to press release published by EDF on 25 September 2019

<sup>(2)</sup> In 2015 Sterling, excluding interim interests and forex effect versus the reference exchange rate for the project 1 Sterling = 1.23 Euro

<sup>(3)</sup> Additional costs net of action plans

# SIZEWELL C: PROJECT OVERVIEW

Location	Sizewell, East Anglia, UK
Technology	Two UK EPR reactors
Capacity	3.2GW (2 x 1.6GW)
Operating life	60 years+
Design	European Pressurised Reactor replicated on HPC design, approved for construction in UK in 2012, UK required design changes achieved and frozen in 2018. EDF provides Responsible Design
Key milestones	The Government launched a consultation process from July to October 2019 to seek views from stakeholders on the considered Regulated Asset Base (RAB) model for New Nuclear projects. Feedback is expected first half of 2020. FID expected to be taken end-2021 assuming appropriate third party funding has been secured
Shareholder's structure	Pre-FID: EDF Energy: 80%; CGN: 20% At FID, EDF Energy will sell the majority of its shares to external partners and does not intend to consolidate the project after FID



# CHINA: TAISHAN 1 AND 2 (EDF 30%)

## BOTH TAISHAN EPR PLANTS ARE OPERATING

- The commercial commissioning of Taishan 1 and Taishan 2 took place respectively on 13 December 2018 and 7 September 2019 <sup>(1)</sup>.
- The Taishan plant can generate up to 24TWh of electricity per year, the equivalent of the annual consumption of 5 million of Chinese people. The plant will prevent 21 million tonnes of CO<sub>2</sub> emission per year.

## TARIFF FOR THE PURCHASE OF TAISHAN PLANT ELECTRICITY

- In March 2019, Chinese authorities published a first tariff for the purchase of electricity generated in these new Chinese nuclear plants, including Taishan. The price set for Taishan amounts to RMB435/MWh (around €56/MWh) <sup>(2)</sup>.
- This tariff will be reviewed by taking into consideration the feedback for operating the plant. The next review is set for end-2021. EDF continues to share information on the subject with its partner CGN and with the Chinese authorities.

## A VALUED FEEDBACK FOR OTHER EPR PROJECTS IN THE WORLD

- The performance of the Taishan Unit 1 is in line with objectives. The availability factor of Unit 1 amounted to 90.9% in 2019, showing a satisfactory availability.
- Following commercial commissioning on 13 December 2018, Taishan Unit 1 generated 12TWh in 2019, and Unit 2 generated 4.2TWh between its commercial commissioning on 7 September 2019, and the end of the year.

## 2 EPR of 1,750MW



<sup>(1)</sup> See EDF press release of 6 September 2019.

<sup>(2)</sup> See CGN press release of 28 March 2019.

<sup>(3)</sup> KD = availability factor



# JAITAPUR

Through the Jaitapur project, the EDF group has been involved in Franco-Indian civil nuclear cooperation since 2010 within the framework of bilateral agreements signed between France and India. It is directly based on the energy transition objectives of the Indian government, set out during the Paris Conference in 2015, which aim to drive forward the increased share of renewable and nuclear energies in the country. Jaitapur is in Maharashtra state and will be the largest nuclear power site in the world.

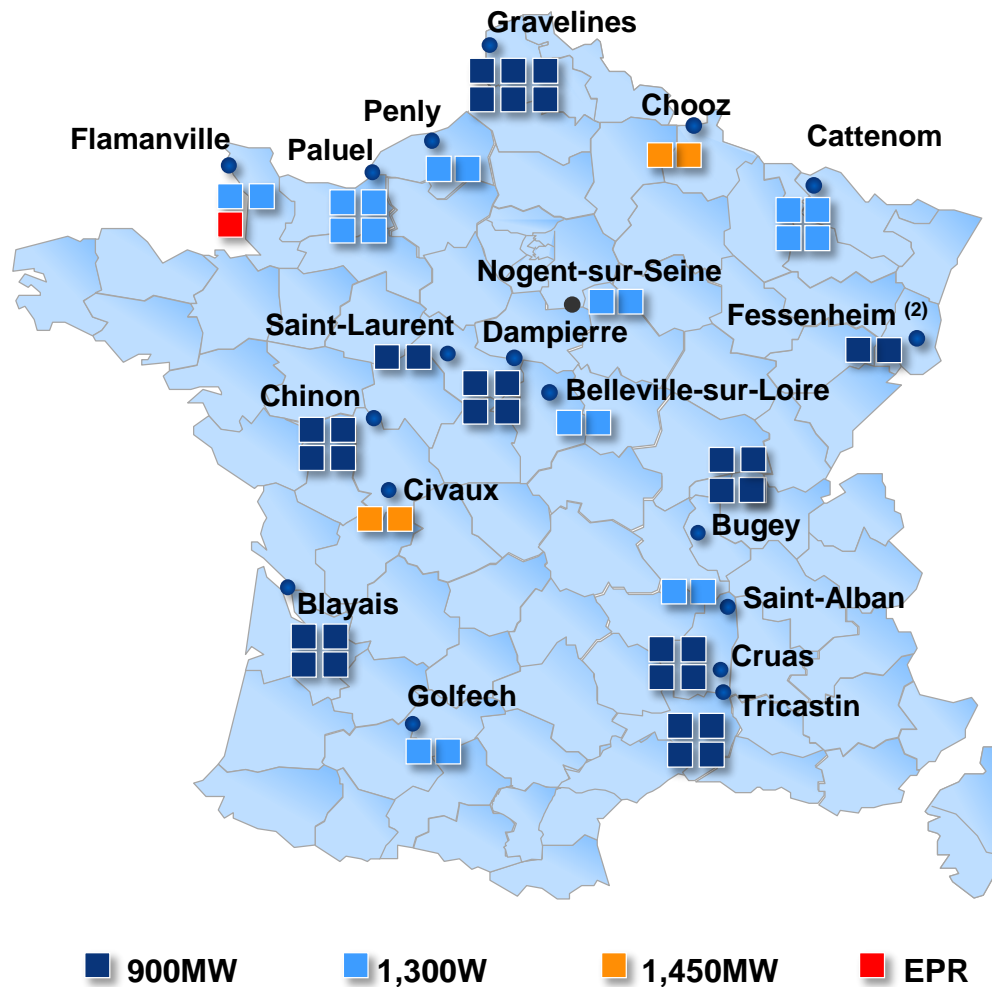
Acting as head of the French nuclear power sector, EDF entered into exclusive negotiations with NPCIL in 2016.

- On Saturday 10 March 2018, Jean-Bernard Lévy, EDF Chairman and CEO, and Satish Kumar Sharma, Chairman and MD of Nuclear Power Corporation of India Limited (NPCIL), the government-owned Indian energy company, signed an Industrial Way Forward Agreement for the implementation of six EPR reactors at the Jaitapur site in India. The agreement defines the project's industrial framework, the roles and responsibilities of the partners, as well as a planned timetable for the next steps.
- Under the terms of the agreement, EDF will act as supplier of the EPR technology. EDF will undertake all engineering studies and all component procurement activities for the first two reactors. For the other four units, the responsibility for some purchasing activities and studies may be assigned to local companies. The Group will also provide NPCIL with its valuable experience from the construction of EPR reactors.



- In its capacity as owner and future operator of the Jaitapur Nuclear Power Plant, NPCIL shall be responsible for obtaining all authorisations and certifications required in India, and for constructing all six reactors and site infrastructures. EDF and its industrial partners will assist NPCIL during the construction phase.
- In accordance with the timetable set out in the IWFA, EDF submitted a complete technical-commercial offer to NPCIL on 14 December 2018. Discussions are underway with NPCIL to reach an agreement on the technical and commercial bases.
- The goal is for EDF, at NPCIL's request, to submit a binding joint technical and commercial proposal which will be followed by the signature of a General Frame Agreement, thus marking the first stage in the construction of 6 EPR reactors in India on the Jaitapur site.

# EDF NUCLEAR FLEET IN FRANCE



- 70.6% <sup>(1)</sup> of French power generation in 2019
- 58 reactors <sup>(2)</sup> in operation with a capacity of 63,130MW <sup>(2)</sup>
- 19 sites
- A unique technology, PWR (Pressurised Water Reactors), 3 series:
  - 900MW    34 reactors    31GW with an average age of 38 years
  - 1,300MW    20 reactors    26GW with an average age of 31 years
  - 1,450MW    4 reactors    6GW with an average age of 19 years

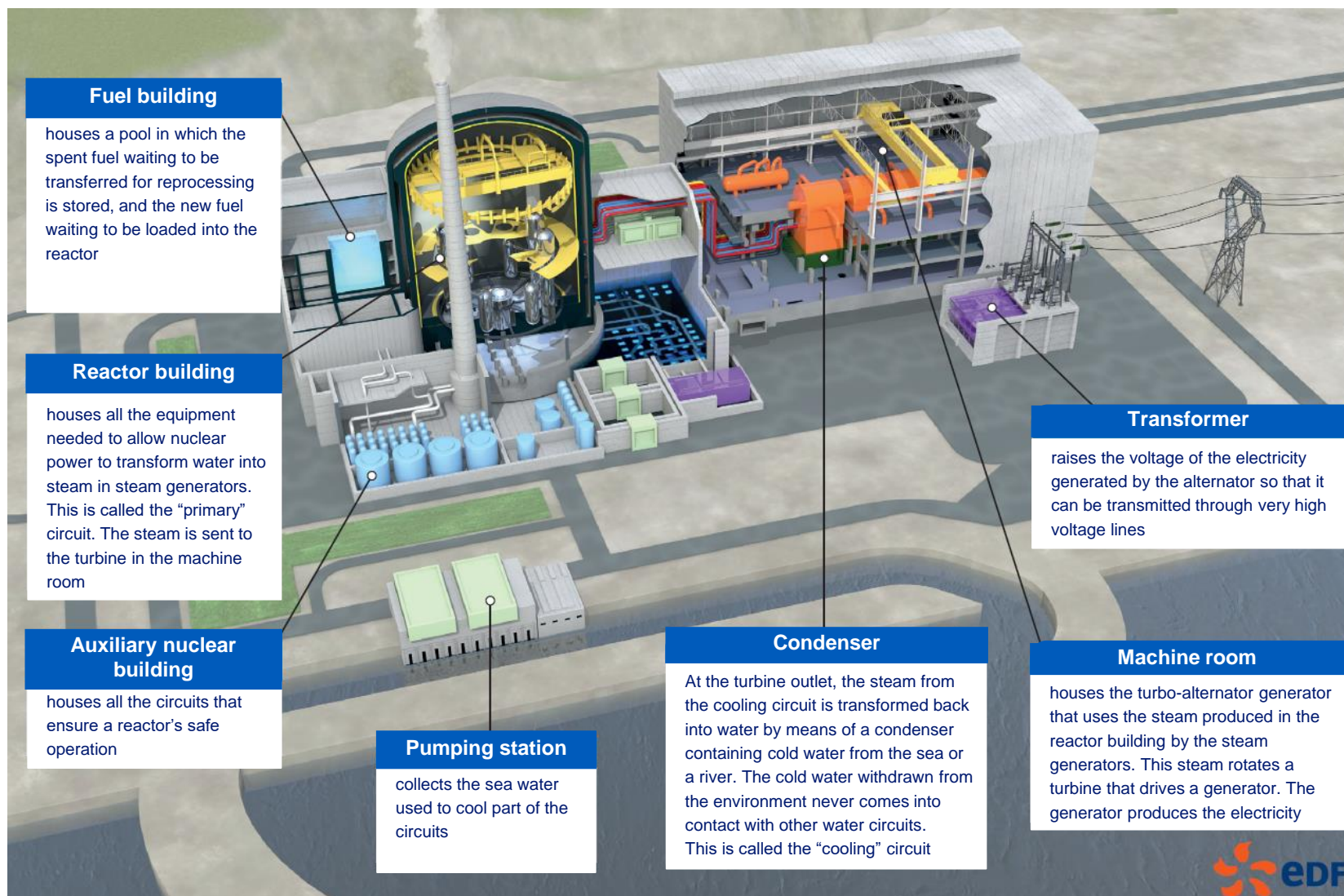
## Did you know ?

The whole fleet in operation today has been built using the same technology (PWR). This standardisation allows for operational synergies and greater efficiency. EDF is responsible for the design, building and operation of the reactors and considers the safety of its facilities as an absolute priority.

<sup>(1)</sup> The total French electricity output reached 537,7TWh in 2019 (*Bilan électrique* 2019 of RTE)

<sup>(2)</sup> On 31/10/2019. Closing of Fessenheim first reactor on 22 February 2020 (the second one will be closed on 30 June 2020), Cf. press release of September 30<sup>th</sup> 2019

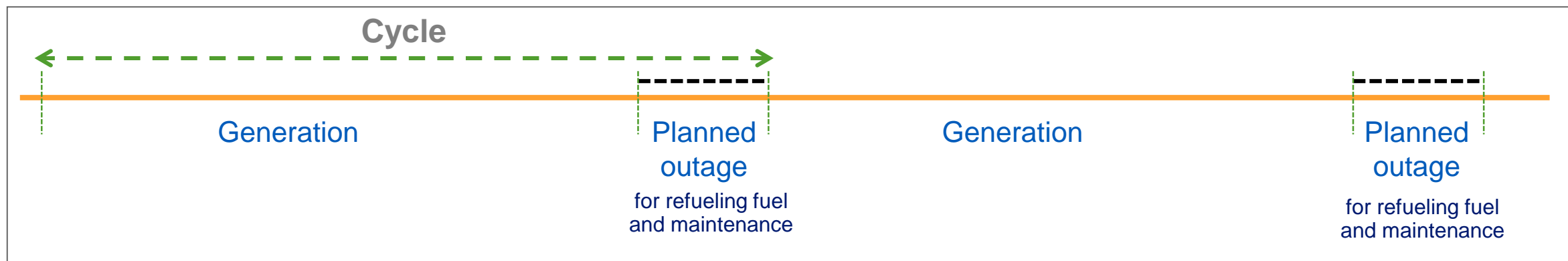
# OPERATING PRINCIPLES OF A PRESSURISED WATER REACTOR (PWR)



Nuclear power plant without air cooling



# THE FRENCH NUCLEAR FLEET: OPERATING CYCLE



## The outages cycle of nuclear reactors

- 900MW: **28 reactors** 12 months cycle  
**6 reactors** 18 months cycle
- 1,300MW: **20 reactors** 18 months cycle
- 1,450MW: **4 reactors** 18 months cycle

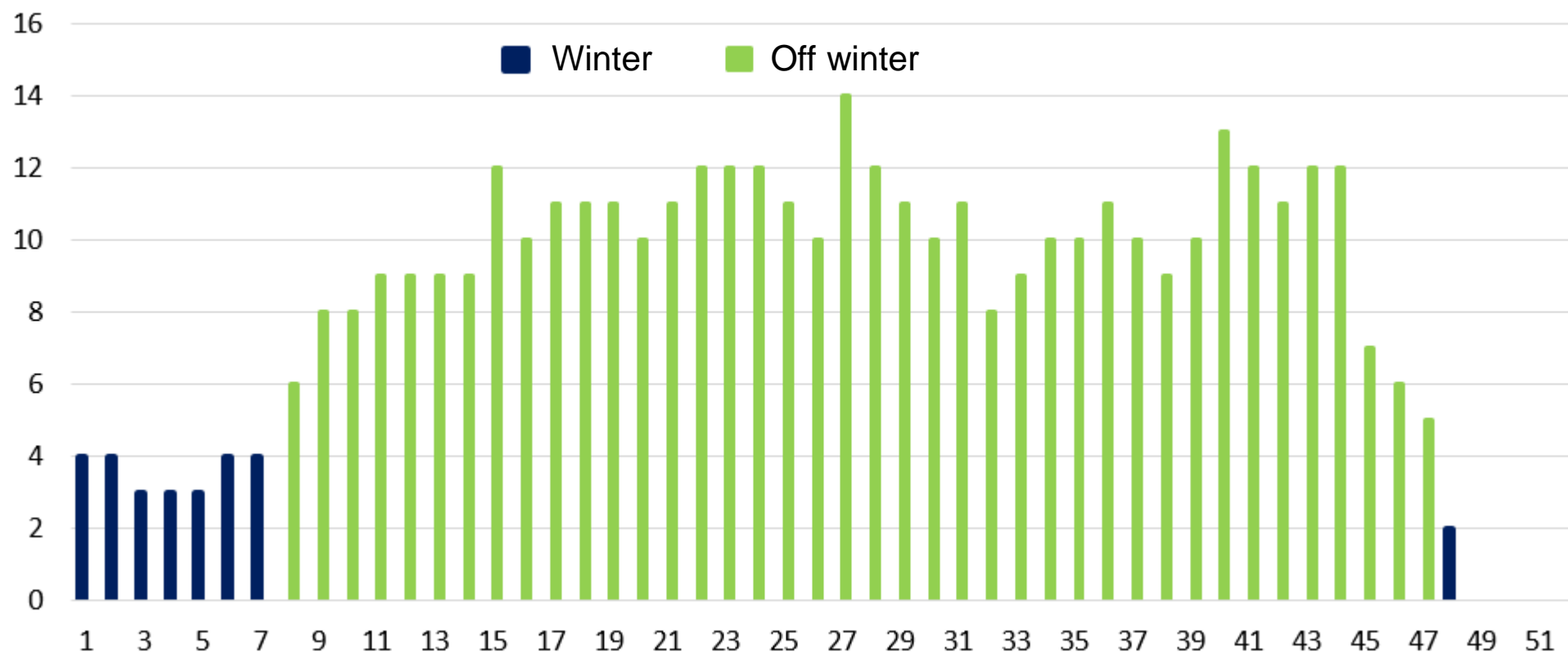
## Types of planned outages

- Two types of planned outages are alternated at the end of each generation campaign:
  - Ordinary outage for refueling only (ASR): unloading spent fuel and refueling fresh fuel. **Standard period ~35 days**
  - Partial inspection (PI): refueling and maintenance  
**Standard period ~70 days**, varying according to programs for maintenance work
- 10-year inspections (VD): **standard period ~150 days**, varying according to programs for safety upgrades and maintenance work
  - Regulatory obligations (safety tests and various controls), adapting safety to latest standards, maintenance work
  - Detailed examination of the main components relating to the safety of the facility (reactor vessel, containment building) and realisation of the upgrades aimed to reinforce the safety level of the facility

# A SEASONAL SCHEDULE OF PLANNED OUTAGES

- A minimum number of planned outages during winter
- Necessary balance between 12-month and 18-month generation cycles

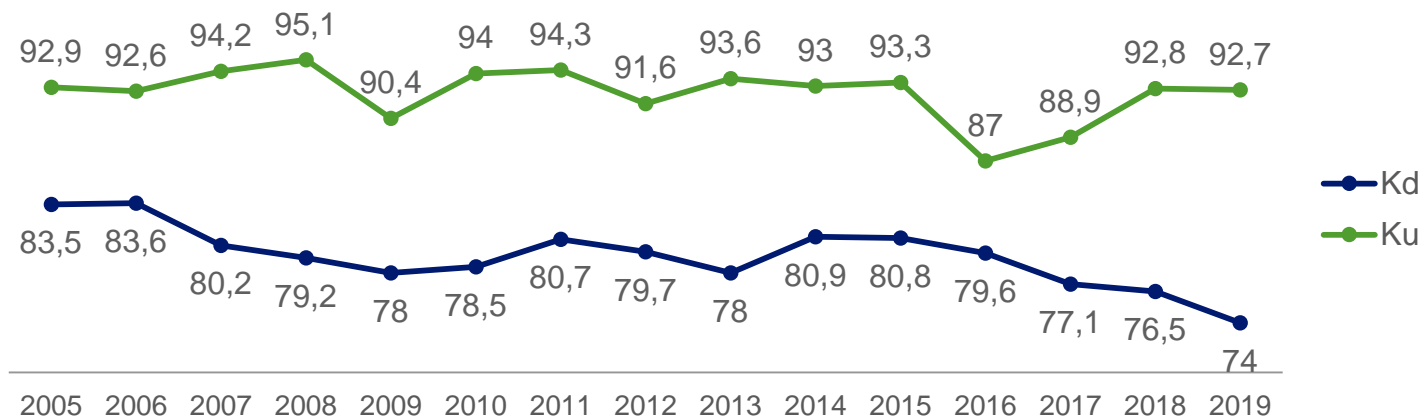
2019 Year: number of reactors in planned outage per week seen from the 1<sup>st</sup> January 2019



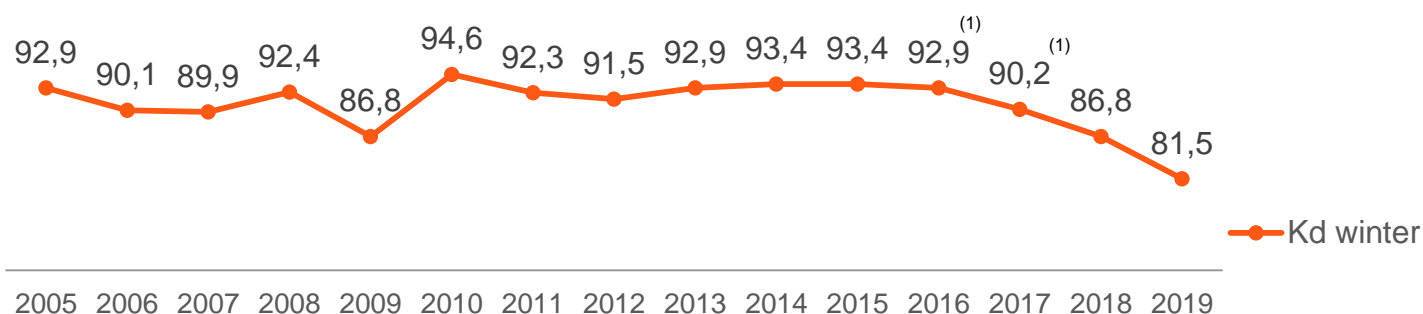
The planning refers to a specific instant t

# HISTORICAL AVAILABILITY OF THE FRENCH NUCLEAR FLEET

*Kd and Ku (%)*



*Winter Kd\* (%)*



(\*) from 1st December (N) to 14 February (N+1)

<sup>(1)</sup> Excluding the outages for regulatory reasons such as outages relating to the irregularities found at Creusot factory, that are included in Ku factor

## Did you know ?

The **Kd**, or “availability factor”, represents the available energy over the maximum theoretical energy corresponding to the maximum capacity all along the year. The winter **Kd** is the availability factor measured between the 1<sup>st</sup> of December and the 14<sup>th</sup> of February of the next year, when the consumption reaches its maximum levels.

The **Ku**, or “utilisation factor”, is the produced energy over the available energy. It reflects environmental, social and regulatory constraints, the consumption profile of customers, the supply of system services and the optimisation

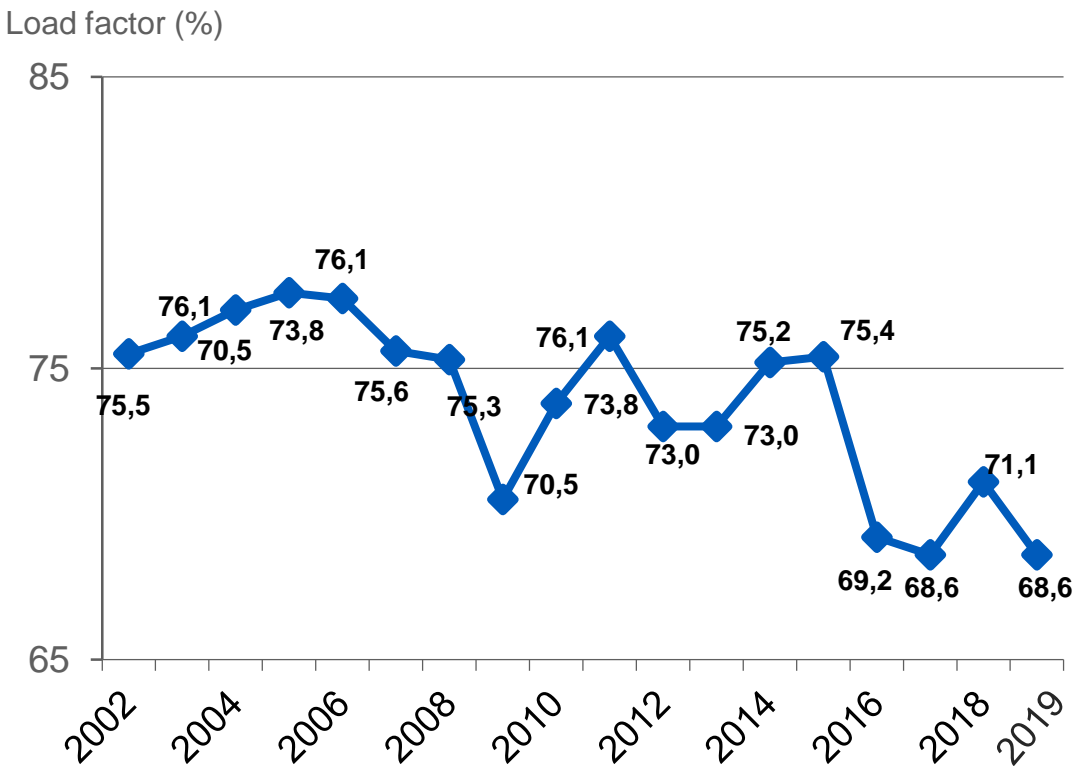
$$Kp = Kd \times Ku$$

The multiplication of the Kd and the Ku leads to the **Kp**, or “load factor”, defined as the generated energy compared to the maximum theoretical energy

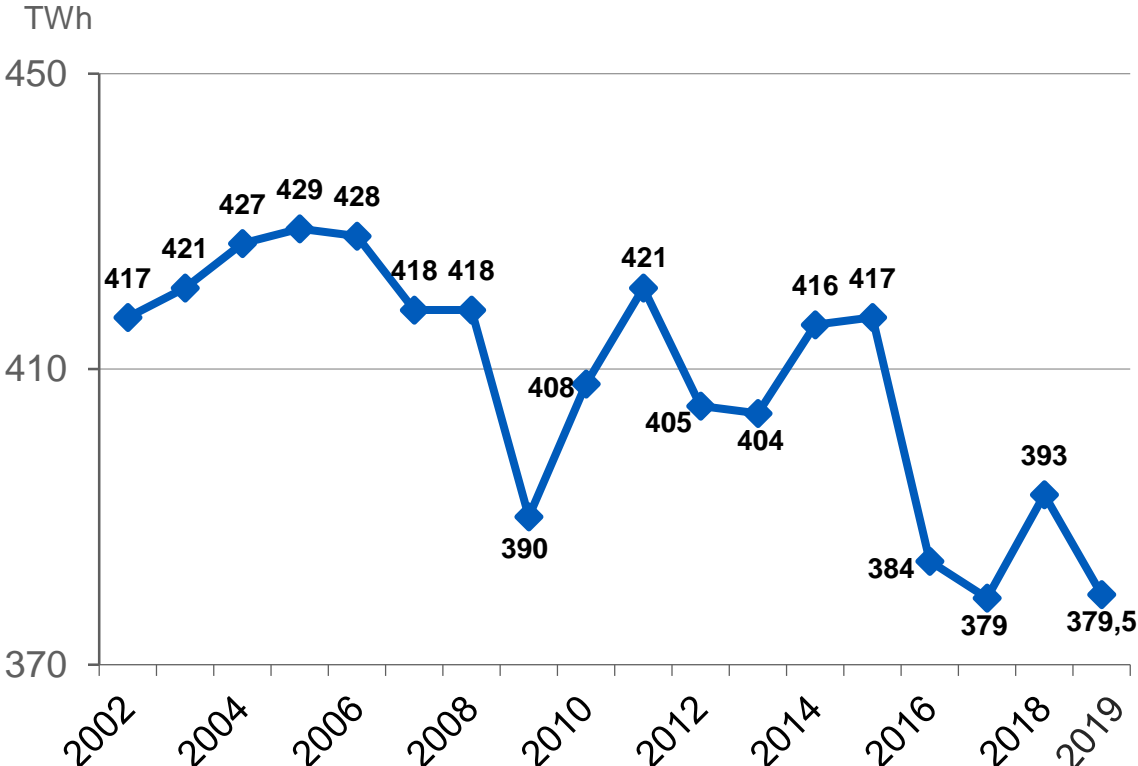


# CHANGE IN LOAD FACTOR AND NUCLEAR OUTPUT IN FRANCE

Annual load factor of nuclear fleet in France



Net output of PWR <sup>(1)</sup> fleet in France

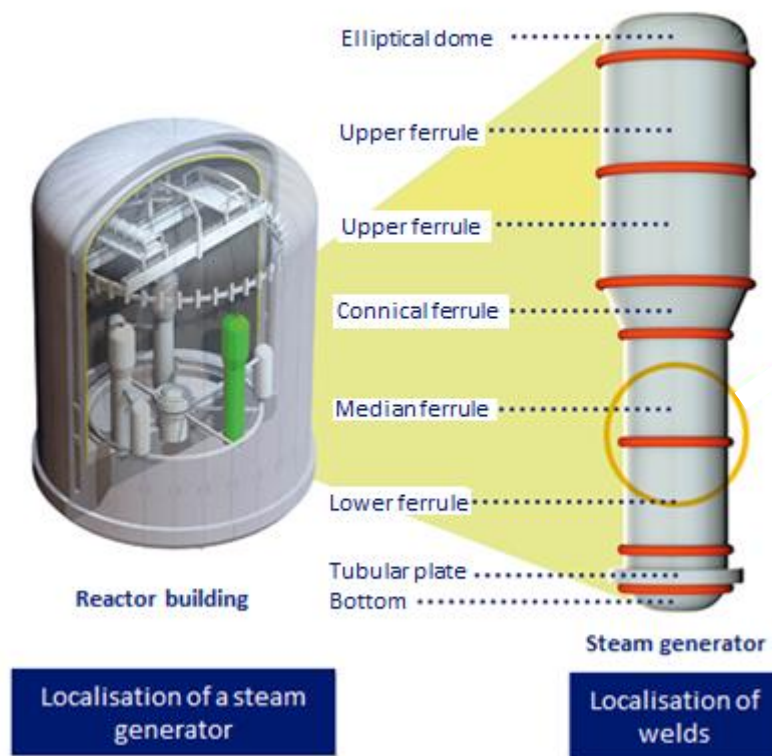


(1) Pressurized Water Reactor

# DISCREPANCIES IN RELATION TO THE TECHNICAL FRAMEWORK FOR THE PRODUCTION OF NUCLEAR REACTOR COMPONENTS BY FRAMATOME

- On the 9th of September 2019, EDF informed France's nuclear regulatory authority of its initial investigations concerning the deviation from a post-weld stress-relieving heat-treatment process applied to certain nuclear-reactor components.
- EDF and Framatome have since identified 16 steam generators installed on six operating reactor units: reactors no. 3 and 4 at Blayais, reactor no. 3 at Bugey, reactor no. 2 at Fessenheim, reactor no. 4 at Dampierre-en-Burly and reactor no. 2 at Paluel.
- Following the publication by the ASN on 24 October 2019 of the information note "Manufacturing deviation at Framatome stress-relieving heat treatment of welds", it has been confirmed that the reactors in question may continue to function as is <sup>(1)</sup>. The checks required to address the deviations will be carried out during scheduled outages. For the Flamanville 3 EPR equipment, these inspections will be carried out after the currently underway hot test phase <sup>(2)</sup>.
- The components that are not yet in service are the 4 steam generators and the pressuriser at the Flamanville 3 EPR, as well as 3 new steam generators that have not yet been installed and that were manufactured for the purpose of replacing the steam generators on reactor units no. 5 and 6 at Gravelines.

## STEAM GENERATOR WELDS



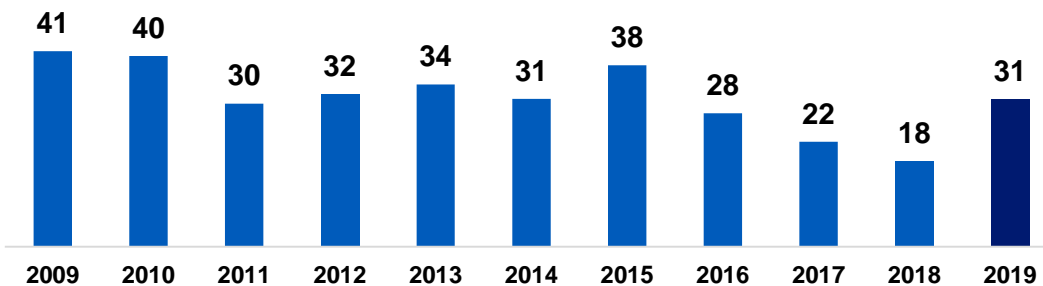
(1) ASN requested complementary information on the specific case of Fessenheim 2.

(2) Refer to press release published on 25 October 2019.

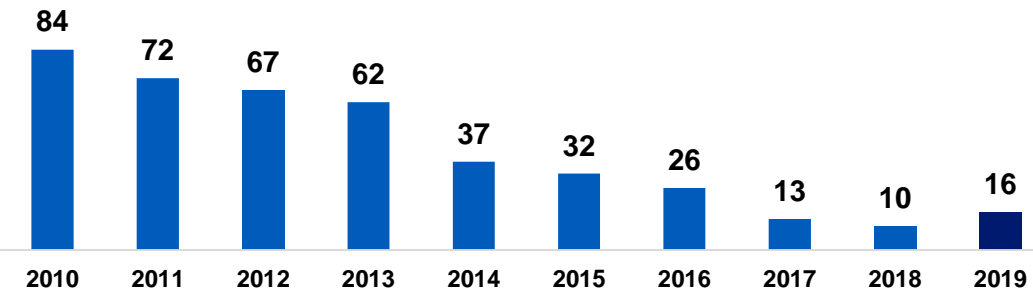
# OPERATIONAL PERFORMANCE OF THE NUCLEAR FLEET IN 2019

## 2019: decreasing in safety and radiation protection indicators

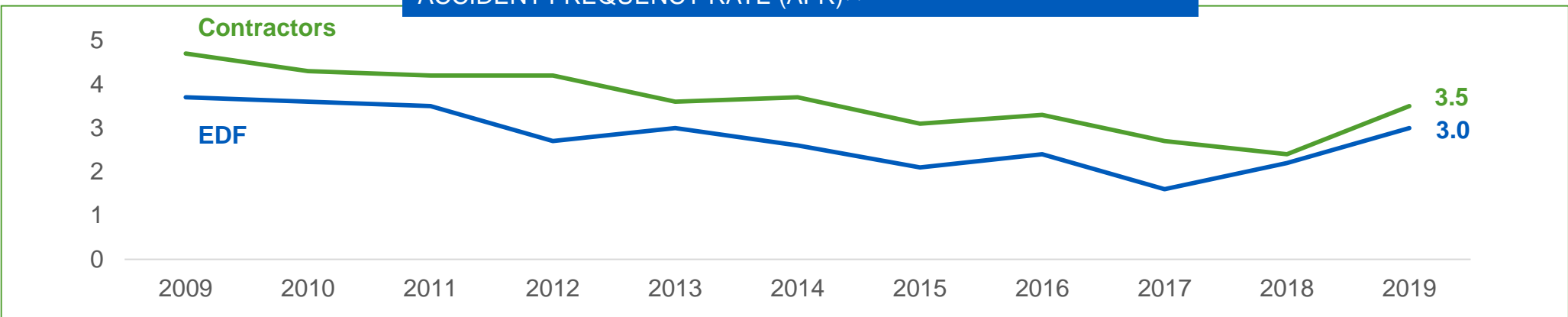
NUMBER OF AUTOMATIC REACTOR OUTAGES<sup>(1)</sup>



NUMBER OF INJURED ON CRITICAL RISKS<sup>(3)</sup>



ACCIDENT FREQUENCY RATE (AFR)<sup>(2)</sup>



(1) Automatic reactor outage is a safety and protection system of a reactor. This is an important indicator in terms of safety which measures the quality and rigour of reactors' operation

(2) Number of accidents with work stoppage per million hours worked of the nuclear generation division in France

(3) Accumulated lifting accidents, electrocution and fall height of the nuclear generation division in France

# EXISTING NUCLEAR FLEET AND “GRAND CARÉNAGE” PROGRAMME

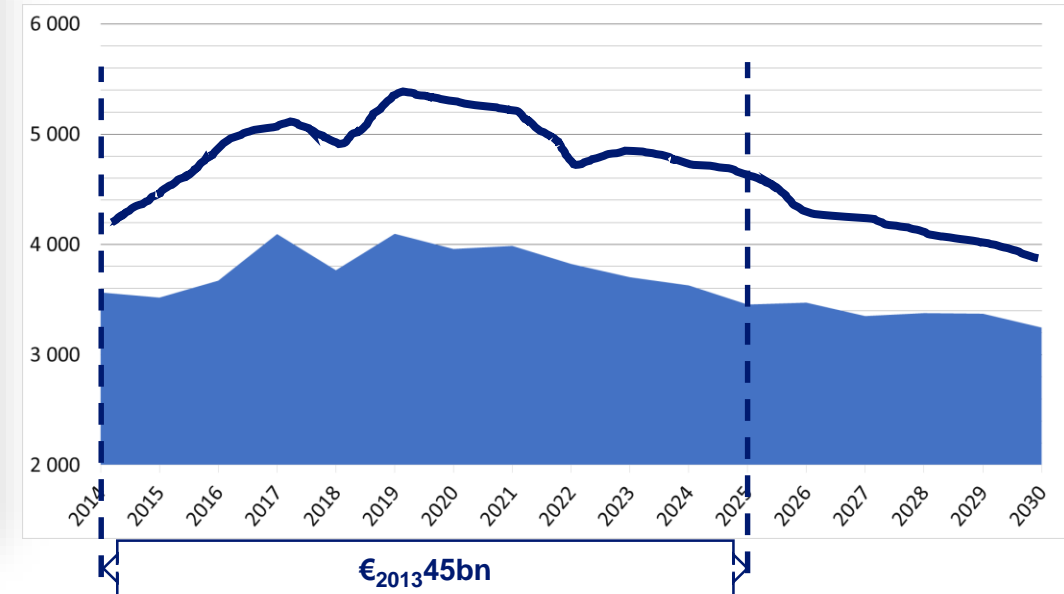
## A COMPETITIVE ENERGY MIX

Industrial strategy to continue the operation of plants after 40 years for a competitive energy mix:

- Technical capacity of the plants to operate beyond 40 years supported by international benchmarks for similar technologies
- Extension from 40 to 50 years of the depreciation period of the 900MW nuclear fleet (except Fessenheim) accounted as of 1 January 2016: the Tricastin 1 reactor is the first to have successfully completed its 4th ten-year inspection in December 2020 and thereby crossed the 40-year milestone.
- Strategy confirmed by the guidelines given for Multi-year Energy Plan (PPE)

## GRAND CARÉNAGE PROGRAMME

- Programme integrating the totality of the investments in the existing nuclear fleet
- Programme cost over the 2014-2025 period: total investments costs of an initial amount of €<sub>2013</sub> 55bn revised to €<sub>2013</sub> 45bn<sup>(1)</sup> mainly through project optimisation allowing a reduction and a postponement beyond 2025
- The ASN is expected to give its generic position early 2021 on measures proposed by EDF for the extension of operations beyond 40 years



(1) The figures presented by the French Cour des comptes in its report of 10 February 2016 cover a longer time horizon, up to 2030, and included, beyond the investment, operating and maintenance expenses. Both assessments are consistent, as stated by the Cour des comptes in its report. Indeed, among the overall estimates calculated by the Cour des comptes and amounting to close to €<sub>2013</sub> 100 billion for the 2014-2030 period, the investment - expenditures estimated at €<sub>2013</sub> 74.73 billion should be distinguished from the operating expenditures estimated at €<sub>2013</sub> 25.16 billion. Within the €<sub>2013</sub> 74.73 billion of investment expenses between 2014 and 2030, €<sub>2013</sub> 55 billion are dedicated to the 2014-2025 period, which allows the two estimates established by the EDF group and the Cour des comptes to be connected

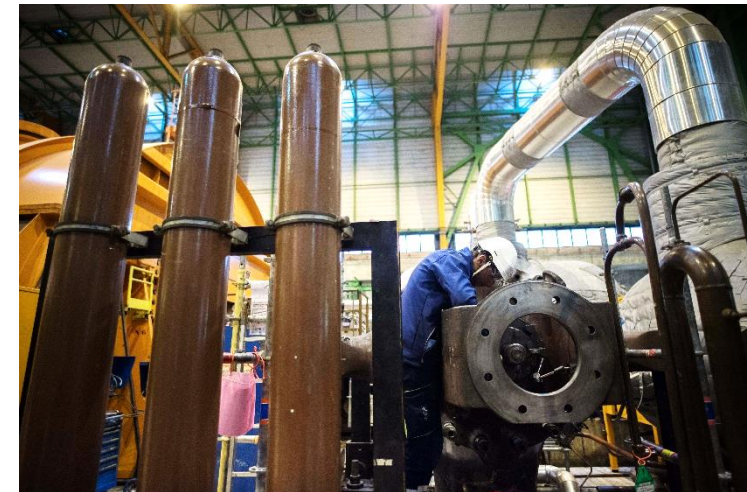
# GRAND CARÉNAGE: CONTINUING OPERATION OF THE POWER PLANTS BEYOND 40 YEARS FOR A COMPETITIVE ENERGY MIX

BY INTEGRATING ALL OF THE INVESTMENTS FOR THE FRENCH NUCLEAR FLEET, THE “GRAND CARÉNAGE” PROGRAMME RESPONDS TO THREE MAJOR CHALLENGES

- **The renewal or replacement of major components** at the end of their technical lifetime (exceptional maintenance)
- **Carrying out the modifications needed** to improve safety (including post-Fukushima modifications and ten-year inspections)
- **The demonstration of equipment qualification after 40 years.** These are studies or tests to ensure that “qualified” equipment, that is, those capable of operating under particularly difficult conditions, retain this capability after 40 years of operation
- The works are carried out mainly during maintenance shutdowns, but also during certain periods of operation of the installations

AN OPERATIONAL PROGRAMME 5 YEARS AFTER ITS LAUNCH

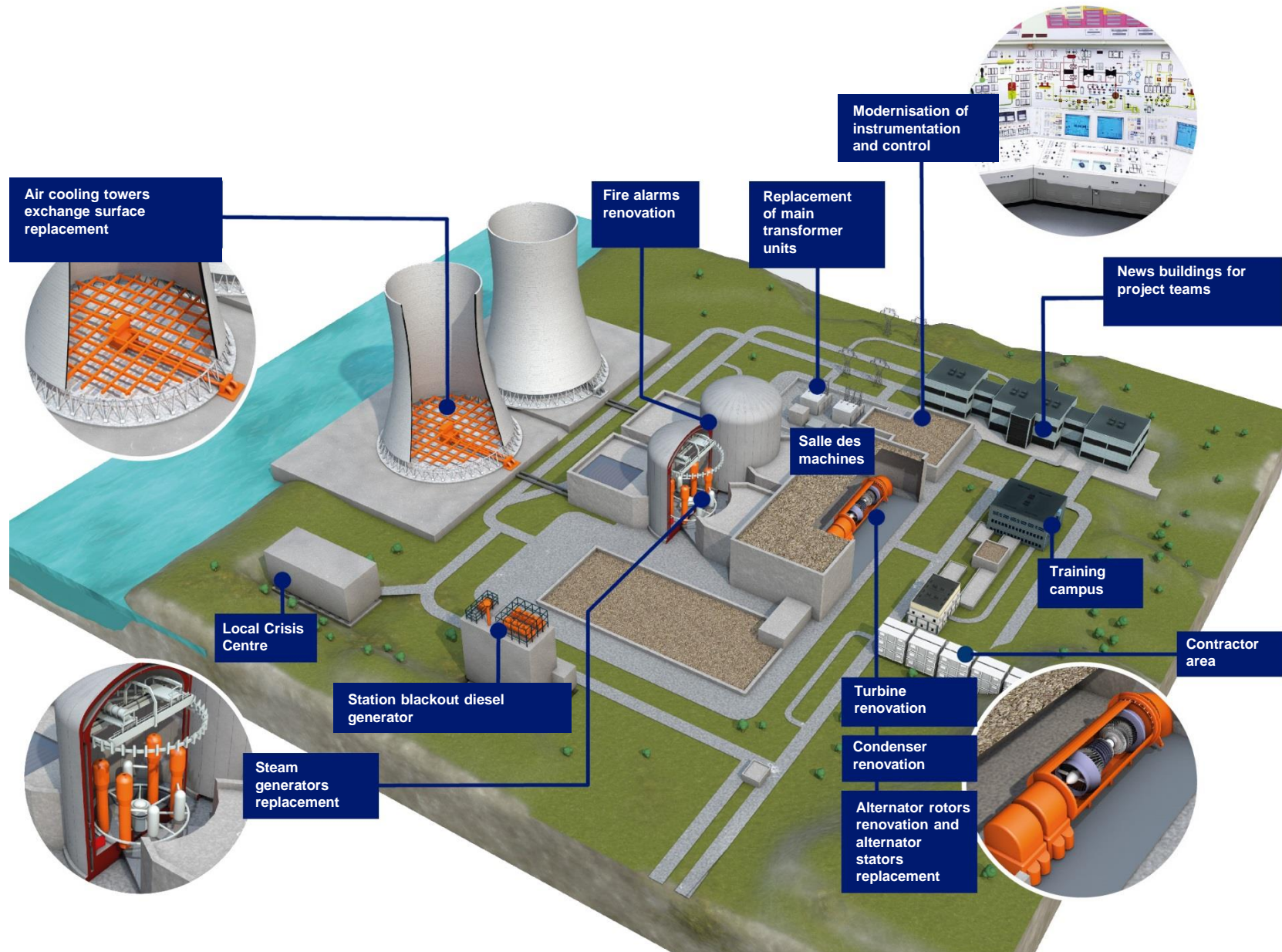
- The 3<sup>rd</sup> ten-year inspections for the 1,300MW series began in 2015 and will be completed by 2025
- More than 3/4 of the 4<sup>th</sup> ten-year inspections for the 900MW series will be completed by 2025, the first of which took place at Tricastin in 2019



Nuclear power plant in Saint Laurent des Eaux, intervention in the machine room as part of the *Grand Carénage*



# GRAND CARÉNAGE : MAIN INDUSTRIAL SITE WORKS 2014-2025



- As a major industrial program, Grand carénage incorporates all the investments made by EDF on its French nuclear fleet. It is now made up of 22 investment projects (of which 20 are active today)
- Each project covers the design and construction phases of all EDF nuclear power plants



# SOME LARGE PROJECTS IN 2019

## 4th ten-year inspection 900



The 4th ten-year inspection of Tricastin 1 was completed on 23 December with the coupling of the unit to the grid

## Backup diesel generators



At the end of December, the 5 scheduled commissionings of backup diesel generators were completed in Cattenom, Golfech and Nogent. During the night of 30 to 31 December, the 35th backup diesel generator was put into operation, allowing for the ASN technical prescription of the 35 generators in service at the end of 2019.

## Ten-year inspection of N4 series



Chooz generation unit No. 2: the recoupling of the unit on 6 August marks the success of the initial unit of the 2nd ten-year inspection of the N4 series

## Heat sink



Replacement of the heat exchange body of the air cooling in the Chooz generation unit 2

## Local crisis centre



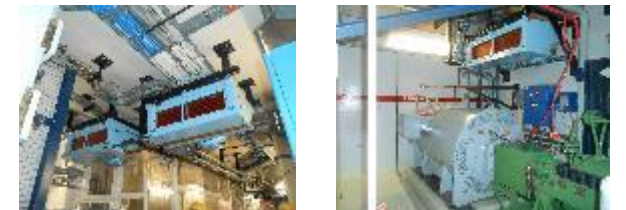
On 25/10/2019, transfer to the operator of the Flamenville local crisis centre.

## Civil engineering work



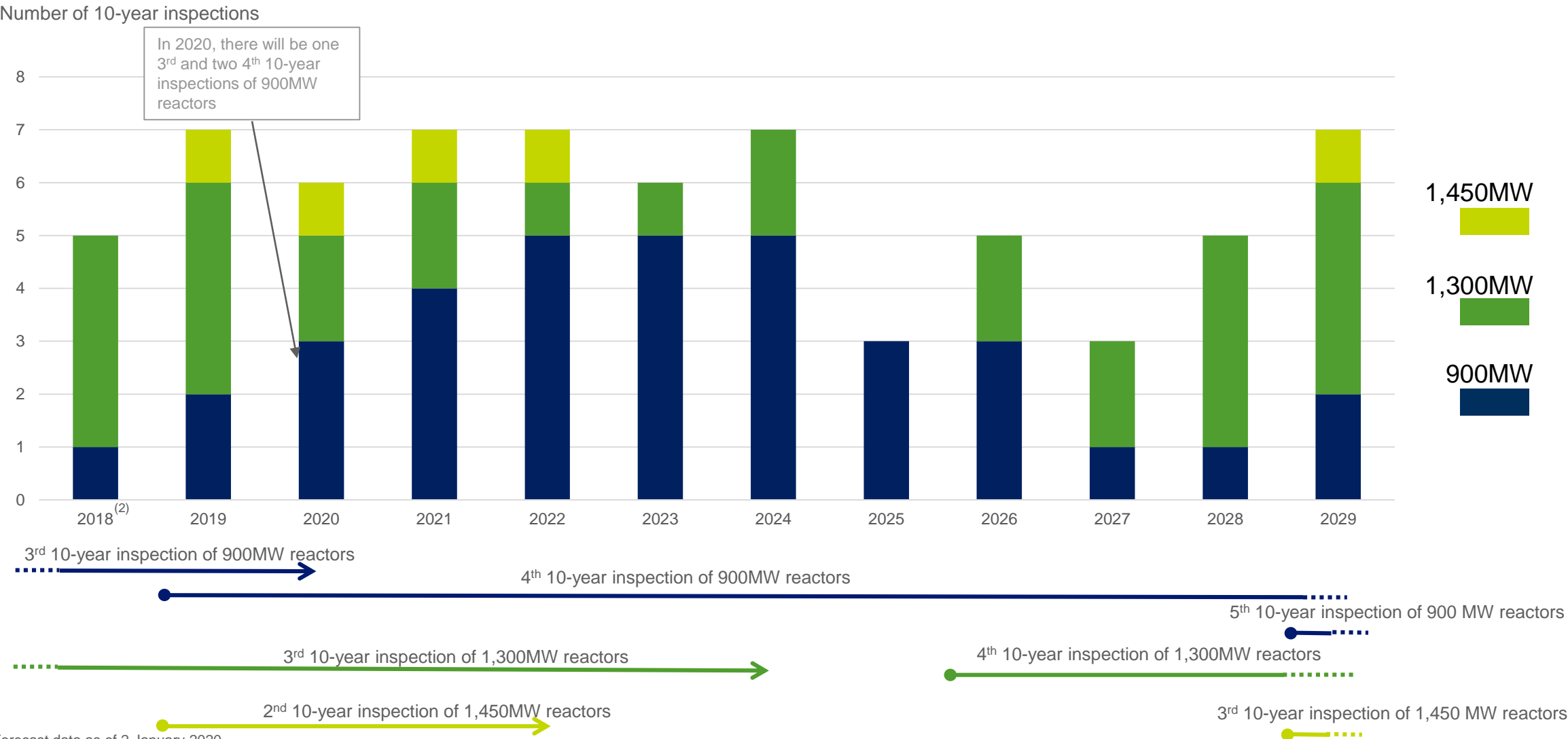
Successful testing of the containment building of Belleville generation unit No. 2 on 16/10/2019

## “Grands Chauds”



The latest “Grands Chauds” modifications at Bugey were undertaken during the ASR unit 4, without impact on the shutdown

# 10-YEAR INSPECTIONS OF THE NUCLEAR FLEET (1)



(1) Forecast data as of 2 January 2020  
(2) Of which 3<sup>rd</sup> 10-year inspection (1,300MW) of Paluel 2 started in 2015 and recoupled in July 2018

- The 18th of February 2020, a decree from France's prime minister was raised, in which it requested the termination of operations and permanent shutdown of both reactors at Fessenheim nuclear power plant (NPP). So, the shutdown of reactor no. 1 took place on 22 February 2020, whilst the shutdown of reactor no. 2 is planned for 30 June 2020.
- This decree follows on from the signing, on 27 September 2019, by the State and by EDF, of a protocol agreement whereby the State will compensate EDF for the early closure of Fessenheim NPP, resulting from the limitation of nuclear power output set by a law passed on 17 August 2015, pertaining to the energy transition in support of green growth.
- According to the terms of this protocol, compensation will comprise:
  - ✓ Initial instalments to compensate for the anticipation of expenses incurred by the closure of the plant (post-operational expenditure, BNI taxes, dismantling and staff redeployment costs), which will be paid over a 4-year period following closure of the plant. These payments are expected to amount to a total between €370m and €443m
  - ✓ subsequent payments in compensation for any loss of earnings, i.e. income from future power generation, based on Fessenheim's previous output figures, up until 2041, calculated "ex post" on the basis of nuclear output selling prices, including observed market prices
- EnBW, EDF's partner in the plant (17.5%), will under certain conditions be entitled to a share of lost earnings in proportion to its contractual rights to the plant's generation capacity.
- As part of this early closure, the government has set up a project entitled "Future of the Fessenheim territory". EDF has created its own programme, called the Haut-Rhin Energy Programme. This is in line with the 4 axes of the government project (job creation and reconversion, territorial mobility, energy transition, innovation).
- The objective of this programme is to support different projects, including in particular:
  - ✓ Participation in an innovation hub to support research, particularly in the field of hydrogen and materials, in connection with a metal recovery project (under study by EDF on the plant site)
  - ✓ Participation in the relaunch of a project for a Lac Blanc-Lac Noir Pumping Energy Transfer Station (STEP) by the French State
  - ✓ Participation in the creation of the Personalised Support Unit, through which 150 employees are monitored
  - ✓ Participation in the creation of the Franco-German semi-public company (*Société d'Economie Mixte*, SEM), a genuine tool for the operational implementation of the territorial project, by choosing to orient it initially towards development and commercial real estate

# EDF ENERGY NUCLEAR FLEET



- Advanced Gas-cooled Reactor (AGR)
- Pressurised Water Reactor (PWR)

## HIGHLIGHTS

- Generated approximately 15% of UK output in 2019 <sup>(1)</sup>
- 8 nuclear power stations
- 15 reactors in operation
- 2 technologies (AGR and PWR), with total capacity of 8.9GW

## Did you know ?

**An AGR** differs in many respects from a PWR. Whereas the AGR design is unique to the UK, the PWR design is the most common reactor type in the world.

**An AGR** has a graphite moderator helping to control the reaction. The reactor is encased in a steel-lined pre-stressed concrete pressure vessel several meters thick which also acts as a biological shield. The steam generator in which water is heated is situated inside the pressure vessel. An AGR uses enriched uranium dioxide encased in a stainless steel pin for its fuel and CO<sub>2</sub> as its coolant.

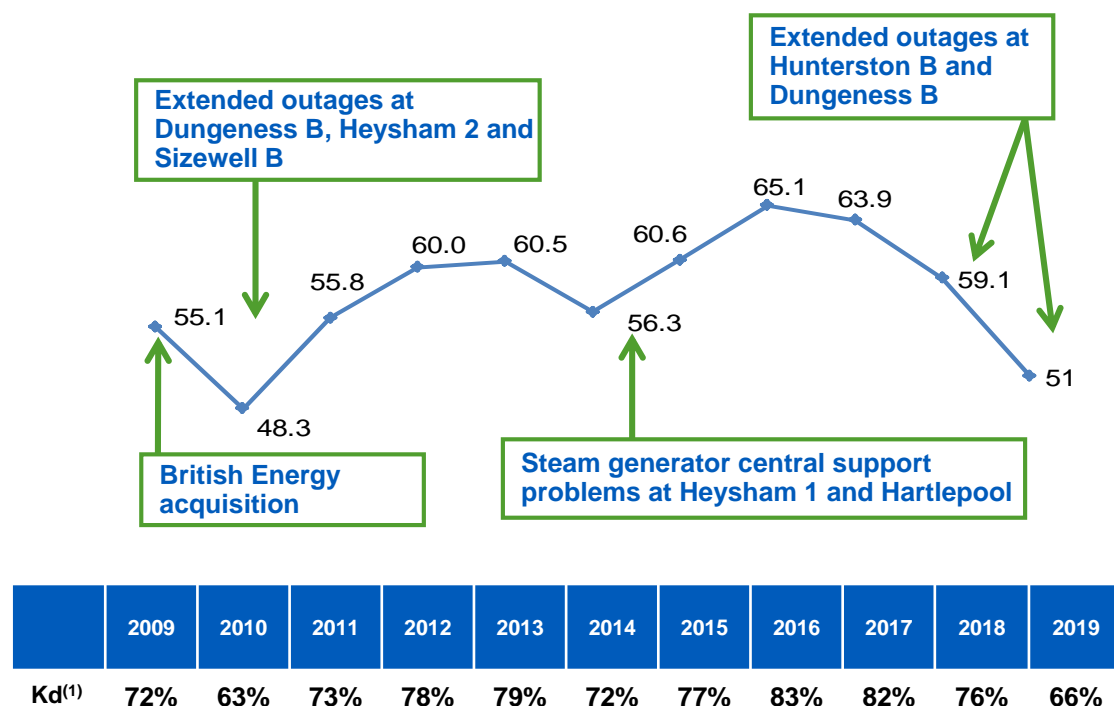
**A PWR** is contained inside a steel pressure vessel filled with pressurised water which acts as the moderator and coolant. The fuel used is enriched uranium dioxide and is contained in zirconium alloy tubes.

(1) Source: The generation output is aggregated from multiple sources by EDF Energy team

# KEY CHARACTERISTICS OF EDF ENERGY'S NUCLEAR FLEET

## Output (TWh)

## Key points



### ➤ A nuclear fleet with an average age of 35 years

- Total power generation capacity of 8.9GW
- An output of 51.0TWh in 2019

### ➤ Nuclear safety is the over-riding priority

- Adequacy of each station confirmed at each statutory outage by the Office for Nuclear Regulation (ONR) that has to provide consent to restart after each outage
- Periodic safety review (PSR) undertaken every 10 years, also requiring ONR acceptance

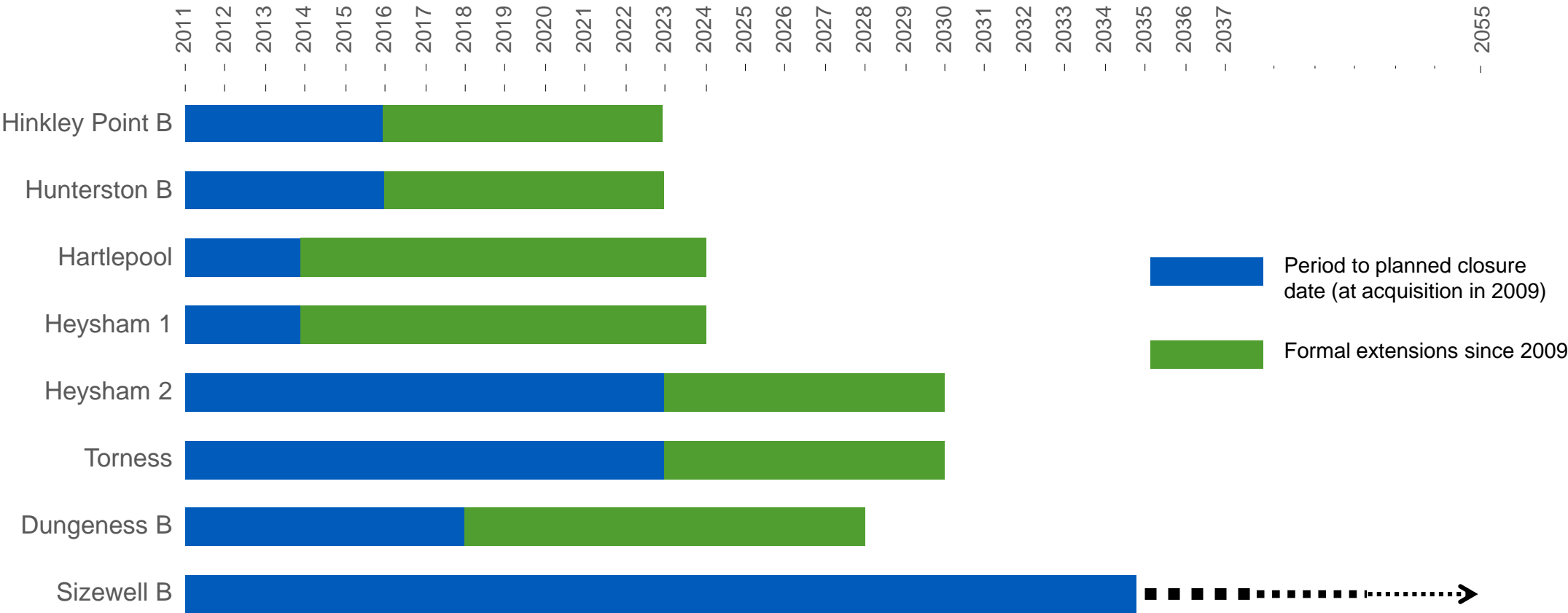
### ➤ Delivering life extensions

- Life extension subject to review of safety, technical and economic factors
- The lives of the AGRs<sup>(2)</sup> have been further extended by an average of 8 years (relative to the planned closure dates at British Energy's acquisition in 2009)
- It is anticipated that Sizewell B PWR<sup>(2)</sup> can be extended by 20 years

(1) Unit Capability factor

(2) For more information about EDF Energy's nuclear fleet and about the AGR and PWR technologies RAG and REP, see p. 98

# EDF ENERGY NUCLEAR POWER STATIONS LIFETIMES



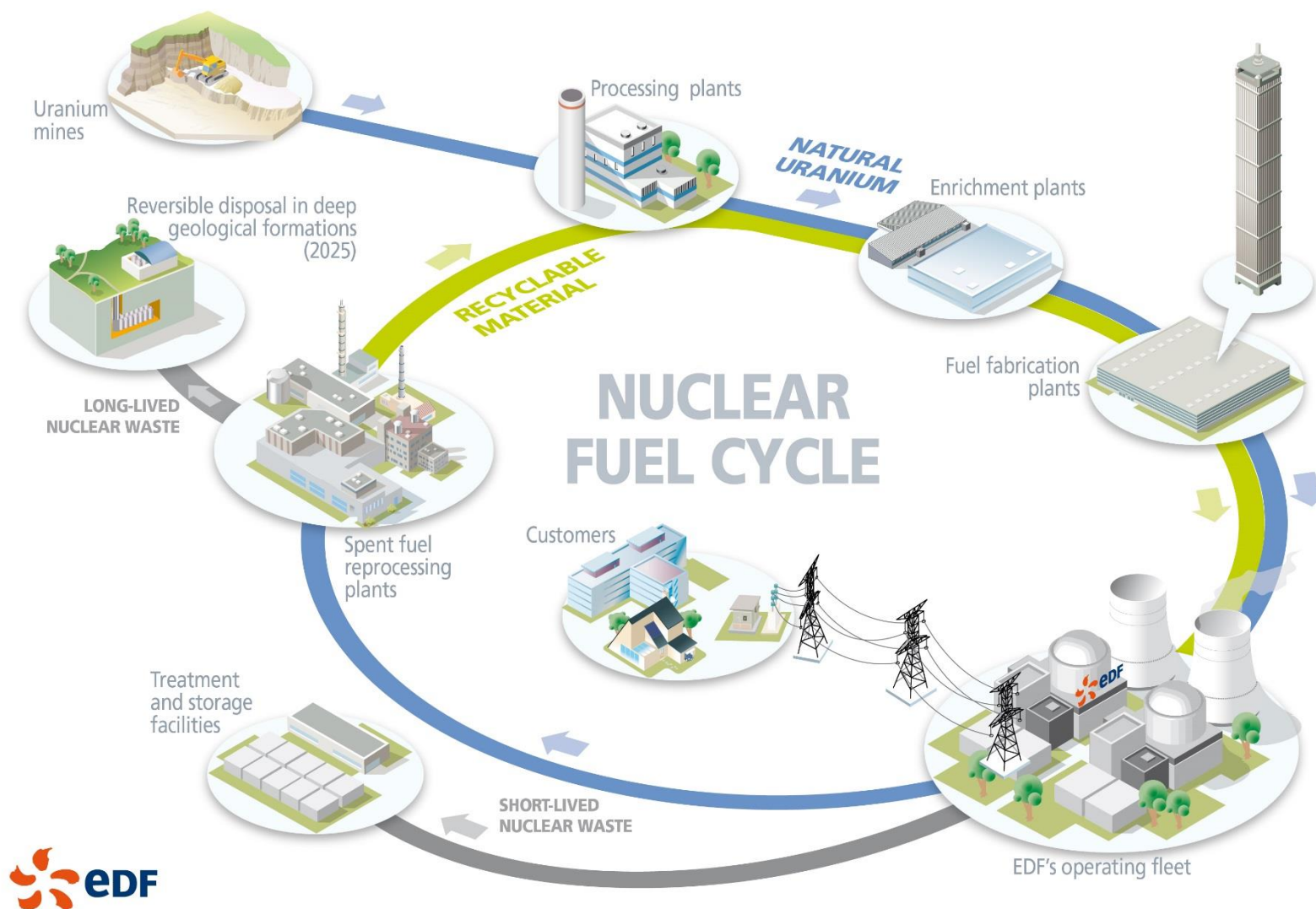
Hartlepool / Heysham 1 were extended by 5 years in 2010 and a further 5 years in 2016, Hunterston B/ Hinkley Point B by 7 years in 2012, Heysham 2 / Torness by 7 years in 2016 and Dungeness B by 10 years in 2015

An average eight-years extension across the AGR <sup>(1)</sup> fleet  
(relative to planned closure dates at British Energy acquisition in 2009)

(1) For more information about EDF Energy’s nuclear fleet and about the AGR and PWR technologies RAG and REP, see p. 98



# STAGES OF THE NUCLEAR FUEL CYCLE IN FRANCE



# THE PLANT DISMANTLING CYCLE: 3 KEY STEPS



## ➤ Final shutdown

- The first phase consists in unloading the fuel and draining all systems (after which 99.9% of the on-site radioactivity has been eliminated), followed by decommissioning (dismantling of decommissioned non-nuclear installations)

## ➤ Dismantling excluding the reactor building

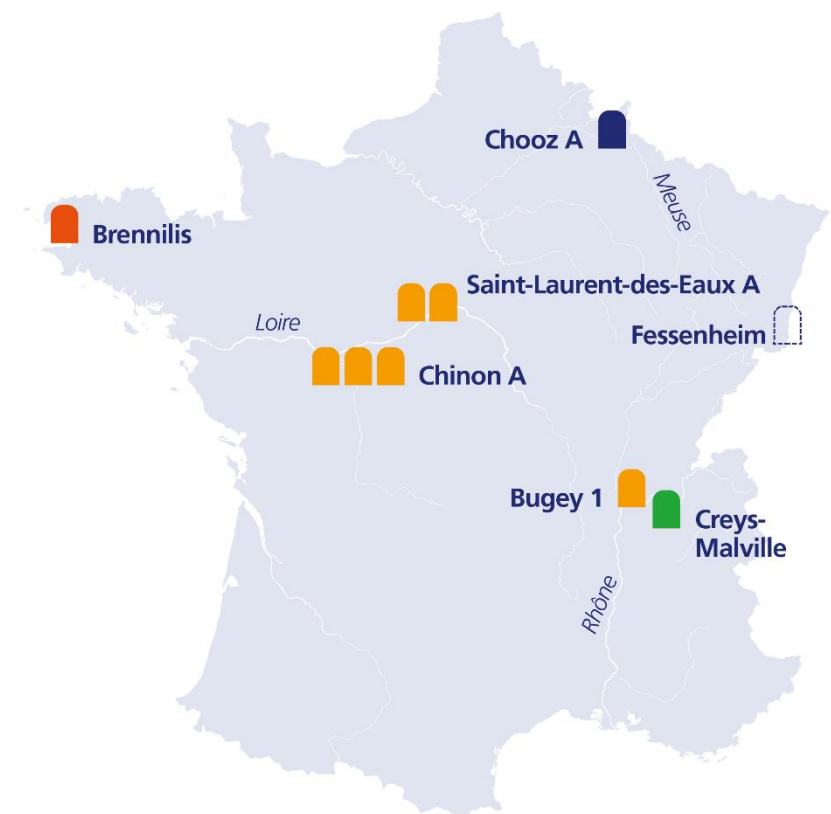
- The second phase starts after the obtaining of the decree on final shutdown and dismantling (MAD/DEM) and consists in dismantling all equipment and buildings (with the exception of the reactor building), as well as the packing and removing of all waste to appropriate storage facilities






## ➤ Dismantling of the reactor building

- This final phase corresponds to dismantling of the reactor vessel, the demolition of the buildings and the soil remediation

The duration of a Pressurised Water Reactor (PWR) is 15 years starting from the decree on the final shutdown and dismantling (MAD/DEM). The duration of the operations may vary for other technologies (NUGG, LWR, FNR) according to the complexity of works that have to be realised.

# EDF NUCLEAR PLANTS BEING DISMANTLED IN FRANCE



-  Heavy water reactor
-  Pressurized-water reactor
-  Pressurized-water reactor in pre-decommissioning
-  Natural uranium graphite gas-cooled reactors
-  Sodium-cooled fast-neutron reactor



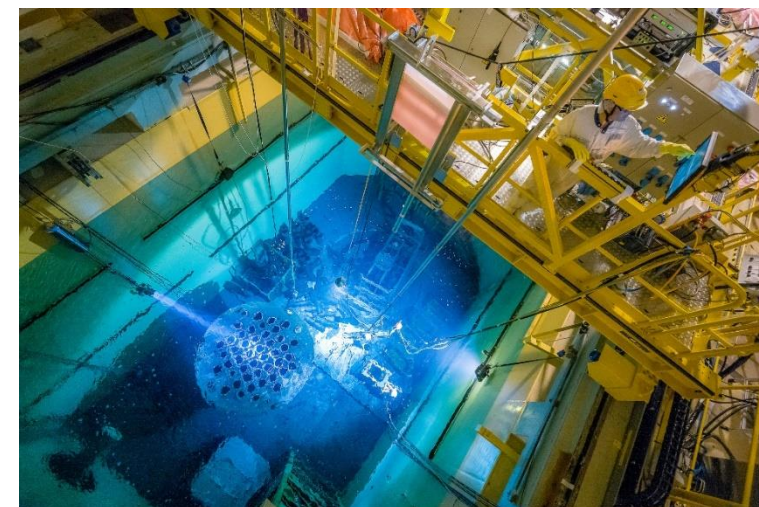
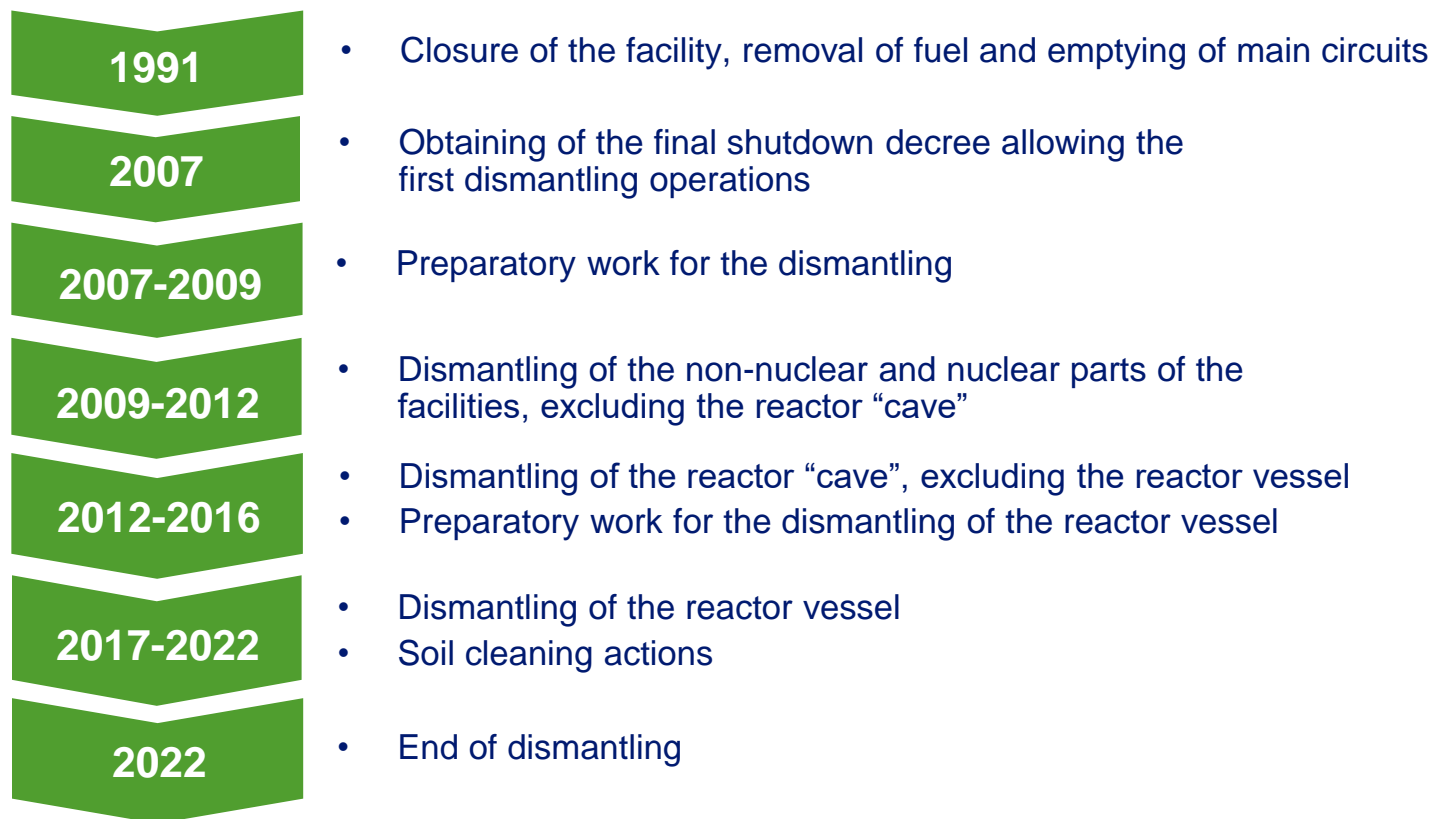
- **1 pressurized-water reactor (PWR) in pre-decommissioning**
  - Fessenheim 1 (900MW) : 1977-2020
- **1 pressurised-water reactor (PWR)**
  - Chooz A (300MW): 1967-1991 – MAD/DEM<sup>(1)</sup> decree: 2007
- **1 heavy-water reactor (HWR)**
  - Brennilis (70MW): 1967-1985 (EDF/CEA) – Partial MAD/DEM decree: 2011
- **6 natural uranium/graphite gas reactors (NUGG)**
  - Chinon A1 (70MW): 1963-1973 – INBE decree<sup>(2)</sup>: 1982
  - Chinon A2 (200MW): 1965-1985 – INBE decree: 1991
  - Chinon A3 (480MW): 1966-1990 – MAD/DEM decree: 2010
  - Saint-Laurent A1 (480MW): 1969-1990 – MAD/DEM decree: 2010
  - Saint-Laurent A2 (515MW): 1971-1992 – MAD/DEM decree: 2010
  - Bugey 1 (540MW): 1972-1994 – MAD/DEM decree: 2007
- **1 fast-neutron reactor (FNR)**
  - Creys-Malville (1,240MW): 1986-1997 – MAD/DEM decree: 2006

<sup>(1)</sup> MAD/DEM decree: decree on the final shutdown and dismantling (*Décret de Mise à l'Arrêt Définitif et Démantèlement*)

<sup>(2)</sup> INBE decree: decree on nuclear spent fuel storage facility (*Installation Nucléaire de Base d'Entreposage*) (partial dismantling authorisation of a nuclear facility)

# THE FIRST PRESSURISED WATER REACTOR UNDER DECOMMISSIONING: CHOOZ A

**Commissioned in 1967 and in operation until 1991, Chooz A is the first Pressurised Water Reactor (PWR) to be decommissioned. On 8 March 2017, the site entered its final phase for the segmentation of the reactor vessel.**



Dismantling of the internal vessel components, December 2017

# RADIOACTIVE WASTE MANAGEMENT (1/2)

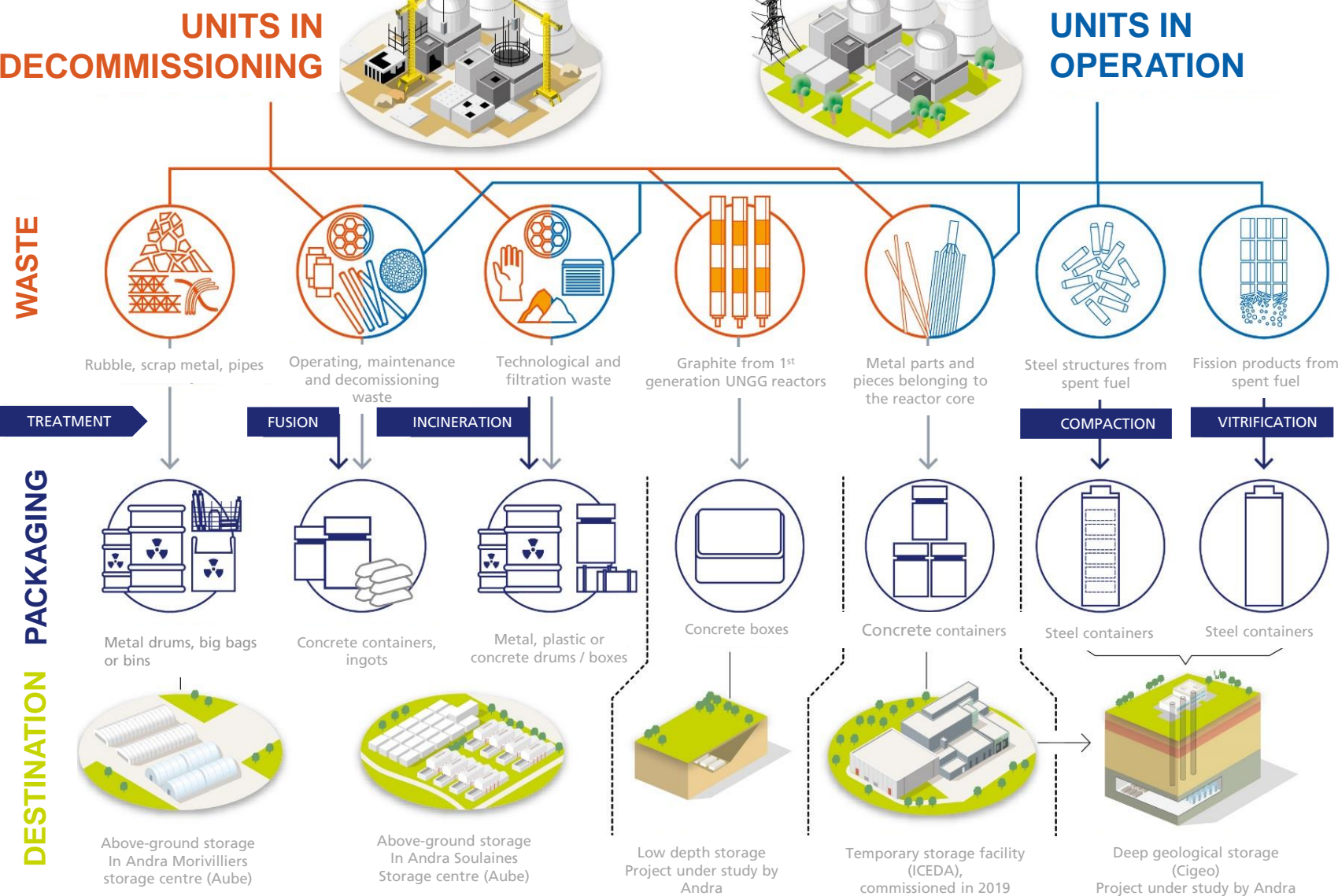
	TYPE OF WASTE	EXAMPLE	POSITION/STORAGE
<b>SHORT-LIVED WASTE</b> Their radioactivity is halved over a period of 31 years or below 90% of waste 0.1% of radioactivity	<b>VERY-LOW-LEVEL WASTE (VLLW)</b>	They come from the decommissioning of nuclear installations (concrete, scrap, piping, etc.)	On the surface at the Morvilliers storage centre managed by ANDRA <sup>(1)</sup>
	<b>SHORT-LIVED INTERMEDIATE- AND LOW-LEVEL WASTE (SL-ILW and -LLW)</b>	They come from maintenance works (tools, clothes, dismantled parts, etc.); waste from the processing of liquid and gaseous effluents of operating plants; other deconstruction waste	On the surface at the Soulaïnes storage centre, managed by ANDRA <sup>(1)</sup>
<b>LONG-LIVED WASTE</b> Their radioactivity is halved over a period of more than 31 years 10% of waste 99.9% of radioactivity	<b>LONG-LIVED, LOW-LEVEL WASTE (LL-LLW)</b>	They essentially are graphite waste from the dismantling of first generation plants	At the production site waiting for a special subsurface storage (from 15 to 200m) to be built. Project under study
	<b>LONG-LIVED INTERMEDIATE-LEVEL WASTE (LL-ILW)</b>	Metallic structures of the assemblies separated during the processing of spent fuel, other dismantling waste	At the production site then at the ICEDA storage facility ( <i>Installation d'Entreposage et de Conditionnement des Déchets Activés</i> ), as early as its commissioning mid-2019, while awaiting for the deep geological waste storage Cigéo <sup>(2)</sup>
	<b>HIGH-LEVEL WASTE (HLW)</b>	Non-recyclable material from the processing of spent fuel	Temporarily stored in dedicated installations in La Hague site of ORANO, while awaiting for the deep geological waste storage (Cigéo) <sup>(2)</sup> . Beginning of the pilot industrial phase in 2026

<sup>(1)</sup> National Agency for Radioactive Waste Management (*Agence Nationale pour la Gestion des Déchets Radioactifs*)

<sup>(2)</sup> For more information about Cigéo, please see [p.108](#)



# RADIOACTIVE WASTE MANAGEMENT (2/2)





# CIGÉO – A DEEP-STORAGE INDUSTRIAL CENTRE

- French deep-storage project for Long-lived Intermediate-level and High-level radioactive waste, generated mainly by the existing French nuclear facilities (nuclear power industry, research, defense, etc.). Such waste represents 3% of the total volume of radioactive waste and is alone responsible for 99% of waste radioactivity
- The French law of 28 June 2006 tasked the National Agency for Radioactive Waste Management (ANDRA) with designing, constructing and operating Cigéo
- The authorisation request of the Cigéo creation will be submitted in 2019. It plan the site to be located in eastern France, on the border between the Meuse and Haute-Marne, near the ANDRA underground laboratory (Bure)

## The principle of reversible storage in deep geological strata

- Principle adopted by the French Law of 28 June 2006 as the only safe solution for the long-term management of this type of waste, without shifting the burden onto future generations. This choice was preceded by 15 years of research, assessments (including by the National Review Board and the Nuclear Safety Authority) and a public debate
- The principle of reversibility for the entire duration of the operation (at least 100 years) in order to adapt Cigéo to possible changes

## Secure and robust facilities that are adaptable on two levels

- On the surface: facilities to receive and prepare waste shipments, and to undertake excavation work and the progressive construction of underground structures
- Below ground: galleries located about 500 meters deep in a stable and impermeable layer of argillaceous rock, chosen for its containment properties over very long periods
- Scalable architecture of the underground facilities during operation, depending on feedback and available technologies



Cigéo facilities on the surface



Cigéo underground galleries modelisation

# CYCLIFE: A SUBSIDIARY DEDICATED TO DECOMMISSIONING AND RADIOACTIVE WASTE TREATMENT OFFERINGS

- Following the acquisition of the English and Swedish assets of Studsvik holding company, in 2016, a **subsidiary “Cyclife”** was created to centralise the Group’s activities on nuclear decommissioning and waste treatment for the French and international market
- The offerings of Cyclife cover the entire value chain of the decommissioning and waste treatment: preliminary studies, engineering, management, training, *etc.*
- Cyclife owns complementary waste treatment facilities located in 3 countries:
  - The low-activity waste processing and packaging centre by smelting or by incineration (Centraco), in France
  - Facilities for waste processing by metal recycling, incineration and pyrolysis situated at the Nyköping site in Sweden
  - The Workington Metal Recycling Facility (MRF) in Workington, the UK

## EDF radioactive waste treatment facilities<sup>(1)</sup>

### UK

Metal waste treatment  
(clean up, cutout):  
3,000 t/year

~ 75 employees

### Sweden

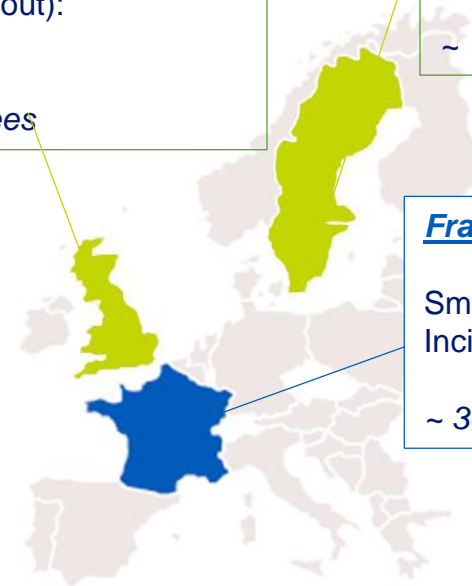
Smelting: 5,000 t/year  
Incineration: 500 t/year  
Pyrolysis: 50 t/year

~ 105 employees

### France

Smelting: 3,500 t/year  
Incineration: 6,000 t/year

~ 305 employees



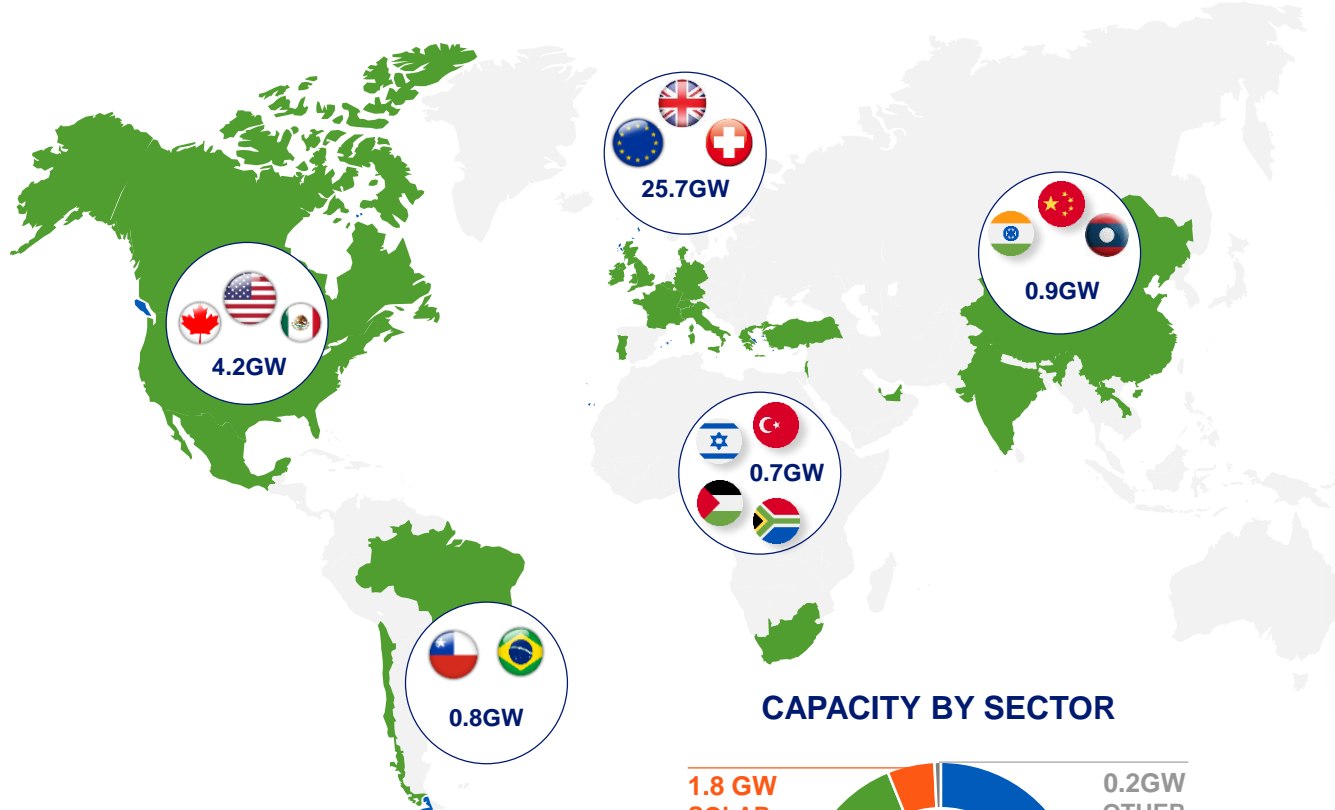
<sup>(1)</sup> After transaction – maximum authorised capacities

# EDF GROUP MAIN BUSINESSES

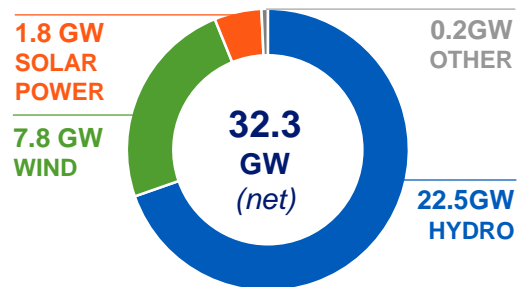
➤ NUCLEAR	P. 72
➤ <b>RENEWABLES</b>	<b>P. 109</b>
➤ THERMAL POWER	P. 134
➤ REGULATED ACTIVITIES (NETWORKS)	P. 139
➤ OPTIMISATION & TRADING	P. 151
➤ CUSTOMER SOLUTIONS	P. 167
➤ ENERGY SERVICES	P. 181
➤ GAS	P. 190

# EDF, THE EUROPEAN LEADER IN RENEWABLE ENERGIES

NET INSTALLED CAPACITY: 32.3GW <sup>(1)(2)</sup>



CAPACITY BY SECTOR



A DIVERSIFIED MIX WITH 32GW IN OPERATION

- 22.5GW of hydropower
- 9.6GW of wind and solar power

HYDROPOWER

- **Leading European producer** from hydropower
- More than **400 production sites** worldwide

A GLOBAL LEADER IN WIND AND SOLAR ENERGY

- **1.9GW gross** commissioned in 2019
- **5.1GW** currently under construction (2.7GW in onshore wind power, 0.9GW in offshore wind power, and 1.5GW in solar power)

<sup>(1)</sup> Installed capacity shown as net, corresponding to the consolidated data based on EDF's participation in Group companies, including investments in affiliates and joint ventures

# RENEWABLE OUTPUT

*Output from fully consolidated entities*

<i>(in TWh)</i>	<b>2018</b>		<b>2019</b>	
Hydro <sup>(1)</sup>	51.6	75.0%	44.2	70.8%
Wind	14.3	20.8%	16.0	25.6%
Solar	1.7	2.5%	1.0	1.6%
Biomass	1.1	1.6%	1.3	2.1%
<b>Total electricity Groupe</b>	<b>68.8</b>	<b>100%</b>	<b>62.5</b>	<b>100%</b>
<b>Total heat Groupe</b>	<b>8.9</b>	<b>100%</b>	<b>8.5</b>	<b>100%</b>

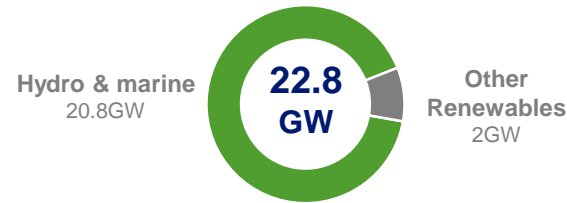
NB: The values correspond to the expression to the first decimal or integer closest to the sum of the precise values, taking into account rounding

<sup>(1)</sup> Hydro output after deductions of pumped volumes is 44.3TWh in 2018 and 37.9TWh in 2019

# FRENCH HYDROPOWER – A DIVERSIFIED & FLEXIBLE FLEET

## THE MAIN SOURCE OF RENEWABLE POWER IN FRANCE

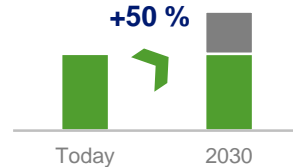
### Net Renewable installed capacity <sup>(1)</sup> of the Group in France



- **432 plants** in France (mainland), average age of **75 years**
- Covering the different kinds of hydropower facilities:
  - Run-of-river / Pondage water / Reservoirs (lake-supplied) / Pumped storage / Tidal power

## UNIQUE STORAGE VALUE, CRITICAL FOR THE ELECTRICITY SYSTEM

### Estimated weekly flexibility needs <sup>(2)</sup>



- **Hydropower France provides ~14GW of storage**
  - Reservoirs: 8.1GW
  - Pumped storage: 5.04GW
    - Including the 1.8GW Grand'Maison facility, the largest European storage asset
- **Only sizeable & cost competitive** electricity storage technology

## AMONG THE MOST FLEXIBLE AND REACTIVE GENERATION MEANS

### Response time to reach full capacity of dispatchable units



- **Allows quick adjustments to within-day fluctuations in the supply-demand balance**
  - Consumption peaks
  - Non forecasted loss of generation capacity
- Hydropower is the **most significant contributor to ancillary services**

<sup>(1)</sup> Power generation capacity, in proportion of the share the EDF group held in each asset

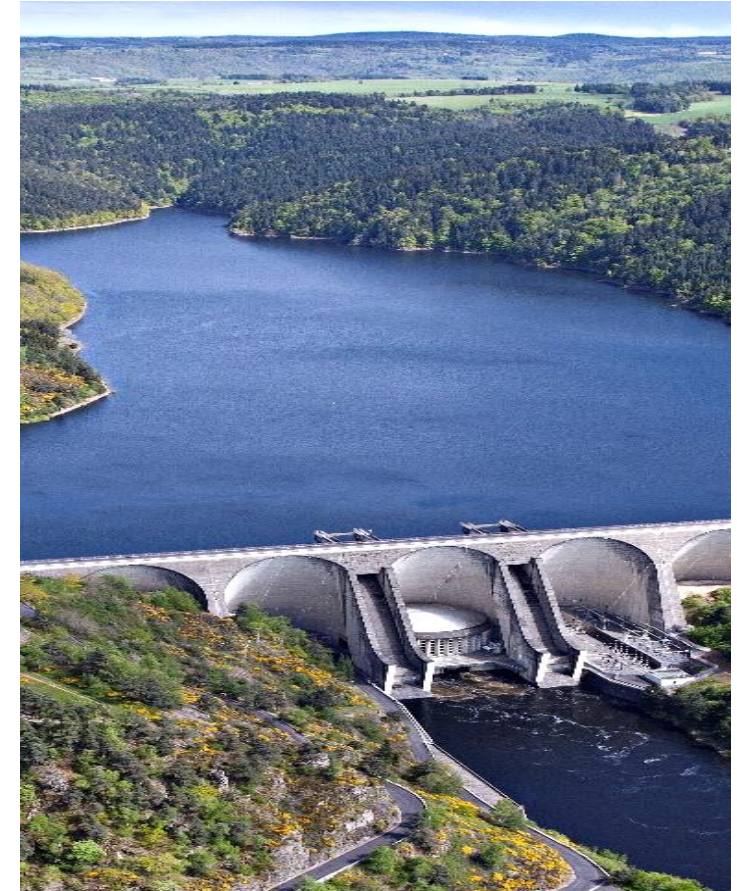
<sup>(2)</sup> Source: RTE (*Bilan prévisionnel*)



# DIFFERENT TYPES OF HYDROPOWER FACILITIES

EDF disposes of numerous hydropower facilities, able to meet base-load and peak demand, designed to optimise the use of water resources

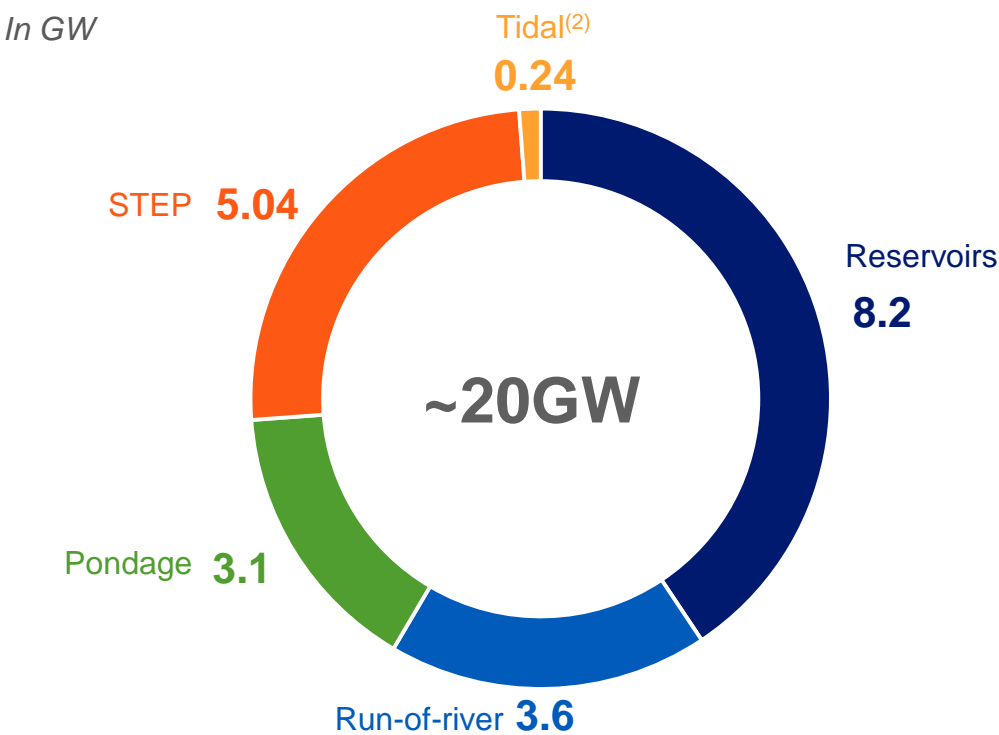
- **Run-of-river**
  - No storage capacity
  - Energy generation depends solely on the current water condition
- **Pondage water**
  - Average sized water reserve, intended for an occasional use during the week or the day
  - Generation is concentrated at peak hours
- **Reservoirs**
  - Large storage capacity
  - Influence on downstream power plants (located in mountain ranges) which calls for a management of valley stations
- **Pumped storage (STEP)**
  - Massive energy storage
  - Water is pumped from a downstream reservoir to an upstream one to create a reserve available during off-peak hours
  - Water is then turbined from the upstream reservoir to the downstream one during periods of high demand
- **Tidal power**
  - The tidal power plant of the Rance river uses the tides and sea currents to power the turbines and thus generate electricity (renewable)



Aerial view of the dam and of the Grandval hydro power plant (GEH Lot Truyère)

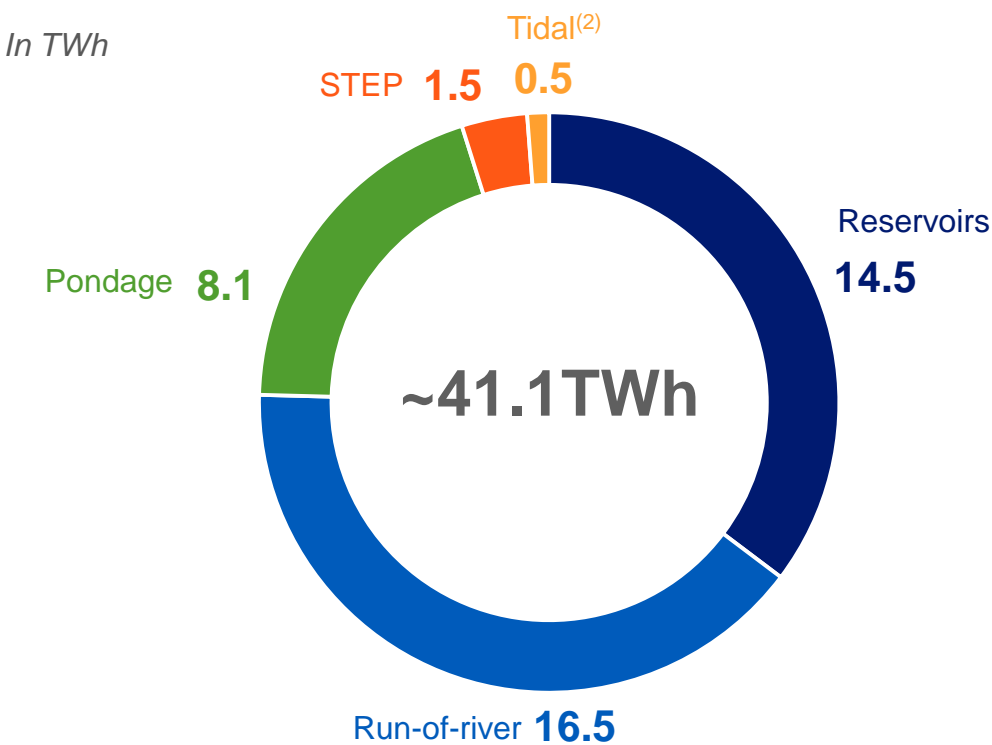
# EDF'S HYDROPOWER FLEET IN MAINLAND FRANCE

Installed capacity ~20GW<sup>(1)</sup>



≈ 23% of the overall EDF's generation capacity in France

Average producible on 50 years: ~41.1TWh

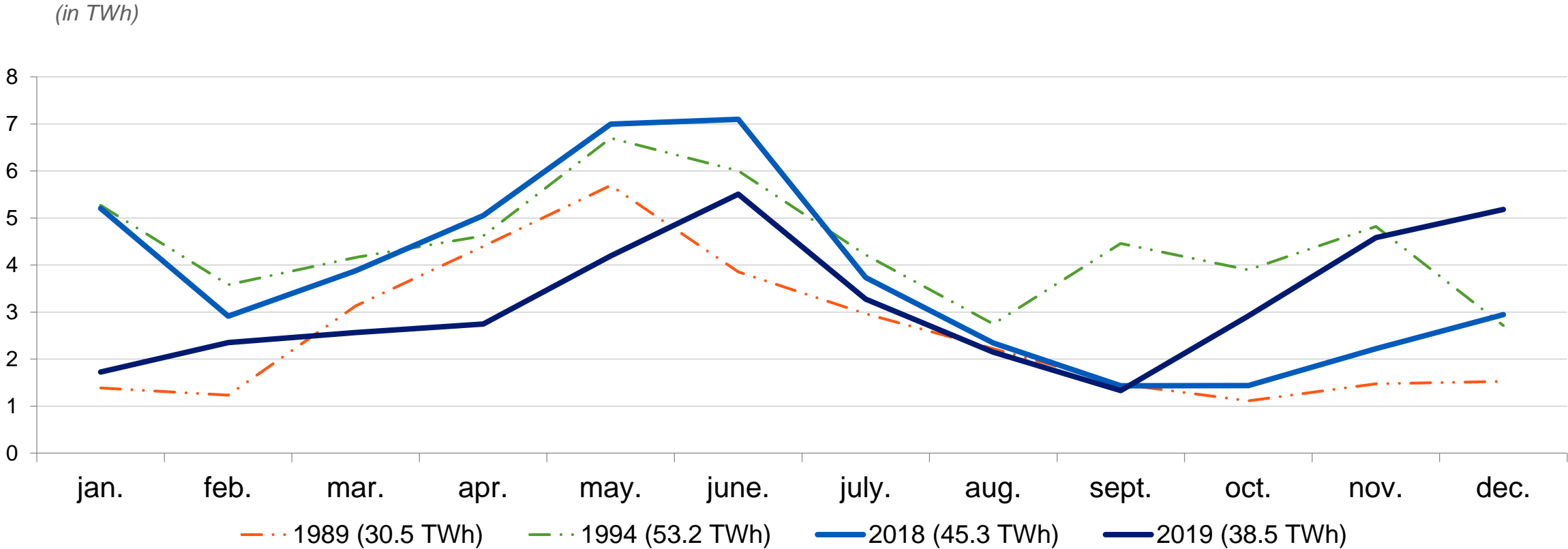


≈ 9% of the average EDF output in France

<sup>(1)</sup> Excluding Corsica and overseas departments, equivalent to 437MW

<sup>(2)</sup> The tidal power plant of the Rance generates electricity by using the up and down movement of the tides

# EDF POTENTIAL HYDROPOWER CAPACITY IN MAINLAND FRANCE<sup>(1)</sup>

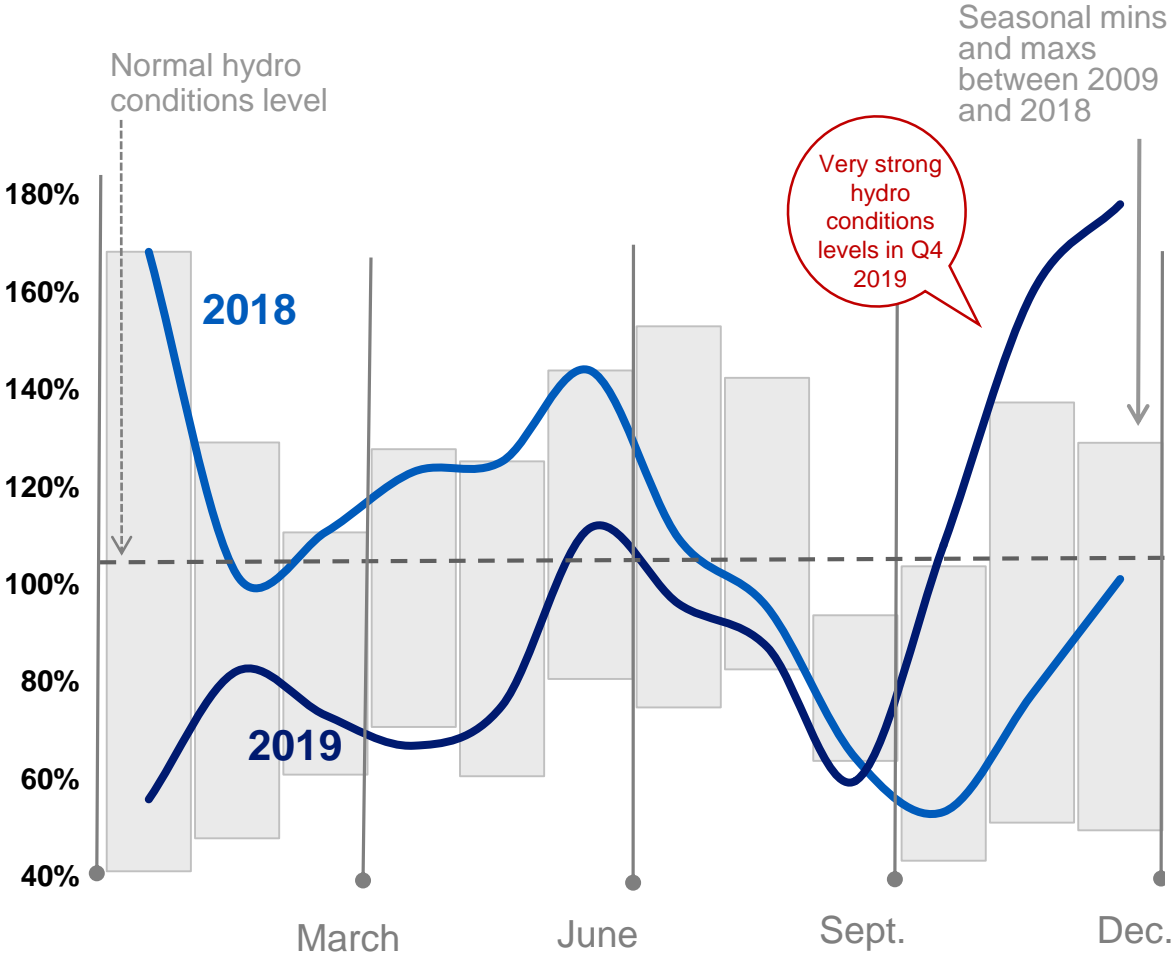
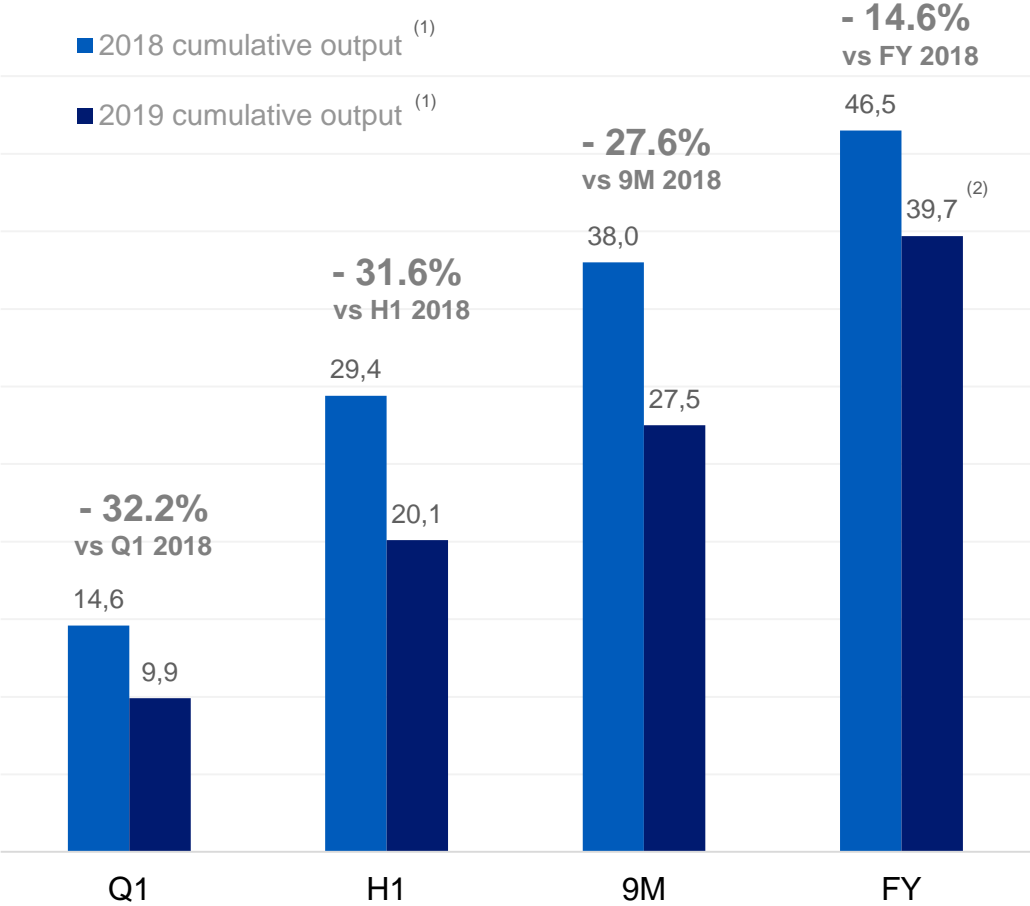


1989: lowest potential hydropower capacity in the last 30 years  
1994: highest potential hydropower capacity in the last 30 years

<sup>(1)</sup> Potential hydropower capacity: maximum quality of power that can be produced from hydraulic sources (rain, snow) over a given period of time

# FRANCE HYDRO OUTPUT IN MAINLAND FRANCE

(in TWh)



(1) Hydropower excluding electrical activities on French islands, before deduction of pumped volumes  
(2) Production after deduction of pumped volumes : 39.2TWh in FY 2018, and 33.4TWh in FY 2019

# DEVELOP HYDROPOWER IN FRANCE AND ABROAD

EDF operates 80% of mainland France's hydropower potential and 66% of hydroelectricity energy output. EDF is committed to developing its hydropower activities in order to increase their power and availability. EDF's expertise is also recognised internationally

## ➤ FRANCE

- **Romanche-Gavet (Isère): increase in hydro output**

Launched in the Romanche valley, near Grenoble, the Romanche-Gavet site consists of replacing six old plants with a single 93MW underground plant that is more efficient and better integrated into its environment. The new plant will ultimately generate 560GWh/year, with 30% more generation than the current six plants. The new hydropower development at Romanche-Gavet will also be more respectful of the environment and will restore ecological continuity over more than 10 km. The end of the construction is scheduled for 2020

- **La Coche (Savoie): commissioning of the most powerful generation unit in France**

In 2019, EDF commissioned the most powerful generation unit in France at La Coche: 240MW. This generation unit, which will be completed in 2019, will increase the capacity of the existing development by 20% and produce additional 100GWh each year

## ➤ INTERNATIONAL

- **Sinop (Brazil):** commissioning of a 402MW dam (see p. [118](#)) in end-2019

- **Nachtigal (Cameroun) :** construction of a 420MW dam (see p. [119](#))

# COMMISSIONING OF THE SINOP DAM IN BRAZIL

## MAIN ASPECTS OF THE PROJECT

- 402MW hydropower facility in the State of Mato Grosso
- 2 X 201MW Kaplan turbines, which are among the most powerful and largest in the world using this technology
- Average output potential of 2,100GWh/yr, reservoir area of 337 km<sup>2</sup>
- The project is led by Companhia Energética SINOP SA (CES), which is responsible for building, equipping and operating the dam. EDF owns a 51% <sup>(1)</sup> stake in the company; the two other shareholders are Eletrobras subsidiaries: Eletronorte (24.5%) and Chesf (24.5%)
- Sale of the electricity generated under 34 Power Purchase Agreements (PPA) with distribution companies over a 30-year period.

## FINANCING STRUCTURE

- Total project cost: circa €807 million <sup>(2)</sup>
- Capital Contribution: €493M (€251M by EDF)
- ~28% of financing from the Brazilian Development Bank (BNDES) and a €52 million infrastructure debenture bond issuance in June 2018. The remainder is equity financed.
- Fitch Rating on 2 July 2019: AA-(bra) outlook stable

## DATES AND KEY FIGURES

### Timeline:

- **24 January 2019:** fill permit
- **11 July 2019:** start of turbine tests
- **16 Sept. 2019:** COD group 2
- **18 Oct. 2019:** COD group 1

### Electricity generation in 2019

- **Group 1:** 136GWh (i.e. 1,800 hours)
- **Group 2:** 150GWh (i.e. 2,544 hours)

400MW hydropower facility



(1) Equity consolidation method

(2) Based on 31 Dec. 2019 exchange rate: BRL 4.53/€



# NACHTIGAL HYDROELECTRIC DAM IN CAMEROON <sup>(1)</sup>

## MAIN ASPECTS OF THE PROJECT

- Design, construction and operation for a period of 35 years of a 420MW run-of-the-river hydropower plant on the Sanaga river near the Nachtigal Falls
- Construction of a 50-km power transmission line
- Project will be owned and operated by NHPC (Nachtigal Hydro Power Company), currently comprising EDF (40%) <sup>(2)</sup>, IFC <sup>(3)</sup> (20%), the Republic of Cameroon (15%), Africa50 (15%) and STOA (10%)
- Expected annual power generation of 3TWh, i.e. 30% of the country's electricity generation output
- Substantial economic benefits: up to 1,500 direct jobs during peak construction periods, of which 65% will be locally sourced within a 65-km radius of the construction site. The project will generate dozens of permanent jobs

## FINANCING STRUCTURE

- Project's expected total cost: €1.2 billion
- Shareholders' equity to fund a quarter of the project, lenders to fund the rest
- The lender group coordinated by IFC includes 11 Development Finance Institutions (DFI) and 4 local commercial banks <sup>(4)</sup>
- The largest hydropower project ever built in Africa through non-recourse project finance debt

## TIMELINE

- Final and binding agreements signed on 8 November 2018, financial closing on 24 December 2018
- Start of construction March 2019: 27% of civil engineering achieved at end of March 2020
- Commissioning expected in 2023

## 420MW run-of-the-river hydropower plant



<sup>(1)</sup> Refer to the press release published by EDF on 8 November 2018.

<sup>(2)</sup> Equity consolidation method.

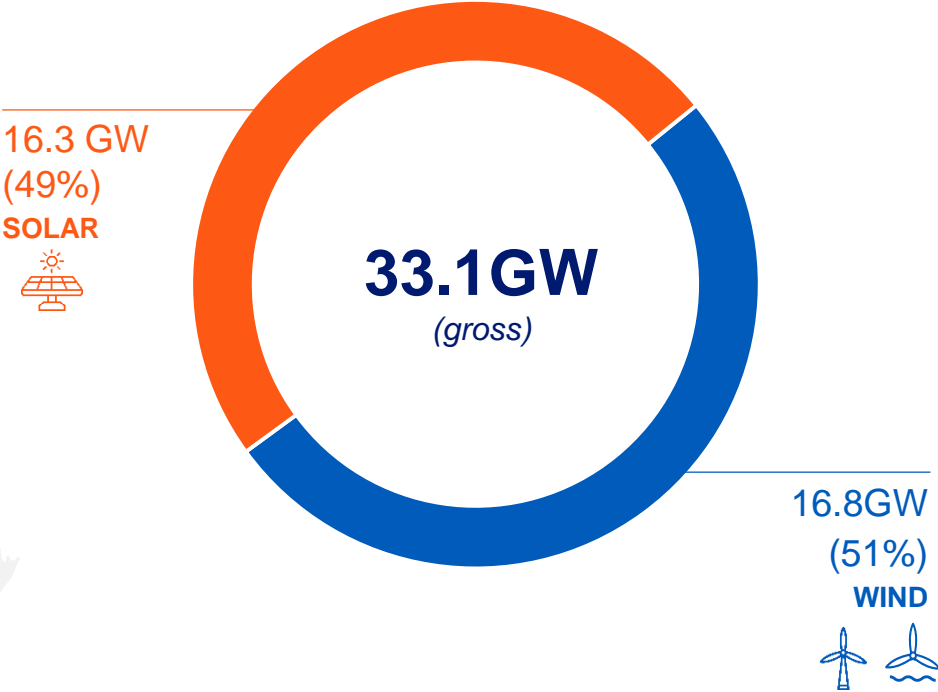
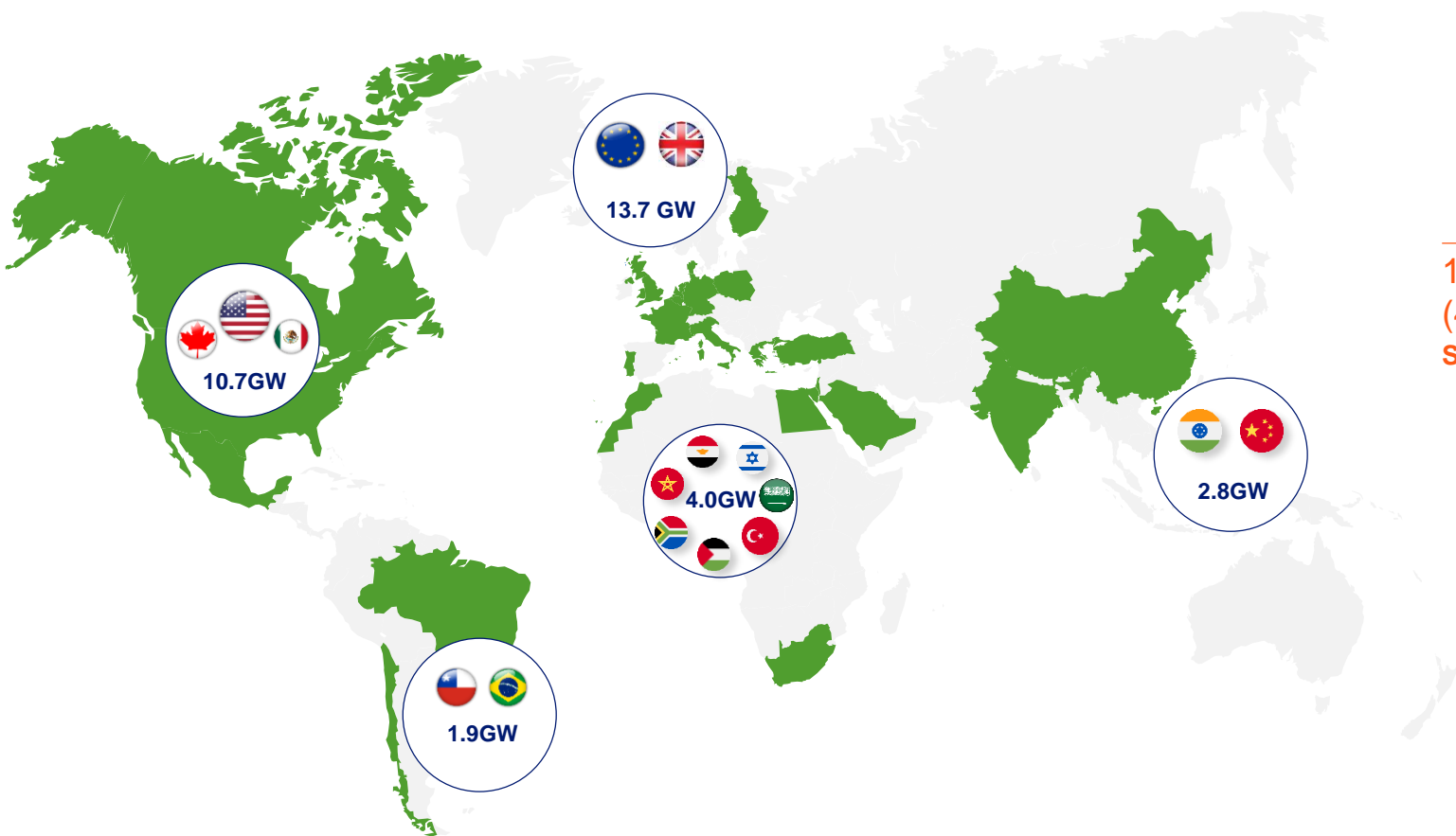
<sup>(3)</sup> IFC (International Finance Corporation) – member of the World Bank Group

<sup>(4)</sup> DFI include: AfDB, IFC, CDC, European DFI coordinated by Proparco (AFD, DEG and FMO), EIB, OFID, EAIF, AFC. Local banks include: Attijari/SCB, BICEC, SG Cameroun and Standard Chartered

# A PORTFOLIO OF WIND AND SOLAR PROJECTS OF MORE THAN 33GW <sup>(1)(2)</sup>

A PROJECT PORTFOLIO THAT IS **DIVERSIFIED GEOGRAPHICALLY...**

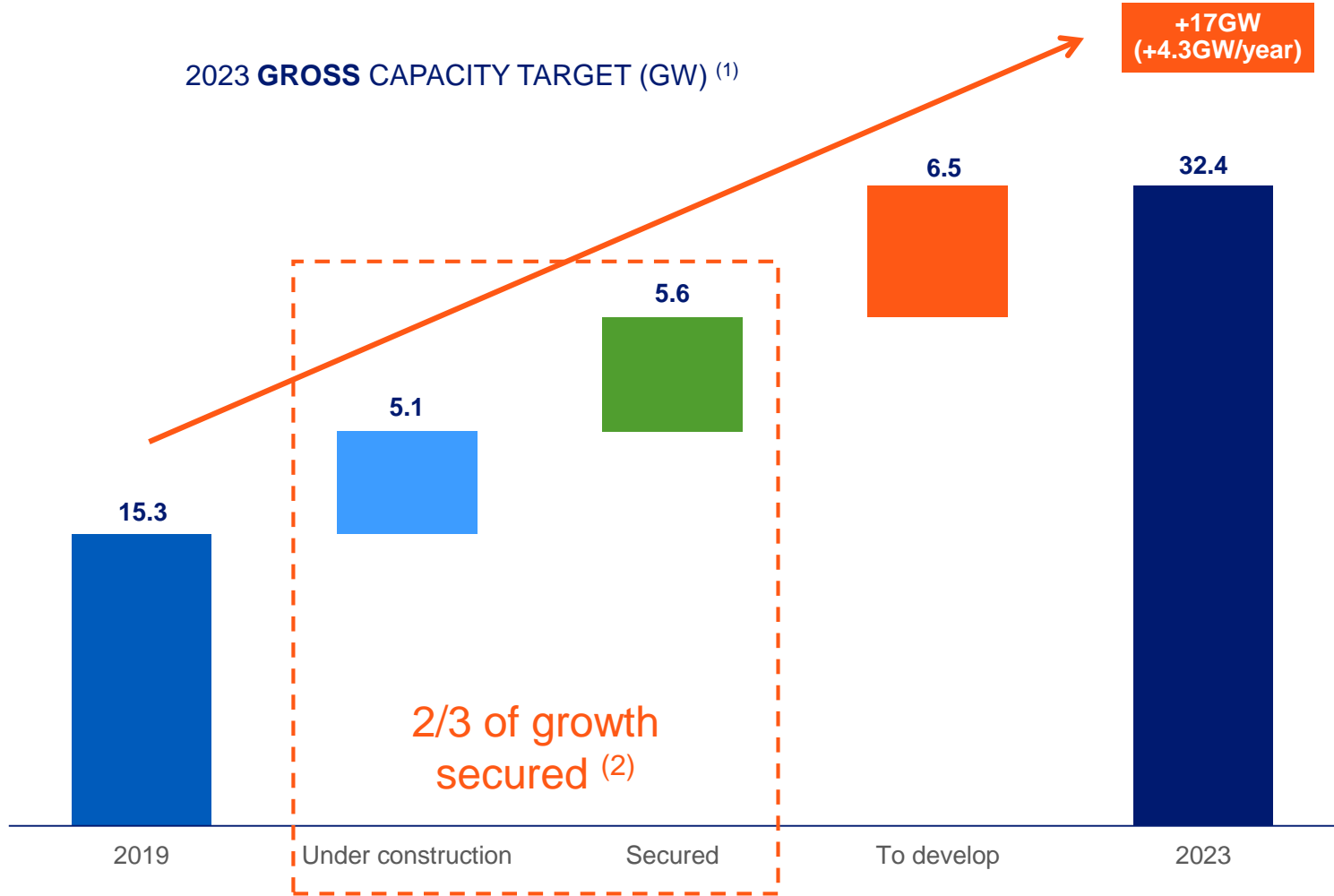
... AND **BALANCED BETWEEN WIND AND SOLAR**



(1) Pipeline excluding capacities under construction, including secured capacities. Gross data corresponding to 100% of the capacity of the projects concerned.  
(2) 2019 year-end data

# STRONG GROWTH EXPECTED THANKS TO MORE THAN 10GW OF PROJECTS ALREADY SECURED

NB: This financial communication contains forward-looking data based on targets. Although management believes that this data is reasonable, investors are cautioned that such data is subject to numerous risks and uncertainties that could cause actual results and developments to differ materially from those expressed herein.

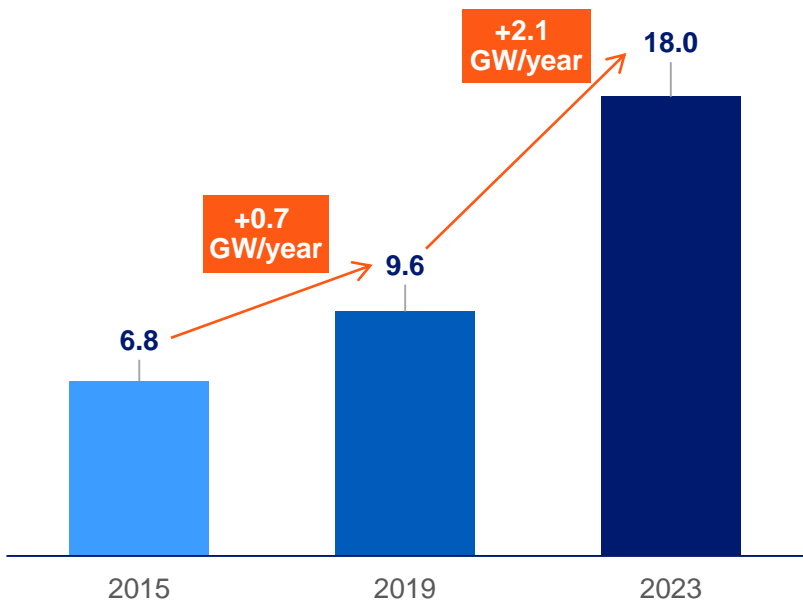


(1) Solar and wind. Gross data corresponding to 100% of the capacity of the projects concerned

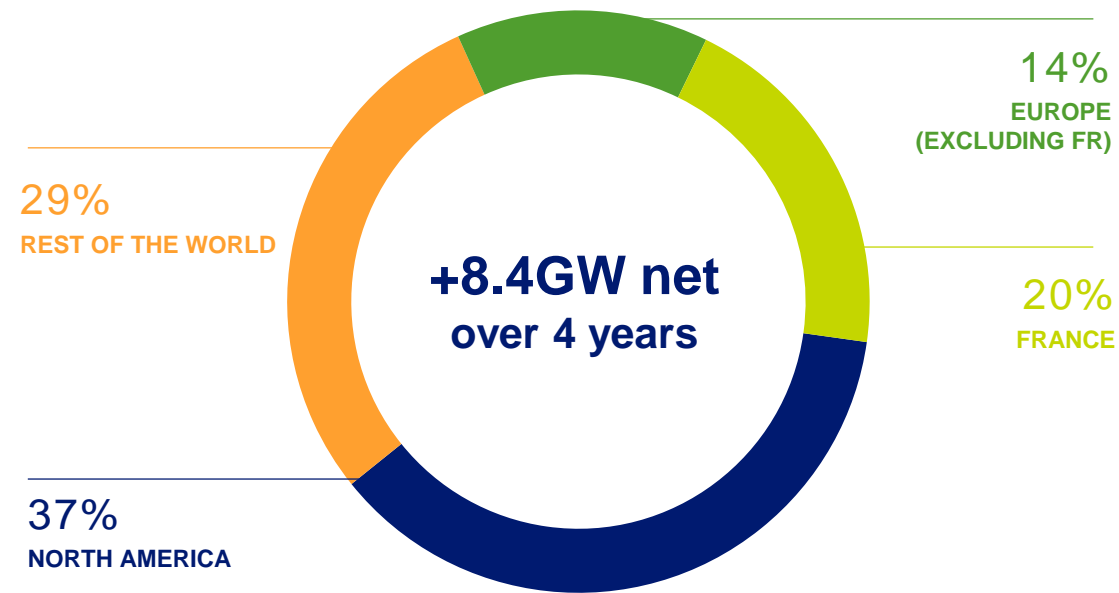
(2) Situation at end of 2019

# BALANCED ACCELERATION ACROSS GEOGRAPHIES AND TECHNOLOGIES

2023 **NET** INSTALLED CAPACITY TARGET (GW) <sup>(1)</sup>



2020-2023 **NET** ADDITIONAL CAPACITY BY GEOGRAPHIC REGION (GW) <sup>(1)</sup>



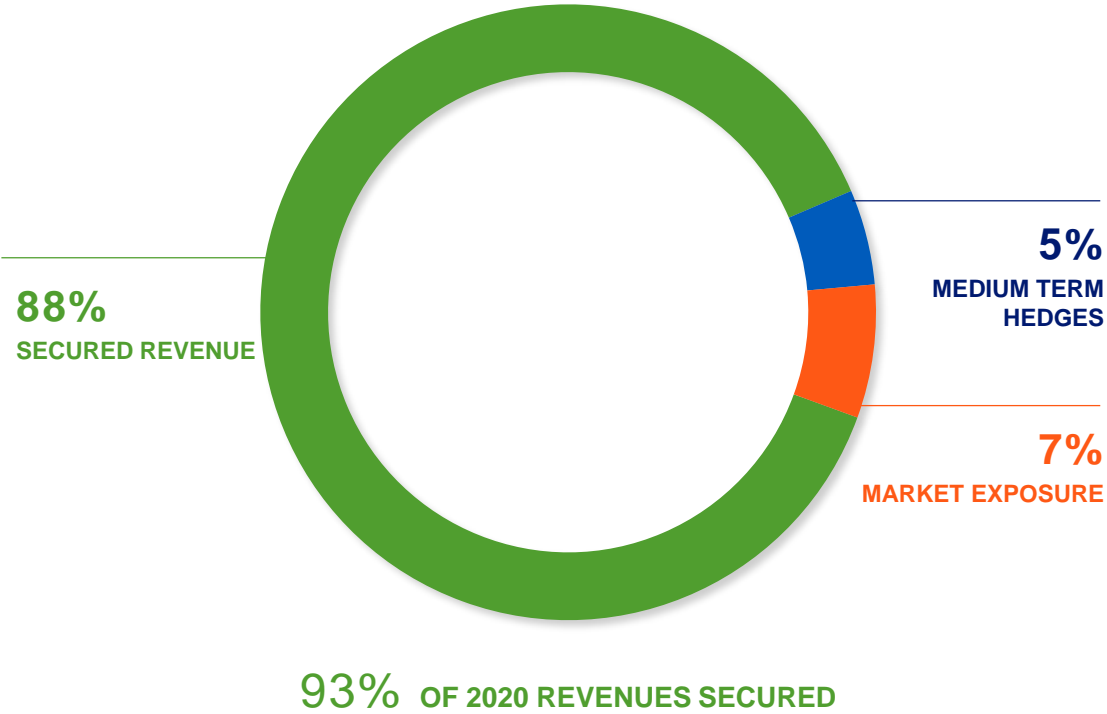
2020-2023 **NET** ADDITIONAL CAPACITY BY TECHNOLOGY



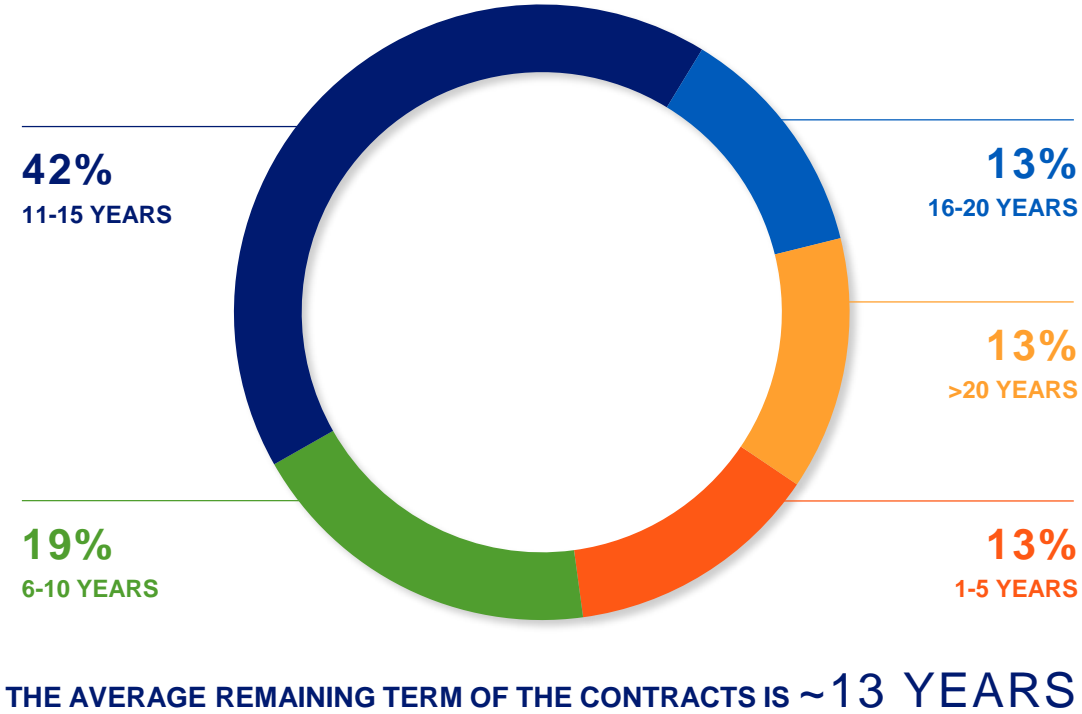
(1) Solar and wind. Installed capacity shown as net, corresponding to the consolidated data based on EDF's participation in Group companies, including investments in affiliates and joint ventures  
NB: This financial communication contains forward-looking data based on targets. Although management believes that this data is reasonable, investors are cautioned that such data is subject to numerous risks and uncertainties that could cause actual results and developments to differ materially from those expressed herein.

# REVENUE SECURED BY LONG-TERM CONTRACTS

CONTRACTUALISATION OF 2020 CONSOLIDATED REVENUES  
FROM RENEWABLE GENERATION (in %) <sup>(1)</sup>



AVERAGE RESIDUAL DURATION OF LONG TERM CONTRACTS  
(in years) <sup>(2)</sup>



(1) Based on the estimate of 2020 revenues from fully consolidated assets  
(2) Weighting according to estimated 2020 revenues of fully consolidated assets

# OFFSHORE WIND DEVELOPMENTS IN FRANCE: 4 PROJECTS FOR A TOTAL CAPACITY OF 2GW, INCLUDING 480MW UNDER CONSTRUCTION



## MAJOR ACHIEVEMENTS IN 2019:

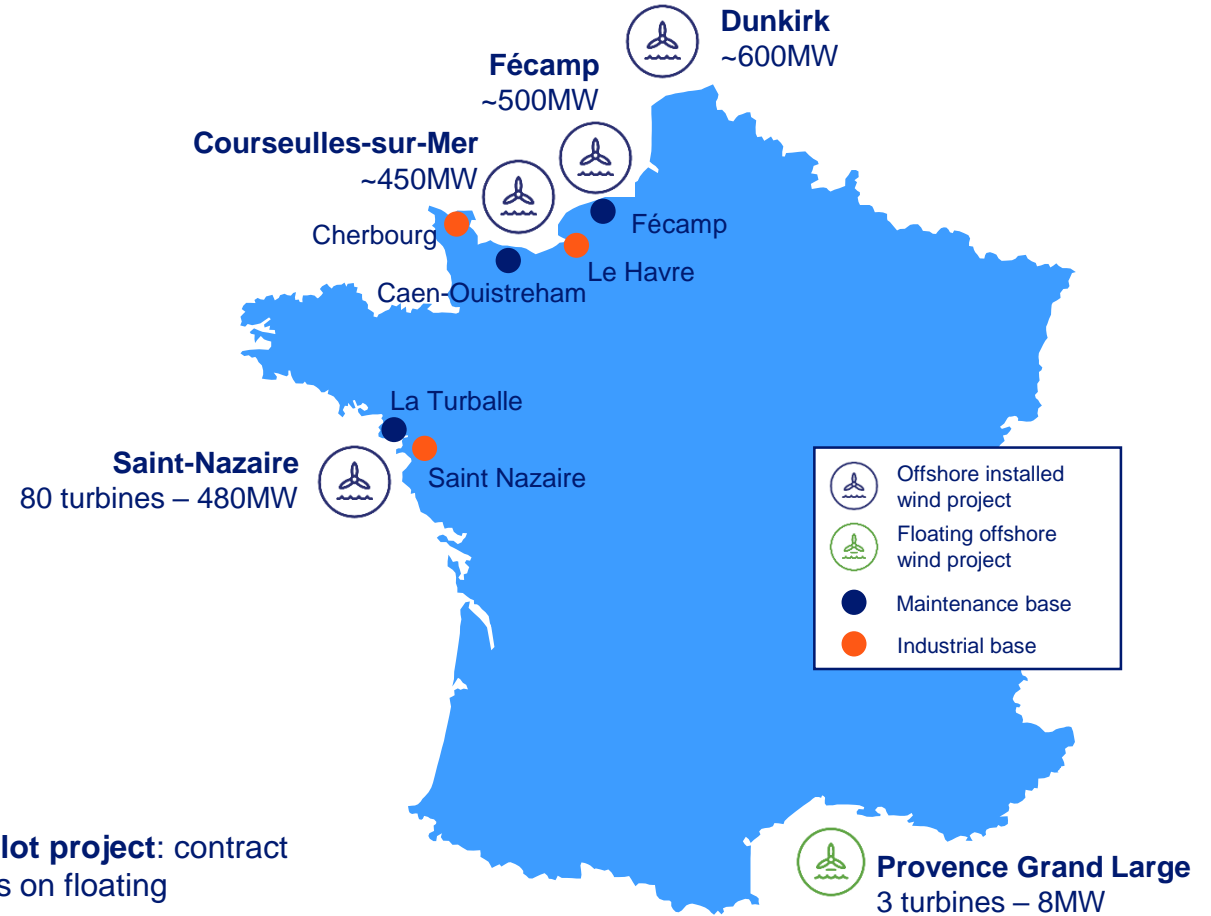
- **Saint Nazaire offshore wind farm:**
  - Start of construction in 2019
  - Commissioning scheduled for 2022
  - Total investments of ~ €2bn in partnership with Enbridge
- **Dunkirk offshore wind farm:**
  - Target date of commissioning in 2026
  - EDF Renouvelables wins the tender, in partnership with Enbridge and Innogy

## FURTHER DEVELOPMENT:

- Expected start of construction of the offshore wind farms at **Fécamp** (~€2bn in total investments) and at **Courseulles-sur-Mer** (~€2bn in total investments) in 2020-2021 for commissionings by 2024.
- The projects are in partnership with Enbridge and wpd.

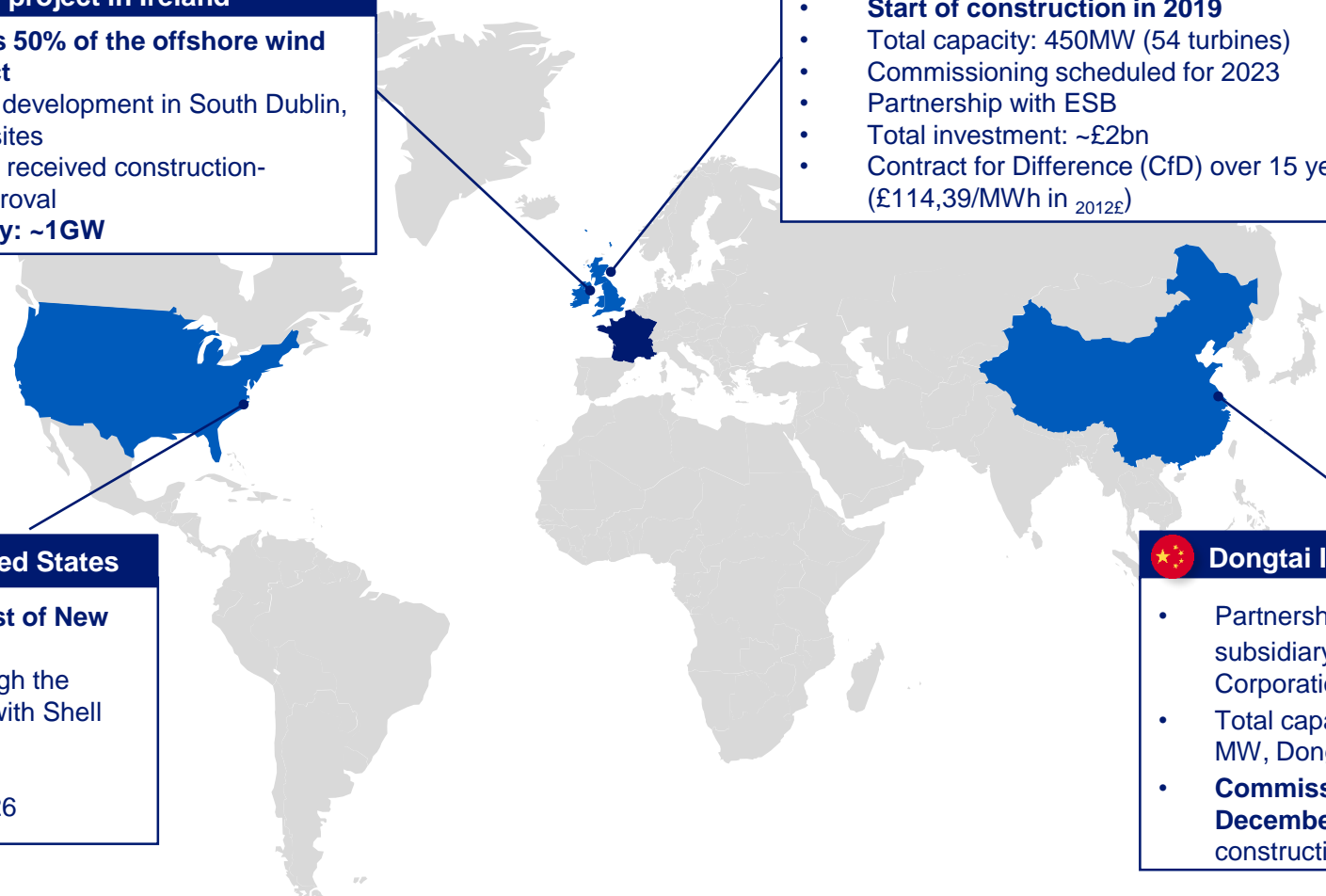



Development in progress of **Provence Grand Large**, a **floating wind pilot project**: contract awarded to EDF Renouvelables for the installation of three 8MW turbines on floating foundations off the coast of Fos-sur-Mer.






# NEARLY 4GW OF INTERNATIONAL OFFSHORE WIND DEVELOPMENTS, 450MW UNDER CONSTRUCTION IN SCOTLAND



 **Codling project in Ireland**

- **EDF acquires 50% of the offshore wind power project**
- Project under development in South Dublin, located on 2 sites
- Codling 1 has received construction-operation approval
- **Total capacity: ~1GW**

 **Neart Na Gaoithe project in Scotland**

- **Start of construction in 2019**
- Total capacity: 450MW (54 turbines)
- Commissioning scheduled for 2023
- Partnership with ESB
- Total investment: ~£2bn
- Contract for Difference (CfD) over 15 years (£114,39/MWh in 2012£)

 **Atlantic Shores project in the United States**

- Ongoing developments **off the coast of New Jersey**
- Securing an area of ~800 km<sup>2</sup> through the signature of a Joint Venture Lease with Shell
- Shallow water depth (~20m)
- **Total potential: ~2GW**
- Construction planned starting in 2026

 **Dongtai IV and V projects in China <sup>(1)</sup>**

- Partnership with **Shenhua Renewables**, a subsidiary of China Energy Investment Corporation
- Total capacity: **500MW** (Dongtai V: 300 MW, Dongtai IV: 200MW)
- **Commissioning of Dongtai IV in December 2019**, Dongtai V under construction

(1) Subject to the approval of the Chinese Antitrust Authority

# A SUSTAINABLE BUSINESS MODEL BASED ON KEY COMPETITIVE ADVANTAGES



**VALUE CREATION:**

**+150-200 bps**

**DIFFERENCE <sup>(1)</sup> BETWEEN THE FORECAST RETURN RATE AND THE WACC**

(1) Average performance estimated as part of a profitability analysis of EDF Renewables projects (scope: 79% of installed capacity, 103 power plants, 6.2GW net, 14 countries). The calculation of TRI take into consideration the various hypothesis, in particular on market prices evolution, excluding volumes and periods covered by the PPAs

# NEW MARKET ACCESS AND SOLUTIONS ADAPTED TO CUSTOMER NEEDS

## NEW ACCESS TO MARKETS...

### — Development of “corporate” PPAs for more than 1.5GW in the United States, Brazil, China, UK, France

- EDF Renewables North America and **Shell Energy North America** have signed a PPA for **15 years for a 132MWp photovoltaic plant in California**
- EDF Renewables UK and **Tesco** have signed a **15-year PPA for 60MW of rooftop solar power and onshore wind**
- Agregio signed PPAs with **Maïsadour and Metro**

## ... AND SOLUTIONS ADAPTED TO CUSTOMER NEEDS

- Installation of **rooftop photovoltaic panels for industrial and commercial customers** (France, UK, Egypt, China, etc.)
- Deployment of **off-grid solar kits** for rural electrification, developments in Africa (>100k customers)
- **Egypt:** strategic acquisition of a stake in **Karm Solar**, a key independent player in the generation of renewable energy, supplying solar energy to farmers and commercial customers, with a portfolio of solar PV projects of 170MWp
- **EMS** <sup>(1)</sup> achievements via **EDF Store & Forecast**: Guadeloupe, Martinique, Corsica, Saint-Nicolas des Glénans, New Caledonia

(1) Energy Management System

# TECHNOLOGICAL INNOVATION: A KEY COMPETITIVE ADVANTAGE



## PHOTOVOLTAIC SOLAR POWER

- **Increase the capacity of installations thanks to two-sided photovoltaic modules**
- **Unlock new potentials in solar PV in geographically constrained areas thanks to floating photovoltaic solar installations...**
  - ✓ Development of a floating photovoltaic solar power plant on the Lazer dam (France, Hautes-Alpes)
- **... and Agri-PV**
  - ✓ 1<sup>st</sup> co-developed pilot project with EDF R&D and INRA



## OFFSHORE WIND

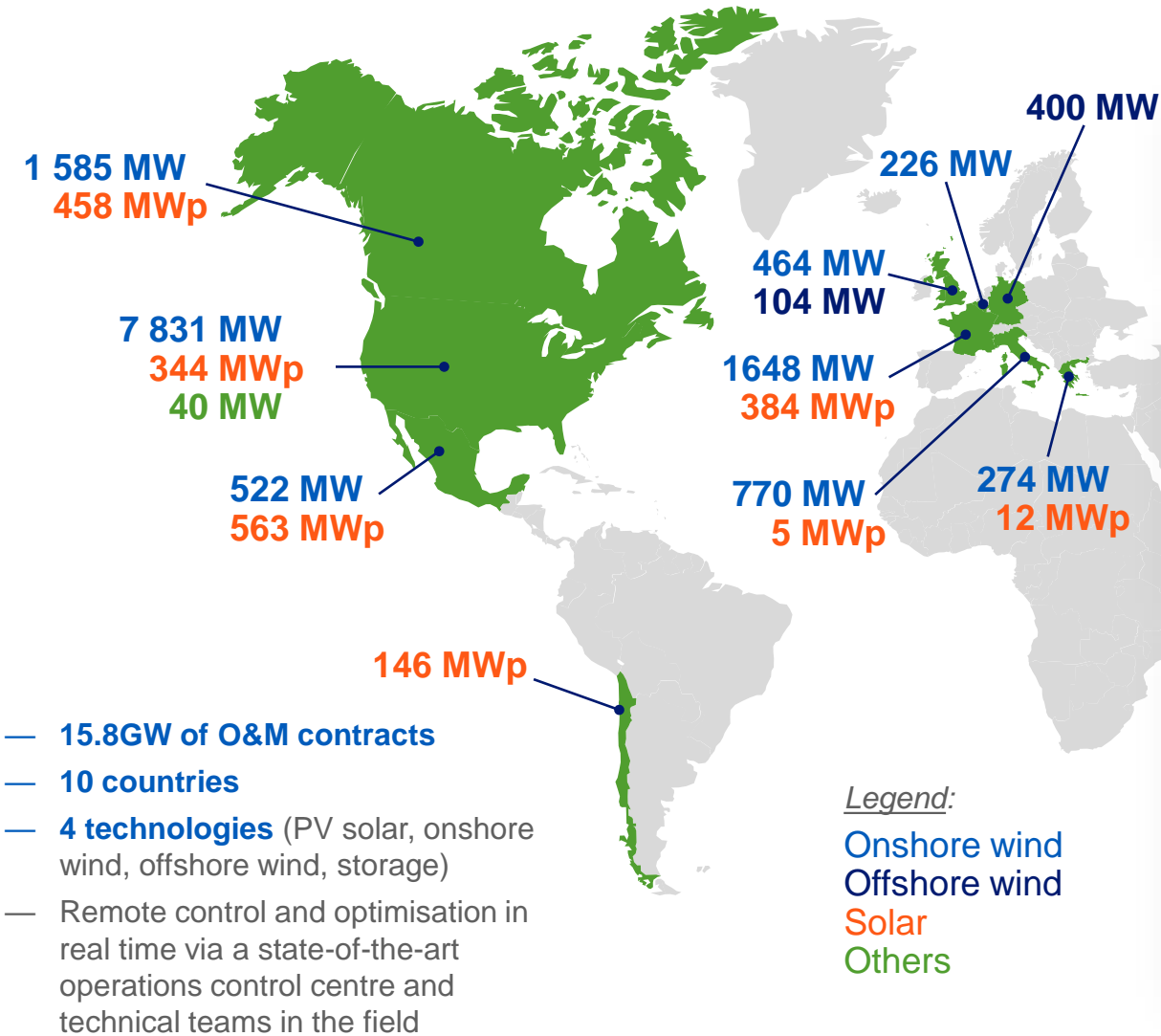
- **Exploiting new potential in offshore wind power with floating wind power:** Provence Grand Large (France, a floating project of 3 x 8.4MW located off the coast of Fos-Sur-Mer)



## STORAGE

- **Hybridisation of renewable assets and thermal storage:** Noor Midelt I project in Morocco (800MW hybrid project combining photovoltaic solar, concentrated solar (CSP), storage using molten salts)
- **Development of flexibility on the grid using Li-ion batteries coupled to generation assets:** Petit Canal, Guadeloupe (wind) and Arrow Canyon, United States (PV power plant)
- **Development of batteries** (acquisition of Pivot Power in the UK) **and charging systems for electric vehicles** (acquisition of PowerFlex in the United States)

# ~ 16GW OF O&M: STRONG EXPERTISE, DIFFERENTIATING FACTOR



## OPTIMISED ASSET PERFORMANCE

- Digitalisation and supervision in real time, continuous innovation and predictive maintenance

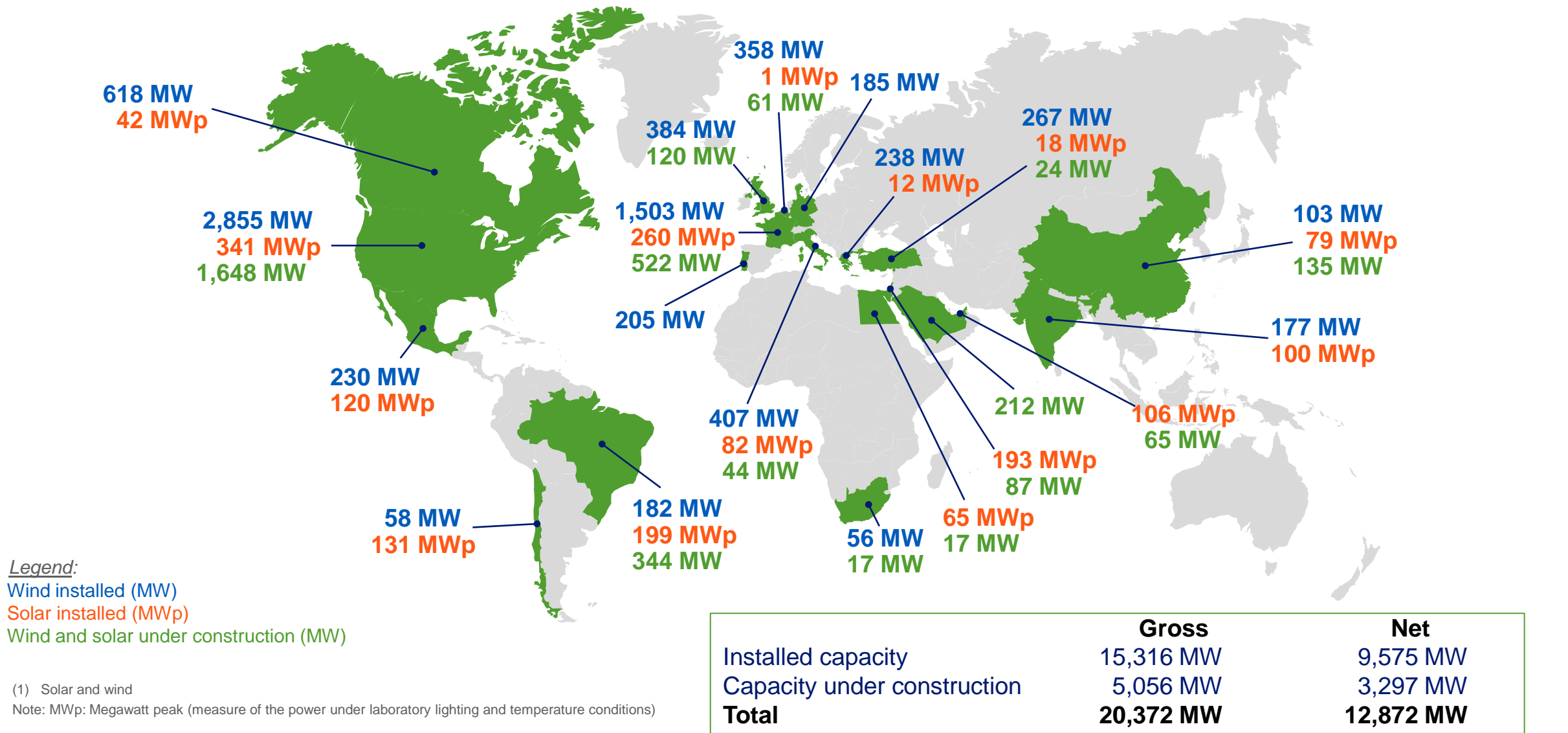
## ENHANCED TECHNICAL EXPERTISE

- Continuous feedback on technical issues via O&M monitoring **strengthening knowledge and understanding of industrial technologies**
- A **strong credibility** vis-à-vis turbine manufacturers and third-party investors

## REINFORCED COMPETITIVENESS DURING THE DEVELOPMENT PHASES

- **Better price positioning for responses to calls for tenders**
- A **contract optimisation** thanks to the competition between turbine suppliers for initial or renewal O&M contracts
- **Optimisation of the project from the initial phases** (development, construction, etc.)

# NET CAPACITY INSTALLED AND UNDER CONSTRUCTION - DECEMBER 2019<sup>(1)</sup>





# INSTALLED CAPACITY AND CAPACITY UNDER CONSTRUCTION, WIND & SOLAR, AS OF DECEMBER 31<sup>ST</sup> 2019

(in MW)	Gross <sup>(1)</sup>		Net <sup>(2)</sup>	
	31/12/2018	31/12/2019	31/12/2018	31/12/2019
Wind	11,716	12,416	7,635	7,826
Solar	2,415	2,900	1,371	1,749
<b>Total installed capacity</b>	<b>14,131</b>	<b>15,316</b>	<b>9,006</b>	<b>9,575</b>
Wind under construction	1,296	3,531	881	2,131
Solar under construction	1,230	1,525	713	1,166
<b>Total capacity under construction</b>	<b>2,526</b>	<b>5,056</b>	<b>1,594</b>	<b>3,297</b>

NB: The values correspond to the expression to the first decimal or integer closest to the sum of the precise values, taking into account rounding

(1) Gross capacity: total capacity of the facilities in which EDF Renewables has a stake

(2) Net capacity: capacity corresponding to EDF Renewables' stake

# OPERATION & MAINTENANCE <sup>(1)</sup>

<i>(in MW)</i>	31/12/2018	31/12/2019	Δ MW	Δ %
United States	7,693	8,214	521	+6.8
Canada	2,058	2,043	-15	-0.7
Mexico	1,017	1,085	68	+6.7
Chile	146	146	-	+0.0
<b>Total America</b>	<b>10,914</b>	<b>11,488</b>	<b>574</b>	<b>+5.3</b>
France	2,013	2,032	18	+0.9
United Kingdom	537	568	31	+5.8
Greece	286	286	-	+0.0
Italy	747	770	23	+3.0
Germany	400	400	-	+0.0
Poland	106	-	-106	-100.0
Belgium	129	226	97	+75.2
<b>Total Europe</b>	<b>4,218</b>	<b>4,282</b>	<b>64</b>	<b>+1.5</b>
<b>Total O&amp;M</b>	<b>15,132</b>	<b>15,770</b>	<b>638</b>	<b>+4.2</b>

(1) MW generated by renewable energy power plants that EDF operates and maintains (plant supervision, monitoring of production, preventive and corrective maintenance, etc.) on its own behalf or for a third party

# STORAGE AND ELECTRIC MOBILITY PLAN ACQUISITION <sup>(1)</sup> OF PIVOT POWER IN THE UNITED KINGDOM

## PIVOT POWER, BRITISH START-UP SPECIALISED:

- in battery electricity storage: portfolio of projects on more than 40 sites with a total potential capacity of nearly 2GW
- in the development of private electricity grids facilitating the deployment of charging infrastructure for electric vehicles (charging stations)

## TWO IMPORTANT LEVERS FOR THE UNITED KINGDOM'S 2050 "ZERO-CARBON" OBJECTIVE:

- enhancing the flexibility and reliability of the electricity grid to facilitate the integration of renewable energies
- developing electric vehicles as a substitute for petrol thanks to a network of rapid charging stations throughout the country

(1) See press release of 4 November 2019

### First-mover advantage with access to strategically located assets

**40**

Connections at National Grid (NG) substations

**49.9MW**

Capacity of each Battery Storage site  
Lithium-Ion technology<sup>3</sup>  
1h duration<sup>4</sup>

**57.0MW**

Capacity connection size being secured on each NG substation site

**7MW<sup>2</sup>**

Capacity available for rapid EV charging or Other power offtake



**2GW**

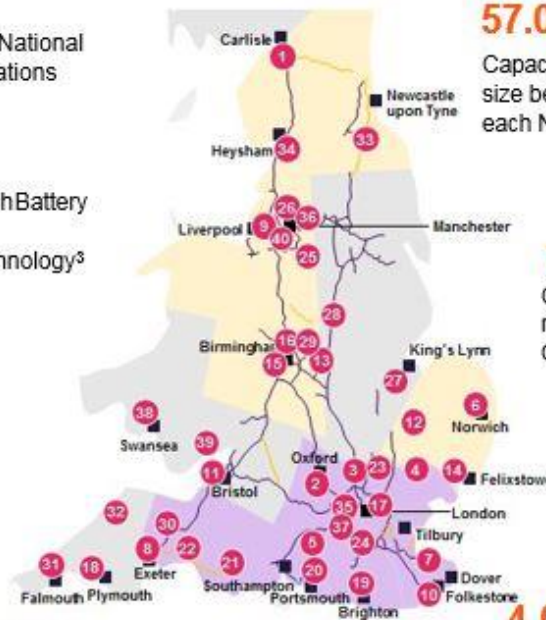
Size of Pivot Power battery storage portfolio



**4,000**

Number of rapid EV chargers unlocked in the UK<sup>1</sup>

Source: Pivot Power



# EDF GROUP MAIN BUSINESSES

➤ NUCLEAR	P. 72
➤ RENEWABLES	P. 109
➤ <b>THERMAL POWER</b>	<b>P. 134</b>
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# ADJUSTMENT OF THERMAL POWER TO EDF'S LOW CARBON STRATEGY

## Modernisation of the EDF's fleet in mainland France to improve its technical and environmental performance

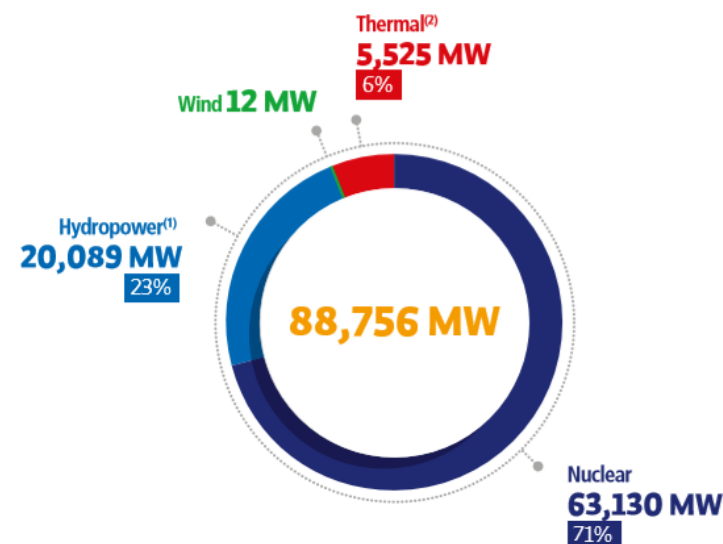
- Final shutdown of fuel oil production units: two units in Aramon on 1 April 2016, four in Porcheville and one in Cordemais in spring 2017. The last fuel oil plant in EDF's French fleet (Cordemais 3) was shut down on 31 March 2018
- Commissioning of 4 Combined Cycle Gas Turbines (CCGT) between 2011 and 2016 to replace coal-fired plants that have been permanently shut down
- The vast program to modernize EDF's thermal power plants, which runs from 2007 to 2016, has significantly improved the Group's carbon footprint. Over the period, the average CO<sub>2</sub> content of the kWh produced by the fleet decreased by 35%
- Thermal represents ~ 6% of the EDF group's installed capacity (1). The share of thermal in the energy mix of the Group varies from one country to another: in 2019, it reached ~ 2% of electricity generation in France (2) and ~ 70% in Italy
- The Group plans to phase out coal-fired power generation by 2030, in all geographical areas

(1) Consolidated capacity of the EDF's group as of end-2019

(2) Excluding Corsica and overseas departments

Source: 2019 EDF Universal Registration Document

## Installed capacity in MW

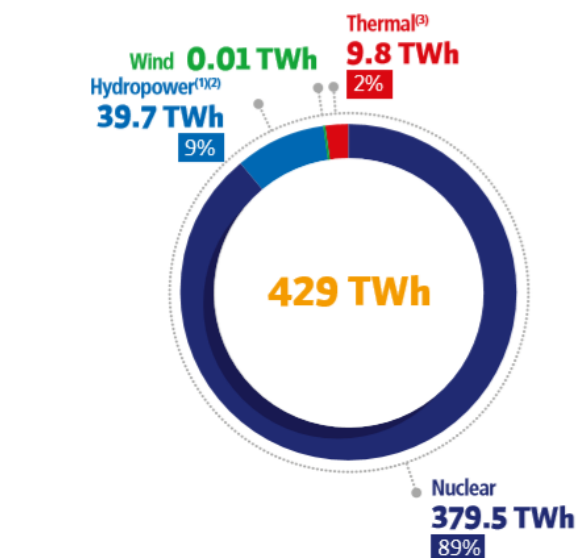


Expressed in megawatts of maximum capacity linked to the network.

(1) Excluding Corsica and overseas departments, 439 MW in 2019 and including tidal generation capacity of 240 MW.

(2) Excluding Corsica and overseas departments, 1,621 MW in 2019.

## Output in TWh



(1) Excluding Corsica and overseas departments, representing 1.2 TWh in 2019.

(2) Generation including pumped storage consumption: the electricity consumption needed for the operation of pumped storage power plants (STEP) amounted to 6.3 TWh in 2019, resulting in net hydropower generation (including pumped storage consumption) of 33.4 TWh, and including generation from the tidal power on the Rance river of 0.5 TWh.

(3) Excluding Corsica and overseas departments, 4.6 TWh in 2019.

NB: The values correspond to the expression to the first decimal or integer closest to the sum of the precise values, taking into account rounding.

(1) Variable generation costs correspond to all costs that vary directly with the amount of energy generated. Variable costs for electricity generation are mainly fuel costs.

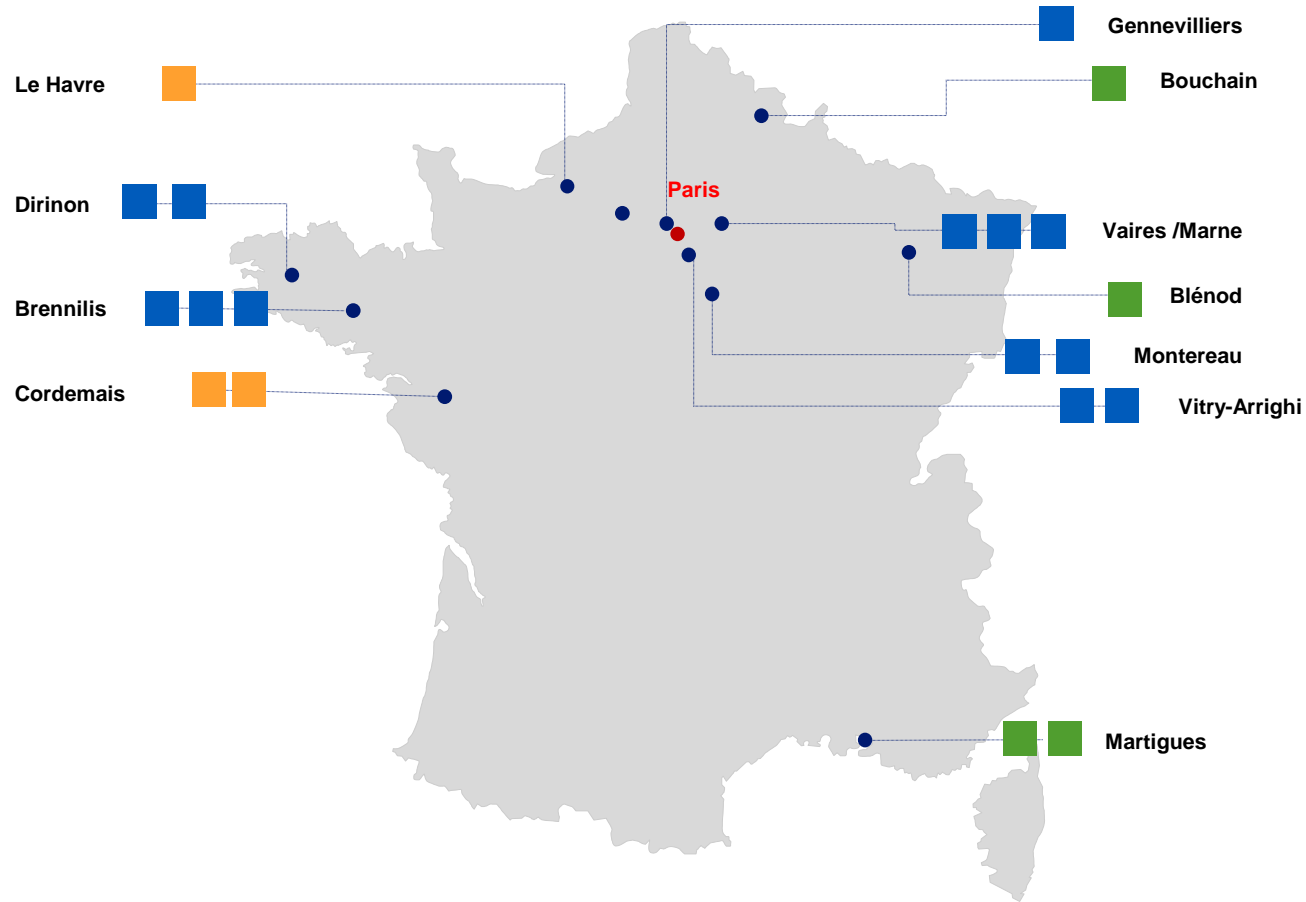
(2) EDF operates 5GW of STEP in France and its engineering is referenced to the tune of 30GW abroad (e.g.: Israel, Chile).

(3) Excluding Corsica and French overseas departments.

(4) Calculation based on the ENTSO-E statistics for the year 2018, as the statistics for the year are only available on 30 April of the following year

(5) Arithmetic mean.

# EDF THERMAL PLANT FLEET IN MAINLAND FRANCE



**~ 11 production sites > 5Gwe <sup>(1)</sup>**

## ➤ Coal-fired plants

Three 1,800MW units

## ➤ Combined-Cycle Gas turbines (CCGT)

Four CCGTs totalling 4,000MW

## ➤ Combustion turbines (TAC)

Thirteen TACs totalling 2,000MW

(1) At End-2019



# AN INDUSTRIAL PROJECT FOR A BETTER ENVIRONMENTAL PERFORMANCE

## Changes to the environmental regulatory framework <sup>(1)</sup>

- EDF's thermal power plants are now operated within the context of regulations that apply to installations classified for environmental protection (*Installations classées pour la protection de l'environnement* – ICPE), as well as regulations relating to greenhouse gas emissions and a specific regulation for air quality
- In 2019, EDF's thermal fleet in mainland France emitted 5.4 million tonnes of CO<sub>2</sub> (compared with 6.4 million tonnes in 2018) for net electricity generation of approximately 9.85TWh (compared to 11TWh in 2018). The CO<sub>2</sub> content of the kWh generated by EDF's thermal power plants in mainland France in 2019 amounted to 545 g/kWh net, i.e. the smallest CO<sub>2</sub> footprint in the history of EDF's thermal power plants (579 g/kWh net in 2018)
- This decarbonation of EDF's thermal kWh is a direct result of the ramp-up of CCG's in EDF's thermal generation mix, which contributed more than 89% of the thermal fleet's output in 2019 (compared to 62% in 2018)
- In 2019, the EDF mainland France thermal fleet also emitted 0.7 kt of SO<sub>2</sub>, 2.6 kt of NO<sub>x</sub> and 0.02 kt of dust. In terms of generated kWh, pollutant discharges from EDF's thermal power plants have been reduced by a factor of 4 for NO<sub>x</sub>, by more than 10 for SO<sub>2</sub> and by more than 20 for dust compared with 2010
- These drastic reductions in emissions have been made possible by shutting down the oldest thermal power stations, renovating and installing flue gas treatment equipment using the best techniques available on the most recent power stations, using fuel with a lower sulphur content and, finally, by commissioning combined cycles using low-polluting natural gas
- The environmental performance of EDF's thermal power plants in mainland France is fully in line with the objectives set by the EDF group's new Sustainable Development policy signed in June 2018

(1) Source: Universal registration document 2019 EDF

## The ECOCOMBUST project

- ECOCOMBUST is the result of work begun in 2015 by EDF teams to study the development of a biomass-based fuel to replace coal at the Cordemais power plant. This project is part of an initiative to launch a new CO<sub>2</sub>-neutral fuel manufacturing process, making it possible to replace the current use of coal, without the need for major changes to industrial processes
- It consists of manufacturing an innovative and ecological fuel from wood residues or wood waste from the region, by means of a densification system to obtain a product that has high calorific value, while being hydrophobic and rot-proof. The manufacture of this fuel would make it possible to launch a new sector for the recovery of wood waste (so-called "Class B" wood), which has no current use and is most often buried, put into landfills or processed elsewhere
- This sector would be attractive for France because it creates additional biomass that can be used locally. It would also be widely deployable internationally
- The projects objectives are:
  - to commission, in 2022, the first industrial installation with a production capacity of 160,000 t/year of this new biomass fuel, which can be substituted for the currently-imported coal, for industrial applications (district heating, cogeneration)
  - to move to 80% ECOCOMBUST fuel and 20% coal in the Cordemais units 4 and 5 from 2022 to 2026, in an operating mode reduced to a maximum of 400 hours per year and per unit, for the safety of the power grid in the Grand Ouest region of France.

# INTERNATIONALLY-VALUED EXPERTISE

EDF enhances its expertise and know-how in thermal power and transportation by developing the sale of services to third parties. Its offer extends over the entire value chain of electricity generation facilities, from feasibility studies to decommissioning and including construction and operation. Among the main operations in 2019:

- **Qatar Project:** assistance for the construction of substations and lines
- **Saudi Arabia:** technical support and maintenance at the e-monitoring system at the Saudi Electricity Company
- **Dubai:** Aweer project, project management assistance for the construction of 2 combustion turbines
- **Morocco:** technical assistance and training for TAQA in safety
- **Greater Mekong:** interconnection studies between the 6 Mekong countries
- **Ivory Coast:** supervision of transmission facilities: substations and high-voltage lines
- **Egypt:** design of the control room for the Talkha regional power grid and New Cairo
- **Emirats Arabes Unis :** supervision project for SEWA jobs



# EDF GROUP MAIN BUSINESSES



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# ENEDIS<sup>(1)</sup>: HIGH VISIBILITY ON GROWTH AND RETURNS FROM REGULATED ACTIVITIES

LEADING  
DISTRIBUTION  
PLAYER IN  
EUROPE



2019 KEY  
FIGURES<sup>(2)</sup>

<i>In millions of Euros</i>	2018	2019	Δ%
<b>Sales</b>	14,023	14,122	-0.6%
<b>EBITDA</b>	3,993	4,140	+2.8%
<b>Net income excl. non-recurring items</b>	791	775	-9.0%
<b>Gross operating investments<sup>(3)</sup></b>	3,767	4,254	+6.4%

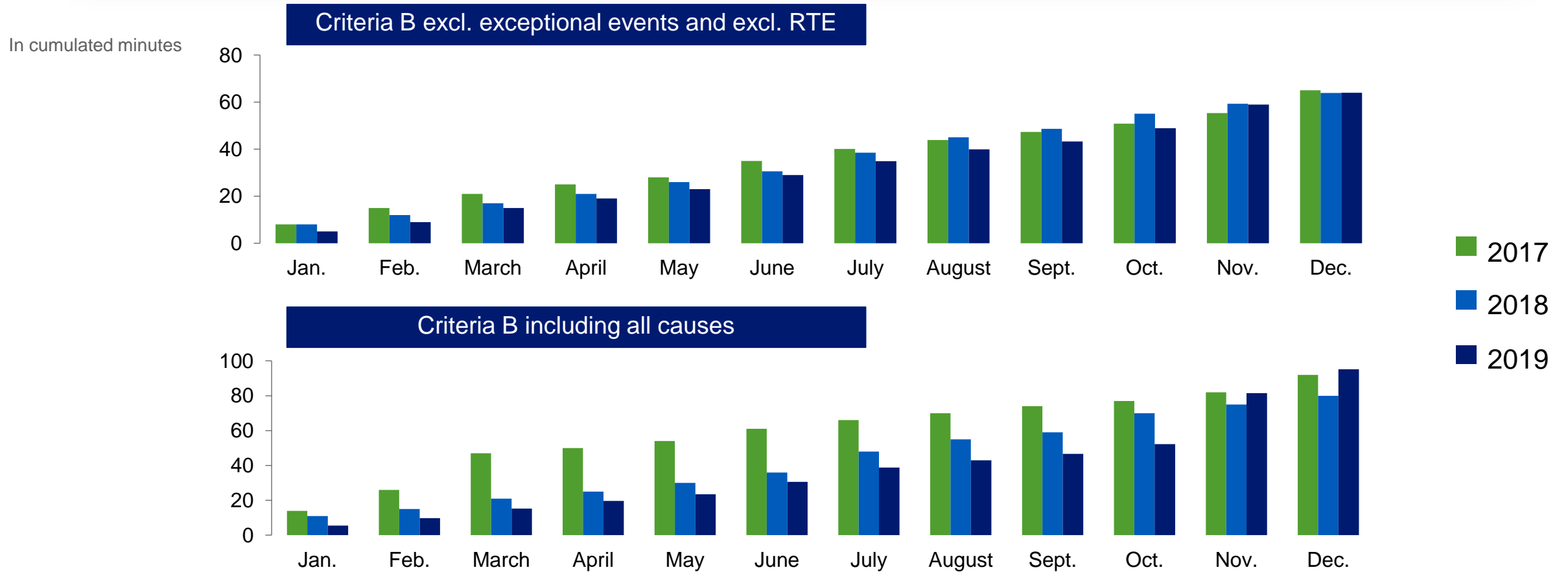
(1) Enedis is an independent subsidiary of EDF under the provisions of the French energy code

(2) Local data

(3) Including Linky, project led by Enedis

# ENEDIS <sup>(1)</sup>: QUALITY OF DISTRIBUTION IN FRANCE

- Criteria B <sup>(2)</sup> excluding exceptional events and excluding RTE: same value as in 2018
- Criteria B <sup>(2)</sup> including all causes (TCC): +15 minutes vs 2018 including +19 minutes due to only one snow event in the Rhone Valley



(1) Enedis, independant subsidiary of EDF under the provisions of the French Energy Code

(2) Cumulated average duration in minutes of outages per low customers voltage

# TARIFF FOR USING THE PUBLIC ELECTRICITY TRANSMISSION AND DISTRIBUTION NETWORKS (TURPE) GENERAL PRINCIPLES

## ➤ TURPE is based on general principles...

- **“Postage stamp”**: network access pricing is dependent on distance
- **Tariff equalisation**: the same rates apply throughout the national territory
- **No discrimination**: tariffs reflect the costs generated by each category of users
- **Time-seasonality**: tariffs are designed to encourage customers to limit their consumption during peak periods

## ➤ ... complemented by criteria to best meet the expectations of stakeholders

- **Efficiency**: the tariff signal leads users to modify their behaviour and encourages the reduction of costs over the long term
- **Readability**: level of complexity appropriate to the type of user and the voltage level considered
- **Consistency**: the different options offered to the same user must reflect the costs with the same degree of detail
- **Feasibility**: tariffs must be able to be implemented
- **Progressivity**: a change in tariffs must generate progressive effects



# TARIFF FOR USING THE PUBLIC ELECTRICITY TRANSMISSION AND DISTRIBUTION NETWORKS (TURPE) FINANCIAL ASPECTS

- From a financial perspective, the TURPE must comply with Article L341-2 of the French Energy Code, which stipulates that “the tariffs for using the public transmission network and the public distribution networks are calculated in a transparent and non-discriminatory manner, in order to cover all the costs borne by the operators of these networks to the extent that these costs correspond to those of an efficient network operator”
- TURPE 5 is structured in this line around the **hedging of operating expenses and capital charges**, and in a differentiated manner for transport and distribution, with two separate resolutions from the regulator

<b>Duration</b>	around 4 years
<b>Tariff change</b>	at 1 August, based on inflation + tariff catch-up
<b>CRCP<sup>(1)</sup></b>	coverage of the difference between the realised and the projected trajectory
<b>Incentive regulation</b>	quality of supply, requirement level in terms of quality of services, performance on controllable OPEX
<b>Operating costs:</b>	for the <u>covered portion</u> to the nearest euro (system operating costs), <u>for the required portion</u> (business operating costs)
<b>Capital charges</b>	includes the differentiated remuneration between transport (remuneration of the RAB <sup>(2)</sup> to a WACC <sup>(3)</sup> ) and distribution (margin on assets included in the RAB of regulated equity), as well as the hedging of long-term investment trajectories

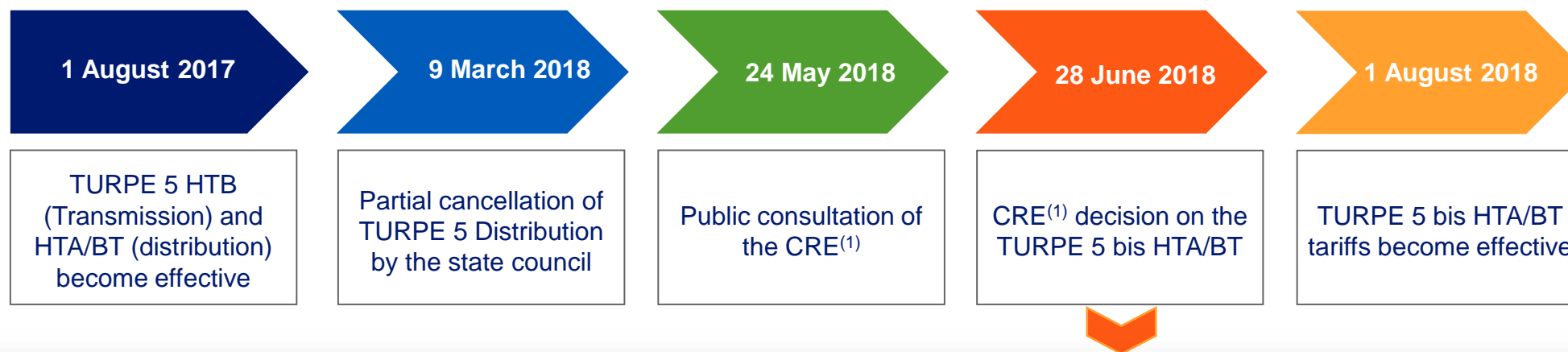
TURPE includes provisions for **incentive regulation** (bonus/malus for technical objectives, in addition to required OPEX), **but also secures financial trajectories** through the “CRCP”<sup>(1)</sup> mechanism

(1) CRCP: “Compte de Régularisation des Charges et des Produits”, Income and expenses adjustment account. This is a non-accounting tool that can be used to cover any ex post facto discrepancies, on clearly identified expense and revenue items, between the realisations and the forecasts taken into account for the preparation of the tariff

(2) RAB: Regulated Asset Basis

(3) WACC: Weighted average cost of capital

# PUBLIC ELECTRICITY NETWORK ACCESS TARIFF (TURPE) KEY DATES OF TURPE 5 “BIS”



Decision by the CRE<sup>(1)</sup> on 28 June 2018<sup>(2)</sup> regarding the decision on the TURPE 5 bis HTA/BT distribution rates, which come into effect from 1 August 2018 for a period of approximately three years (not retroactive):

- Increase in regulated equity of Enedis<sup>(3)</sup> pursuant to the decision by the Council of State of 9 March 2018 totalling circa €1.6 billion. Over time, this will provide Enedis with additional income equal to, on a net present value of cash flows before tax basis, €<sub>2018</sub>750m according to the estimate by the French Energy Regulator.
- Update of the corporate tax rate, resulting in an adjustment of the return rate to 4% for regulated equity and 2.5% for the margin on assets (versus 4.1% and 2.6% previously)
- No reconsideration of the other aspects of TURPE 5 HTA/BT: trajectory of operating expenses, net investments, incentive regulatory framework of TURPE 5 HTA/BT and of Linky maintained

Average change as of 1 August 2019 of +3.04%, including in particular +1.61% for inflation and +1.45% to clear the balance of the so-called CRCP, a balancing mechanism

(1) CRE: *Commission de Régulation de l'Énergie* (French Energy Regulator)

(2) Published in the Official Journal of 28 July 2018

(3) Enedis, an independant EDF subsidiary as defined in the French Energy Code

# REGULATED ASSET BASE IN FRANCE

	Regulated Asset Base as of 01/01/2020	Nominal remuneration rate before corporate tax	Price indexation
TRANSMISSION	NBV of fixed assets <sup>(2)</sup> = €14.3bn	6.125%	<b>Indexation CPI + K <sup>(1)</sup></b>  +3.0% as 01/08/2018 +2.16% as 01/08/2019
DISTRIBUTION	NBV of fixed assets excluding Linky <sup>(2)</sup> = €52.2bn ----- Regulated equity <sup>(3)</sup> = €8.3bn ----- NBV of Linky = €2.3bn	2.5% <sup>(4)</sup> ----- 4.0% <sup>(4)</sup> ----- 7.25% +3%/-2% <sup>(5)</sup>	<b>Change in tariff</b>  -0.21% as 01/08/2018 +3.04% as 01/08/2019

(1) CPI: Consumer price index covering all of France excluding tobacco of year Y-1 - K: CRCP reconciliation term, within a range of +/-2% (CRCP: The CRCP mechanism (Compte de Régularisation des Charges et des Produits) corrects for the differences between forecast and actual expenses and products, from one year to another)

(2) Excluding financial assets and assets under construction and after regulatory restatement of investment subsidies  
Under TURPE 3, tariffs included only industrial D&A's. Under Turpe 4, provision for renewal as well as all D&A's are included

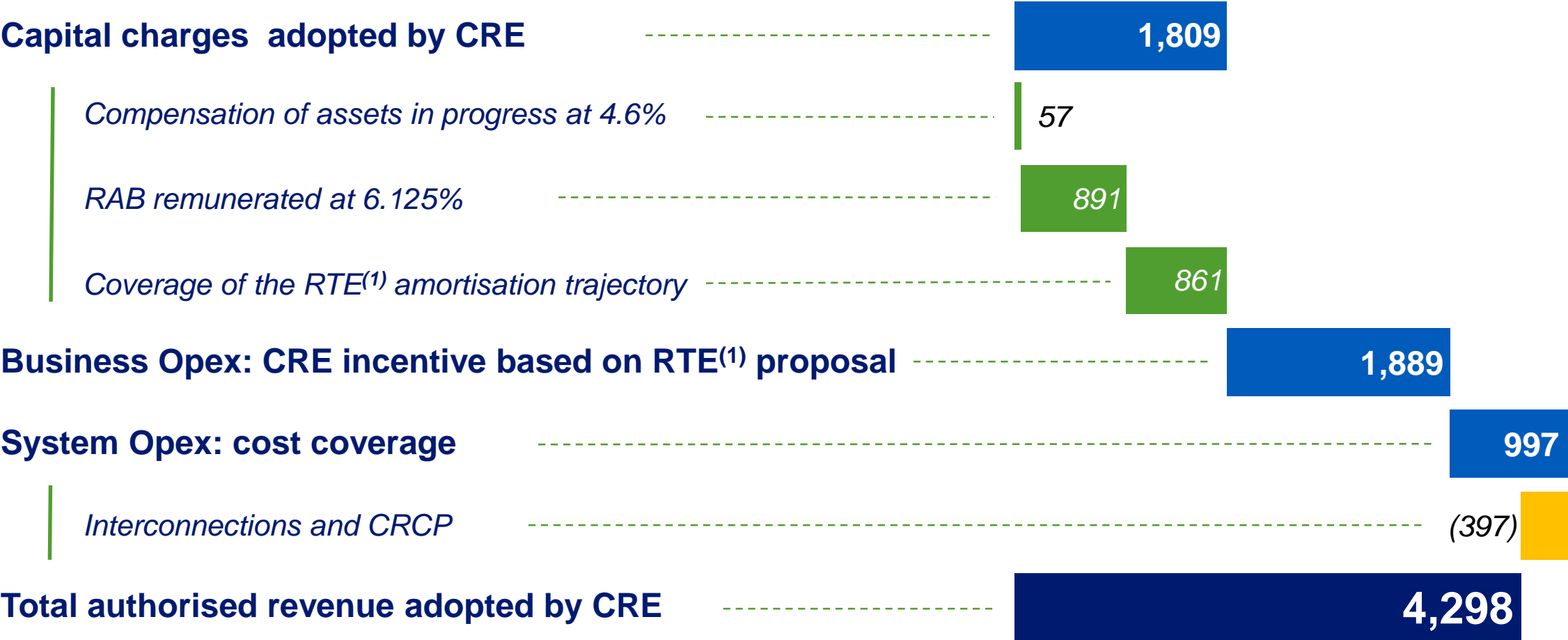
(3) Difference between the net book value of the fixed assets and the sum of the specific accounts of concessions, the provisions for renewal, the investment subsidies and, where appropriate, the financial loans; the regulated equity amount indicated takes into account the TURPE 5 bis decision and includes 1.6 billion in regulated equity as such

(4) Rates revised by the CRE in TURPE 5 bis vs. TURPE 5 to take into account the reduction of corporate tax rates provided for in the 2018 French Finance Act

(5) Premiums/penalties during the deployment phase

# TURPE 5 TRANSMISSION (TRANSPORT): AVERAGE FIGURES FOR 2017-2020

In millions of Euros

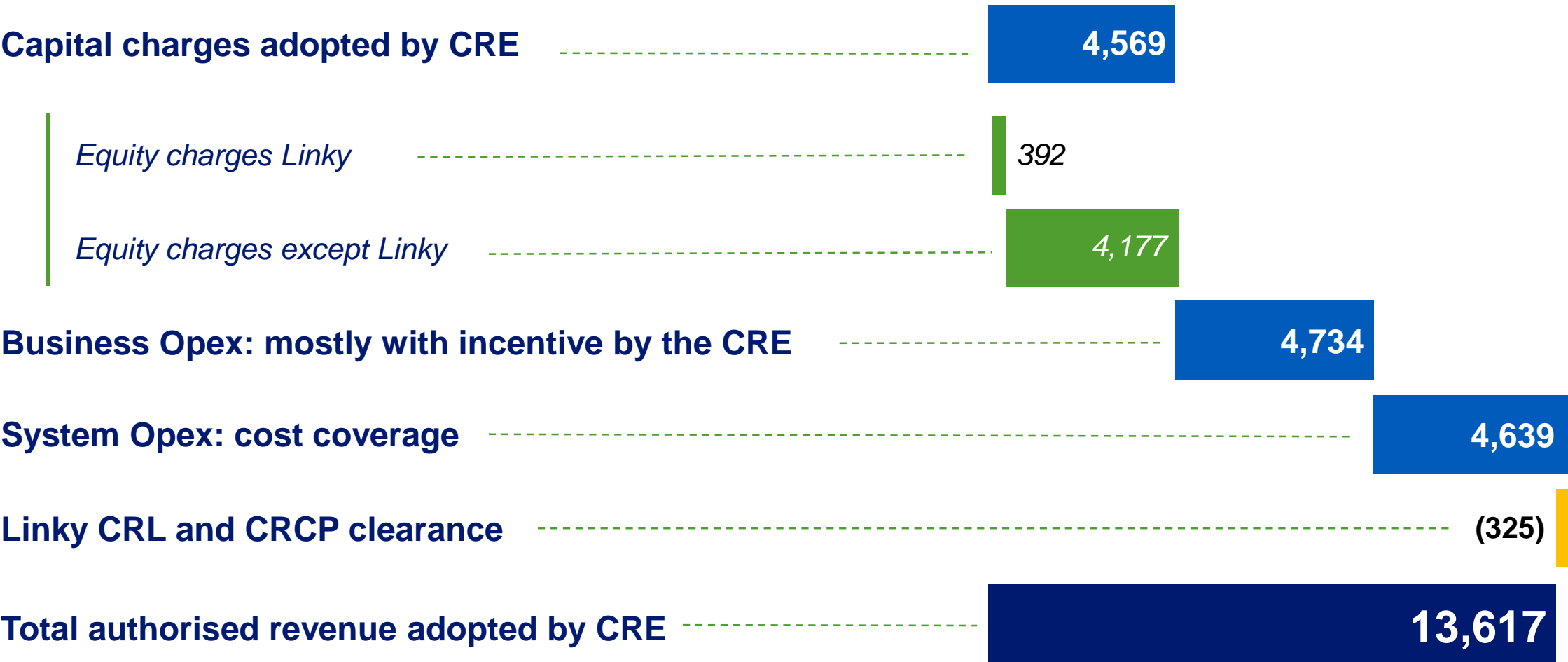


Source: French Energy Regulation Commission (CRE)

(1) RTE is an independent subsidiary of EDF under the provisions of the French energy code

# TURPE 5 DISTRIBUTION: 2019 FIGURES (1)

In millions of Euros



Source: French Energy Regulation Commission (CRE)

# LINKY<sup>(1)</sup>: PREDICTABLE REGULATED RETURNS AND POSITIVE CASH FLOWS FROM 2022

AT THE HEART OF  
NEW NETWORK  
SERVICES  
FOR BETTER  
PERFORMANCES

23.4m

customers  
equipped with  
the Linky meter  
at end-2019

~ 34.4m

clients  
equipped  
by end-2021



Linky

~ €4bn<sup>(4)</sup>

investments  
over 2014-2021

A specific  
20-year tariff  
(regulation  
model with  
dedicated  
RAB)

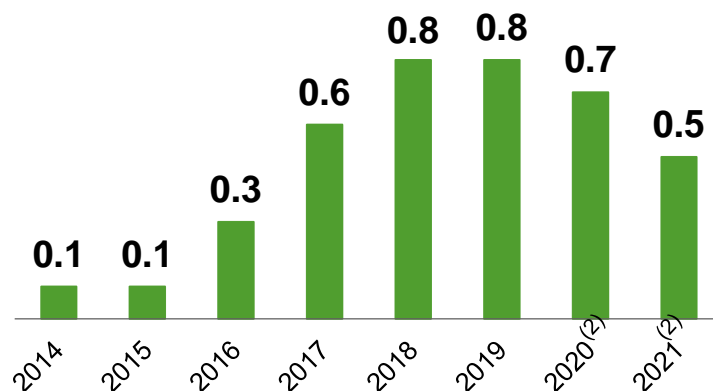
Key points as of  
31/12/2019

- First year with positive Linky EBITDA contribution
- Compliance with cost, deadlines and efficient-incentive regulation targets for the system
- 550,000 stations equipped with a concentrator
- ~ 2.8 billion of renewable subscriptions with hourly publication of consumption data have been purchased by suppliers and third parties

POSITIVE CASH  
FLOWS FROM  
2022

2014 – 2021 investment pattern

In €bn



Linky – Return

7.25%  
pre-tax nominal return rate



3%  
additional premium<sup>(3)</sup>

(1) Linky is a project led by Enedis, independent subsidiary of EDF under the provisions of the French energy code

(2) Estimated Data

(3) +3% / -2% incentive premium / penalties depending on cost control, fulfilment of deadlines and system performance, during the deployment phase

(4) Costs at the end of the program have been revised downwards after taking into account the prices of the last equipment markets (concentrating meters) and delivery services signed.



# ELECTRICITY SMART METERING REGULATORY FRAMEWORK IN FRANCE, GREAT BRITAIN AND ITALY

	FRANCE <sup>(1)</sup>	GREAT BRITAIN	ITALY
DEPLOYMENT RESPONSIBLE ENTITY	Distributors	Energy Suppliers	Distributors
REGULATORY ENTITY	CRE (deliberation of 17 July 2014) Specific regulation over a 20-year period	Department for Business, Energy & Industrial Strategy (BEIS) responsible for policy making with Ofgem responsible for monitoring performance and compliance	Since 2000: business-driven process, led by Enel Since 2006: process fully regulated by the <b>Authority for Electricity and Gas</b>
TARGETS	<b>35 million meters (deployment rate of 90%) to be installed by 2021.</b> Incentive-based regulation focusing on 3 parameters (installation schedule, costs management and service quality) with bonuses and penalties	<b>Take “all reasonable steps” to achieve 100% of residential and small business customers by end of 2020.</b> Material fines for non-compliance with milestones and targets. 53 million meters <sup>(2)</sup> to be installed, and ‘In-Home-Displays’ must be offered to customers	<b>Already reached:</b> Italy has been a pioneer and deployment rate of smart meters exceeds 95% by the end of 2011
PROJECT STATUS	Start of the <b>large-scale deployment in December 2015.</b> <b>26 million customers equipped</b> with Linky meter at end-2019	More than <b>17.5 million first generation smart meters</b> were installed at Q3 2019. As of Feb 2020, 4m second generation smart meters were installed. <50% of customers will have smart meters by 2020 nationally; therefore BEIS is expected to clarify the policy framework for post 2020	In April 2017, <b>the Authority approved Enel's plan to roll out, from 2017 to 2031, the 2<sup>nd</sup> generation smart meters</b> , replacing all the 1 <sup>st</sup> generation and having additional functionalities, to provide innovative services. The roll out is on going. Meanwhile, other distributors also started their roll-out plans
REMUNERATION	Tariff model, based on OPEX coverage and on a specific RAB remuneration, applicable for the whole life of assets, until 2040	2019 Impact Assessment published by BEIS shows the cost of the national programme (from 2013 to 2034) at £13.5bn vs. £19.5bn benefits, leading to a net present value of c£6bn	Investment and installation costs of meters for distributors are remunerated on the basis of the tariff set by the Authority

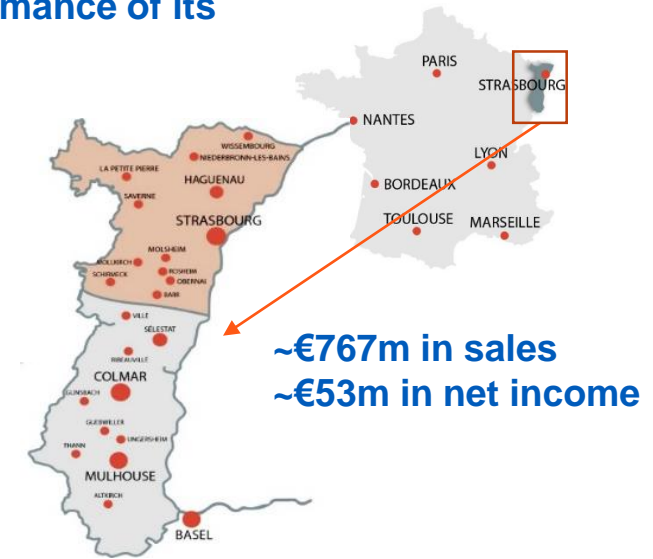
(1) For more information on France, please see [p.148](#)

(2) Electricity and gas meters

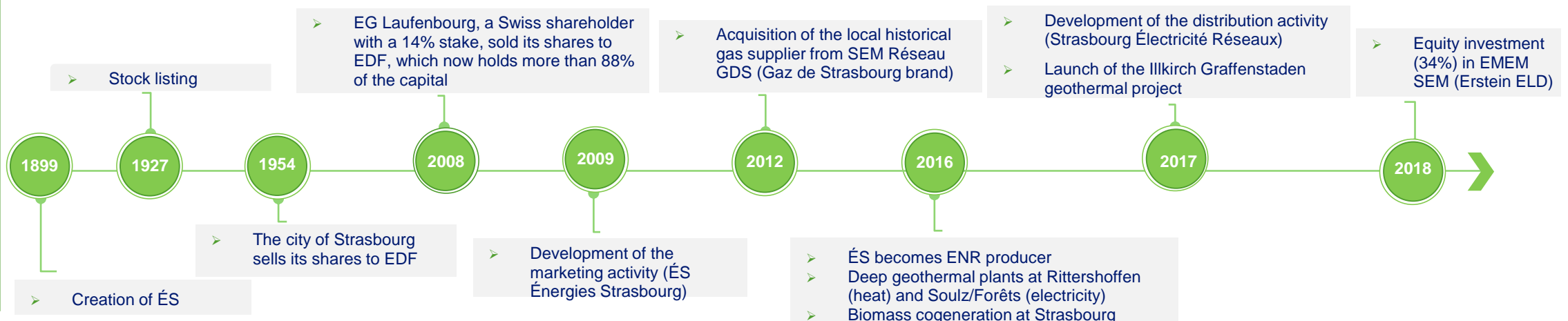
# ÉLECTRICITÉ DE STRASBOURG

ÉS is an Alsatian energy producer which is committed to long-term energy and economic performance of its territory through its four activities:

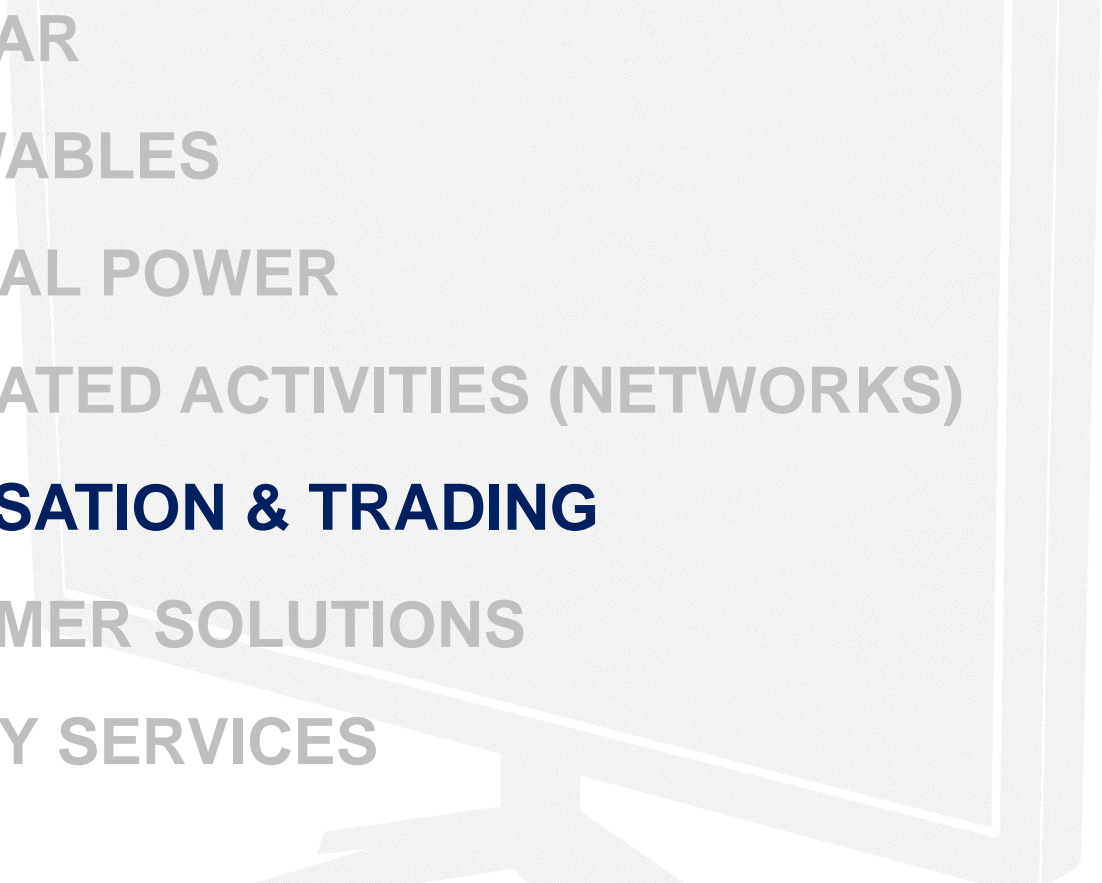
- **Electricity distribution** (Strasbourg Électricité Réseaux)
  - 14,000 kilometres of lines (including 700 kilometres in HVB) in more than 400 Alsatian municipalities having conceded their distribution network
  - 560,000 delivery points, 6.8TWh distributed
- **Supply of energies** (ÉS Énergies Strasbourg)
  - 550,000 customers for electricity (5.5TWh) and 112,000 for gas (4.8TWh) : residentials, businesses and local authorities
  - associated services (corrective maintenance, digital services), as well as support services for residential customers in home renovation and construction
- **Energy services** (ÉS Services Énergétiques)
  - realisation and operation of energy services installations for local governments, homes, healthcare, the tertiary sector and industry
  - operation of the three large-scale Eurométropole heat networks and 2,500 thermal installations
- **Renewable energy generation**
  - **Deep geothermal energy:** 2 installations in service (Rittershoffen 175GWh of heat, Soultz-sous-Forêts 6.3MWh of electricity) and a cogeneration project in progress
  - **Biomass:** a cogeneration plant (65GW of electricity and 118GW of heat)



120 years of local anchorage



# EDF GROUP MAIN BUSINESSES



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➤ RENEWABLES	P. 109
➤ THERMAL POWER	P. 134
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➤ <b>OPTIMISATION &amp; TRADING</b>	<b>P. 151</b>
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# OPTIMISATION AND TRADING: LEVERAGING THE VALUE CHAIN

The main role of the optimiser is to:

- **ensure the balancing** between EDF's upstream resources and markets in France,
- **secure and maximise the gross electricity margin** of the “generation-supply” entity by constantly seeking the best opportunities to buy or sell on the wholesale markets.

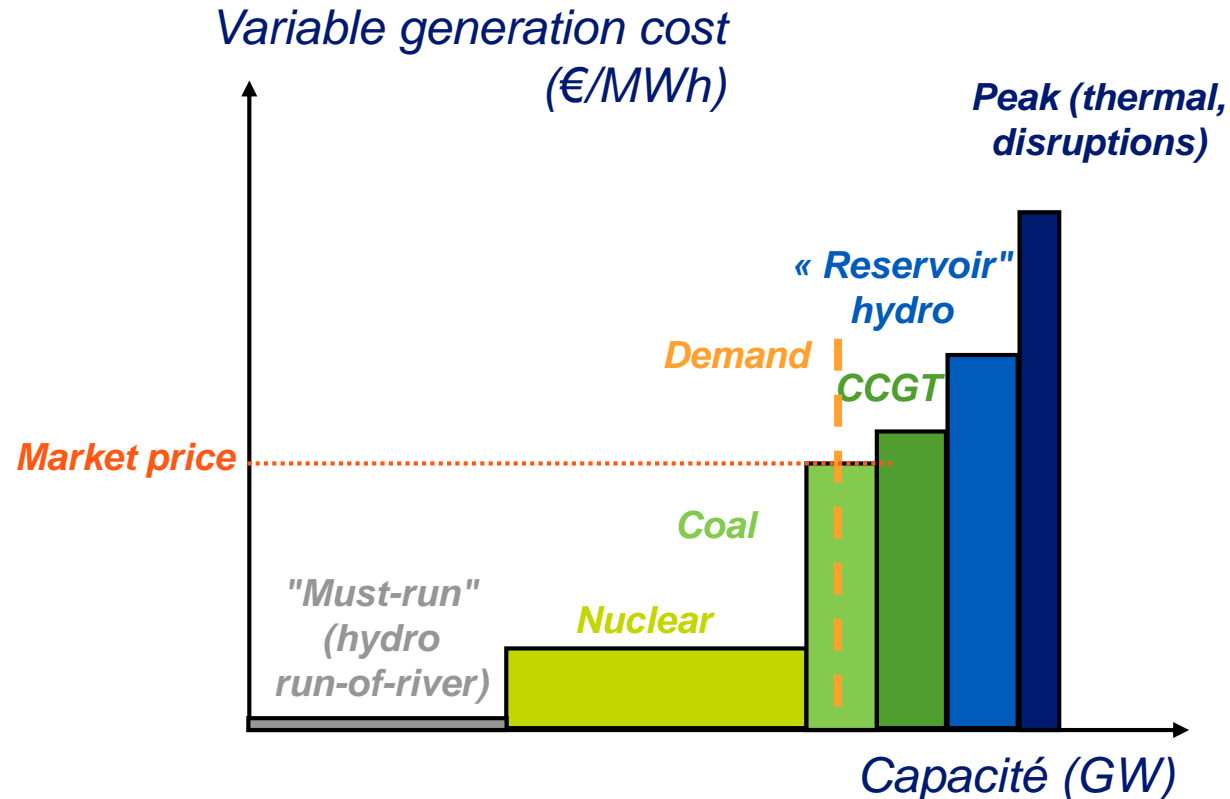
**Upstream resources:** generation fleet, purchases on wholesale markets, contractual demand-side response capacity

**Markets:** sales to end customers, long-term supply contracts, sales on wholesale markets, sales to competitors in France (ARENH), partnership contracts

The optimizer programs the use of physical assets, secures financial results, operates on the wholesale market (through EDF Trading)

The supply-demand balance is forecasted over different time horizons

# DAILY OPTIMISATION: THE MERIT ORDER



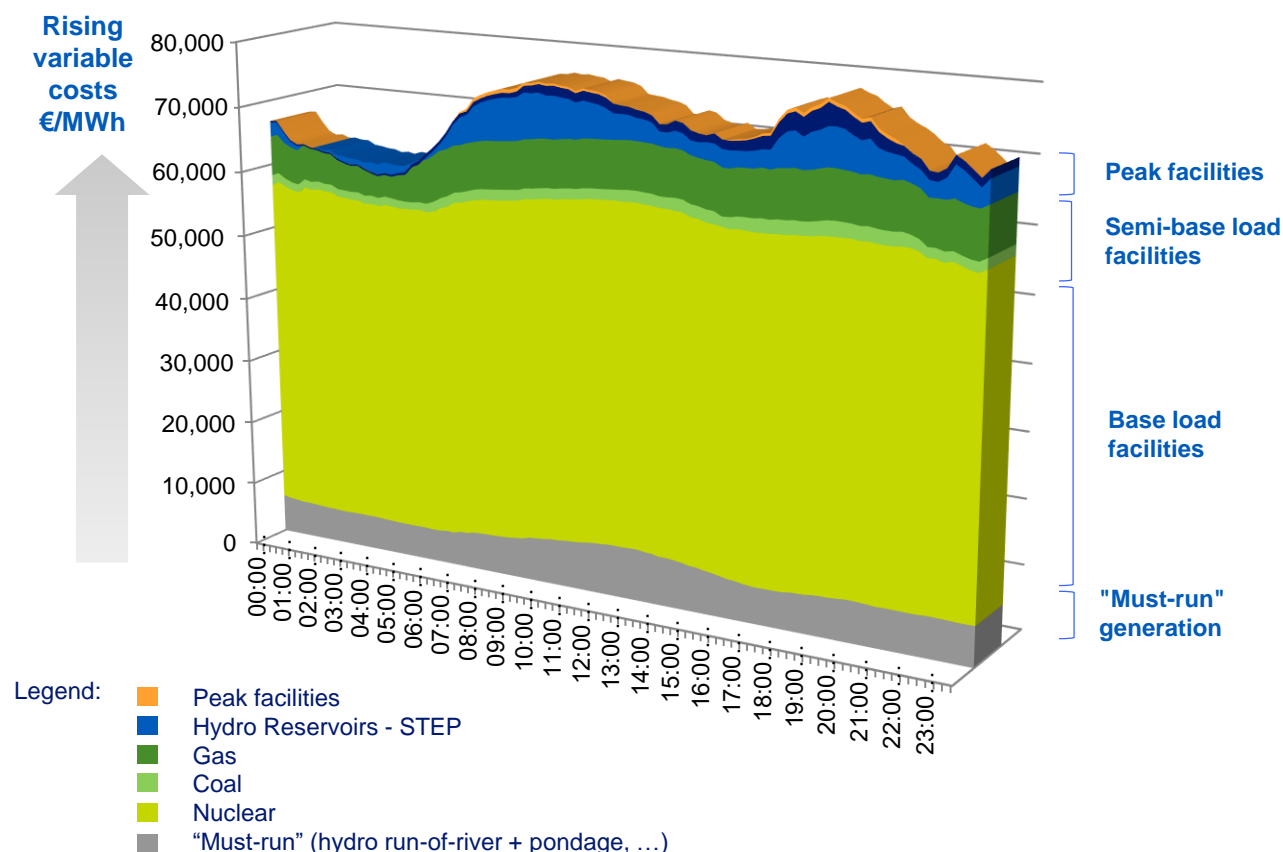
- **For each moment**, the optimiser schedules the operation of available means of generation, mobilising them according to the merit order of variable costs<sup>(1)</sup> until the estimated demand is met
- Before using the market, each producer determines the resources required to meet a given level of demand. It classifies them from the least expensive to the most expensive
- It then determines the marginal cost, the variable cost of the most expensive means of generation called to meet the supply/demand balance of its own portfolio
- Given this marginal cost, it determines the sales and purchases volumes
- Spot power price (day ahead) is based on the marginal cost that forms the intersection of the supply of all producers with the overall demand to meet

(1) Variable costs: operating costs proportional to the generated energy, fuel costs, CO<sub>2</sub>, costs of injection into the grid

# COST OPTIMISATION – SCHEDULING OF GENERATION FACILITIES BASED ON VARIABLE COSTS

## Stack chart of generation facilities

Example of one high consumption day in winter in France



- Every day, the optimiser sets up for the next day the functioning tool of the generation facilities, reflecting their dynamic constraints

## Did you know?

The merit order is a way of ranking available sources of energy, especially electrical generation, in ascending order of their short-run marginal costs of generation, so that those with the lowest marginal costs are the first ones to be brought online to meet demand, and the plants with the highest marginal costs are the last to be brought on line



# MAXIMISING CONSOLIDATED GROSS MARGIN AND USE OF THE WHOLESALE MARKETS

- The optimiser, via EDF Trading, accesses the wholesale markets, which can take different forms:
  - OTC (over the counter) bilateral agreements: direct trade with counterparty
  - Regulated/market exchanges: pooling of supply and demand by a market organiser and settlement of trades (Epexspot in France, Belpex in Belgium, etc.)
  
- **The wholesale market** is possible over different time periods, and allows the optimiser to secure income against unforeseen circumstances:
  - Medium-term: purchases or sales of annual products for the years Y+1/Y+2/Y+3
  - Short-term: same principle with purchases/sales today for the next day (spot) or over the next few hours of the day
  - Intermediate products (monthly and quarterly products over two to three coming quarters and months, and weekly products over two to three coming weeks) also exist

# EDF TRADING, ACCESS PLATFORM TO WHOLESALE ENERGY MARKETS

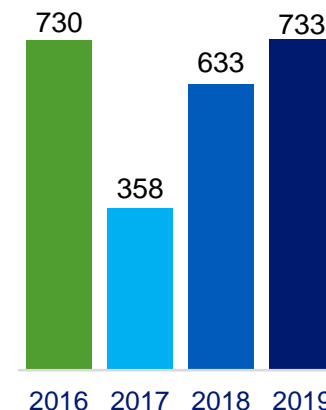


## Well positioned with a broad geographical presence



## EDF Trading EBITDA

In €m

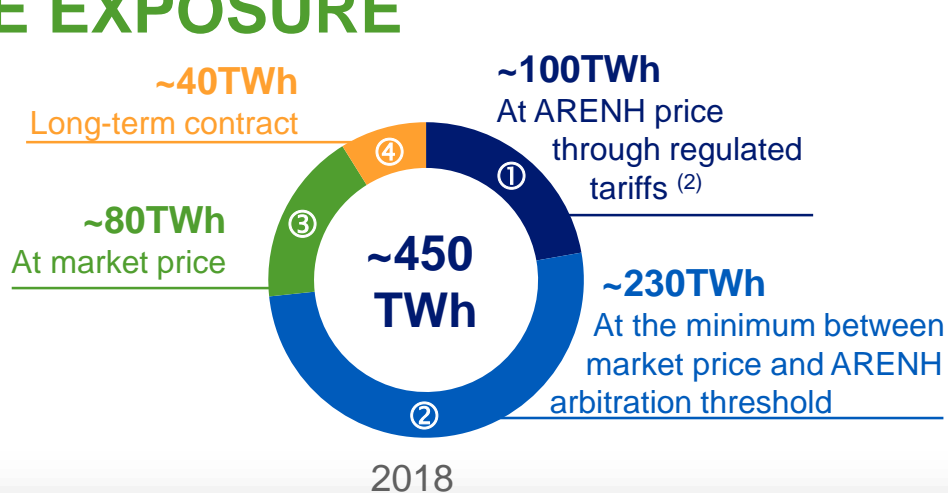


## Did you know?

### In 2019, EDF Trading:

- completed its LNG optimization and trading joint venture with JERA. JERA Global Markets is now the LNG optimizer for JERA and the EDF Group.
- managed a significant increase in the number of LNG cargoes being delivered to Dunkerque.
- adapted the framework to market Guarantees of Origin from EDF's carbon free portfolio of assets.

# DISTRIBUTION OF ELECTRICITY SALES <sup>(1)</sup> ACCORDING TO THEIR MARKET PRICE EXPOSURE



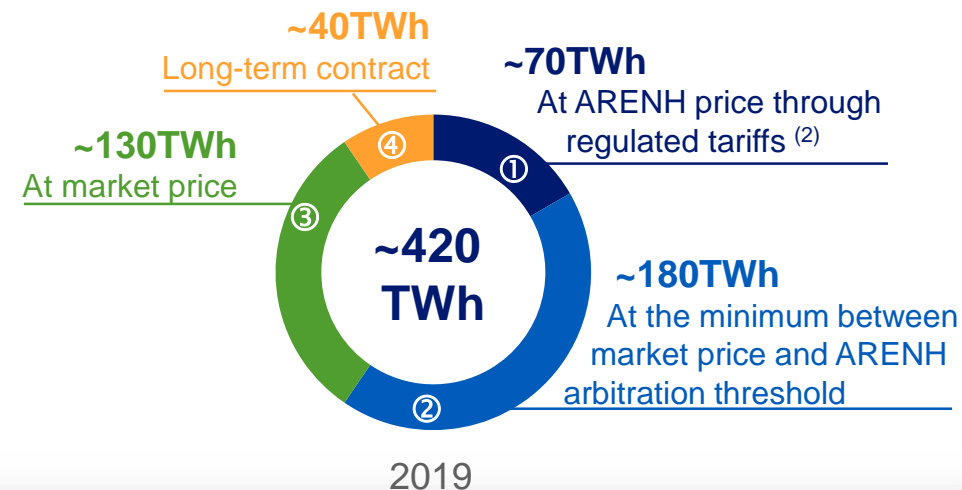
**①** Volumes sold at the ARENH price following the cost-stacking formula in the regulated sales tariffs (essentially blue residential and non-residential tariffs)

**②** Volumes sold at the market price if this price is lower than ARENH arbitration threshold (ARENH price - capacity price) and ARENH price otherwise <sup>(3)</sup>, which include:

- The ARENH volumes that can be requested by alternative suppliers and network operators for their purchases of losses
- Part of the volumes <sup>(4)</sup> sold to EDF final customers under market-based contracts

(1) Sales excluding purchase obligations volumes and volumes under long-term supply contracts. Estimated distribution based on the respective situations in 2018 and in 2019, in particular in terms of EDF downstream market shares. In 2019, the level of cropping corresponding to ARENH over subscription (133TWh) by alternative suppliers has been applied to downstream offers

(2) Regulated electricity sales tariffs



**③** Volumes sold at the market price, whatever the price, which include:

- Part of the volumes sold to EDF final customers: “market complement supply” in the regulated tariffs <sup>(4)</sup>, balance of the volumes sold to clients under market-based contracts
- Volumes sold on wholesale power markets

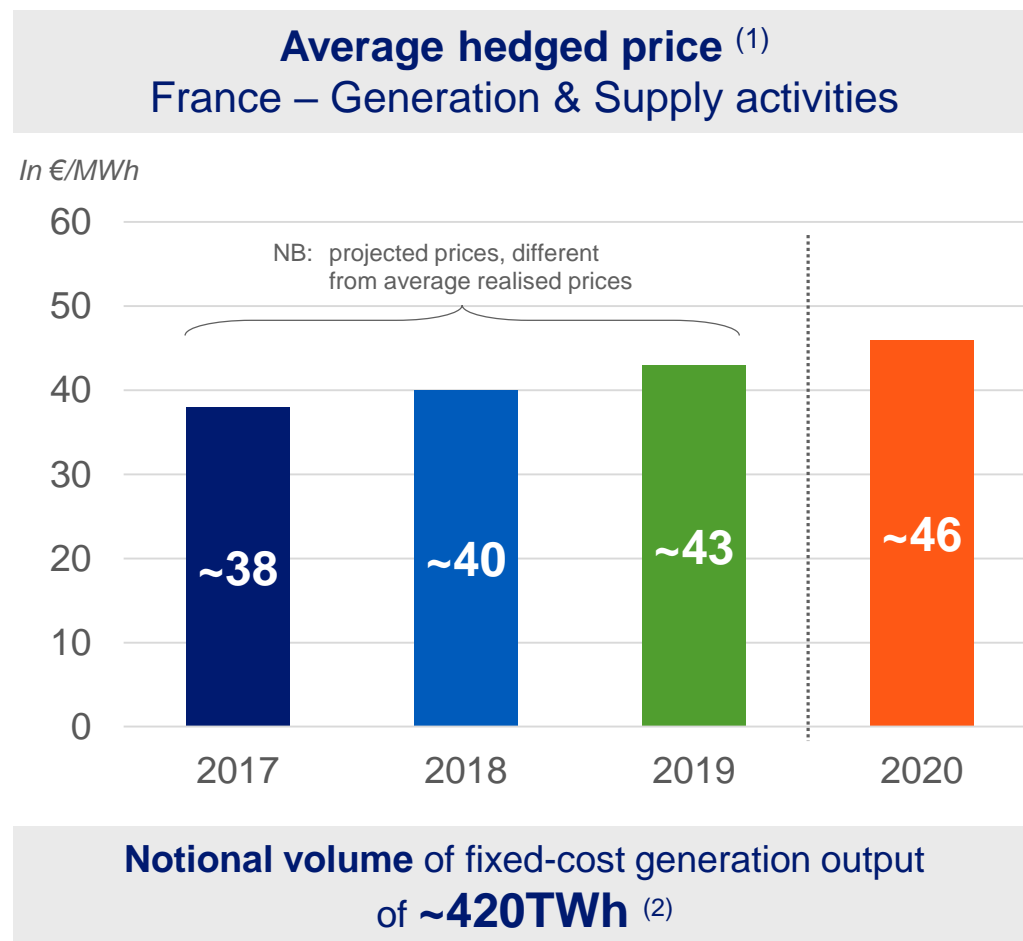
**④** Contracts at negotiated prices that do not follow a market-indexed structure

(3) EDF is subjected to the arbitrage between the two prices and its date of exercise is variable depending on the volumes (it takes place at the latest at the time of the ARENH end of year subscription window for a delivery the following year)

(4) Related to the replication of the sourcing cost structure of alternative suppliers: shares of the volumes corresponding to the “ARENH rights”

(5) Related to the replication of the sourcing cost structure of alternative suppliers: the balancing volumes sourced on the market which exceed the “ARENH rights”

# FRANCE: ESTIMATED AVERAGE FORWARD HEDGED PRICE



Average price captured through hedging activities on forward contracts before the beginning of the delivery year <sup>(3)</sup>

Estimation based on:

- Forecasted distribution of electricity sales volumes
- 'Shaped demand' (baseload vs peakload, seasonality)

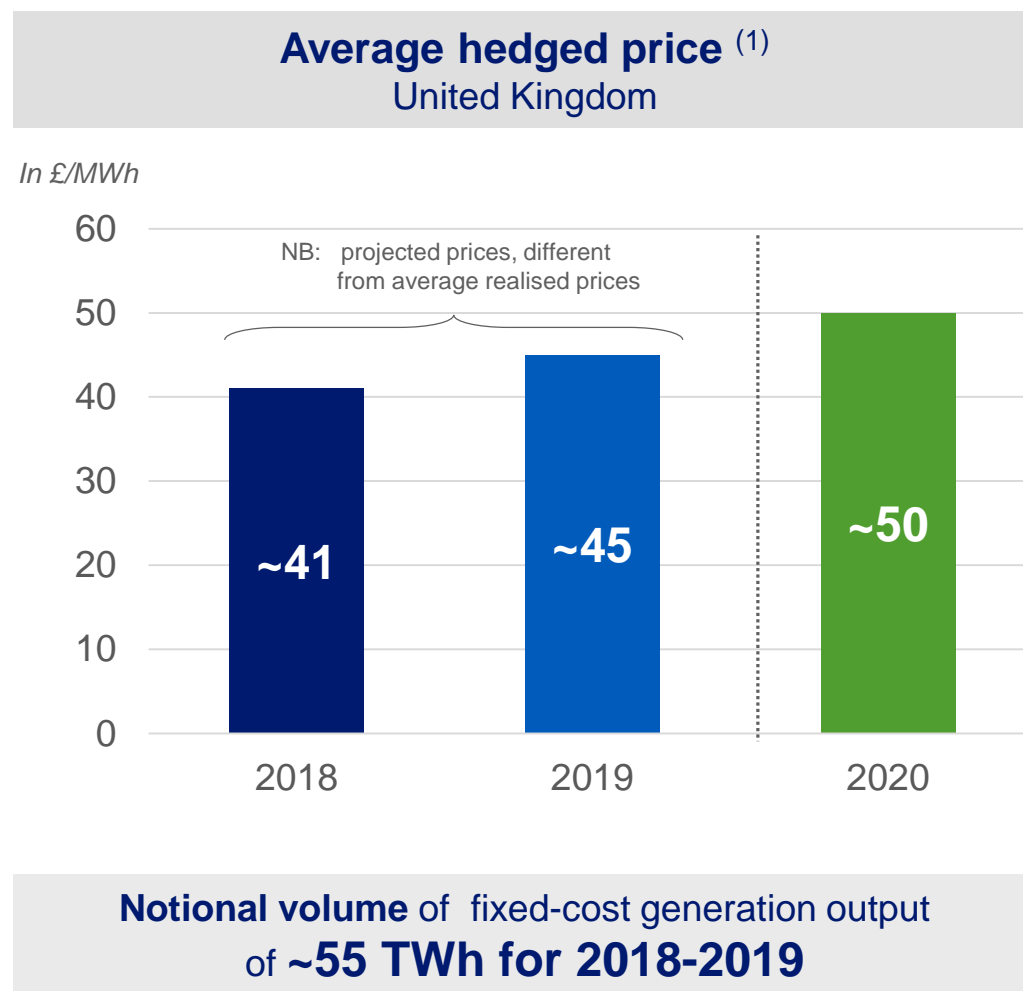
This average price does not take into account purchases and sales on wholesale markets that may take place during the delivery year depending on unexpected generation or consumption events.  
**It is not the average realised sale price.**

(1) Rounded to the nearest whole number. Excluding revenue associated with capacity certificates.

(2) Only from nuclear and hydro generation means, on the basis of normal hydro conditions

(3) Based on a principle of gradual closing of net positions before the end of the delivery year, based on a predefined hedging trajectory (typically 2 years for the wholesale power market in France) that captures an average price, potentially with overweighting of year Y-1 in view of liquidity constraints on the forward markets. Subject to very high uncertainty over EDF's net exposure due to the fact that the ARENH system is optional (the option cost is embedded in the market hedges).

# EDF ENERGY: ESTIMATED AVERAGE FORWARD HEDGED PRICE



Average price captured through hedging activities in relation with wholesale prices before the beginning of the delivery year <sup>(2)</sup>

Estimation based on:

- Notional generation volumes
- Season contracts prices

This average price does not take into account purchases and sales on wholesale markets that may take place during the delivery year depending on unexpected generation events.

**It is not the average realised sale price.**

(1) Rounded to the nearest whole number. Excluding revenue associated with capacity certificates.

(2) Based on a principle of gradual closing of net positions before the end of the delivery year, based on a predefined hedging trajectory in view of liquidity constraints on the forward markets.

# ARENH: CURRENT MECHANISM

- The **regulated access to historic nuclear power** (ARENH) mechanism entered into effect in 2011 to allow alternative suppliers who so request, for the supply to end customers, to benefit from a supply “under economic conditions equivalent to those for EDF resulting from the use of its nuclear power plants” through an annual product, which may be requested twice a year (in November and May), within the limit of an annual ceiling of 100TWh (excluding network losses). This mechanism is open to network operators to cover their technical losses. The Energy Regulation Commission (CRE) is responsible for managing the mechanism and calculating the quantities of which it informs the alternative suppliers individually, and EDF in an aggregated manner
- **The ARENH price has been fixed at €42/MWh** since 1 January 2012<sup>(1)</sup>. Since 2017, the delivered product includes 1MW of capacity certificates per megawatt of subscribed ARENH
- **The law of 8 November 2019 on energy and climate** granted the ministers responsible for the economy and energy the power to set:
  - to set by decree the ceiling of the ARENH, as of 2020, within the limit of 150TWh; this ceiling having to be set “with the aim of contributing to price stability for the end consumer”;
  - until the entry into force of the decree establishing the method for calculating the ARENH price, to set the ARENH price by decree; among the elements that may be taken into account to revise this price are in particular the changes in the consumer price index and the ARENH ceiling.
- **However, the government has indicated that, for 2020, it does not plan to change either the price or the ceiling of the ARENH**, and that EDF will therefore continue in 2020 to cede to its competitors a quantity of nuclear-generated electricity of up to 100TWh at the current price of €42/MWh. Raising the ceiling and/or the price of the ARENH requires an amendment to the European Commission’s decision of 12 June 2012 approving the ARENH scheme, which was not possible before the November 2019 deadline.
- **A structural reform, however, remains necessary to ensure a balanced regulatory framework for the current nuclear facilities**, particularly with regard to the remuneration of the generation affected by ARENH and its asymmetrical nature
  - In the French Strategy for Energy and Climate presented at the end of November 2018, the government indicated that it would propose, in view of supporting the energy transition in France, “*modalities for a new regulation of the current nuclear fleet, making it possible to guarantee the protection of consumers against market price increases beyond 2025 by allowing them to benefit from the competitive advantage linked to the investment made in the existing nuclear fleet, while giving EDF the financial capacity to ensure the economic sustainability of its generation facilities to meet the needs of PPE (French multi-year energy programme) in low price scenarios*”
  - The government launched a public consultation, running from 17 January 2020 to 17 March 2020, to involve economic players in these considerations.

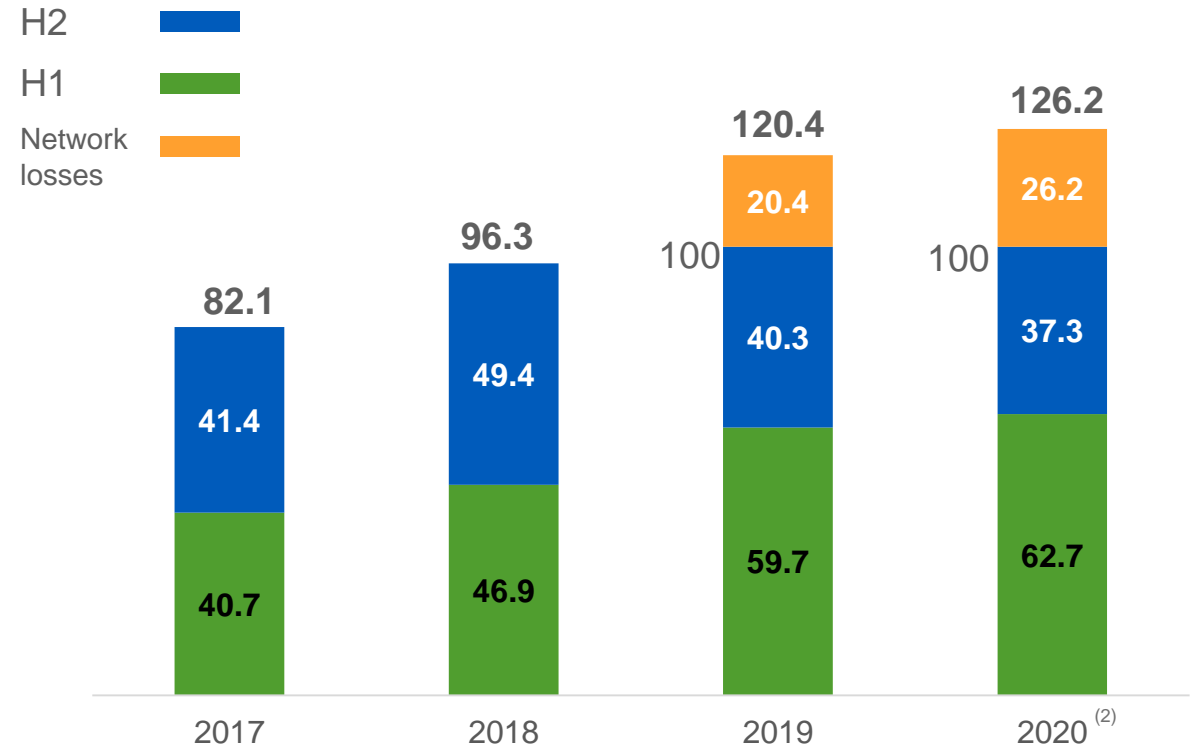
(1) Order of 17 May 2011



# ARENH: VOLUMES ALLOCATED TO ALTERNATIVE SUPPLIERS

- Maximum annual sales volume of 100TWh (2) by EDF for alternative suppliers and ~25TWh for network losses coverage.
- In November 2019, ARENH requests from alternative suppliers for 2020 amounted to 147TWh.
- The volume was therefore cropped to the legal ceiling of 100TWh (see slide 113).
- Volume sold for the year 2020, including 26.2TWh sold for network losses coverage:
  - 62.7TWh for H1
  - 63.5TWh for H2

VOLUMES ALLOCATED IN TWH



Source: CRE

(1) Difference between half year estimated by EDF from the annual data provided by the CRE, and likely to change during the year through the application of legal, regulatory and contractual provisions (sub-annual window, cancellations, defaults, etc.)

(2) The energy climate law provides for the possibility to raise this ceiling level for ARENH subscription volumes via a ministerial order, up to 150TWh; as well as the ARENH price, via a ministerial order. The government announced end-September 2019 a status quo for both ARENH volumes and price for 2020.

# PURCHASE OBLIGATION AND SALE ON WHOLESALE MARKET

Public service mission: EDF and the LDCs<sup>(1)</sup> must buy electricity generated by certain electricity generation facilities (or pay them an "additional remuneration") whose development the French government would like to encourage, at rates set by the government (by decree or through tenders)

Pursuant to Article L. 121-7 of the French Energy Code, EDF is compensated for the additional costs resulting from the purchase obligations (PO) on the basis of a reference to prices from wholesale electricity markets, known as "avoided cost" (compensation). Starting from 1 January 2017, the costs of managing these contracts are also compensated.

➤ EDF-Purchase obligations:

According to the CRE ruling of 16 December 2014, the energy of purchase obligations is resold on the markets:

- the near certain component (*i.e.* predictable over the medium term) directly by tenders under transparent and non-discriminatory conditions
- the variable component (*i.e.* predictable for the day ahead) on EPEX Spot via EDF Trading (in the dedicated book).

Since the capacity mechanism has been set up, EDF has in charge the certification of the facilities under the purchase contract and resells these capacities at the auctions (nearly 6GW)



>400,000

Managed contracts  
+20,000  
new contracts/year

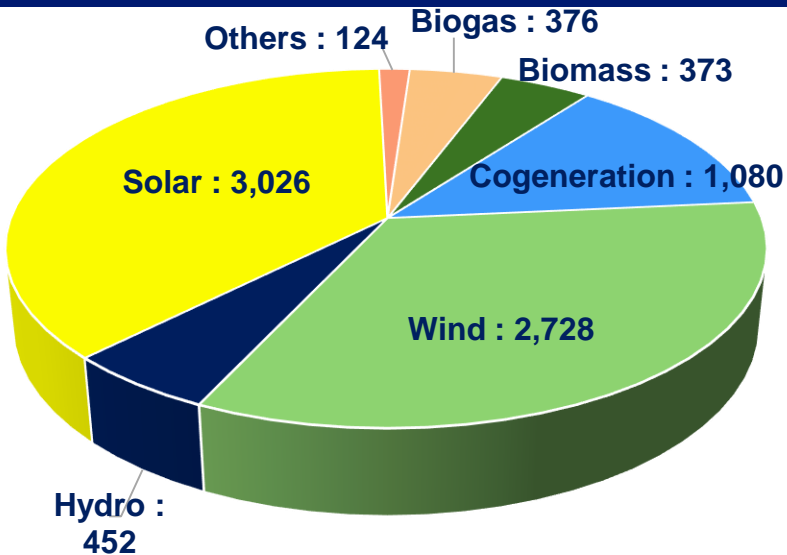


~€45m

in  
management  
fees for EDF

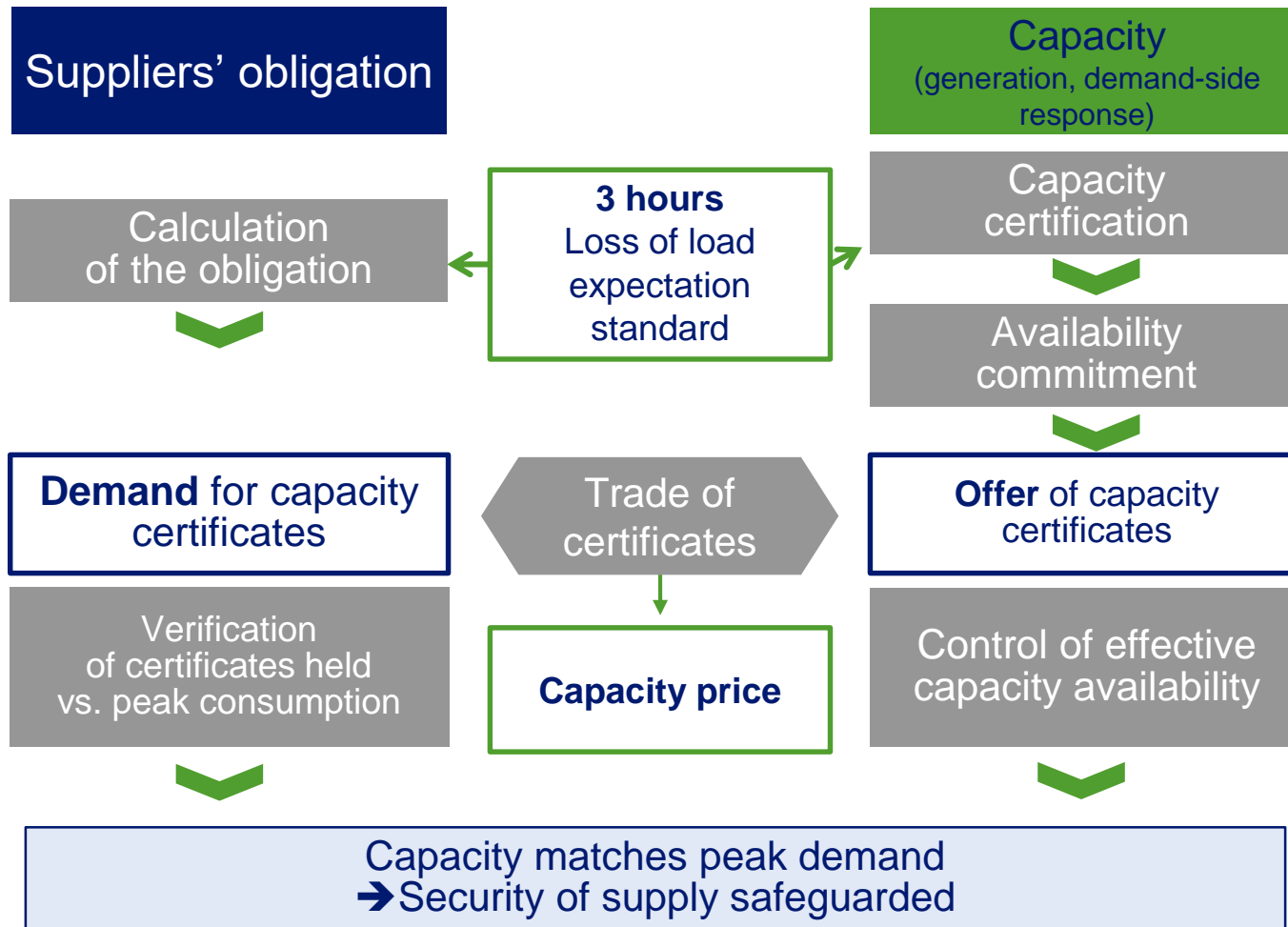
2019 Key figures <sup>(2)</sup>	OA	CR
	60TWh of purchased electricity €8bn of purchases	2TWh of sustained electricity €0,1bn of support

Purchasing breakdown by sector in 2019 (in €m)



(1) Local distribution company  
(2) Excluding Corsica and French overseas departments

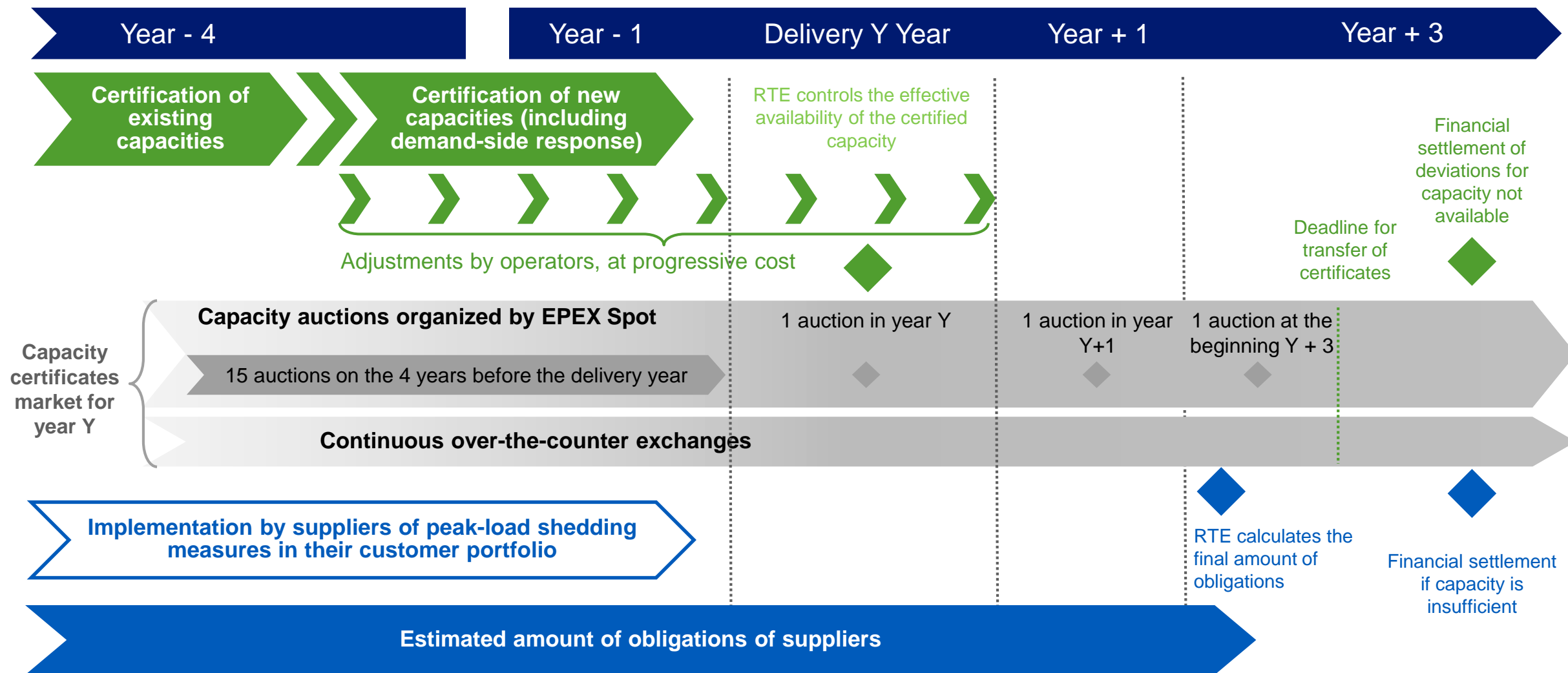
# CAPACITY MECHANISM IN FRANCE: STARTING ON 01.01.2017



- Established by the NOME law, approved by the European Commission on 8 November 2016
  - Latest version of the rules published by decree on 21 December 2018 (explicit participation of cross-border assets and implementation of long-term tender procedures)
  - Objective: to remunerate the means of generation and load shedding useful to security of supply
  - Definition of the criterion of security of supply by the public authorities: 3h of shedding on average per year
- Operated by RTE
  - Definition of calculation methods and identifying peaks
  - Issue of capacity certificates, controls and management of capacity registry and settlement of gaps
  - Ex-post calculation of each supplier's obligations and the actual availability of certified facilities
  - Provision of information on supply and demand for certificates

Source: DGEC, RTE

# CAPACITY MECHANISM IN FRANCE: STANDARD CALENDAR



Source: RTE

# CAPACITY MARKET IN FRANCE: IMPACT ON EBITDA (YEAR Y)

Valuation method for certificates	Timing of EBITDA impact	Certificates concerned	Price	Volumes concerned <sup>(1)</sup>
Pass through of the capacity price to end customers (market component of supply contracts and tariffs)	At the time of energy delivery	Certificates for delivery year Y	Calculated from auction prices	From 25 to 45GW (depending on the ARENH volumes subscribed and included in the supply contracts)
Transfers related to ARENH volumes (incl. ARENH share of supply contracts and tariffs)	At the time of energy delivery	Certificates for delivery year Y	ARENH price at €42/MWh includes delivery of associated capacity certificates	~115MW per TWh of ARENH
Certificate sales on the market (via auctions or OTC)	At the time of closing of the transactions	Any certificate	Auction price (or negotiated price for OTC sales)	Variable (according to ARENH volumes)
Certificate purchases on the market (via auctions or OTC)	At the time of energy delivery	Certificates for delivery year Y	Auction price (or negotiated price for OTC sales)	Variable (according to ARENH volumes and needs of final customers)

(1) The volume of certified capacity certificates in France may be higher than RTE's estimate of demand. In such a case, a certain amount of the certificates held by EDF would not be sold

# CAPACITY MECHANISM IN FRANCE: IMPACT FOR EDF

	Capacity auctions	Volume of EDF certified capacities	Impact on EBITDA
2017	<ul style="list-style-type: none"> <li>➤ <b>Market Reference Price (PRM): €10/kW</b> (EPEX session on December 2016)</li> <li>➤ Prix of the session of April 2017: €10.42/kW</li> </ul>	73GW	+ €580m <sup>(1)</sup> Cumulative impacts on regulated sales tariffs <sup>(2)</sup> , offers at market prices and purchases/sales on the wholesale markets
2018	<ul style="list-style-type: none"> <li>➤ <b>Market Reference Price (MRP): €9.34/kW</b> (sessions of November and December 2017)</li> <li>➤ Session of 26 April 2018: €9.37/kW</li> </ul>	72GW	+ €591m <sup>(1)</sup> The 2018 MRP will apply to the billing of the vast majority of our customers on market-price contracts in 2018 and has been be incorporated into the new February 2018 schedules for customers on regulated tariffs <sup>(3)</sup>
2019	<ul style="list-style-type: none"> <li>➤ Market reference price: €17.37/kW, defined as the unweighted average bid price before delivery year</li> </ul>	71GW	+ €701m <sup>(4)</sup> The 2019 MRP will apply to the billing of the vast majority of our customers on market-price contracts in 2019 and has been be incorporated into the new February 2019 schedules for customers on regulated tariffs <sup>(5)</sup>
2020	<ul style="list-style-type: none"> <li>➤ Market reference price: <b>€19.5/kW</b></li> <li>➤ Auction prices: <b>€20.0/kW</b> (March 2019), <b>€20.0/kW</b> (May 2019), <b>€22.38/kW</b> (June 2019), <b>€20.0/kW</b> (Sept. 2019), <b>€17.78/kW</b> (Oct. 2019), <b>€16.58/kW</b> (Dec. 2019)</li> </ul>	69GW	In 2020, the majority of market offer customers will be billed on the basis of the 2020 capacity auction price. The 2020 MRP should be integrated into the changes in the 2019 FIR tariffs.

- Not all of these capacities are directly usable. In particular, the ARENH subscriptions have a negative impact on capacity revenues insofar as the ARENH product at €42/MWh includes the delivery of capacity guarantees by EDF
  - 14.3GW of capacity was thus transferred to suppliers having subscribed to the NWRA for 2020.

(1) Includes sales on the market of 2018 Capacity Guarantees made by EDF at the December 2016 auction and at the two auctions held in 2017.

(2) The PRM for the 2017 capacity of €10/kW has been included in the July 2017 tariff schedule.

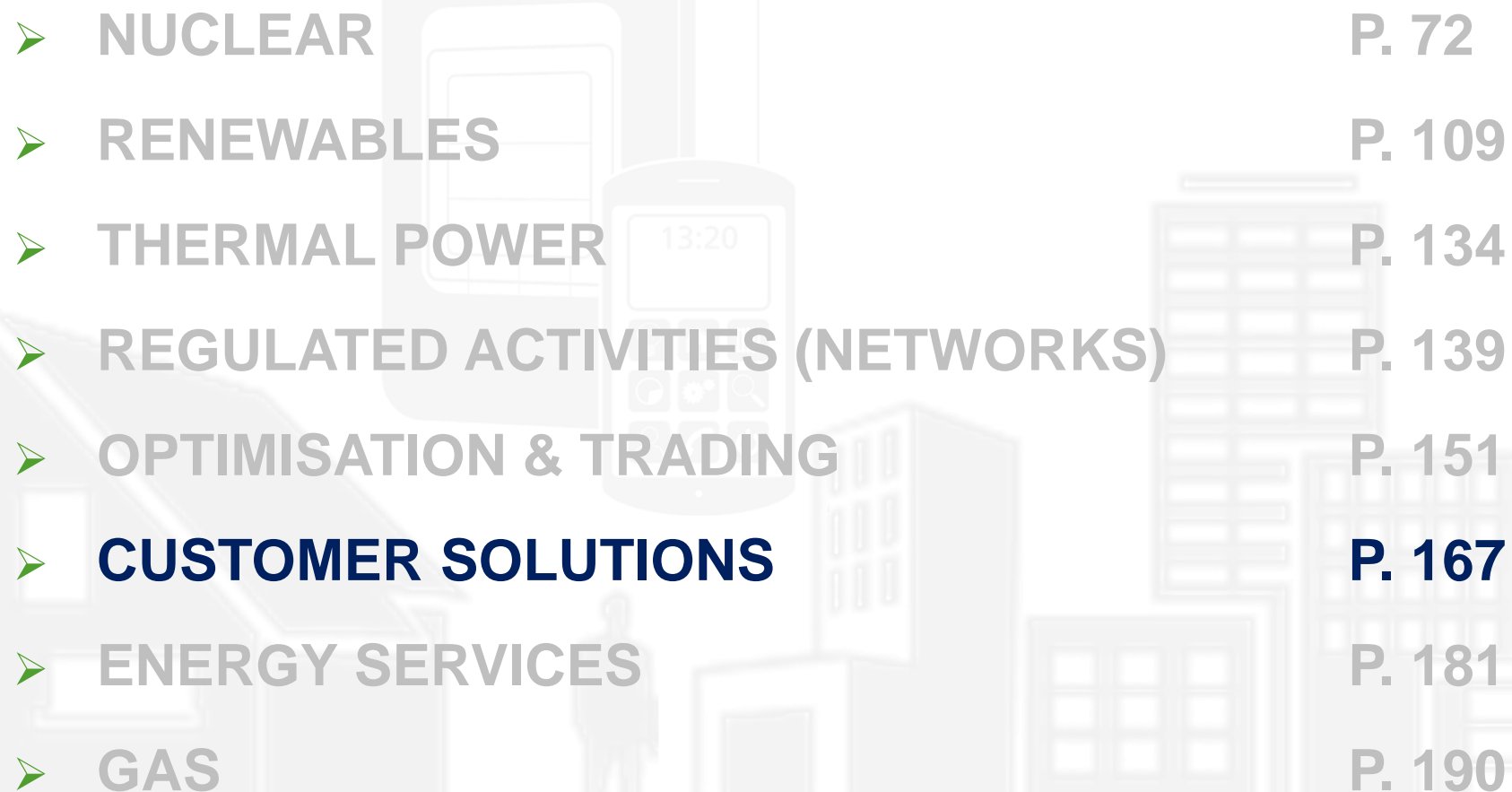
(3) Cf. CRE deliberation of 11 January 2018

(4) Theoretical figure: the capacity on the DCo side has not been fully passed on in the TRVs in 2019 (tariff freeze). The estimated shortfall on the capacity side due to this freeze is around €120 million, but will be recovered in 2020-2021.

(5) Cf. CRE deliberation of 7 February 2019.



# EDF GROUP MAIN BUSINESSES

- 
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# A RECOGNISED, INNOVATIVE AND DIGITAL CUSTOMER RELATIONSHIP

29 million of EDF customer accounts,  
including more than 1.5 million in gas

In the electricity market, 264TWh sold in 2019.

In the gas market, more than 31TWh sold  
in 2019



Satisfied  
customers

## High customer satisfaction in France

BUSINESSES AND  
PROFESSIONALS

LOCAL  
AUTHORITIES

RESIDENTIAL  
CUSTOMERS

9 out of 10 customers

## Did you know ?

All EDF Customer Relationship Centers are located in France. They help to maintain employment areas throughout the territory. EDF is committed to promoting the choice of this social model. A choice shared by the French since 94% of them consider that a customer service based in France is important<sup>(2)</sup>. EDF reaffirms its commitment to continue its labeling process that has been in place for more than 10 years and is an essential component of its strategy as a responsible employer. The next label adopted by EDF will enable the adoption of a demanding standard based on the ISO 26000 standard. It will value both the quality of the company's social practices in relation to customer relations, particularly through the training of customer advisors or the attention paid to their working conditions, as well as their choice of location.

(1) Excluding Corsica and overseas (2) Source AFRC 2017 Consumer Survey

## Close customer relations based on personalised, human and digital services



- 5,000 customer advisers serving customers
  - 300 “inclusion” advisers
  - Sales teams in 8 Regional Directorates serving Businesses and Local Authorities
- ➔ All teams based in France, close to customers

A continuous evolution of our offers and  
services: to innovate both for and with our  
customers



# EDF CUSTOMER SOLUTIONS IN FRANCE: RESIDENTIAL CUSTOMERS



**5,000**  
customers  
advisors, all  
located in France



**9,1 million**  
EDF & Moi app  
downloaded



**167**  
million of  
visits to websites  
and the EDF & Me  
app

**EDF pulse & you**

France's first co-innovation site\* with  
already more than 100,000 ideas and  
comments shared

\* Faber Novel Study 2019

**EDF innovates in order to be the supplier for the well-being of its customers  
With a high quality services and reference offers**

## Energy offers tailored to customer expectations

**Electricity supply offers tailored to customer expectations:** the regulated sales tariff and new market offerings:

- **“Mes jours Zen”** launched in 2019, the first electricity offer that adapts to the needs of consumers. With **“Mes Jours Zen Plus”** you can choose a day in addition to the weekend when the price is lower
- The **“Gamme Vert Electrique”** with:
  - **Vert Électrique**
  - **Vert Électrique Week-end** (for customers equipped with Linky)
  - **Vert Électrique Auto** (for customers with an electric vehicle)
- **An online offer with attractive prices: digiwatt**
- The **“Gamme Avantage Gaz”** :
  - **Avantage Gaz**
  - **Avantage Gaz Durable**, incorporating carbon offsetting
  - **Avantage Gaz Connecté**, integrating the management of the individual boiler

## Services and support to reduce energy consumption

- **An offer of troubleshooting assistance**  
Three options of troubleshooting assistance, And an efficient and rapid intervention in case of failure in the home
- **« Assurénergie » offer** to help the customers to pay their in the event of hardship
- **Customer support dedicated to energy savings with an online path on EDF residential customers « Mes Ecos et moi » website :**
  - **Energy saving tips**
  - The website **Prime-energie-edf.fr** to receive financial assistance for renovation work
  - The network of qualified **Energy Saving Partners** RGE (Recognized Environmental Guarantor).
  - The **“Mon chauffage durable”** offer for the replacement of oil, gas or coal boilers by a heat pump, in order to reduce energy bills and CO<sub>2</sub> emissions.



## Innovative digital solutions

- The digital solution **Mes écos et moi** enables all customers to **better understand and control their consumption**. With their explicit consent, customers equipped with Linky communicating meters can monitor their actual daily or 30-minute consumption in euros and kWh.



- **The Fil d'Actu solution**, on the EDF & Moi application, also provides access to information to understand your consumption and make energy savings.

# EDF CUSTOMER SOLUTIONS IN FRANCE: BUSINESS MARKET (COMPANIES, PROFESSIONALS AND LOCAL AUTHORITIES)

EDF is positioned as local *business partner* to assist its customers in the energy transition and their competitive challenges

## Energy offers for all consumption profiles

- **Electricity and gas supply offers tailored to every customer segment:** tailor-made offers, guaranteed price offers, differentiated prices offers by time-slots and by season (off-peak hours/peak hours, Matina, Estivia)...
- **Packaged offers for simplicity** with the Performance package (Guaranteed contract and *SuiviConso* service (to monitor consumption)) and *Tandem* service (electricity and gas).
- All customers have the opportunity to choose a **Renewable Energy option**, for any offer chosen

## An extended range of services

- **Services to facilitate contract management:** electronic billing, consolidated billing...
- **Services to control and monitor the consumptions:** *SuiviConso*, *AnalyseConso*...
- **Troubleshooting assistance** offer for electrical, gas and plumbing issues, enriched with guarantees for window glass and locksmithing
- **Local services for business customers:** when they set-up, with *Bénéfices-Pro* and at all times on *Izi-by-edf* platform
- **Assistance services in the energy transition:** self-consumption, energy audit, ISO 50001 energy management ...

## An omnichannel and personalised relationship

- **A personalised, human and digital customer relationship:** advisors in France, information at every stage of the customer journey, websites and a dedicated Customer Space, giving customers access to the most important elements of their contracts and billing. It also allows support requests to be sent online
- **SMS interactions and Web Call Back :** SMS conversations between advisors and customers to meet their requests. The customers can ask to be called back at a time most convenient to them
- **Specific tools for large customers:** Business Board to track sourcing optimisation and send purchase orders with one click

### Key figures



**4.2 million**

of visitors on websites and client areas



**330,000**

sheets of Frequently Asked Questions consulted



**866,000**

downloaded invoices

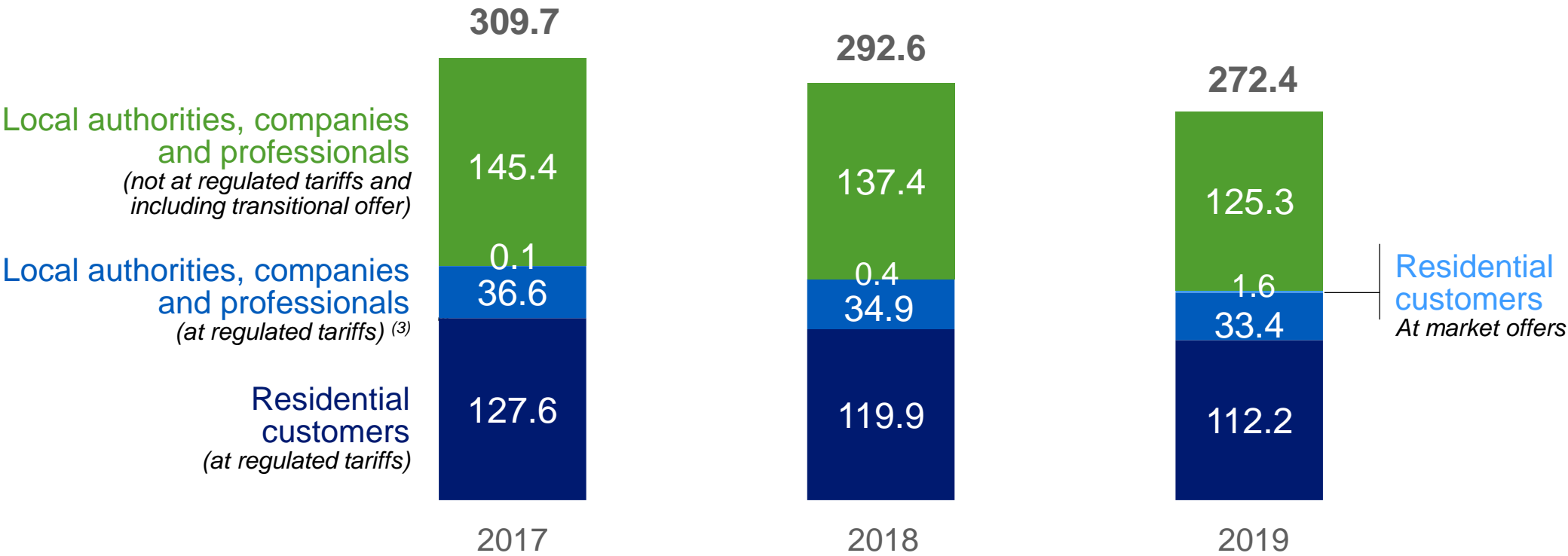
### Specific support for local authorities and social housing lessors

EDF has developed offers tailored to the needs of **local authorities and private actors**: local energy offers and services, advices for the *smartcity* (energy policy, renewable energy, lighting, mobility) ; or contribution to combat energy insecurity. Special measures for social landlords are also proposed to improve the energy efficiency of social housing: it is the CEE (energy efficiency certificate) production tool “amount of charges”

# ELECTRICITY SUPPLY IN FRANCE

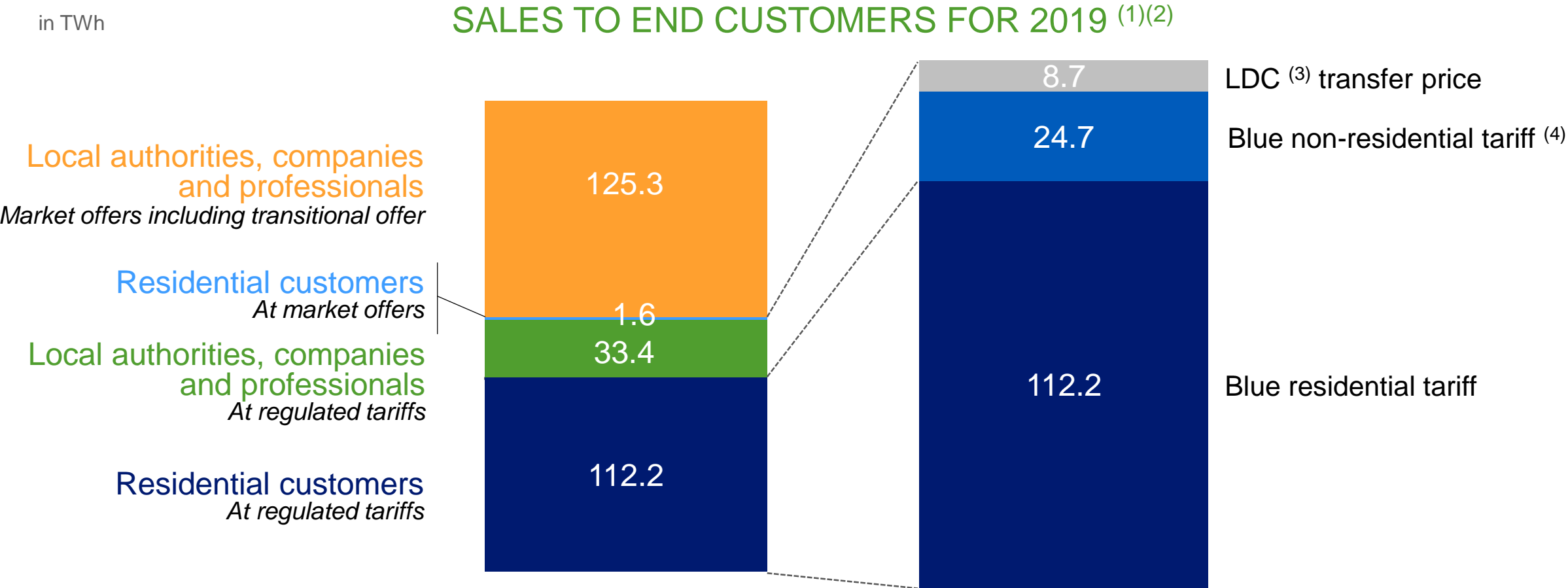
in TWh

## SALES TO END CUSTOMERS (1) (2)



(1) Rounded to the nearest tenth  
(2) Including EDF's own consumption  
(3) Blue professional tariff, LDC (Local Distribution Companies) at transfer price and Green tariffs, below 36kVA that persist beyond 2015

# ELECTRICITY SUPPLY IN FRANCE – SALES UNDER REGULATED TARIFFS SPLIT



(1) Rounded to the nearest tenth  
(2) Including EDF's own consumption  
(3) Local Distribution Companies (LDCs)  
(4) Of which Yellow and Green tariffs for 0.2TWh - Tariffs lower than 36 kVA



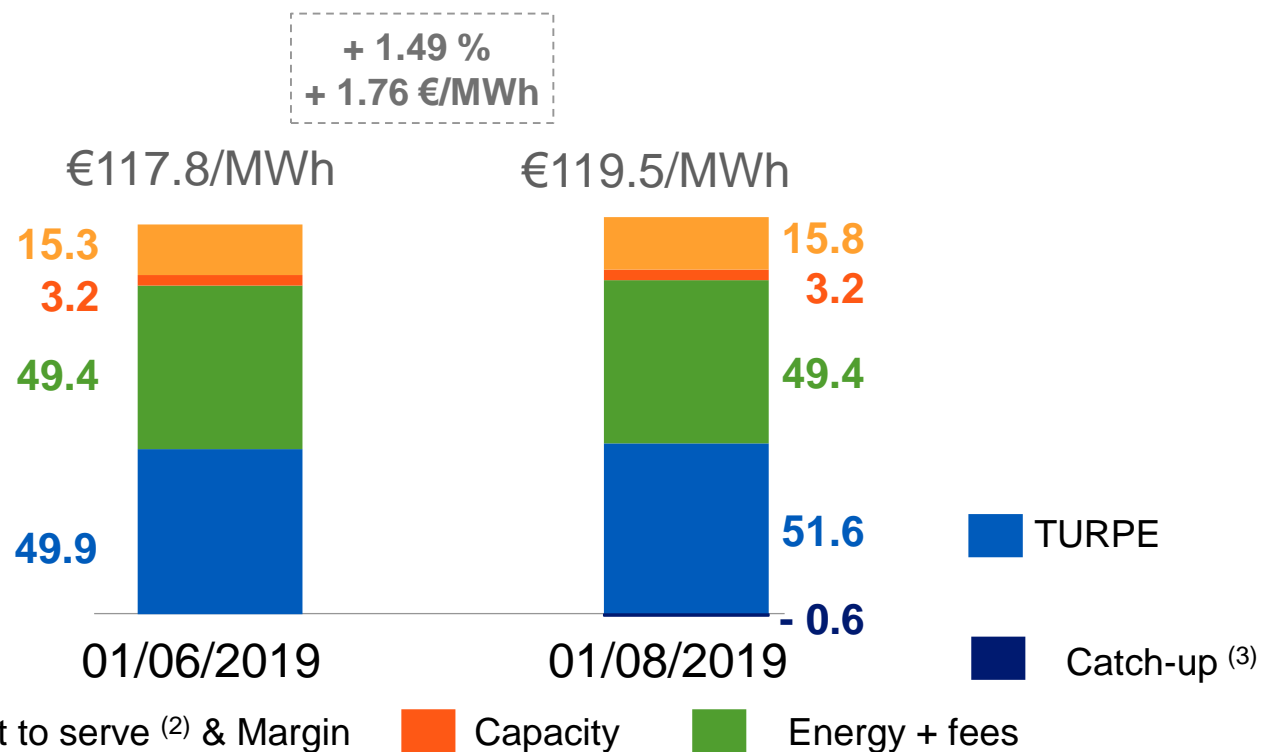
# REGULATED SALES TARIFFS IN FRANCE (1/2)

## Change in Blue tariff

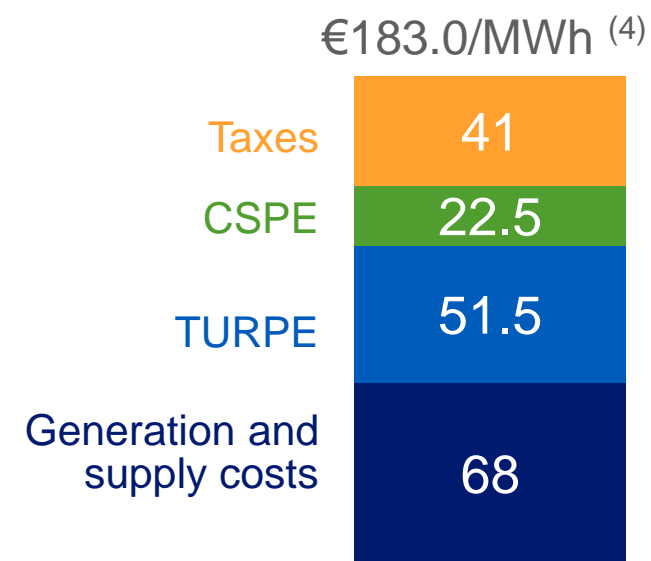
Date	Change in Residential Blue tariff		Change in Non-Residential Blue tariff	
	(VAT excluded)	(including VAT)	(VAT excluded)	(including VAT)
01/08/2016	-0.5%	-0.4%	-1.5%	- 1.1%
01/08/2017	+1.7%	+1.4%	+1.7%	+ 0.9%
01/02/2018	+0.7%	+ 0.6%	+1.6%	+ 1.3%
01/08/2018	-0.5%	- 0.3%	+1.1%	+ 0.9%
01/06/2019	+7.7%	+ 5.9%	+7.7%	+ 5.9%
01/08/2019	+1.49%	+ 1.26%	+1.34%	+1.1%
01/02/2020	+ 3.0 %	+ 2.4 %	+ 3.1 %	+ 2.4 %

# REGULATED SALES TARIFFS IN FRANCE : CHANGE IN AUGUST 2019 (2/2)

## Residential Blue tariff excluding taxes <sup>(1)</sup>



## Average bill breakdown. VAT included (Blue residential customer)



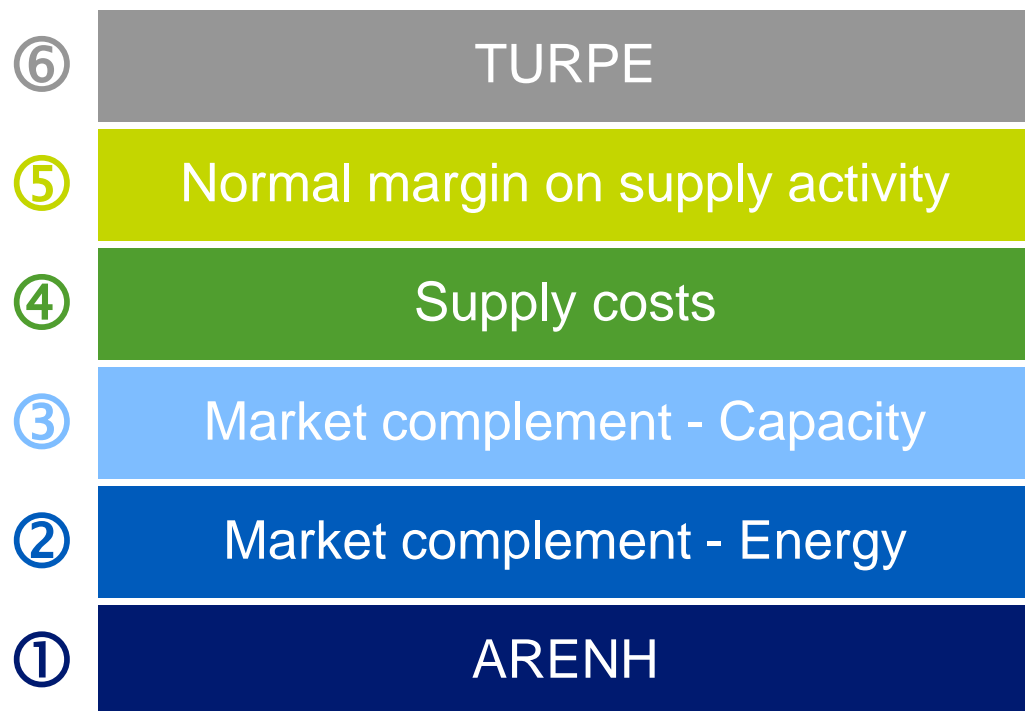
(1) Source: Data from the deliberation of the CRE of 25 June 2019 approved by official decision published at the *Journal Officiel* on July 31<sup>st</sup> 2019

(2) Including cost of Energy Efficiency Certificates

(3) Decreasing catch-up related to 2018 TRV overcompensated costs

(4) Half-rounded figures

# FRANCE: COMPONENTS OF THE COST STACKING METHOD FOR THE BLUE TARIFF



- ① Cost of regulated access to historical nuclear electricity taking into account the NWRA ceiling
- ② Cost calculated according to average consumption characteristics and observed forward market prices
- ③ Cost of the capacity guarantee from the mechanism requiring suppliers to have capacity guarantees as from 2017 covering their customers' peak consumption
- ④ Commercial costs of a supplier at least as efficient as EDF in the business of supplying electricity to those customers having subscribed contracts under regulated tariffs
- ⑤ Margin earned on electricity supply activity:
  - Return on capital employed in marketing activity
  - WCR coverage
- ⑥ Delivery cost, which reflects the cost of using the electricity transmission and distribution systems

(1) Source: Decree no. 2014-1250 of 28 October 2014 modifying the decree no. 2009-975 of 12 August 2009 on regulated tariffs

# ENERGY SAVING CERTIFICATES SYSTEM

Implemented in 2006  
Confirmed in 2015

The French response to requirements of the European Directive 2012/27/EU on energy efficiency.

Article 30 of the energy transition law for Green Growth of 17 August 2015: a new EEC obligation benefiting households suffering from energy poverty, in addition to the traditional EEC obligation starting in 2016

Enhanced targets, new  
ambitions  
and an increasingly  
costly system

The national obligation for the 4th period (2018-2021) is set at 2,133TWhc by the decree of 11 December 2019

- Including 533TWhc for the benefit of households that suffer from energy poverty and 1,600TWhc of obligation of classic CEE
- This represents a doubling over the 3rd period 2015-2017 (700TWhc classic CEE, 150TWhc energy poverty CEE).
- Between the two periods, the cost of the CEE scheme is multiplied by 7 and now exceeds €5bn/year.

Involved parties

An obligation imposed on energy suppliers to achieve energy savings for customers called “obligated parties”.

- Electricity, gas, heating, refrigeration, domestic fuel and automotive fuel

Actively promote energy efficiency to their customers

- Households, local authorities, social housing landlords or business/professionals

EDF and the  
Mechanism

EDF is the first obligated party and intervenes in several areas (2018 data):

- Residential (138,000 renovation operations, “heating boost” via the “Mon chauffage durable” offer), social-housing lessors (167,000 housing units), industry (1,700 operations), etc.
- Financing of national programmes (*Toits d’abord* with the Abbé Pierre Foundation, ADVENIR for electric vehicle recharging stations, FEEBat for training craftsmen, *Habiter mieux* from ANAH to fight against energy poverty, ACTEE with the FNCCR, etc.).

# EDF HYNAMICS – LOW-CARBON HYDROGEN PRODUCTION

WITH HYNAMICS, EDF STRENGTHENS ITS CONTRIBUTION TO THE ENERGY TRANSITION

95% of hydrogen is currently produced from fossil fuels. Unlike this method, which produces a lot of carbon dioxide, Hynamics has opted for water electrolysis to produce its hydrogen, a technology that does emit very little CO<sub>2</sub>, as long as the electricity used in the process comes from low-carbon production methods (which is the case for 96% of the electricity generated by EDF in France).

In April 2019, EDF announced the creation of “Hynamics”, a new subsidiary for the Group responsible for offering effective low-carbon hydrogen for industry and mobility.

Hynamics offers two different low-carbon hydrogen solutions:

- For industrial clients, for whom hydrogen is a necessity (refinery, glassware, agri-food, chemistry etc.), Hynamics installs, runs and maintains hydrogen production plants, by investing in the necessary infrastructure;
- For mobility providers, both public and professional, Hynamics helps link up different areas with service stations to provide hydrogen to recharge fleets of commercial vehicles, like trains, buses, bin lorries, utility vehicles and means of waterway transport. These services constitute an additional asset for the Electric Mobility Plan announced by the Group in October 2018.



After the acquisition of EDF's stake in the French company McPhy in June 2018, a leading player in this market, the creation Hynamics confirmed the EDF Group's ambition when it comes to low-carbon hydrogen, and applies it to new uses. Since its creation, Hynamics has responded to numerous calls for tender in France and has explored opportunities for international deployment, particularly on the German market. Hynamics is also present in three associations to contribute to the creation of a strong and competitive hydrogen sector: Hydrogen Council, Hydrogen Europe and Afhyac

# CUSTOMER SOLUTIONS IN THE UK: EDF ENERGY

## RESIDENTIAL CUSTOMERS

- **Highly competitive market with ~49 suppliers** <sup>(1)</sup>. 31% of market share gained by small and medium suppliers (end October 2019)
- During 2019, EDF Energy supplied 11.1TWh of electricity and 28.1TWh of gas for the domestic segment
- As at 31 December 2019, EDF Energy had 3.0 million electricity accounts and 2.0 million gas accounts on this segment
- **2<sup>nd</sup> place among Major Suppliers** was in the **Citizen's Advice (domestic) League Table**
- **EDF Energy continues to achieve high levels of customer satisfaction assisting a high level of recommendations** (Advisor Recommendation score of +53)
- 67.5% of transactions completed by customers using digital self-service. Digital Net Ease Score of 4.4 out of 5 achieved in **digital transition**
- Ofgem announced an increase to the Default Tariff cap on 7th August 2019, decreasing the level of the cap to £1,179 for a dual fuel customer at typical consumption from 1<sup>st</sup> October 2019. EDF Energy has announced a decrease to Standard Variable tariff in line with the Default Cap, effective from 1<sup>st</sup> October 2019

## BUSINESS CUSTOMERS

- In 2019, the non-domestic segment supplied a total of 33.5TWh of electricity, 2.2TWh to 176k small business customers ("SME") and 31.3TWh to medium and large business customers ("I&C") accounts
- In large Business, Crown Commercial Service (CCS) has chosen EDF Energy to supply the UK's single largest annual energy supply agreement, for the third consecutive time. The four-year deal will run from April 2020 to March 2024. the Group will be supplying >10TWh of electricity per year – equivalent of 3.2 million homes

<sup>(1)</sup> Cornwall Insight data

## INNOVATION



**EDF Energy: fairness and convenience for customers; efficient operations; innovation (digital technology & smart metering)**

- **Blue Lab, is an internal accelerator team, that brings concepts to market** through a rapid development approach. A high focus is on the Internet of Things (IoT) with multiple applications being developed.
- Blue Lab has also developed a number of products aimed at helping customers save money with the introduction of Powervault – a smart way to store free solar or cheap energy from the grid to reduce energy bills
- In addition Blue Lab has founded two spin-off projects - PowerShift, which aims to be a platform for aggregating and commercialising demand side response as well as Hoppy, a novel Home Services, energy and home media marketplace
- EDF Energy acquired the Electric Vehicles (EV) charge point operator Pod Point in the UK. It's the UK group largest investment in EV technology to date and will allow EDF to offer even more attractive EV deals to their customers
- 550k smart-meters installed by EDF Energy for its customers in 2019



# CUSTOMER SOLUTIONS IN ITALY: EDISON

- Edison, through its 100% controlled company **Edison Energia** is involved in the electricity and gas supply to Italian customers
- The acquisition of the Italian activities of Gas Natural/Naturgy in 2018, and its integration into Edison Energia, allowed to increase Edison's customer base and to enlarge the company's presence in Central and Southern Italy

## Business market (B2B)

- Edison is a leader in the B2B market both in power and gas
- Second operator in terms of volumes to final customers, after the incumbents (Enel and Eni)
- Agreement with Envitec for the development of the biomethane and bioLNG business segment to make the transport sector more sustainable

## Retail market (B2C)

- **Late 2008: Edison entered the retail free market** in power and gas, positioning itself as the new real alternative to incumbents (Enel, Eni, ex-Municipalities)
- Completion of the acquisition of **Assistenza Casa**, company active in maintenance and domestic fault repair services, also allowed the development of further value-added services and an expansion of the offer

POWER SALES IN 2019	GAS SALES IN 2019
12.6TWh	6.8bcm <sup>(1)</sup> o/w 1.9bcm resellers 4.9bcm business
2.3TWh	703Mcm <sup>(2)</sup>
0.6m contracts <sup>(3)</sup>	0.9m contracts <sup>(3)</sup>

## New innovative offers and services

- **Edison World Platform:** a suite of products and services for a connected, safe and comfortable home
  - **Edison Casa Relax:** 24 h x 365 assistance for electricity system, Unlimited interventions, Monthly fee.
  - **Edison My Comfort:** Sale, Installation, Maintenance, Insurance of cooling and heating systems.
  - **Edison Energy Control <sup>(5)</sup>:** device which enables families to supervise, through a data reader and a digital platform, their energy spending in real time.
  - **My Sun:** a new innovative service that combines a photovoltaic system, a storage and a commodity offer
  - **Edison Plug & Go:** electric cars long rental (2-5 years) , installation of a charging wall box and app (for public recharges).

(1) Billion of cubic meters

(2) Million of cubic meters

(3) Data at end 2019

(4) Source ARERA Report 2019

(5) Already launched in 2013

# CUSTOMER SOLUTIONS IN BELGIUM: LUMINUS

- **The second largest player in the Belgian energy market, Luminus** supplies electricity and gas to more than **1.7 million** residential and professional **customers** and local authorities. EDF holds **68.63%** of Luminus via its wholly-owned subsidiary EDF Belgium

- ❑ **Wind:** Luminus is present in renewable energy through **7 hydropower plants** and **52 onshore wind farms**, for a total of **189 turbines**. Since 2015, the company has been the leader in onshore wind farms in Belgium and has an installed capacity of **438.5MW**. At end 2019, the Group erected **27 wind turbines** for a total capacity of **81.8MW**. EDF acquired MegaWindy CVBA, which operates onshore projects in the Flemish region.
- ❑ **Thermal:**
  - Luminus has a thermal park composed of several plants (combined cycles and open cycles) for a total installed capacity of **1,208MW**
  - In 2019, Luminus continued its strategy of adapting its assets, with the transformation of the Ham CCGT into an OC (39MW), and the increase of the nominal capacity of the Ringvaart CCGT from 365 to 375MW, as well as the withdrawal of the notifications of closure of the Izegem and Angleur TG3 OCs and their continued presence on the market
- **Energy services:**
  - Sales of boiler and PV installations remain at a high level, with around 2,800 installations in 2019. The launch of new combined service/maintenance offers for boilers
  - In the B2B market, the acquisitions of Censatech, Studieburo De Klerck and ERVAC have strengthened our position in energy services
- In 2019, SOFICO Wallonia and the Luwa consortium, made up of **Citelum** (lead partner), **Luminus**, CFE and DIF, signed the PPP contract for the design, modernisation, financing, management and maintenance of street lighting equipment for the major roads in the Walloon region. Maintenance work, which will be spread over the duration of the contract, as well as works over 4 years, also started this year. This **4.0 Lighting Plan** notably provides, over a period of 20 years, the LED renovation of 100,000 light points, the installation of various flow and detection sensors and a remote management system and will ultimately lead to energy savings of 76%, equivalent to 166,000 tons of CO<sub>2</sub> emissions avoided

## Key figures

- **2,129MW** installed
- **7.1TWh** of electricity generation
- **1.7 million delivery points**
- **~18%** market share
- **~97 % B2C**

## Best employer 2020

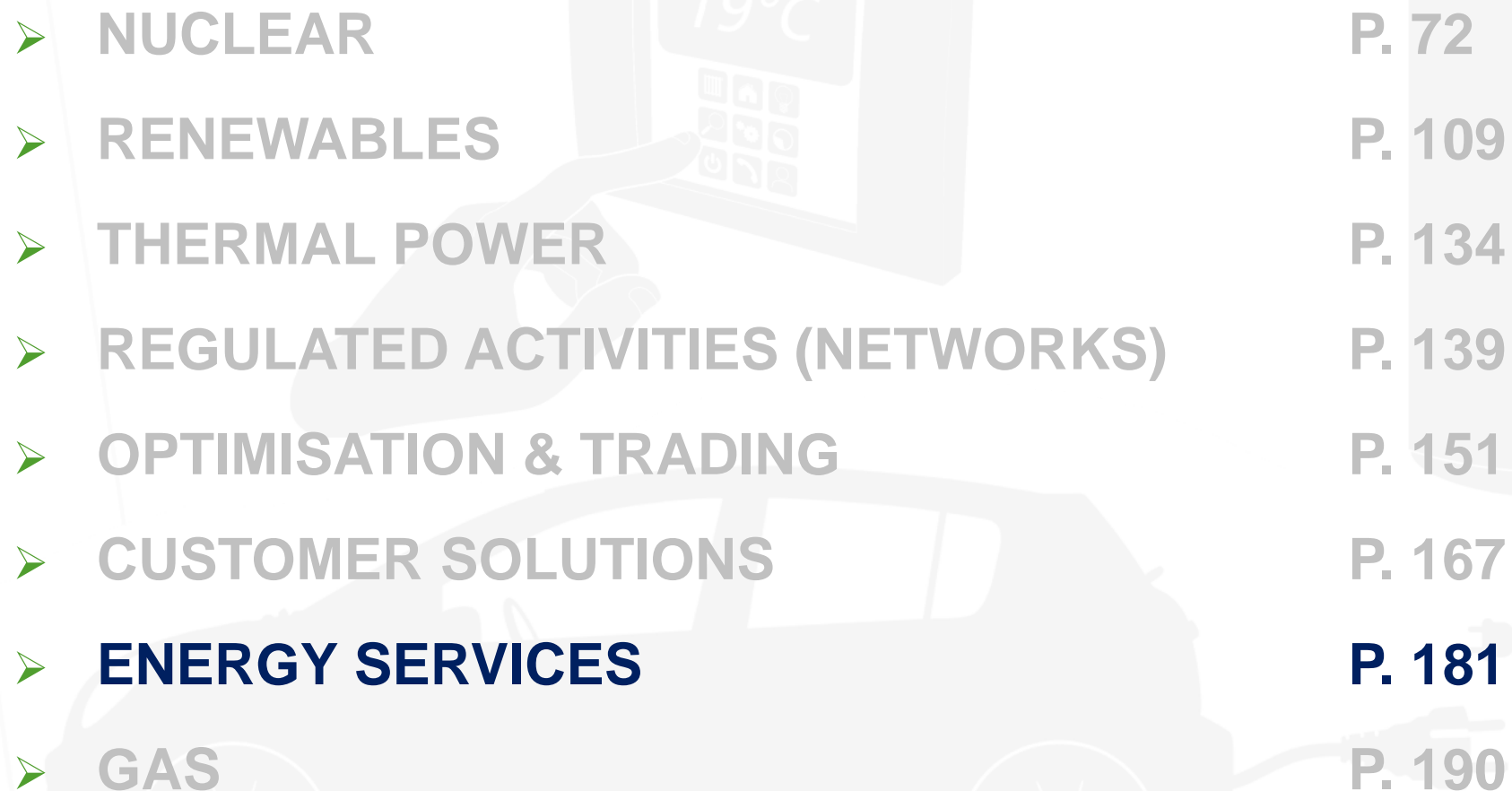
In early 2020, Luminus was awarded the “Top Employer” label for the eighth year in a row

## Did you know?

- In 2019, the Villers 4 project was successfully delivered, representing 13 wind turbines and an additional capacity of 45MW. Thanks to this extension, the “Villers” wind park is the largest wind park in Wallonia. Thanks to a total annual output of **122GWh**, its 26 wind turbines can provide **30,450 homes** with green energy and to **eliminate 52,000 tons of CO<sub>2</sub>**



# EDF GROUP MAIN BUSINESSES

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  - RENEWABLES P. 109
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  - REGULATED ACTIVITIES (NETWORKS) P. 139
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  - CUSTOMER SOLUTIONS P. 167
  - **ENERGY SERVICES P. 181**
  - GAS P. 190

# ENERGY SERVICES: SUPPORTING ALL THE CUSTOMERS IN THE ENERGY TRANSITION

- EDF is developing a wide range of services to support all their customers in the energy transition with the goal of consuming less, but consuming better
- Group's beliefs:
  - Energy efficiency is a major driver of the energy transition
  - The proposed solutions must adapt to each customer's situation and must be sustainable over the long term
  - The development of digital technology allows more innovation and performance



**Smart home**



**Smart Building**



**Smart Factory**



**Smart City**



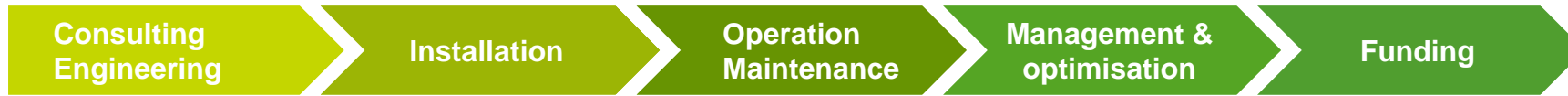
# SERVICES FOR THE GROUP'S INDIVIDUAL CUSTOMERS

- Strong expectations of Group's individual customers:
  - homes are becoming increasingly connected,
  - customers want to control their consumption and limit their impact on the environment, in search of reliable solutions and at the right price
- **Our range of service offers is growing, for more serenity and to support the challenges of today and tomorrow:**



# SERVICES FOR THE B2B CLIENTS

- The EDF Group, through its expertise, can support companies, industries and territories throughout the entire energy chain and on projects as different as heat networks, intelligent lighting, low-carbon decentralized generation, energy management, sustainable mobility or eco-neighborhoods



- Combining digital expertise, economic and low carbon performance, EDF and its subsidiaries invent innovative solutions tailored to each need, as a sustainable energy partner



## Smart Building

Energy efficiency, buildings, energy management, self-consumption, heat recovery, ...



## Smart Factory

Data, artificial intelligence, predictive maintenance, energy efficiency, circular economy, economic performance, ...

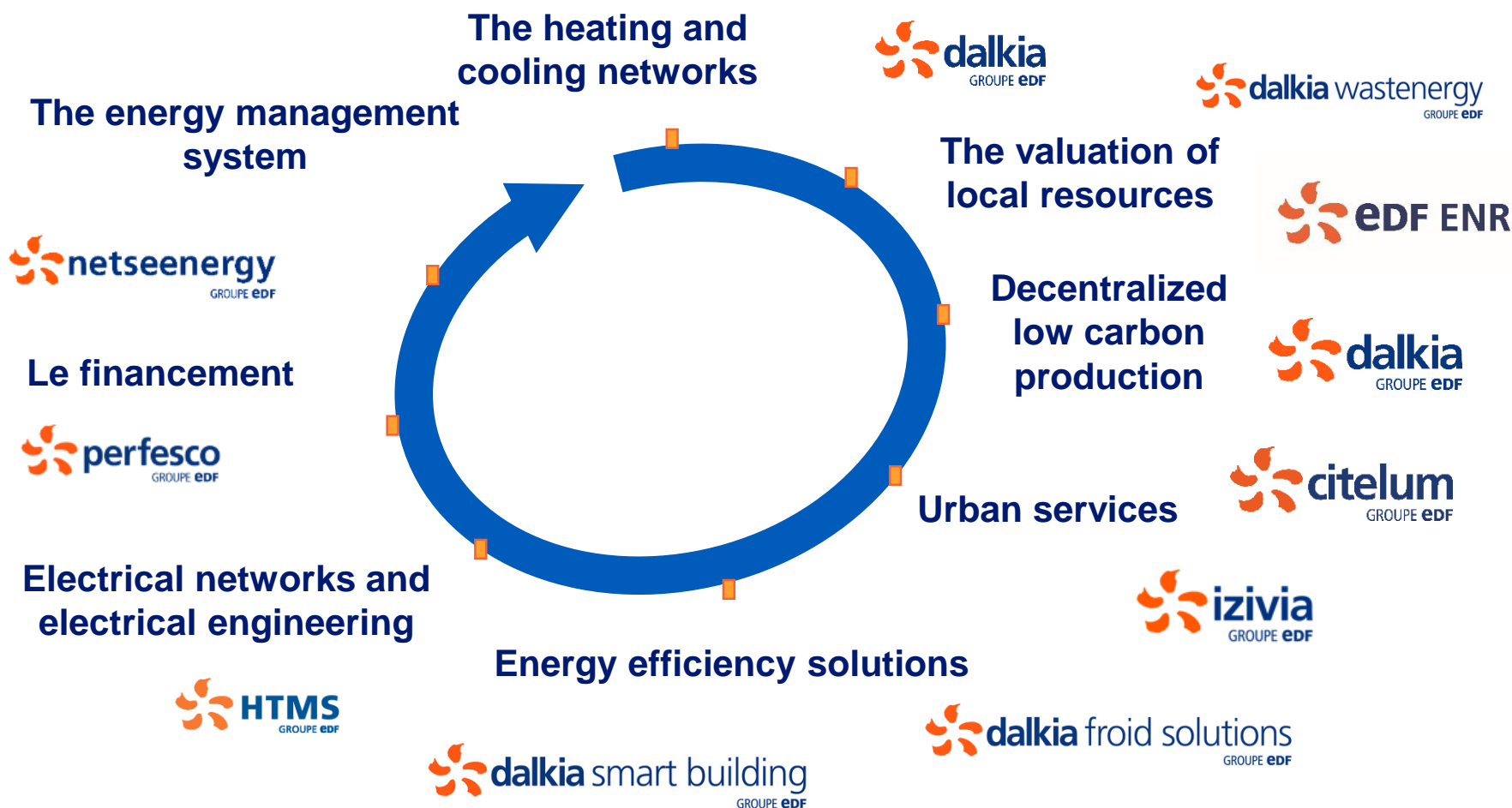


## Smart City

Local production, heat networks, renewable and recovery energy, thermal and electrical smart grids, collective self-consumption, urban services, ...



# SERVICE SUBSIDIARIES: EXPERTISE ON THE ENTIRE B2B ENERGY CHAIN



## Did you know ?

To affirm its position in this area, **EDF** launched, in June 2017, "**EDF Solutions énergétiques**", a new banner that highlights its know-how and the skills of its subsidiaries, increasing the visibility of each of its brands<sup>(1)</sup>

 **EDF Solutions énergétiques**

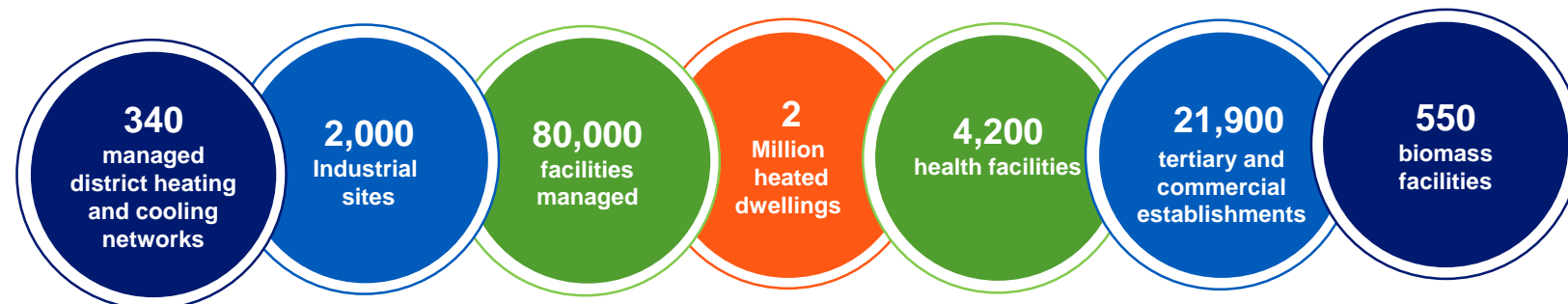
(1) For more information see the press release of 20 June 2017

# DALKIA: A MAJOR PLAYER IN THE ENERGY TRANSITION AT THE SERVICE OF ITS CUSTOMERS



EDF'S AMBITION IS TO DEVELOP SIGNIFICANT POSITIONS IN ENERGY SERVICES, THANKS TO THE KNOW-HOW AND EXPERTISE OF DALKIA AND ITS SUBSIDIARIES

- **A leader in energy services in France,** Dalkia has been helping regions accelerate their sustainable energy performance for 80 years
- **Presence at each stage of the value chain:** from decentralised generation to demand-side management
- **Innovation and digital technologies helping development:**
  - management of the energy consumption of the installations by an interactive platform: DESC
  - digital offer dedicated to industries with Dalkia Analytics powered by METRONN
  - Development of digital tools for operational staff
  - Deploying a new customer area



## CHANGE IN ENVIRONMENTAL PERFORMANCE IN 2019

**Dalkia enables its customers to reduce their greenhouse gas emissions while developing renewable and recovery energies locally**



# DALKIA: TAILOR-MADE SOLUTIONS IN FRANCE AND ABROAD

## SPECIALTY SUBSIDIARIES



Valorisation of energy waste



Industrial and commercial refrigeration



Valorisation of biogas



Design and realization of energy efficiency solutions



Nitrogen compressed air and breathable air production



Building energy services

## INTERNATIONAL SUBSIDIARIES

UNITED KINGDOM IRELAND

Dalkia Wastenergy UK  
IMTECH UK and Irlande  
Breathe

RUSSIA

Dalkia Rus

POLAND

Dalkia Polska Energia  
Matex Controls

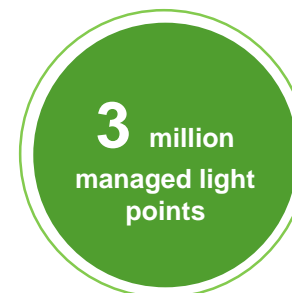
UNITED STATES

Dalkia Energy Solutions  
Aegis Energy Services

# CITELUM: SMART LIGHTING AND CONNECTED SERVICES



- **Smart and efficient lighting reference,** Citelum has developed a whole range of connected services to meet the new challenges of its public and industrial customers: **energy saving, security, mobility, attractiveness, sustainable development, etc.**
- Projects and expertise across the value chain, **from design to operation**
- **An innovation pole based on:**
  - Reliable technological partners: manufacturers in lighting, security, mobility, IoT sectors..., start-ups
  - the collaborative platform for urban space management, MUSE®, developed by Citelum subsidiary Citégestion, now available on the Microsoft Azure Cloud



## MUSE® PLATFORM

- Inventorying, geolocation, urban equipment tracking
- Fast and efficient planning and coordination of maintenance and operations
- Monitoring the operation and consumption of equipment
- Management of daily and special events and communication between stakeholders

## MUSE® in figures

- 2,500 users
- Present in 12 countries
- 100 hosted sites
- 3.7m connected objects and urban equipment (light points, traffic lights system, cameras, sensors, etc.)

## Citelum Services

Ranges to suit all needs and customer profiles:

- **Smart lighting:** renovation, interior lighting, remote management, artistic lighting *etc.*
- **Security:** Video protection, traffic light and speed radars, warning systems, *etc.*
- **Mobility:** traffic light system, smart parking, electric vehicle charging solutions, *etc.*
- **Communication and information:** variable message signs, Wi-Fi, Li-Fi *etc.*
- **Quality of life:** air quality, noise sensors, *etc.*

# CITELUM: INNOVATION, THE COMPANY'S ENGINE

## Smart and connected infrastructures

Citelum builds, with and for its customers, Smart City projects that are tailored to their needs and focused on the quality of life of citizens.



In 2019, Dijon Métropole inaugurated and put into service its connected cockpit (PPC) designed as part of the contract won by Bouygues Énergies & Services and Citelum with Suez. The PPC, based on the MUSE® platform of Citégestion, a subsidiary of Citelum, connects the urban facilities of the 23 municipalities in metropolitan France. Dijon Métropole thus manages from a single station everyday and exceptional incidents and events to provide citizens with a quality public service, enhanced security and a better living environment

The contract also provides for the modernisation of public services and infrastructure (lighting, video protection, access points, etc.), which will result in energy savings of 65% by the end of the contract

In 2019, SOFICO Wallonia and the LuWa Consortium, composed of Citelum (lead partner), Luminus, CFE and DIF, signed the PPP contract for the design, modernisation, financing, management and maintenance of public lighting equipment for the major (car)roads of the Walloon region. Maintenance, which will be spread out over the duration of the contract, and work over 4 years also started this year

SOFICO's 20-year Lighting Plan 4.0 includes the replacement of 100,000 LED lighting points and energy savings of 76%, i.e. 166,000 tonnes of CO<sub>2</sub> emissions avoided. The lighting points will be connected and controlled thanks to several remote management and sensor systems that will enable the light intensity to be modulated according to different uses: traffic, timetables, weather conditions, accidents, works, etc.



## Creative solutions for added value Already on the market

### Smart lighting:

- ❑ In L'Aquila, Italy, Citelum has set up the first European system that automatically regulates the intensity of lighting according to the circadian wake-sleep rhythm. The system, incorporated in street lights, adjusts lighting from cooler colours that are closer to sunlight in the early evening to a warmer colour in the middle of the night



### Charging stations for electric vehicles:

- ❑ In Calais, Citelum and Ubitricity are connecting charging stations directly to the existing public lighting infrastructure. These charging points require little work to install, and can be used simply by scanning a QR code to start the charging. Users are then billed according to the time used



### Noise sensors:

- ❑ Citelum installed noise sensors connected to the street lighting of several public squares in Sant Cugat, Spain. As soon as the noise on the spot exceeds the authorised limit, the street lights begin to flash to alert users and encourage them to make less noise

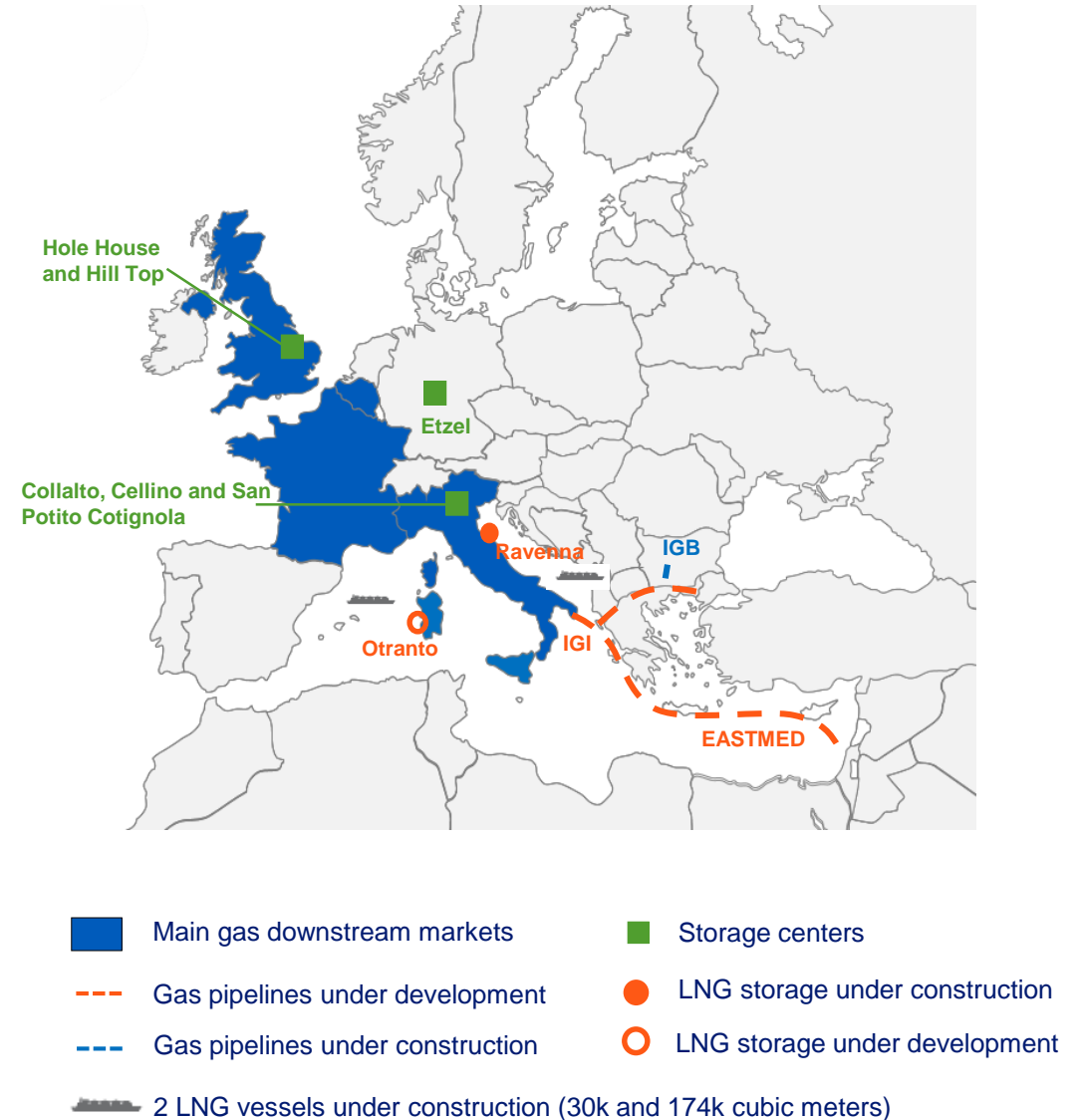


# EDF GROUP MAIN BUSINESSES

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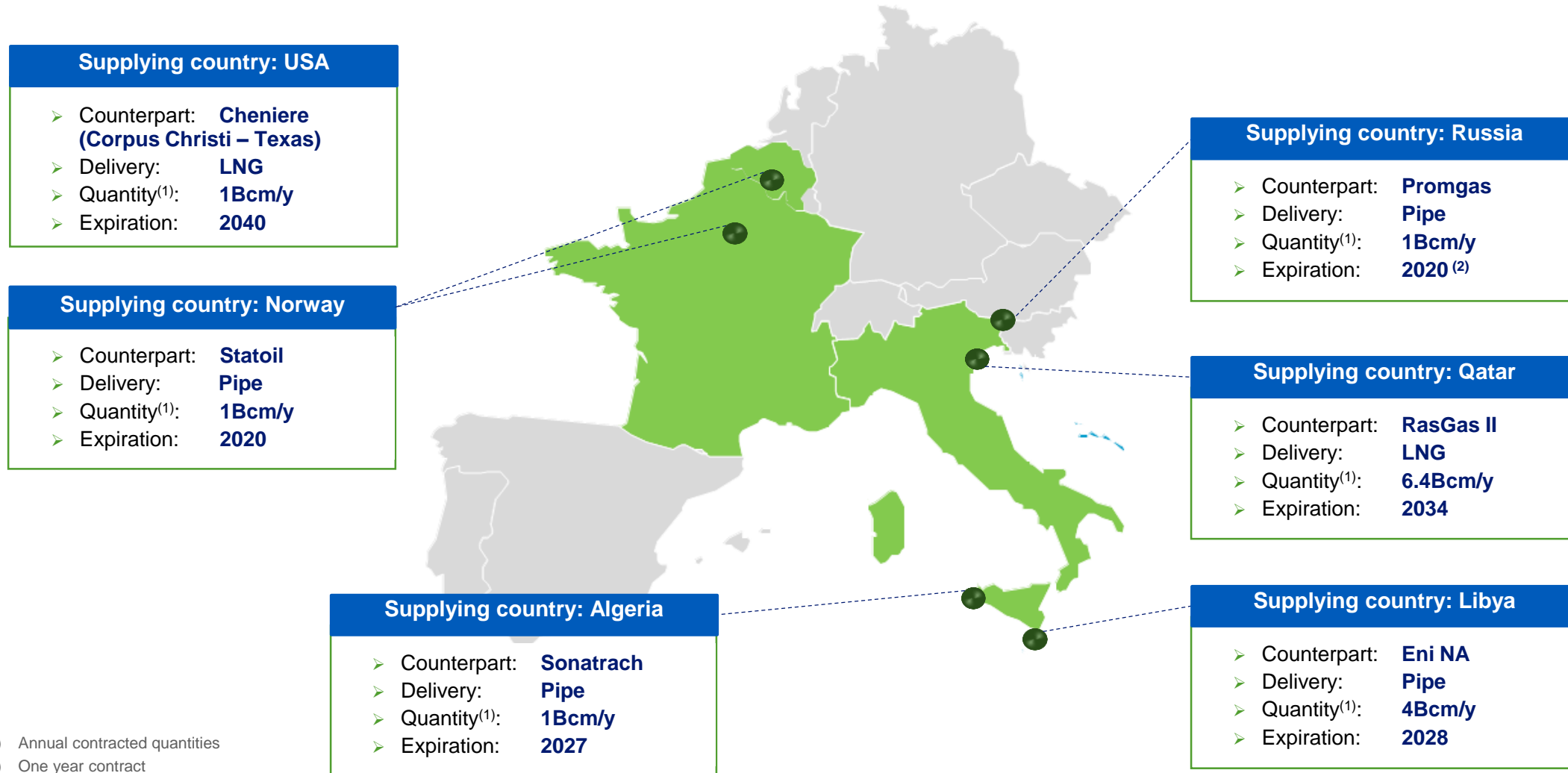
# EDF IS WELL POSITIONED ON THE GAS VALUE CHAIN



# GAS SUPPLY SOURCES AS OF TODAY

## ➤ Gas supply contracts

- The total volume of EDF's long-term gas contracts is 14.4bcm/year<sup>(1)</sup>, of which 12.4bcm imported by Edison



(1) Annual contracted quantities

(2) One year contract

# GAS END-MARKET

## DOWNSTREAM CUSTOMER PORTFOLIO IN EUROPE AS OF 31 DECEMBER 2019

	Number of Customers	TWh sold
FRANCE (EDF SA) <sup>(1)</sup>	~ 1.7 million	32.0
ITALY (EDISON)	~ 0.9 million	86.0
UK (EDF ENERGY) <sup>(2)</sup>	~ 2.0 million	29.0
BELGIUM (LUMINUS)	~ 0.6 million	13.0

- EDF is present on the European gas market for over 10 years, with ~5.2m clients and ~160TWh sold
- Dual fuel offer with value added services

(1) Excluding Corsica and the French overseas department

(2) Excluding Northern Ireland

# EDF TRADING: JERA AND EDF TRADING COMPLETE THEIR LNG OPTIMIZATION AND TRADING JOINT VENTURE

- LNG is a new chapter in the long-term partnership between JERA Co Inc (“JERA”) and EDF, which was cemented by the creation of JERA Trading (now JERA Global Markets) in April 2017 (1/3 EDF Trading, 2/3 JERA).
- EDF’s LNG trading and optimisation business has acquired a significant scale, in particular since the commissioning of the Dunkerque LNG terminal in 2017. JERA is a major player in the sector.
- The combined optimisation of the JERA and EDF LNG portfolios will represent a significant increase in scale which will maximise the scope and the value for both partners without requiring any investment.
- EDF expects a return from EDF Trading’s 33% stake in JERA Global Markets and will report its share of the LNG optimisation activity in its operating results.

## Key Steps in EDF/JERA Partnership





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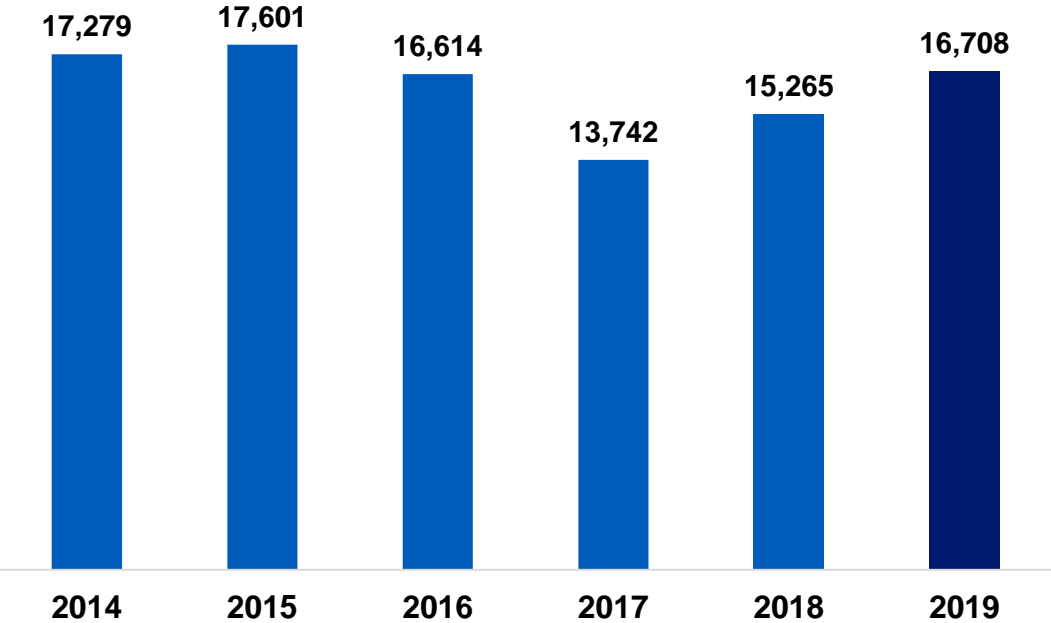
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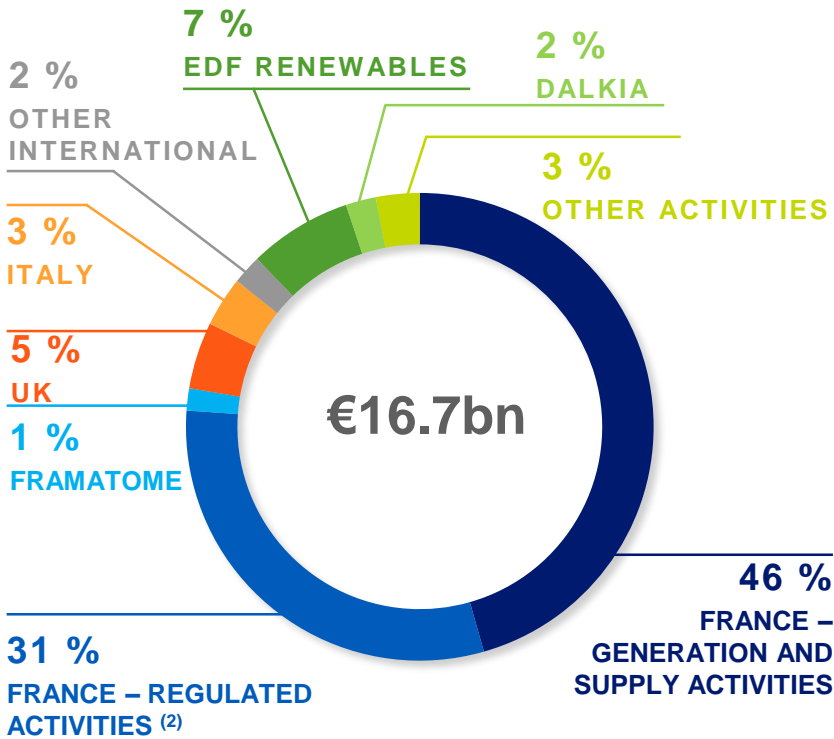
# HISTORICAL FINANCIALS: EBITDA

EBITDA growth

In millions of Euros



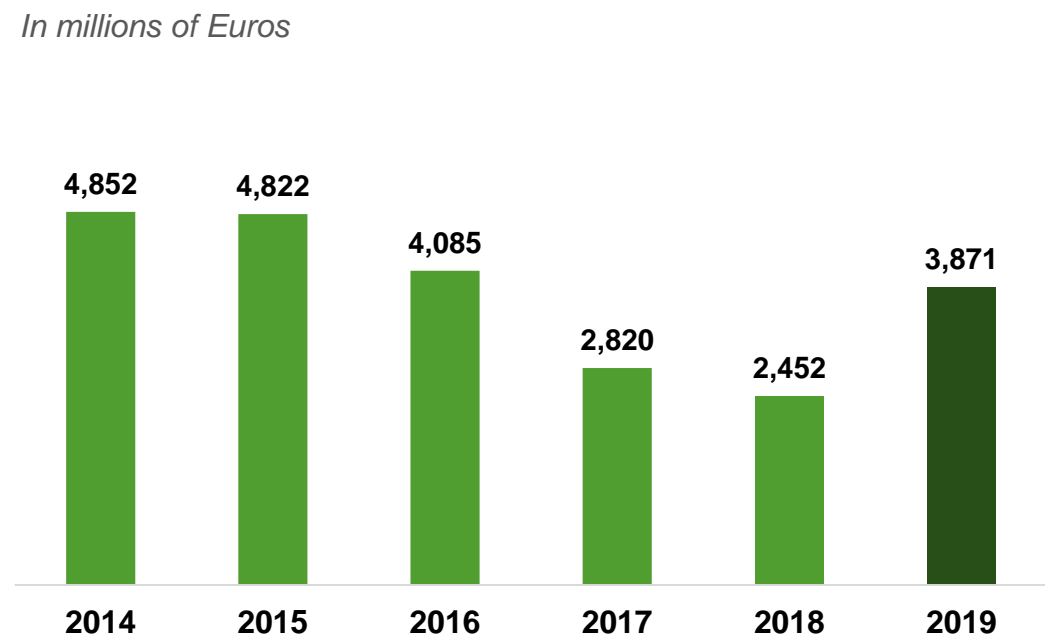
2019 Group EBITDA by segment



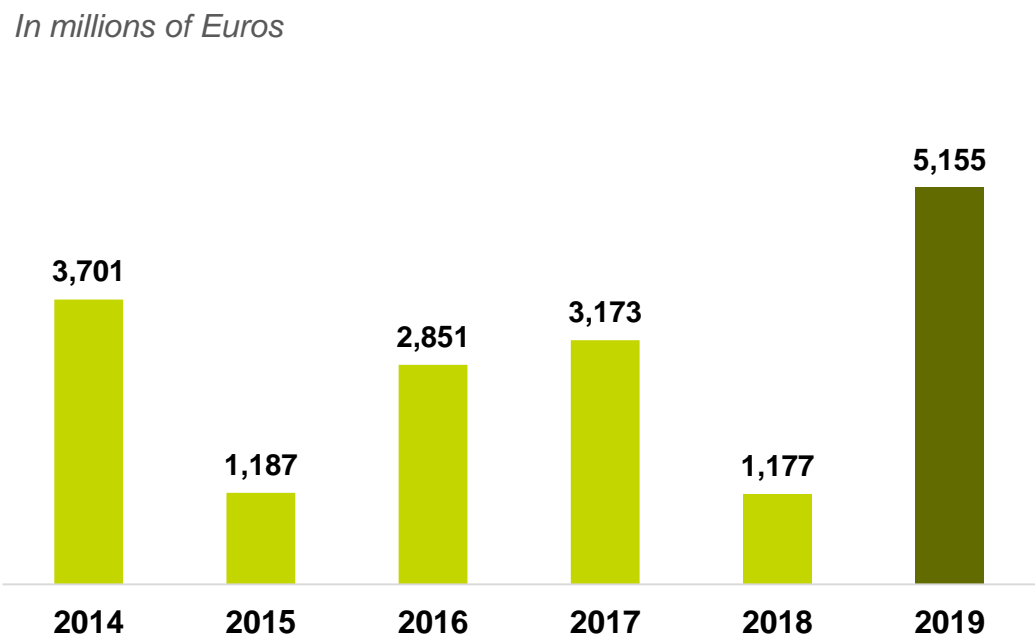
Note: presented figures are pro forma data from one year to another, but are not restated consistently throughout all years  
(1) Regulated activities: Enedis, ÉS and island activities; Enedis, an independent EDF subsidiary as defined in the French energy code

# HISTORICAL FINANCIALS: NET INCOME

Evolution of Net income excluding non-recurring items



Evolution of Net income – Group share



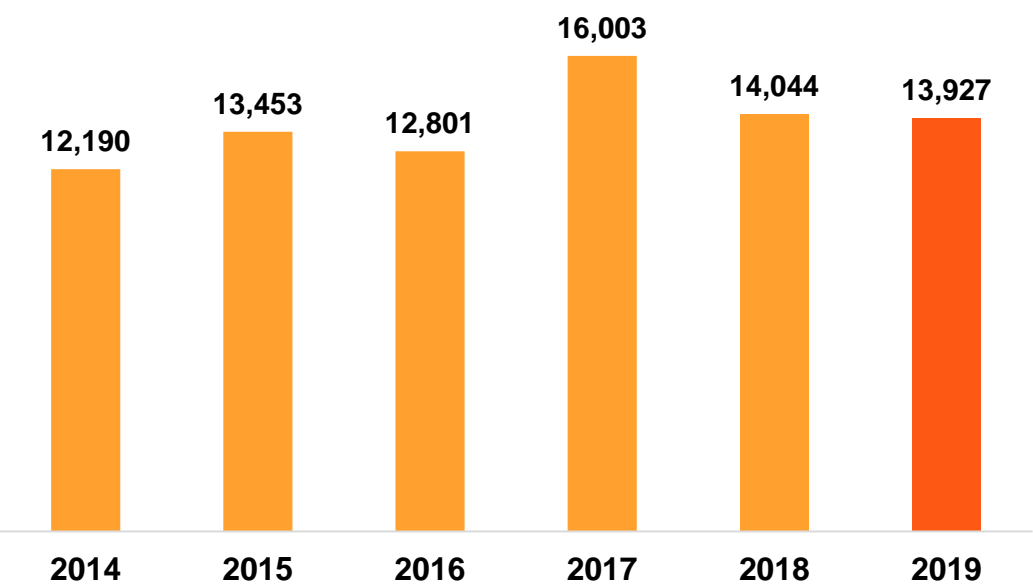
Net income excluding non-recurring items = Net income Group share excluding non-recurring items

*Note: presented figures are pro forma data from one year to another, but are not restated consistently throughout all years*

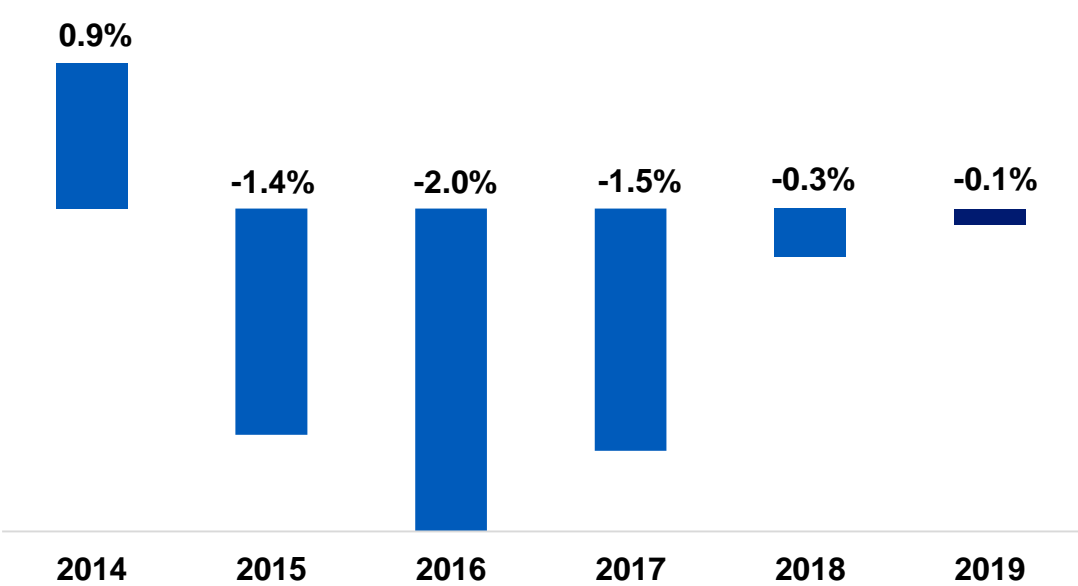
# HISTORICAL FINANCIALS: INVESTMENTS AND OPEX

## CHANGE IN NET INVESTMENTS<sup>(1)</sup> SINCE 2014

*In millions of Euros*



## OPEX<sup>(2)</sup> ORGANIC CHANGE<sup>(3)</sup> FROM 2014



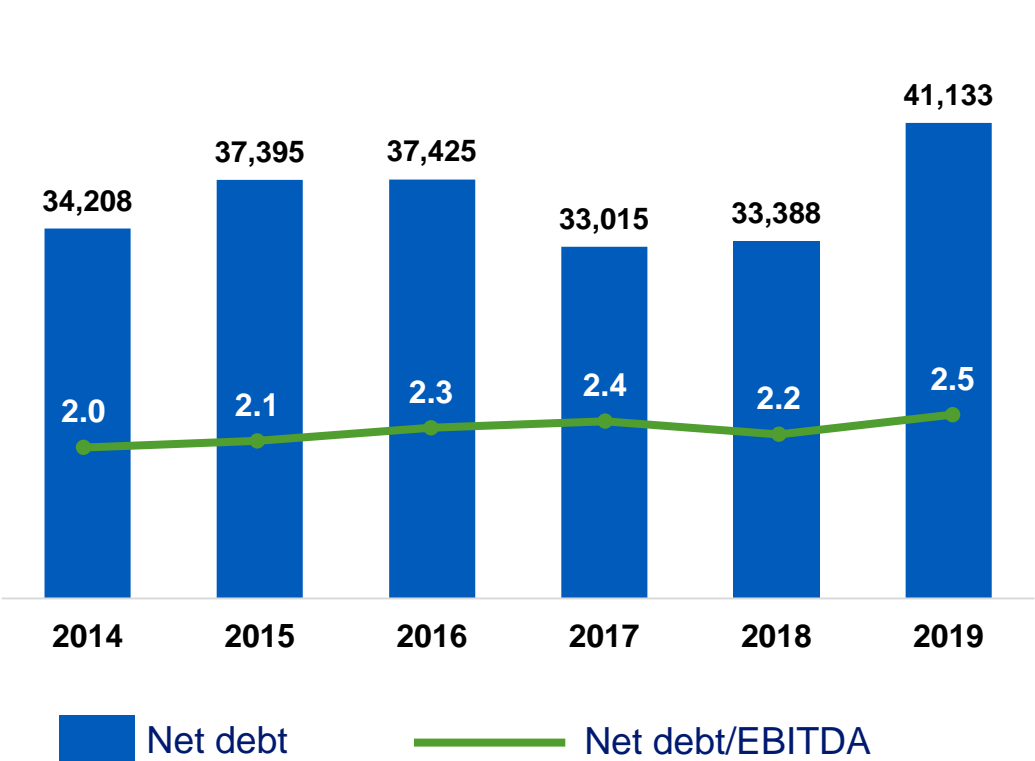
*Note: presented figures are pro forma data from one year to another, but are not restated consistently throughout all years*

- (1) Total net investments (as defined for each year) excluding disposals of strategic assets
- (2) Aggregate of personnel expenses and other external expenses
- (3) Data published with organic change at constant scope and exchange rates

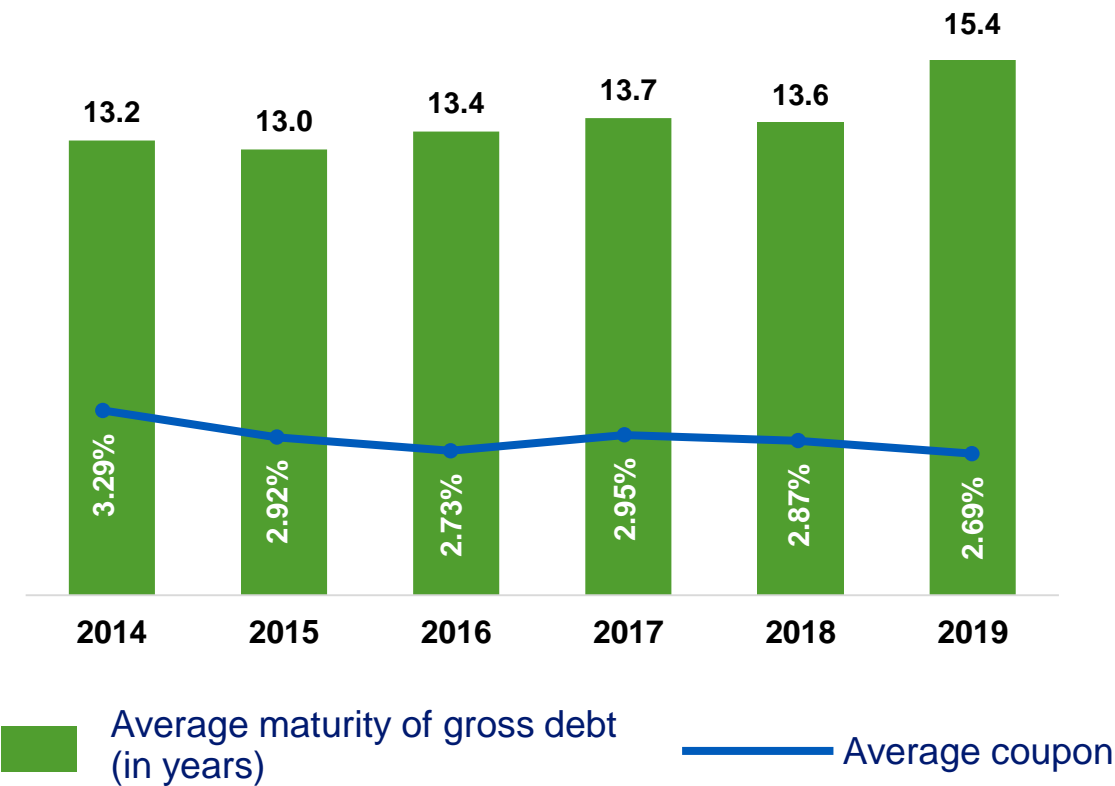
# HISTORICAL FINANCIALS: DEBT

## Net debt and net debt/EBITDA evolution

*In millions of Euros*

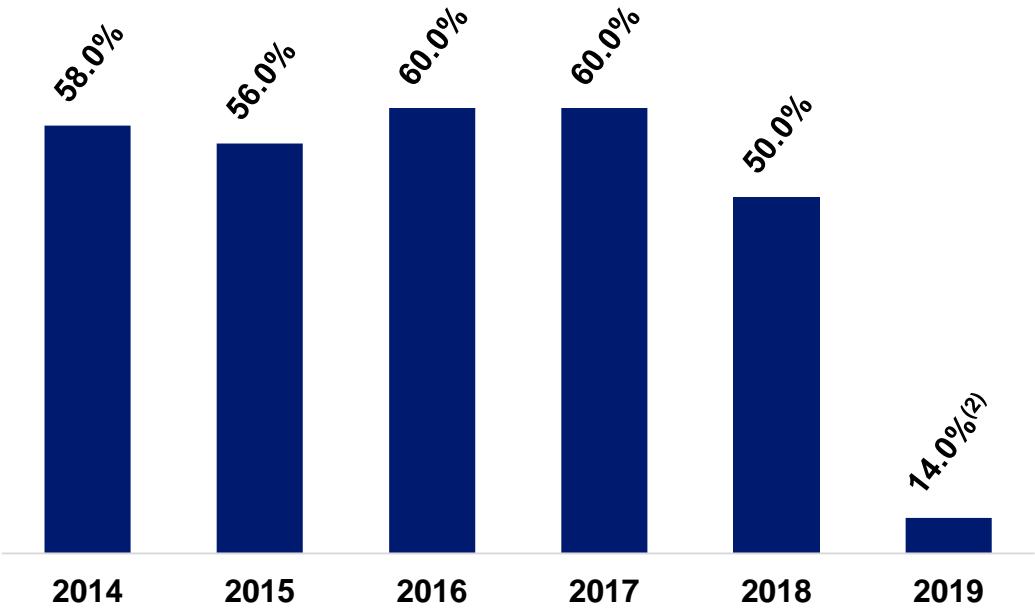


## Debt maturity and coupon evolution



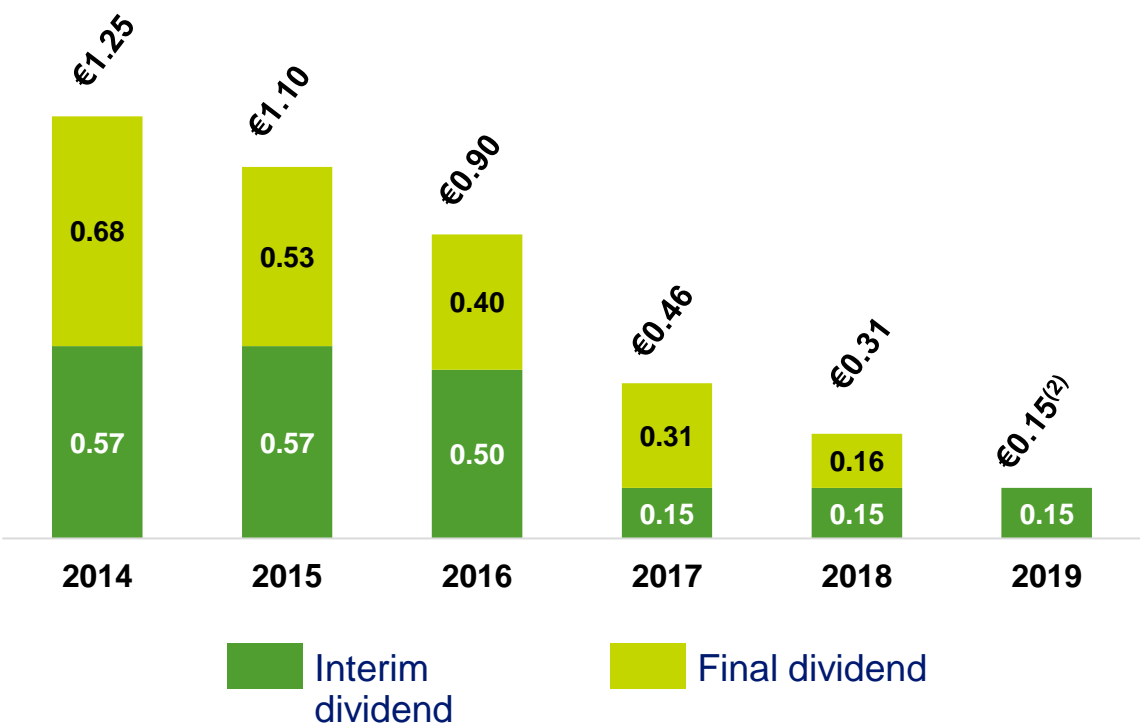
# HISTORICAL FINANCIALS: DIVIDEND

Dividend payout ratio since 2014<sup>(1)</sup>



Dividend per share since 2014

In € per share



(1) Payout ratio applied to the Net result excluding non-recurring items adjusted for interest payments on hybrid issues booked in equity  
(2) Cf Press release of 2 April 2020 : Board of Directors decision not to carry out the distribution of the balance of the dividend due to corona virus health crisis

# IMPACTS OF APPLYING IFRS 16 *LEASES* AT 1 JANUARY 2019 (1/2)

## DATE OF APPLICATION BY THE GROUP: 1 JANUARY 2019

- The 2018 comparative year was not restated, in accordance with the provisions of IFRS 16 as part of the modified retrospective method. Specific information was communicated in this regard at 31 December 2018 in the note “Group accounting standards” (Note 1.2.4.1), as well as in the financial statements of 31 December 2019 in the note “Comparability” (Note 2.1), and is presented below.
- All lease agreements, with the exception of two specific exemptions (short-term leases and low value contracts <\$5,000), are recognized in the balance sheet as a “Right of Use” (ROU) asset, against a financial liability.
- The implementation of the standard thus led to the recording, instead of rental charges (in other external expenses in EBITDA), depreciation charges and financial expenses.
- The ROU and debt assessment is based on fixed lease payments, taking into account the likely duration of the contract (including reasonably certain extension/termination options), discounted at the lessee’s marginal borrowing rate.
- On the transition date, the “modified retrospective” method (calculation of debt and assets on 01/01/2019 by applying the rates in force on this date) was used.
- The main lease agreements relate to real estate assets (commercial and residential) and industrial facilities (land, wind farms) and, to a minor extent, to transport vehicles and various IT and industrial equipment.



# IMPACTS OF APPLYING IFRS 16 LEASES AT 1 JANUARY 2019 (2/2)

*Impacts of the application of IFRS 16 as of 1 January 2019  
as part of the modified retrospective method*

In millions of euros

31/12/2018

EBITDA impact +517\*

Amortisation expenses -634

Financial expenses -74

Income before taxes -191

Debt impact and right of use  
as of 01/01/2019 +4,492

In millions of euros	EBITDA impact 31/12/2018	Amortisation expenses impact 31/12/2018
France – Generation and supply activities	291*	(290)
France – Regulated activities	167	(158)
Framatome	44	(43)
United Kingdom	18	(17)
Italy	21	(19)
Other international	9	(8)
EDF Renewables	56	(46)
Dalkia	41	(41)
Other activities	(130)*	(12)
<b>Total Group</b>	<b>+517</b>	<b>(634)</b>

\* Including partial termination of gain on disposal related to real estate transactions in France for a total amount of (€166)m

# FINANCE

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# ALL 2019 FINANCIAL TARGETS ARE MET

	ACTUAL 2019	TARGETS	
EBITDA	€16.7bn	€16bn – €16.7bn	✓
REDUCTION IN OPERATING EXPENSES <sup>(1)</sup>	€1.2bn vs. 2015	~€1.1bn	✓
TOTAL NET INVESTMENTS <sup>(2)</sup>	€13.9bn	~ €15bn	✓
CASH FLOW excl. HPC and Linky	€1.8bn	> €0.6bn	✓
NET DEBT/EBITDA	2.46x	≤ 2.7x	✓
GROUP DISPOSALS	~€0.5bn achieved <sup>(3)</sup>	€2bn to €3bn for 2019-2020	In progress

DIVIDEND PROPOSED:

**€0.48 per share,**  
payout of 45% <sup>(4)</sup>

For a payout target of  
45%-50% <sup>(4)</sup>

(1) Sum of personnel expenses and other external expenses. At comparable scope, IFRS 16 and exchange rates. At constant pension discount rates. Excluding change in operating expenses of the service activities.

(2) Total net investments excluding acquisitions and "Group Disposals 2019-2020".

(3) Does not take account the signed binding disposal agreements (Edison E&P business).

(4) Payout ratio based on net income excluding non-recurring items, adjusted for the remuneration of hybrid bonds accounted for in equity.

# 2019 KEY FIGURES

In €m	2018 restated <sup>(1)</sup>	2019 <sup>(2)</sup>	Δ%	Δ% Org. <sup>(3)</sup>
Sales	68,546	71,317	+4.0	+3.5
<b>EBITDA</b>	<b>14,898</b>	<b>16,708</b>	<b>+12.1</b>	<b>+8.4</b>
Net income excluding non-recurring items	2,452	3,871	+57.9	
<b>Net income – Group share</b>	<b>1,177</b>	<b>5,155</b>	<b>x 4.4</b>	
	<b>31/12/2018</b>	<b>31/12/2019 <sup>(2)</sup></b>		
Net debt (in €bn)	33.4	41.1		
<b>Net debt/EBITDA ratio <sup>(1)</sup></b>	<b>2.24x</b>	<b>2.46x</b>		

*Significant impact on NFD of IFRS 16 standard implementation on 1 January 2019 (€4.5bn) and net purchase of hybrid securities (€1.1bn) at H2 2019*

(1) The FY 2018 data published (except NFD) were restated due to the impact linked to the Edison E&P activity presentation as a discontinued operation.

(2) The 31/12/2019 financial statements are prepared applying the IFRS 16 standard, from 1 January 2019 (using the “modified” retrospective approach). The comparative data was not restated in compliance with the transition provisions.

(3) Organic change at comparable scope, standards and exchange rates.

# SIMPLIFIED INCOME STATEMENT

In millions of euros	2018 restated <sup>(1)</sup>	2019 <sup>(2)</sup>
<b>Sales</b>	<b>68,546</b>	<b>71,317</b>
Fuel and energy purchases	(33,056)	(35,091)
Other external expenses	(9,262)	(8,619)
Personnel expenses	(13,642)	(13,793)
Taxes other than income taxes	(3,690)	(3,798)
Other operating income and expenses	6,002	6,692
<b>EBITDA</b>	<b>14,898</b>	<b>16,708</b>
Impact of the commodities volatility	(224)	642
Net depreciation and amortisation	(8,775)	(9,994)
Net increases in provisions for renewal of property	(50)	(8)
(Impairment)/reversals	(290)	(403)
Other income and expenses	(105)	(185)
<b>EBIT</b>	<b>5,454</b>	<b>6,760</b>
Financial income	(4,798)	(361)
<b>Income before taxes of consolidated companies</b>	<b>656</b>	<b>6,399</b>
<b>Net income – Group share</b>	<b>1,177</b>	<b>5,155</b>
<b>Net income excl. non-recurring items <sup>(3)</sup></b>	<b>2,452</b>	<b>3,871</b>

(1) The 31/12/2018 published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation.

(2) The 31/12/2019 financial statements are prepared applying the IFRS 16 standard, from 1 January 2019 (using the “modified” retrospective approach). The comparative data was not restated in compliance with the transition provisions

(3) Excluding non-recurring items & commodities volatility

# CHANGE IN SALES <sup>(1)</sup>

In millions of euros	2018 restated <sup>(2)</sup>	Forex	Scope	Organic growth	2019 <sup>(3)</sup>	Δ% org. <sup>(4)</sup>
France – Generation and supply activities	26,096	-	83	1,691	27,870	+6.5
France – Regulated activities <sup>(5)</sup>	16,048	-	-	39	16,087	+0.2
Framatome	3,313	33	10	21	3,377	+0.6
United Kingdom	8,970	75	-	529	9,574	+5.9
Italy	8,077	-	142	(652)	7,567	-8.1
Other international	2,411	(1)	17	263	2,690	+10.9
EDF Renewables	1,505	29	(12)	43	1,565	+2.9
Dalkia	4,189	4	20	68	4,281	+1.6
Other activities	2,601	11	(62)	178	2,728	+6.8
Inter-segment eliminations	(4,664)	-	-	242	(4,422)	-5.2
<b>Total Group</b>	<b>68,546</b>	<b>151</b>	<b>198</b>	<b>2,422</b>	<b>71,317</b>	<b>+3.5</b>

(1) Breakdown of sales across the segments, before inter-segment eliminations

(2) The 31/12/2018 published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation

(3) The 31/12/2019 financial statements are prepared applying the IFRS 16 standard. The comparative data was not restated

(4) Organic change at constant scope and exchange rates

(5) Regulated activities: Enedis, éS and island activities; Enedis, an independant EDF subsidiary as defined in the French energy code



# CHANGE IN EBITDA <sup>(1)</sup>

In millions of euros	2018 restated <sup>(2)</sup>	IFRS 16	Forex	Scope	Organic growth	2019 <sup>(3)</sup>	Δ% org. <sup>(4)</sup>
France – Generation and supply activities	6,327	291	-	(22)	1,019	7,615	+16.1
France – Regulated activities	4,916	167	-	-	18	5,101	+0.4
Framatome	202	44	4	-	6	256	+3.0
United Kingdom	783	18	7	-	(36)	772	-4.6
Italy	424	21	-	45	88	578	+20.8
Other international	240	9	-	3	87	339	+36.3
EDF Renewables	856	56	20	(26)	287	1,193	+33.5
Dalkia	292	41	-	2	14	349	+4.8
Other activities	858	(130)	3	(1)	(225)	505	-26.2
<b>Total Group</b>	<b>14,898</b>	<b>517</b>	<b>34</b>	<b>1</b>	<b>1,258</b>	<b>16,708</b>	<b>+8.4</b>

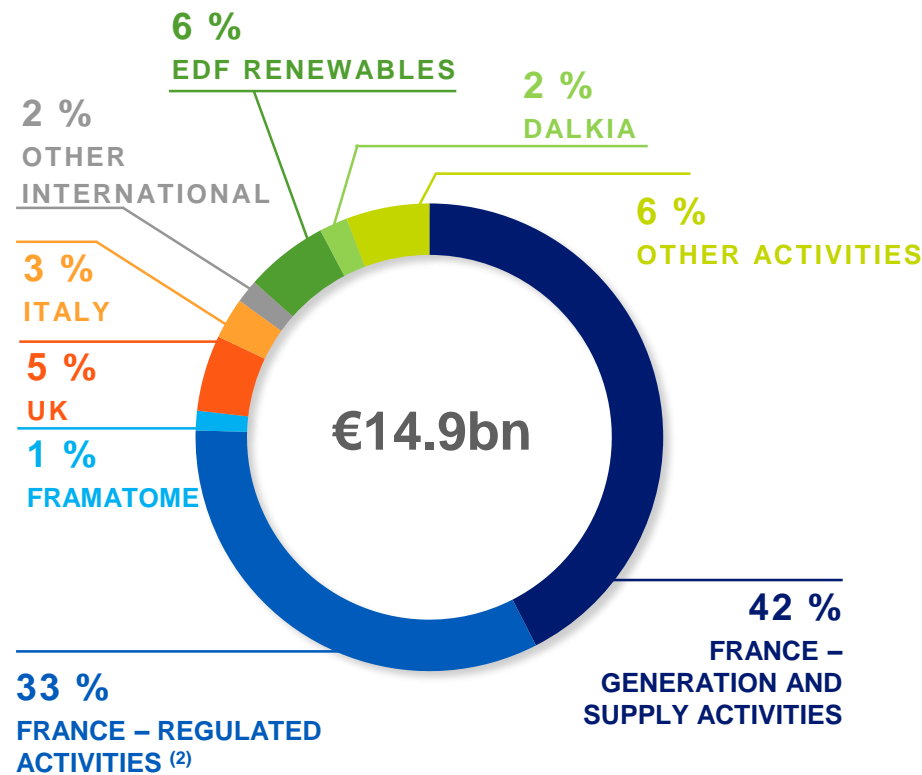
(1) Contribution to the Group

(2) The 31/12/2018 annual published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation

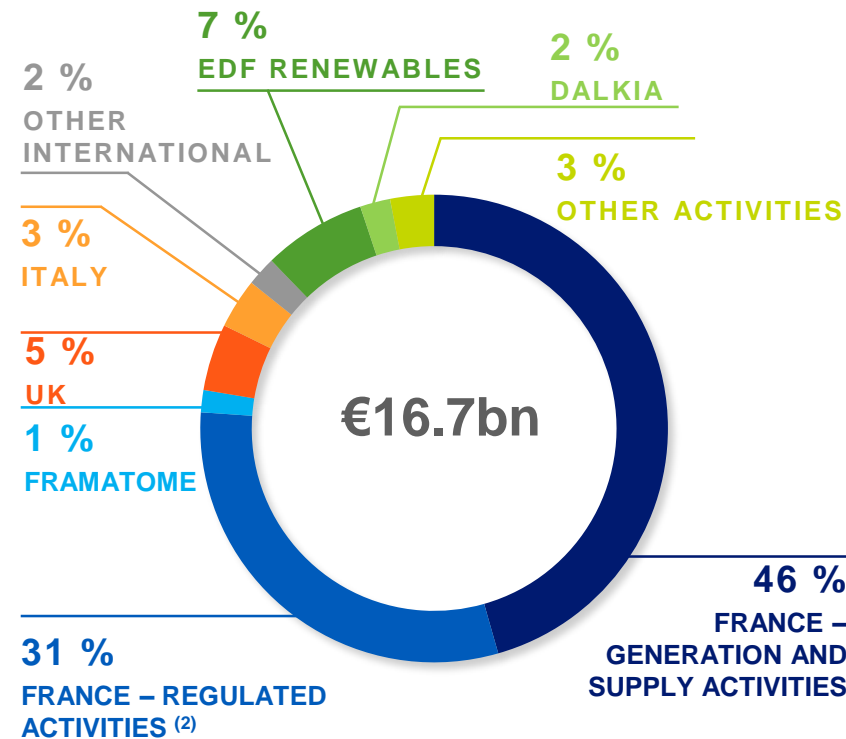
(3) The 31/12/2019 annual financial statements are prepared applying the IFRS 16 standard. The comparative data was not restated

(4) Organic change at constant scope, standard and exchange rates

# BREAKDOWN OF GROUP EBITDA



2018 (1)



2019

(1) The 31/12/2018 annual published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation

(2) Regulated activities: Enedis, éS and island activities; Enedis, an independant EDF subsidiary as defined in the French energy code

# CHANGE IN OPEX <sup>(1)</sup>

In millions of euros	2018 restated <sup>(2)</sup>	2019 <sup>(3)</sup>	Δ	Δ %
France – Generation and supply activities	8,887	8,458	(429)	-4.8
France – Regulated activities	4,905	4,696	(209)	-4.3
Framatome	1,774	1,691	(83)	-4.7
United Kingdom	2,097	2,108	11	0.5
Italy	832	869	37	4.4
Other international	588	612	24	4.1
EDF Renewables	915	932	17	1.9
Dalkia	2,491	2,558	67	2.7
Other activities	415	488	73	17.6
<b>Total Group</b>	<b>22,904</b>	<b>22,412</b>	<b>(492)</b>	<b>-2.1</b>

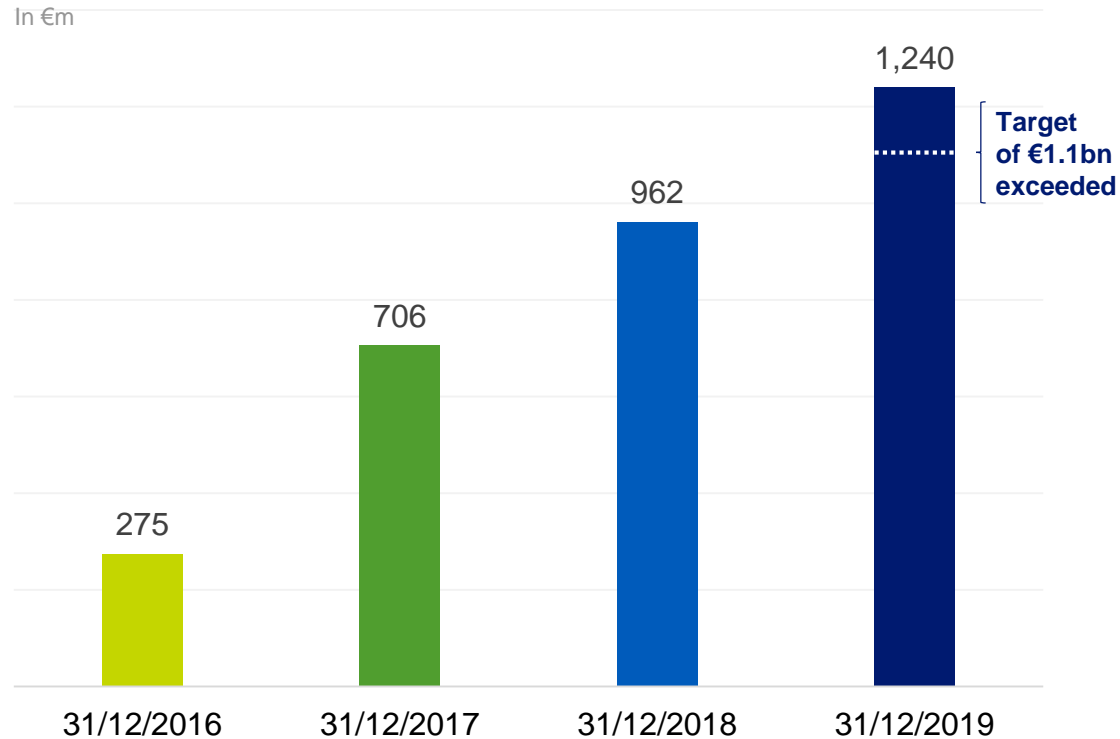
(1) Opex (operational expenses) corresponding to the sum of personnel expenses and other external expenses after inter-segment eliminations

(2) The 31/12/2018 annual published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation

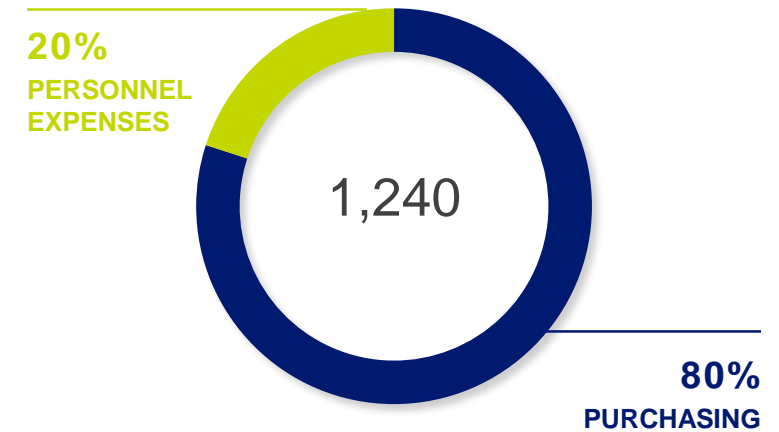
(3) The 31/12/2019 annual financial statements are prepared applying the IFRS 16 standard. The comparative data was not restated

# TARGET EXCEEDED IN REDUCTION OF OPERATING EXPENSES <sup>(1)</sup>

## CONTINUOUS REDUCTION IN OPERATING EXPENSES SINCE 2015 <sup>(1)</sup>



## BREAKDOWN OF CUMULATED GAINS BY NATURE



(1) At constant scope, exchange rates, IFRS 16 and pension discount rate. Excluding change in operating expenses of the service activities.

# CHANGE IN NET INCOME

In millions of euros

	2018 restated <sup>(1)</sup>	2019 <sup>(2)</sup>	Δ
<b>Income before taxes of consolidated companies</b>	<b>656</b>	<b>6,399</b>	<b>5,743</b>
Income tax	178	(1,581)	(1,759)
Share in income of associates and joint ventures	569	818	249
Net income of the discounted operations	(212)	(454)	(242)
<b>Net income – consolidated</b>	<b>1,191</b>	<b>5,182</b>	<b>3,991</b>
Deducting net income from minority interests	14	27	13
<b>Net income – Group Share</b>	<b>1,177</b>	<b>5,155</b>	<b>3,978</b>
Neutralisation of non-recurring items including commodities volatility	1,275	(1,284)	(2,559)
<b>Net income excl. non-recurring items</b>	<b>2,452</b>	<b>3,871</b>	<b>1,419</b>

(1) The 31/12/2018 annual published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation

(2) The 31/12/2019 annual financial statements are prepared applying the IFRS 16 standard. The comparative data was not restated

# SIMPLIFIED BALANCE SHEET

## ASSETS

(In millions of euros)

	31/12/2018	31/12/2019 <sup>(1)</sup>
Intangible and tangible assets	162,219	174,345
Other non-current assets	48,165	55,120
<b>Non-current assets</b>	<b>210,384</b>	<b>229,465</b>
Inventories and trade receivables	30,137	29,655
Other current assets	39,358	36,568
Cash and cash equivalents	3,290	3,934
<b>Current assets</b>	<b>72,785</b>	<b>70,157</b>
Assets held for sale	-	3,662
<b>Total Assets</b>	<b>283,169</b>	<b>303,284</b>

## LIABILITIES

(In millions of euros)

	31/12/2018	31/12/2019 <sup>(1)</sup>
Equity (EDF's share)	44,469	46,466
Equity (non-controlling interests)	8,177	9,324
<b>Total equity</b>	<b>52,646</b>	<b>55,790</b>
Non-current provisions	71,772	80,760
Special concession assets	46,924	47,465
Non-current other liabilities	59,012	64,225
<b>Non current liabilities</b>	<b>177,708</b>	<b>192,450</b>
<b>Current liabilities</b>	<b>52,815</b>	<b>54,001</b>
Liabilities related to assets classified as held for sale	-	1,043
<b>Total Liabilities</b>	<b>283,169</b>	<b>303,284</b>

(1) The 31/12/2019 financial statements are prepared applying the IFRS 16 standard. The comparative data was not restated



# CHANGE IN CASH FLOW

In €m	2018 restated <sup>(1)</sup>	2019 <sup>(2)</sup>
<b>EBITDA <sup>(2)</sup></b>	<b>14,898</b>	<b>16,708</b>
Non-cash items <sup>(2)</sup>	(1,245)	(1,943)
<b>EBITDA Cash <sup>(2)</sup></b>	<b>13,653</b>	<b>14,765</b>
Δ WCR	470	452
Net investments <i>(excluding Group assets disposal plan, HPC et Linky <sup>(3)</sup>)</i>	(11,508)	(11,345)
Other items o/w dividends received from associates and group ventures	383	303
<b>Cash flow generated by operations</b>	<b>2,998</b>	<b>4,175</b>
Group assets disposal plan	1,937	531
Income tax paid	(309)	(922)
Net financial expenses disbursed <sup>(2)</sup>	(1,048)	(798)
Dedicated assets	(501)	(394)
Dividends paid in cash (including hybrid bond remuneration)	(1,278)	(801)
<b>Group Cash flow excluding Linky and HPC (Guidance) <sup>(2)</sup></b>	<b>1,799</b>	<b>1,791</b>
Linky <sup>(3)</sup> and HPC	(2,400)	(2,582)
<b>Group cash flow <sup>(2)</sup></b>	<b>(601)</b>	<b>(791)</b>

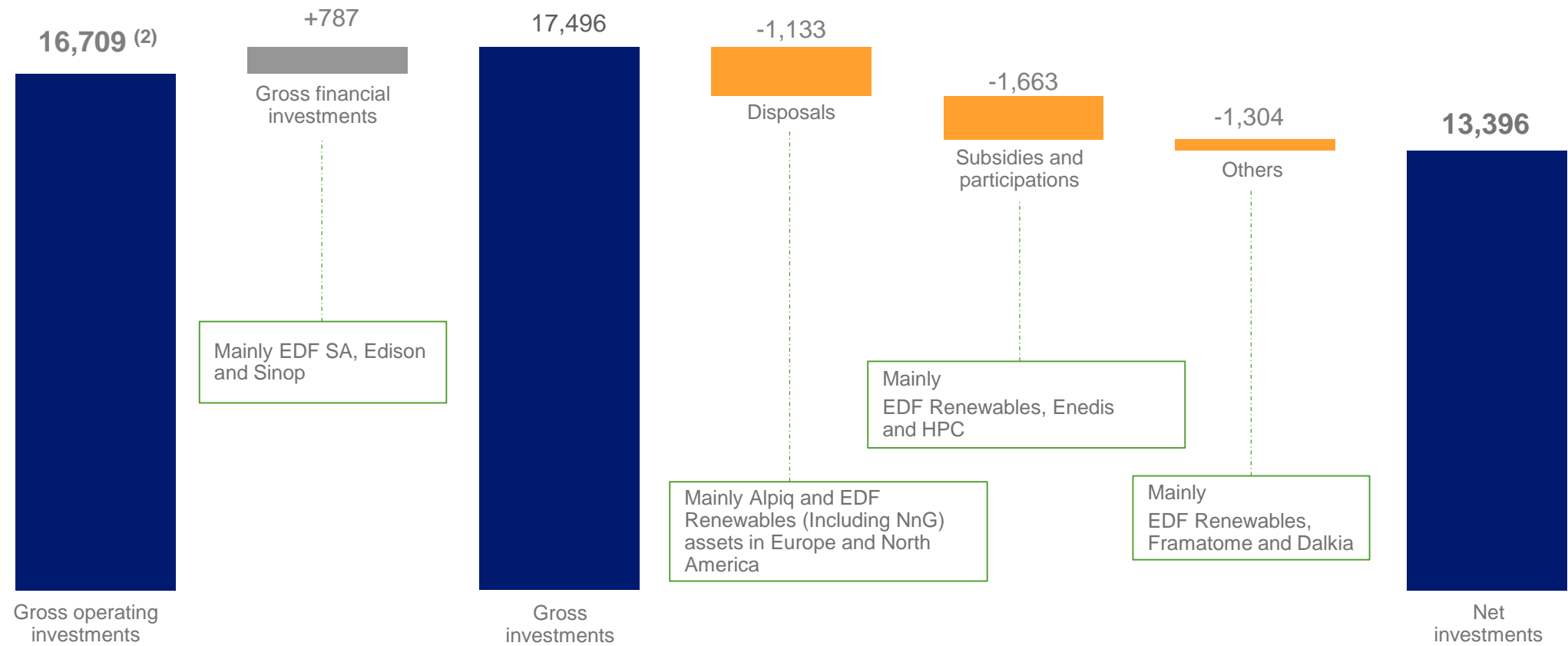
(1) The data published in respect of FY 2018 were restated due to the new CFS presentation and to the impact linked to the Edison E&P activity presentation as a discontinued operation. As of 31/12/2019, the total cash flows of E&P amounting to €21m is presented on a dedicated line below the Group Cash flow.

(2) The 31/12/2019 financial statements are prepared applying the IFRS 16 standard. The comparative data was not restated, and the impact on the Group cash flow (and Guidance CF) would have been +€609m as of 31/12/2018.

(3) Linky is a project led by Enedis, independent subsidiary of EDF under the provisions of the French energy code.

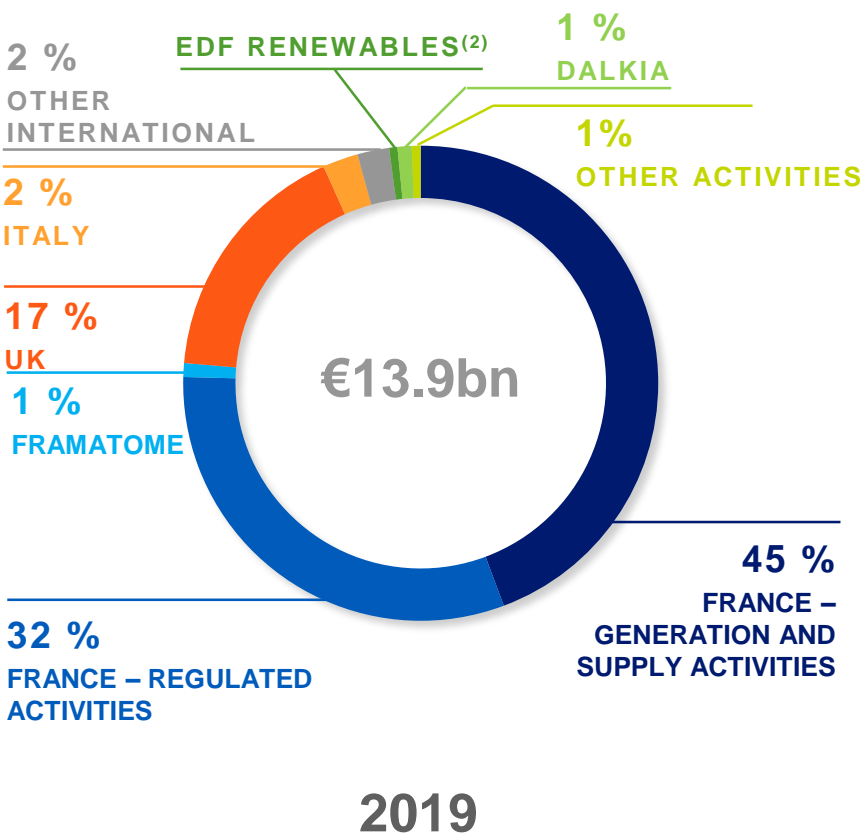
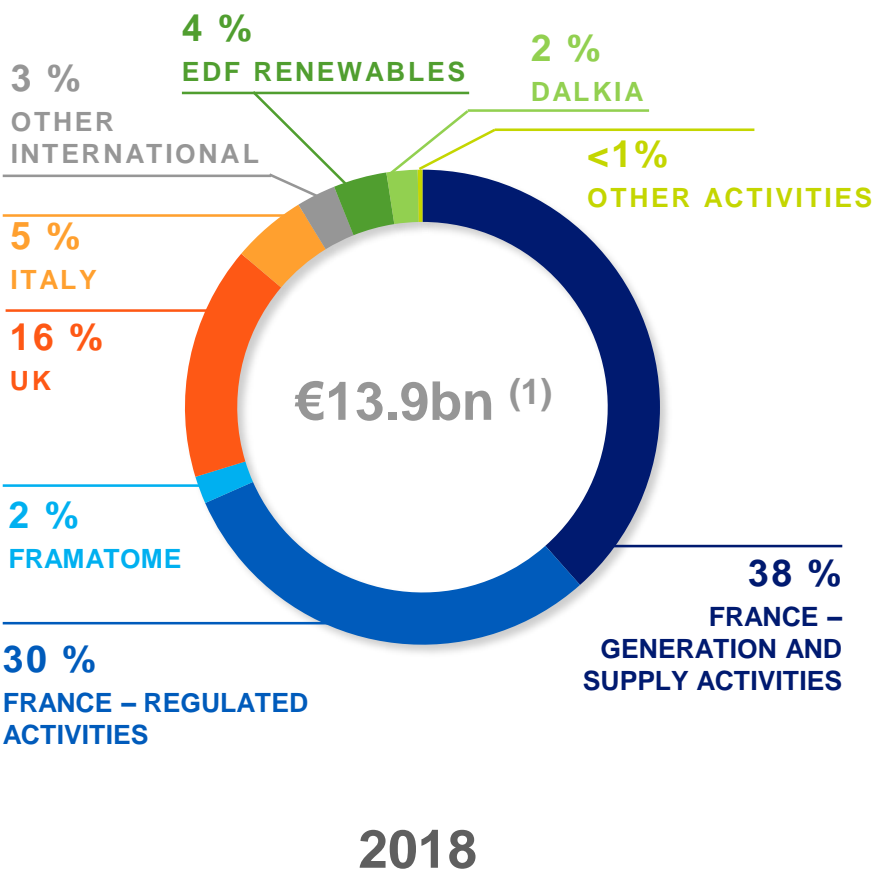
# INVESTMENTS: FROM GROSS TO NET (1)

In millions of euros



(1) Net investments in the Change in NFD statement including Linky, HPC and assets disposals  
(2) Investments in intangible assets and property, plant and equipment in consolidated cash flow statement

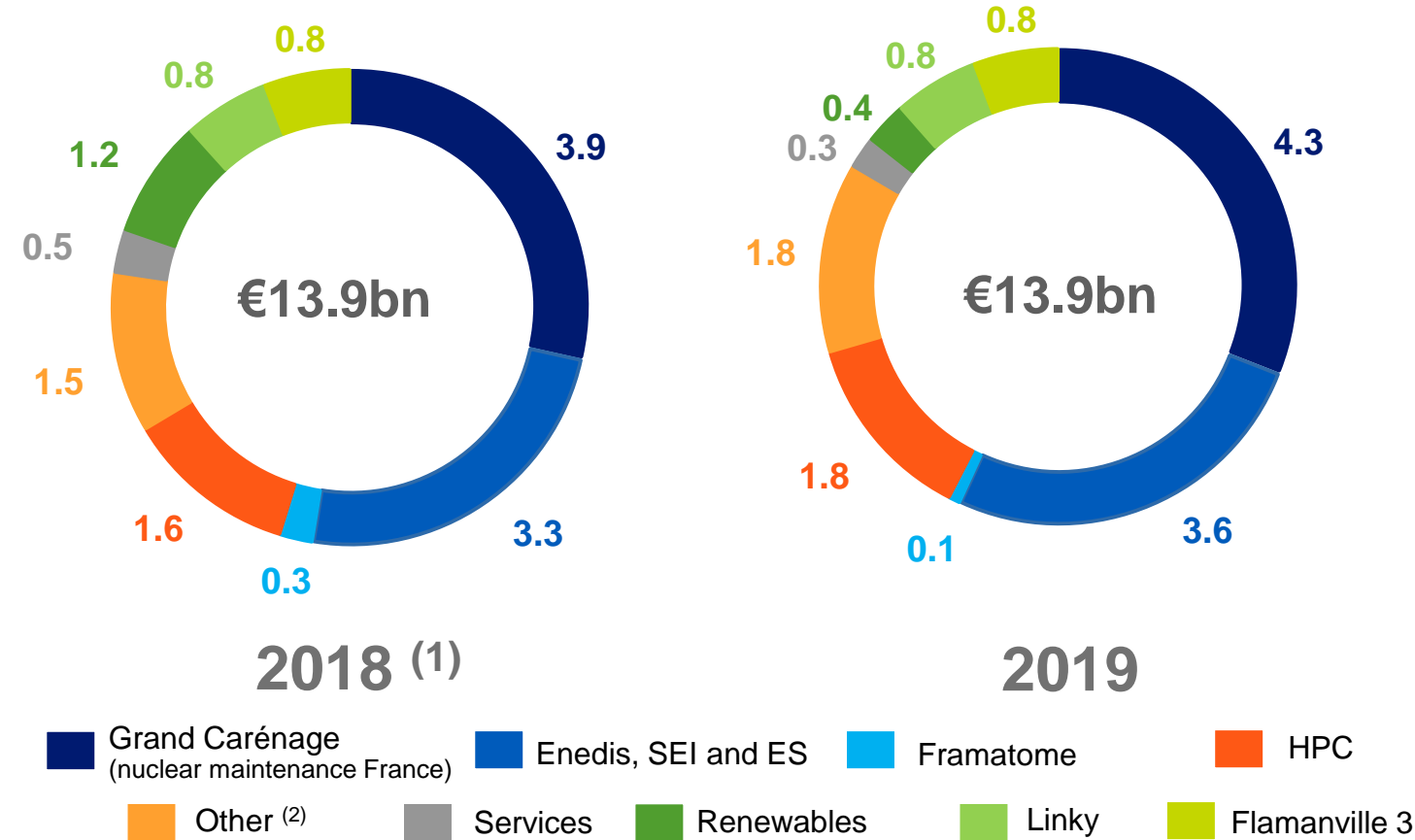
# NET TOTAL INVESTMENTS INCLUDING ACQUISITIONS, EXCLUDING 2015-2020 DISPOSAL PLAN



(1) The 31/12/2018 published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation  
(2) Including -2% of net investments for EDF Renewables explained by the deconsolidation of debt related to the NnG offshore project following the disposal of 50% of shares

# NET INVESTMENTS INCLUDING ACQUISITIONS EXCLUDING 2015-2020 DISPOSAL PLAN

In billions of euros



In billions of euros

	Maintenance	Development	TOTAL
Renewables	0.4	-	0.4
Nuclear maintenance including Grand Carénage	4.3	-	4.3
Enedis, SEI and ES	2	1.6	3.6
Framatome	0.1	-	0.1
Project Flamanville 3 <sup>(3)</sup>	-	0.8	0.8
Services	0.3	-	0.3
Other <sup>(2)</sup>	1.4	0.4	1.8
<b>Net investments</b>	<b>8.6</b>	<b>2.8</b>	<b>11.3</b>
Linky	-	0.8	0.8
HPC	-	1.8	1.8
<b>TOTAL</b>	<b>8.6</b>	<b>5.4</b>	<b>13.9</b>

NB: figures rounded up to the nearest whole number  
 (1) The 31/12/2018 published amounts were restated of the impact linked to the E&P activity presentation as a discontinued operation and of New developments

(2) Mainly nuclear maintenance excluding France, thermal maintenance, France and UK nuclear development  
 (3) See note 25 of the 2019 consolidated statements

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# DEBT AND LIQUIDITY

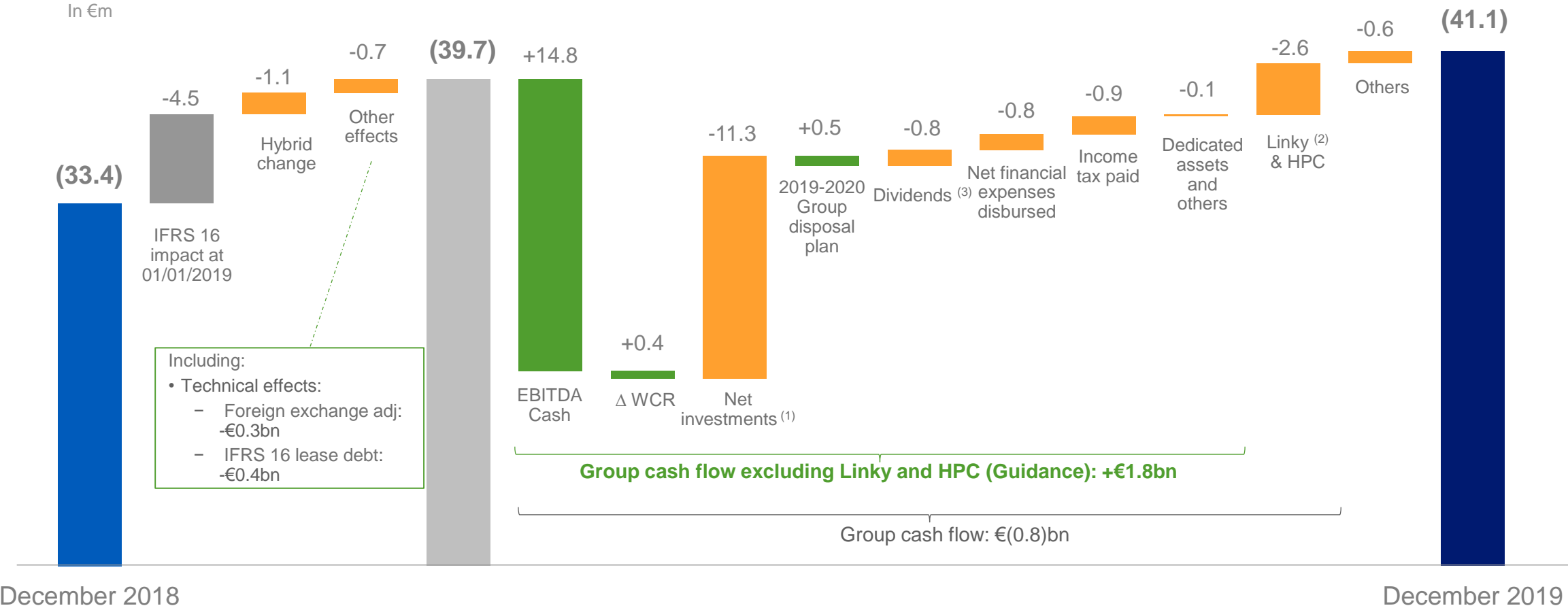
In billions of euros

	31/12/2017	31/12/2018	31/12/2019
<b>Net financial debt <sup>(1)</sup></b>	33.0	33.4	<b>41.1</b>
Net financial debt/EBITDA	2.41x	2.24x	<b>2.46x</b>
<b>Debt</b>			
• Bonds	47.3	50.4	<b>52.4</b>
• Average maturity of gross debt (in years)	13.7	13.6	<b>15.4</b>
• Average coupon	2.95 %	2.87 %	<b>2.69 %</b>
<b>Gross liquidity <sup>(2)</sup></b>	34.6	35.2	<b>33.4</b>

(1) Significant impact on net financial debt of the entry into force of IFRS 16 on 1 January 2019 (€4.5 billion) and of the net buyback of hybrid securities (€1.1 billion) in H2 2019

(2) With cash and cash equivalents, Available-for-sale financial assets (liquid assets), and undrawn line of credit

# NET DEBT



NB : figured rounded up to the nearest whole number.

(1) Net investments including Linky, HPC and 2019-2020 assets disposal plan.

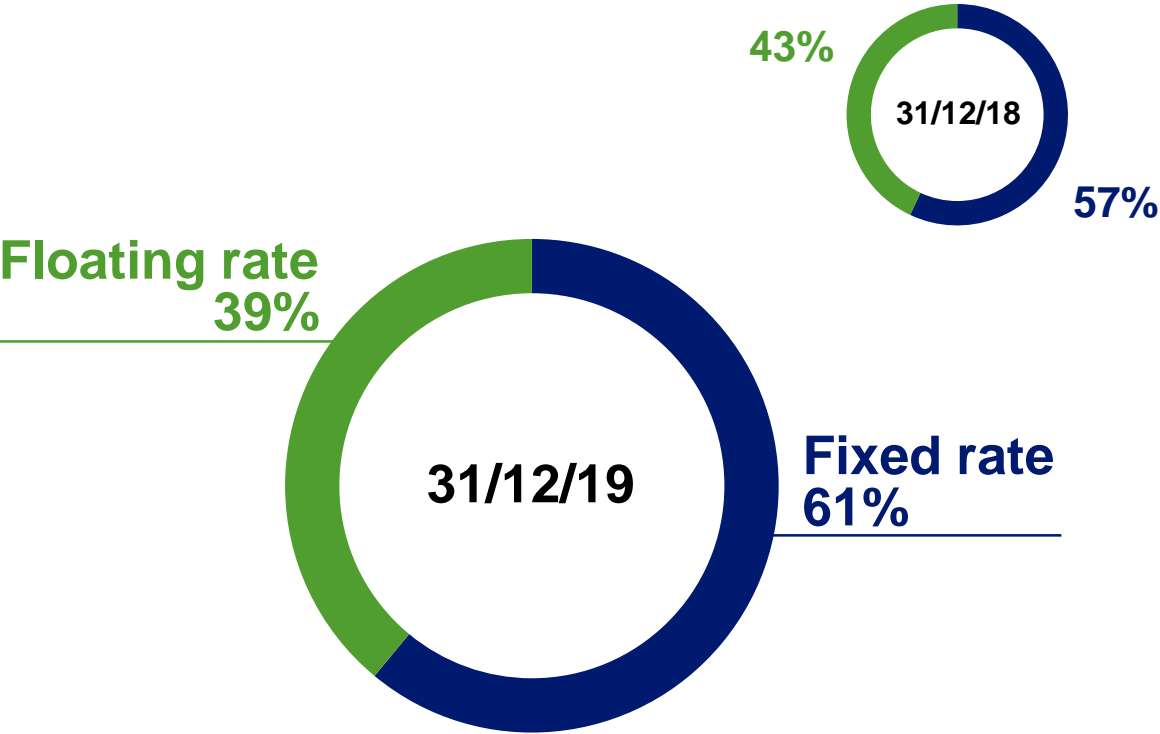
(2) Linky is a project led by Enedis, independent subsidiary of EDF under the provisions of the French energy code.

(3) Dividends including hybrid bonds remuneration.

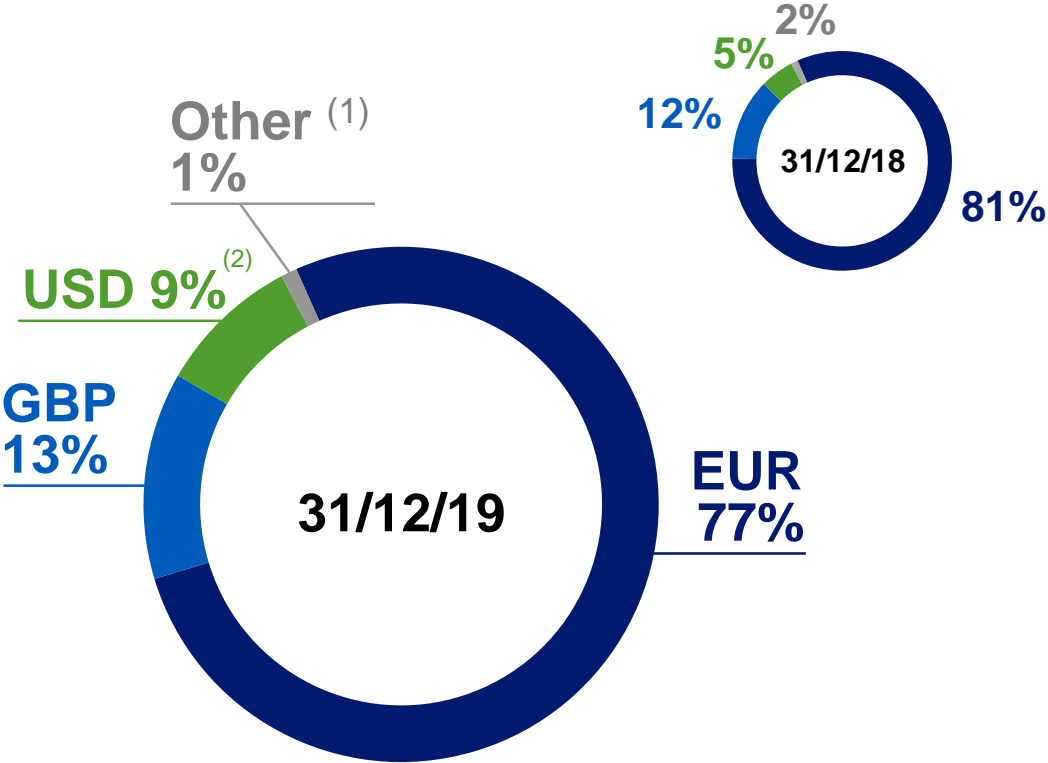


# GROSS FINANCIAL DEBT AFTER SWAPS

Breakdown by type of rate



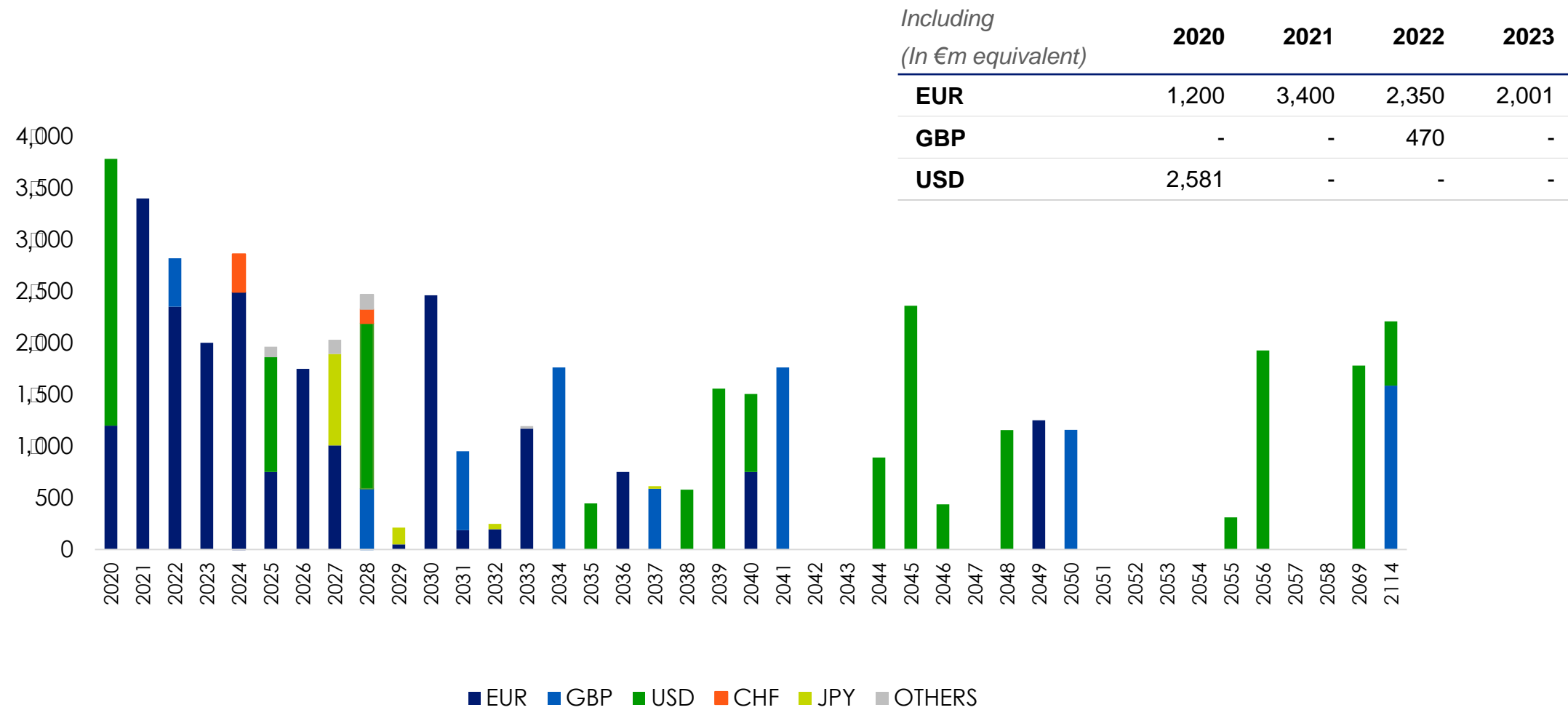
Breakdown by currency



(1) Mainly CHF, PLN, CAD and JPY  
(2) Bond issue of \$2bn

# BREAKDOWN OF BOND DEBTS BY CURRENCY

In millions of euros, before swaps



# MAIN OUTSTANDING BONDS AS OF 31 DECEMBER 2019 (1/2)

	Issue date <sup>(1)</sup>	Maturity	Nominal amount (in millions of currency units)	Currency	Coupon
	01/2010	01/2020	1,400	USD	4.60%
	05/2008	05/2020	1,200	EUR	5.38%
	10/2015	10/2020	1,500	USD	2.35%
	01/2009	01/2021	2,000	EUR	6.25%
Green Bond	11/2013	04/2021	1,400	EUR	2.25%
	01/2012	01/2022	2,000	EUR	3.88%
	09/2012	03/2023	2,000	EUR	2.75%
	09/2009	09/2024	2,500	EUR	4.63%
Green Bond	10/2015	10/2025	1,250	USD	3.63%
	11/2010	11/2025	750	EUR	4.00%
Green Bond	10/2016	10/2026	1,750	EUR	1.00%
	01/2017	01/2027	107,900	JPY	1.09%
	03/2012	03/2027	1,000	EUR	4.13%
	09/2018	09/2028	1,800	USD	4.50%
	04/2010	04/2030	1,500	EUR	4.63%
	10/2018	10/2030	1,000	EUR	2.00%

(1) Date of funds reception

# MAIN OUTSTANDING BONDS AS OF 31 DECEMBER 2019 (2/2)

Issue date <sup>(1)</sup>	Maturity	Nominal amount <i>(in millions of currency units)</i>	Currency	Coupon
07/2001	07/2031	650	GBP	5.87%
02/2003	02/2033	850	EUR	5.63%
06/2009	06/2034	1,500	GBP	6.13%
10/2016	10/2036	750	EUR	1.88%
09/2018	09/2038	650	USD	4.88%
01/2009	01/2039	1,750	USD	6.95%
11/2010	11/2040	750	EUR	4.50%
10/2011	10/2041	1,250	GBP	5.50%
01/2014	01/2044	1,000	USD	4.88%
10/2015	10/2045	1,500	USD	4.75%
10/2015	10/2045	1,150	USD	4.95%
09/2018	09/2048	1,300	USD	5.00%
12/2019	12/2049	1,250	EUR	2.00%
09/2010	09/2050	1,000	GBP	5.13%
10/2016	10/2056	2,164	USD	4.99%
11/2019	12/2069	2,000	USD	4.50%
01/2014	01/2114	1350	GBP	6.00%

(1) Date of funds reception

# FOCUS ON HYBRIDS SECURITIES

## Partial Hybrid Refinancing in November 2019

### TRANSACTION OBJECTIVES

- Refinancing of some existing lines
- Extending the average maturity of the portfolio of hybrid securities
- Reducing in average cost of hybrid securities portfolio

### OVERVIEW OF KEY ELEMENTS

- EDF early refinanced part of the hybrid securities:
- On 26 November 2019:
    - ✓ Issuance of new hybrid bonds with a buyback option in 2027 in the amount of €0.50bn
    - ✓ Launch of partial buyback operations on the lines of hybrid securities EUR 2022 for a purchased amount of €0.40bn <sup>(1)</sup> and USD 2023 for a purchased amount of \$0.90bn <sup>(2)</sup>
  - On 29 January 2020: EDF exercised its option to buy back its EUR 2020 hybrid stock for €0.34 billion
- All of these operations, recorded under shareholders' equity for €1.1 billion, brought the portfolio of hybrids to €9.2 <sup>(3)</sup> billion, i.e. a decrease in the portfolio of c. 9%.

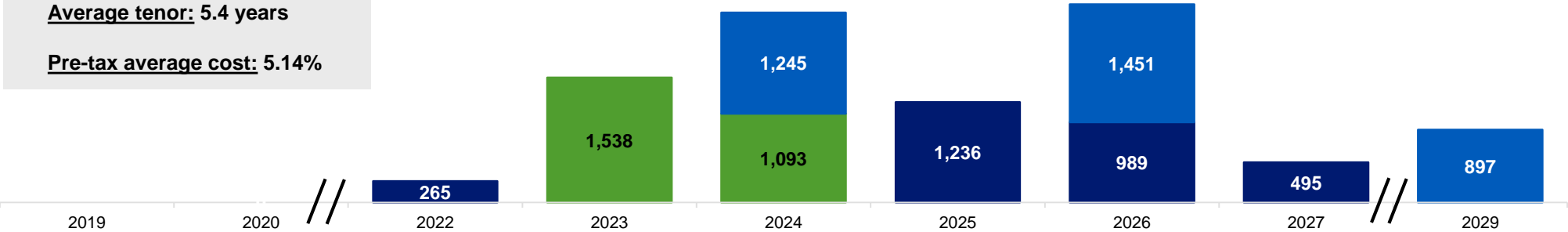
## Hybrid Securities Snapshot Following Refinancing, 31 December 2019 (EUR) <sup>(3)</sup>

**Total amount:** €9.2bn <sup>(3)</sup>

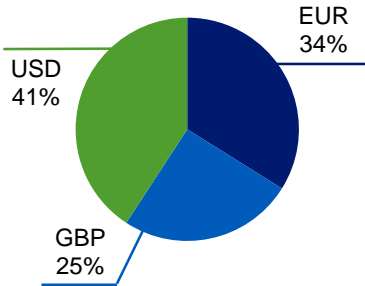
**Average tenor:** 5.4 years

**Pre-tax average cost:** 5.14%

Hybrid Debt Maturity Schedule Based On First Call Dates



By currency

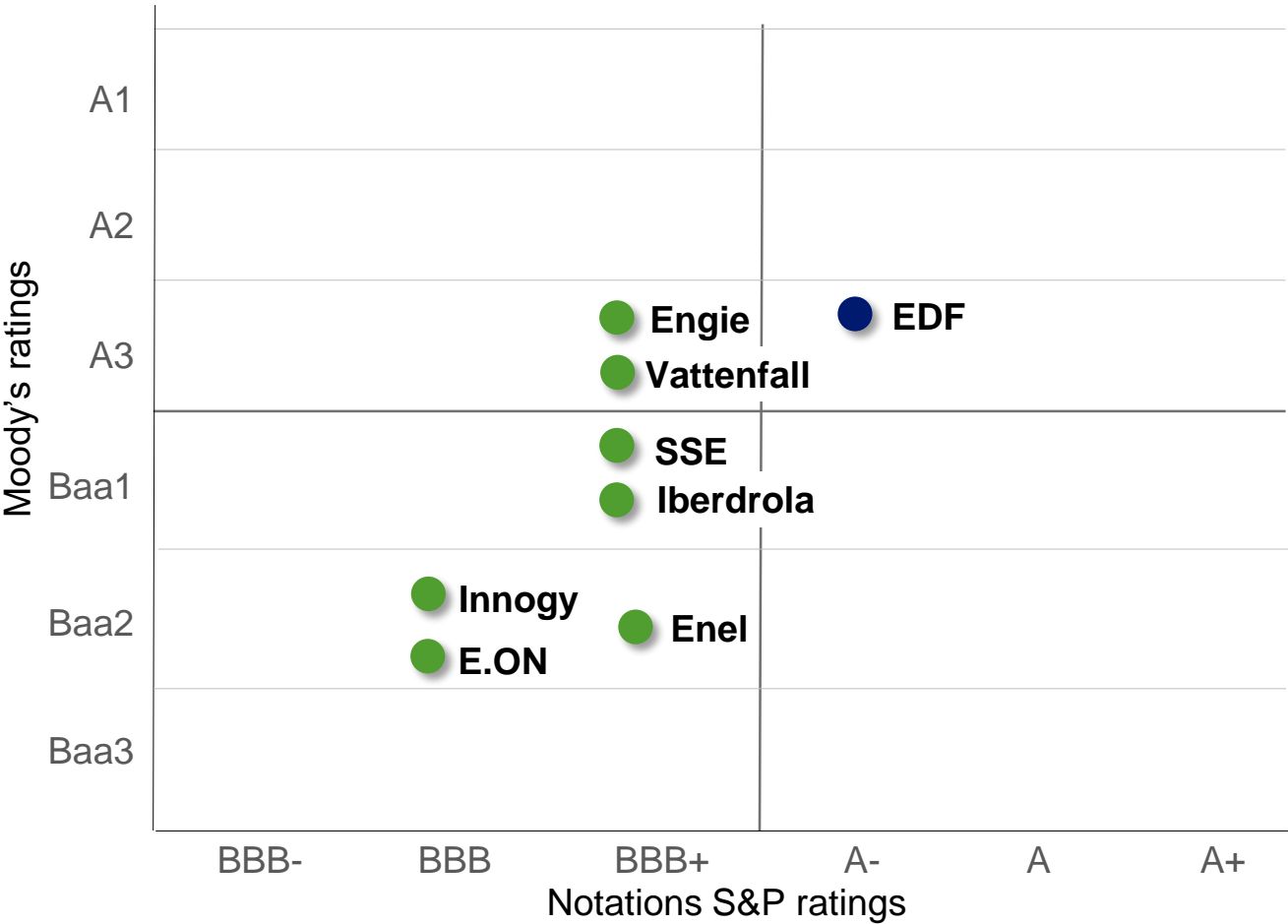


(1) Amount in circulation post-operation is approximately €0.27bn

(2) Amount in circulation post-operation: c. \$2.10bn

(3) Exchange rate as of transaction time

# COMPARATIVE CREDIT RATINGS



	S&P ratings	Moody's ratings	Fitch Ratings
EDF	A- negative <sup>(1)</sup>	A3 negative <sup>(2)</sup>	A- negative <sup>(3)</sup>
Engie	BBB+ stable	A3 stable	A stable
Vattenfall	BBB+ stable	A3 negative	n.d
SSE	BBB+ stable	Baa1 stable	BBB stable
Iberdrola	BBB+ stable	Baa1 stable	BBB+ stable
Enel	BBB+ stable	Baa2 positive	A- stable
Innogy	BBB stable	Baa2 stable	BBB+ stable
E.ON	BBB stable	Baa2 stable	BBB+ stable
Uniper	BBB negative	n.d.	n.d.
RWE	n.d	Baa3 positive	BBB stable

Sources: rating agencies as of 27/04/2020  
 (1) Update of the rating and outlook of EDF Group by S&P on 17 April 2020  
 (2) Update of the rating and outlook of EDF Group by Moody's on 24 April 2020  
 (3) Update of the rating and outlook of EDF Group by Fitch's on 22 April 2020

# GREEN BONDS: EDF'S COMMITMENTS

## EDF IS A LEADING ISSUER IN THE GREEN BOND MARKET

- **1st company** to issue a Green Bond in 2013
- **Active member** in the governance of **Green Bond Principles**
- **Co-founder** of the **Corporate Forum on Sustainable Finance**
- **2 updates to the Green Bond Framework** in order to help create market best practices

### GREEN BOND FRAMEWORK 2013

- **November 2013: 1<sup>st</sup> issue** of a Green Bond by EDF
  - **€1.4bn**, 7.5-year maturity
- **October 2015: 2<sup>nd</sup> issue**
  - **€1.25bn**, 10-year maturity

Construction of **new wind power and PV projects**

### GREEN BOND FRAMEWORK 2016

- **October 2016: 3<sup>rd</sup> issue**
  - **€1.75bn**, 10-year maturity
- **January 2017: 4<sup>th</sup> issue**, in 2 tranches
  - **¥19.6bn**, 12-year maturity
  - **¥6.4bn**, 15-year maturity

Construction of **new wind power and PV projects**

Modernisation and improvement of **existing hydropower facilities** in France

### GREEN BOND FRAMEWORK 2020

- **Applicable starting in January 2020**
- **Update of the Framework in line with the CAP 2030 strategy**

New generation projects in **renewable energies**

Modernisation and improvement of **existing hydropower facilities** in France and abroad

**Energy efficiency projects**

**Biodiversity preservation projects**



# EDF'S GREEN BOND FRAMEWORK FOLLOWS BEST MARKET PRACTICES AND GREEN BOND PRINCIPLES (GBP)

## 1 - USE OF FUNDS

- **Development of new renewable generation capacities**
- **Renovation and modernisation of existing hydroelectric assets** with the aim of:
  - improving their efficiency, flexibility and ability to contribute to meeting the needs of electricity systems that evolve as the share of intermittent means of generation increases in the energy mix,
  - adapting the existing hydropower assets to changes in climate.
- **Energy efficiency solutions** to allow all EDF customers to make better use of energy, mainly through its subsidiary Dalkia.
- **Biodiversity**, to enable EDF to continue to pursue its goal of having a positive impact on biodiversity, from simple prevention measures to measurable improvements.

## 4 – REPORTING

- **At half-yearly intervals**: allocation of funds
- **Annually**: allocation of funds + list of projects financed by the Green Bond and aggregated impacts (at the level of each green issue)

## 2 - PROJECT SELECTION PROCESS

- A **internal organisation** dedicated to the evaluating and ensuring that **only Eligible Projects** as defined in the Use of Funds section are eligible to receive **Green Bond financing**
- **Respect of specific environmental and social criteria**
- Investments may include:
  - **tangible or intangible assets**
  - **Investments** (including acquisitions mainly related to new developments/technologies)
  - **certain operating expenditures** such as R&D and investments in the maintenance of green assets

## 3 - FUND MANAGEMENT

- Funds are **managed and monitored separately** until they are allocated to eligible projects.
- They are invested in **SRI funds** until their allocation

## 5 – EXTERNAL REVIEW

- **External ex-ante opinion**: “**reasonable**” level of assurance delivered by **Vigeo Eiris** on EDF's Green Bond Framework (their highest level),
- **Ex-post certification**: annual report issued by an **external auditor** on the allocation of funds and the compliance of Green Bond issues with the Green Bond Framework and the Green Bond Principles.

# GREEN BONDS: PROCEEDS ALLOCATION

				Allocated funds as of 31/12/2019			
Issue date <sup>(1)</sup>	Maturity (in years)	Nominal amount (in millions of currency units)	Currency	Construction of new renewable capacity <sup>(2)</sup> (excluding hydro)	Renovation, modernisation and development of existing hydroelectric facilities <sup>(2)</sup>	Total (% of raised funds)	
Nov. 2013	7.5	1,400	EUR	1,400	<i>Not included in the « Use of Proceeds »</i>	<b>1,400</b>	(100 %)
Oct. 2015	10	1,250	USD	1,250	<i>Not included in the « Use of Proceeds »</i>	<b>1,250</b>	(100 %)
Oct. 2016	10	1,750	EUR	1,248	502	<b>1,750</b>	(100 %)
Jan. 2017	12	19,600	JPY	5,690	11,451	<b>17,141</b>	(87 %)
Jan. 2017	15	6,400	JPY	-	-	-	

## Green Bond Euro of October 2016 - 100 % of funds allocated

- ~3/4 dedicated to financing the construction of 9 wind and solar projects in the United States and Canada and 1 solar project in Mexico.
- ~1/4 dedicated to the financing of more than 800 renovation, modernisation and development operations on existing hydroelectric facilities in France.

## Green Bond YEN of January 2017 - 2/3 of funds allocated

- Allocation in 2019 of funds from January 2017 “Samurai” issues, up to 87% on the ¥19,600m line, i.e. 66% of the total of both lines, essentially on hydroelectric projects in France and in Belgium.
- Finalisation of the allocation of funds on all tranches issued scheduled for mid-2020

(1) Date of funds reception

(2) Since 2019, Green Bonds fund eligible investments of Luminus in Belgium : construction of wind farms and renovation of a hydropower plant

# GREEN BONDS: AVOIDED CO<sub>2</sub> EMISSIONS

Issue date	Funds raised	Funds allocated	Projects financed by the Green Bond	Part of the total investments financed by the Green Bond	Gross total capacity of GB funded projects (in MW)		Expected output (in TWh/year)		Expected avoided CO <sub>2</sub> emissions (in Mt/year)	
					Gross <sup>(1)</sup>	Net <sup>(2)</sup>	Gross <sup>(1)</sup>	Net <sup>(2)</sup>	Gross <sup>(1)</sup>	Net <sup>(2)</sup>
Nov. 2013	€1.4bn	€1.4bn	13 EDF Renewables projects <sup>(3)</sup>	59%	1,755	976	6.0	4.1	2.21	1.55
Oct. 2015	\$1.25bn	\$1.25bn	7 EDF Renewables projects <sup>(3,4)</sup>	58%	1,306	815	4.6	3.3	2.53	1.83
Oct. 2016	€1.75bn	€1.248m	10 EDF Renewables projects <sup>(4)</sup>	68%	1,788	1,354	6.7	5.2	3.19	2.54
		€502m	600 EDF Hydro operations	100% <sup>(5)</sup>	14,596	1,011	0.2 <sup>(6)</sup>	0.2 <sup>(6)</sup>	0.01 <sup>(6)</sup>	0.01 <sup>(6)</sup>
Jan. 2017	¥19.600bn	¥5.690bn	3 Luminus wind projects	41%	67	29	0.1	0.06	0.03	0.01
		¥11.451bn	206 EDF Hydro operations + 1 Luminus hydro project	83%	2,468	145	0.1	0.05	0.01	0.01

- Decrease of about 6% in CO<sub>2</sub> emissions from Green Bonds n°1 and 2 compared to emissions estimated at end-2018, due to lower network emission factors in the United States

- Share of Green Bond funded capacity owned by EDF at the end of Dec. 2019:

- Green Bond n°1 (Nov. 2013) : 39 %
- Green Bond n°2 (Oct. 2015) : 14 %
- Green Bond n°3 (Oct. 2016) : 91 %
- Green Bond n°4 (Jan. 2017) : 100 %

The detailed list of EDF Renewables projects and hydraulic investment operations by category published in the 2019 EDF URD document

- (1) Sum of the gross impacts of each project funded by the corresponding Green Bond  
 (2) Sum of the impacts of each project weighted by the share of total investment funded by the corresponding Green Bond  
 (3) Of which one project received funding from both Green Bonds of November 2013 and October 2015

- (4) Of which one project received funding from both Green Bonds of October 2015 and October 2016  
 (5) Share of investments funded by EDF taken in full, including half of Romanche-Gavet investment amount  
 (6) Only linked to additional output expected from development investments, including half of the additional output expected from the Romanche-Gavet project

# FINANCE

- HISTORIC DATA P. 196
- 2019 RESULTS & PERSPECTIVES P. 204
- FOCUS ON CREDIT P. 219
- **PROVISIONS & DEDICATED ASSETS P. 232**
- CSPE P. 248

# GROUP PROVISIONS

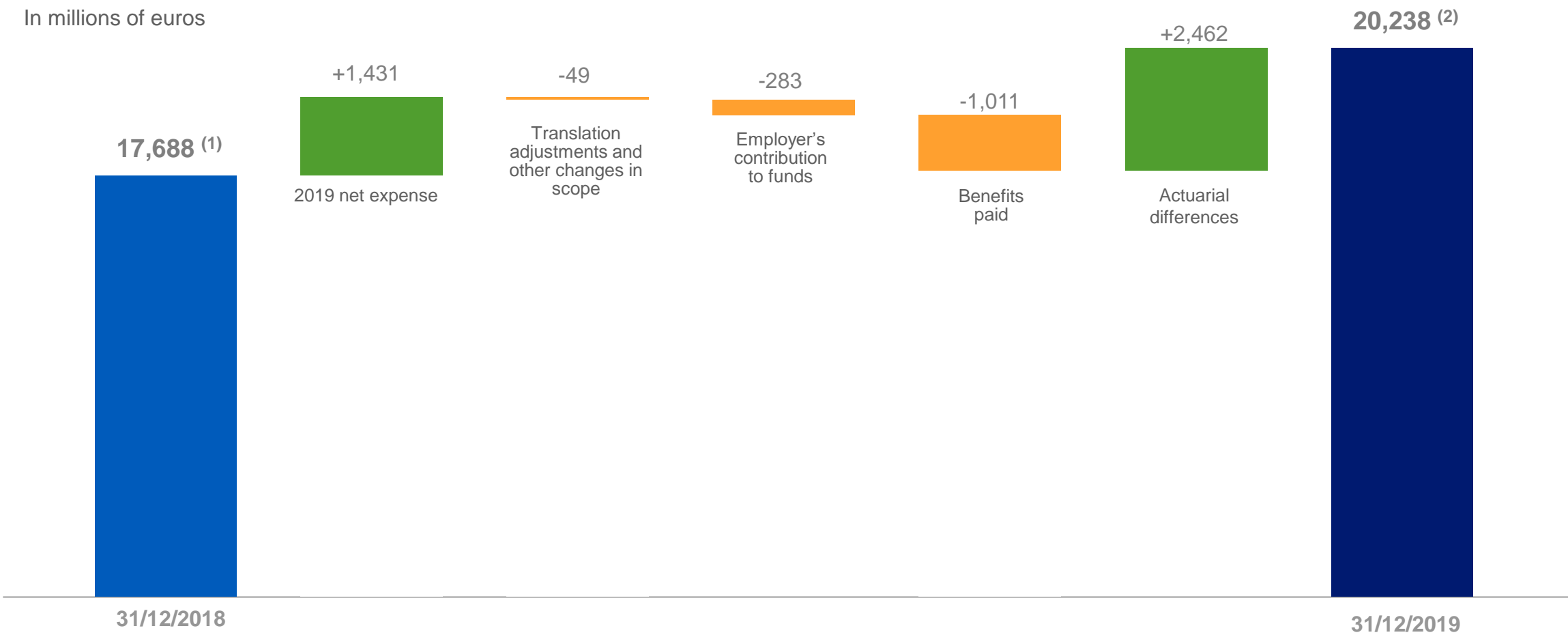
## 31 December 2018

In millions of euros	Current	Non Current	Total
Provisions for back-end nuclear cycle	1,515	22,362	23,877
Provisions for nuclear decommissioning and last cores	302	26,842	27,144
Other provision for decommissioning	91	2,033	2,124
Provisions for employee benefits	998	17,627	18,625
Other provisions	3,104	2,908	6,012
<b>Total Provisions</b>	<b>6,010</b>	<b>71,772</b>	<b>77,782</b>

## 31 December 2019

	Current	Non Current	Total
Provisions for back-end nuclear cycle	1,432	23,822	25,254
Provisions for nuclear decommissioning and last cores	363	31,762	32,125
Other provision for decommissioning	106	1,572	1,678
Provisions for employee benefits	945	20,539	21,484
Other provisions	2,710	3,065	5,775
<b>Total Provisions</b>	<b>5,556</b>	<b>80,760</b>	<b>86,316</b>

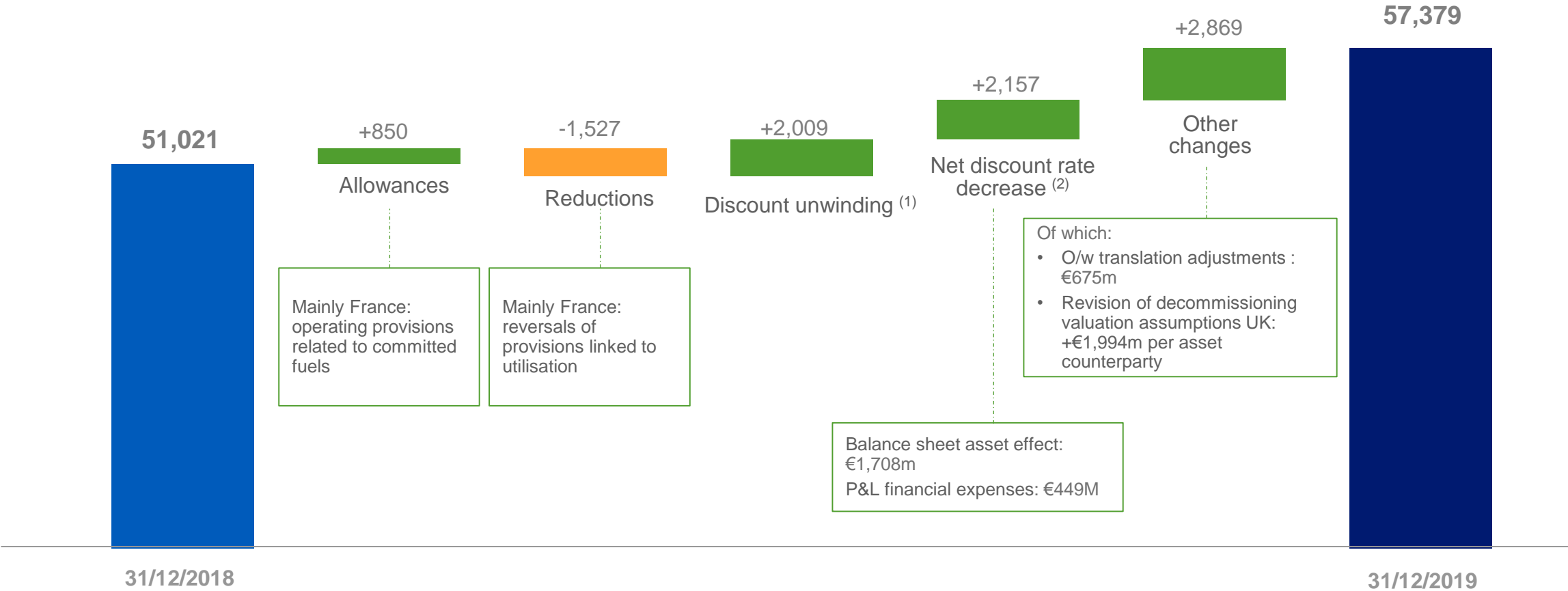
# GROUP PROVISIONS FOR EMPLOYEE BENEFITS: CHANGE IN NET LIABILITY



(1) Including: provisions for employee benefits €18,625m and non-current financial assets (€937m)  
(2) Including: provisions for employee benefits €21,484m and non-current financial assets (€1,246m)

# GROUP NUCLEAR PROVISIONS

In millions of euros



(1) Of which France (+€1,543m) and United Kingdom (+€456m)

(2) Effects of a change in net discount rate for France:

- for provisions with no related assets: impact on P&L
- for provisions with related assets (matching assets and underlying assets): impact on balance sheet



# FRANCE NUCLEAR PROVISIONS

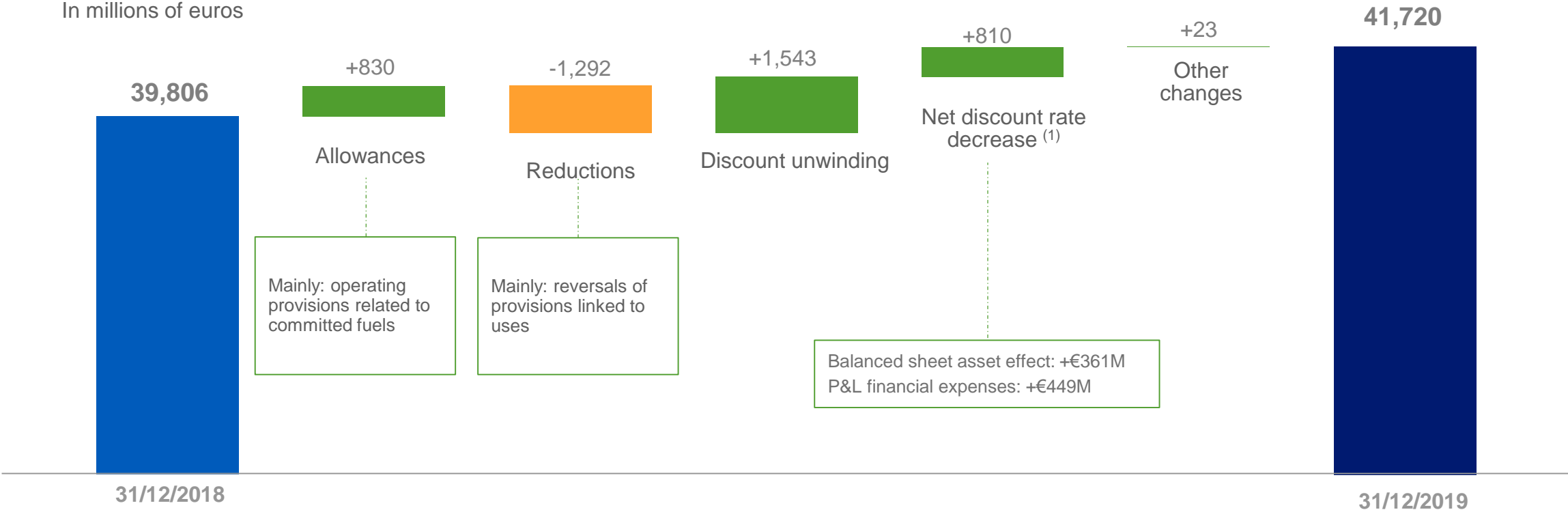
In millions of euros	31/12/2018	Net allowances	Discounting <sup>(1)</sup>	Other changes <sup>(2)</sup>	31/12/2019
<b>Total provisions for back-end nuclear cycle</b>	<b>21,295</b>	<b>(426)</b>	<b>1,201</b>	<b>89</b>	<b>22,159</b>
Provisions for management of spent fuel	10,698	(355)	515	(35)	10,823
Provisions for waste removal and conditioning	751	-	36	18	805
Provisions for long-term management of radioactive waste	9,846	(71)	650	106	10,531
<b>Total provisions for nuclear dismantling and last cores</b>	<b>18,511</b>	<b>(36)</b>	<b>791</b>	<b>295</b>	<b>19,561</b>
Provisions for dismantling power stations	15,985	(36)	694	294	16,937
Provisions for last cores	2,526	-	97	1	2,624
<b>TOTAL FRANCE NUCLEAR PROVISIONS</b>	<b>39,806</b>	<b>(462)</b>	<b>1,992</b>	<b>384</b>	<b>41,720</b>

NB: Regarding the allocation to Dedicated Assets for nuclear provisions coverage, please refer to the slide "Dedicated Assets" on [p.244](#)

(1) P&L financial expenses of which: cost of unwinding the discount: +€1,543 M and impact of actual discount rate change for provisions with no asset on the balance sheet: +€449 M

(2) Other changes include the changes in provisions with related assets (assets associated with provisions and underlying assets). These variations are not included in the income statement

# FRANCE NUCLEAR PROVISIONS



(1) Effects of a change in net discount rate for France:

- for provisions with no related assets: impact on P&L
- for provisions with related assets (matching assets and underlying assets): impact on balance sheet

# FRANCE NUCLEAR PROVISIONS: 2015-2019 CHANGES

	2015	2016	2017	2018	2019
Decommissioning costs plants in operation	<p>Conclusions of the external audit commissioned by the DGECE on the cost of dismantling published in January 2016 <sup>(1)</sup>, stating that the overall audit confirms EDF's estimate of the cost of decommissioning its nuclear fleet</p> <p>Three-year review of the cost assessment for dismantling first-generation plants to incorporate lessons learned from current sites.</p>	<p>Extensive revision of the cost estimate for the decommissioning of the plants in operation, taking into account the DGECE audit recommendations</p> <p>Limited changes of the cost estimate and related provisions: -€0.5bn <sup>(2)</sup></p>	<p>Having thoroughly revised the estimate, EDF continues to undertake an international comparison to back up its analyses taking care to take account of a number of factors that could distort direct comparisons. These include differences in the scope of the estimates or in the national (for example in France, this includes the number of plants) and regulatory contexts.</p> <p>Since its revision, the estimate has been subject to an annual review which, in 2017, 2018 and 2019, resulted in not-material adjustments.</p>		
Decommissioning costs closed plants	<p>Update to the industrial dismantling scenario for GCR reactors <sup>(3)</sup>:</p> <ul style="list-style-type: none"> <li>✓ Dismantling of the caissons (reactor buildings) in the open air, and no longer under water</li> <li>✓ Lessons learned from dismantling a first caisson before commencing operations on the five others</li> </ul> <p>Provisions increased by €0.3 billion</p>	<p>Update of the evaluation of the decommissioning costs of the 1st generation plants</p> <p>These annual studies confirm the changes previously made and do not lead to a significant change in the provisions.</p>	<p><b>GCR: Annual estimate review → non-material adjustments</b></p> <div> <div> <p>Independent expert review required by the French nuclear safety authority (ASN). EDF's main choices were ratified</p> <p>Hearing by the ASN college in June</p> <p>Strategy dossier, DOS <sup>(5)</sup> on the secure configuration and detailed 2017-2032 schedule sent at the end of December</p> </div> <div> <p>The ASN sent its main questions and conclusions on the UNGG strategy dossier. Dismantling in the air, advantage of industrial demonstrator and the schedule for the first dismantled reactor (Chinon A2) seem to be approved.</p> <p>Discussions continue on the schedule for dismantling the five other reactors.</p> </div> <div> <p>ASN draft decisions submitted for public consultation from July to November 2019.</p> <p>The ASN recognises the complexity of the operations to be carried out and the merits of the EDF risk control strategy. It calls for a slight acceleration of the work on the five reactors following the first series.</p> <p>Taking into account the decision projects → + € 105M in the IA decommissioning provisions.</p> </div> </div>		
Cost of the Cigéo project	<p>Cost of the Cigéo project set at €25bn <sup>(4)</sup> by the Ministerial Order <sup>(1)</sup>, which substitutes the 2005 estimated benchmark cost of €20.8bn on which EDF group used to rely.</p> <p>€0.8bn increase in provision</p>	Continuation of the design studies (ANDRA)		<p>Continued design studies (ANDRA)</p> <p>On 15<sup>th</sup> January 2018, the ASN gave its recommendation on the Cigéo DOS: satisfactory technological maturity, request for a study on an alternative for storing bituminous waste</p> <p>September 2018: expert group engaged by the French Directorate General of Energy and Climate (DGECE) to draw up an inventory of how bitumen is managed</p> <p>Application dossier to build the facility by 2019 (for a permit in 2022)</p>	<p>Continuation of design studies (ANDRA).</p> <p>The group of experts mandated in September 2018 concluded in September 2019 on the a priori feasibility of the various bitumen management options but stresses the importance of continuing the studies undertaken to identify the most appropriate option.</p> <p>ANDRA planning → request for the creation of CIGEO in 2020, industrial pilot phase by 2030, reception of the first waste packages maintained for 2031.</p>

(1) Please refer to the release from the French Ministry for Ecology, Sustainable Development and Energy from 15 January 2016

(2) Lower provision for counterparty of underlying assets

(3) GCR: Gas-cooled reactor

(4) At the economic conditions of 2011

(5) Safety Operations Record « Dossier sur les Opérations de Sûreté »

# DISCOUNT RATE OF NUCLEAR PROVISIONS IN FRANCE (1/4)

	December 2018	December 2019
Regulatory ceiling rate	4.0% <sup>(1)</sup>	3.8 % <sup>(2)</sup>
Taux d'actualisation nominal	3.9%	3.7%
Inflation	1.5%	1.4%

The discount rate resulting from the company's usual calculation method is 3.7% at 31 December 2019, taking into account an inflation assumption of 1.4%.

- The decrease in the real discount rate from 2.4% to 2.3% led to an increase in nuclear provisions of €810 million in 2019, with a corresponding increase of €449 million in financial expenses and €361 million in the increase in the value of balance sheet assets.

(1) 3.97 % rounded to 4,0 %

(2) 3.75 % rounded to 3.8 %

# DISCOUNT RATE OF NUCLEAR PROVISIONS IN FRANCE (2/4)

## REGULATORY CEILING

- **The discount rate** used for nuclear provisions in France must respect a **regulatory ceiling** calculated using a formula defined in the ministerial order of 29 December 2017.
- **The formula for the regulatory ceiling** is defined until 31 December 2026 as the weighted averages of a first term fixed at 4.3% and a second term corresponding to the arithmetical average over the last 48 months of the TEC 30 plus 100 basis points (1%). The weighting assigned to the first constant term of 4.3% decreases linearly from 100% at the end of 2016 to 0% at the end of 2026.
- The formula leads, **gradually over a period of 10 years**, from the regulatory ceiling observed at 31 December 2016 (4.3%), **to a ceiling that would equal, in 2026, the average, over the last four years, of the constant 30-year rate (TEC 30)**, plus 100 basis points.
- The application of the formula at 31/12/2019 leads to **a regulatory ceiling of the discount rate of 3.8%** (3.75% rounded to 3.8%).

# DISCOUNT RATE OF NUCLEAR PROVISIONS IN FRANCE (3/4)

## CONSEQUENCES

- On the basis of assumptions made for the TEC 30, the current formula may result in a **discount rate between 3.5% and 3.7% at the end of 2020**.
- All other things being equal, depending on discount rate and inflation rate assumptions, **the sensitivity to a decrease in the real discount rate of 0.2% (excluding the related tax effect) would be:**
  - On the balance sheet provision: €1,799 million (including €1,560 million <sup>(1)</sup> for provisions covered by dedicated assets)
  - On income before tax: €(1,025) million
- This increase in nuclear provisions, in particular those to be covered by dedicated assets, **in no way implies the direct transposition of this effect onto the Group's Net financial debt** on the dates under consideration, given that the amount to be allocated for each year may vary, particularly depending on:
  - the profitability of the dedicated assets and the resulting coverage rate (no need to allocate once the coverage rate has reached 110%)
  - the period within which the allocation is made, the regulations allowing ministers to set a maximum period of 3 years to make the allocation (Article 14 of the amended decree of 23 February 2007 and Article L594-5 of the French Environmental Code).

(1) Including €775m recorded against assets

# DISCOUNT RATE OF NUCLEAR PROVISIONS IN FRANCE (4/4)

## SENSITIVITY ANALYSIS OF THE DISCOUNT RATE

		Sensitivity to the discount rate				
<i>For a variation of 20 base points</i>		Provisions (discounted value)	On balance sheet provisions		On pre-tax earnings	
In millions of euros			+0.20 %	-0.20 %	+0.20 %	-0.20 %
Back-end nuclear						
Management of nuclear fuel	10,823	(228)	249	196	(215)	
Provisions for waste removal and conditioning	805	(25)	27	16	(17)	
Long-term management of radioactive waste	10,531	(659)	750	554	(636)	
Dismantling and last cores						
For decommissioning permanently shut-down nuclear plants	13,244	(506)	529	7	(7)	
For decommissioning nuclear plants in operation	3,693	(139)	150	139	(150)	
Last cores	2,624	(88)	94	-	-	
Total	41,720	(1,645)	1,799	912	(1,025)	

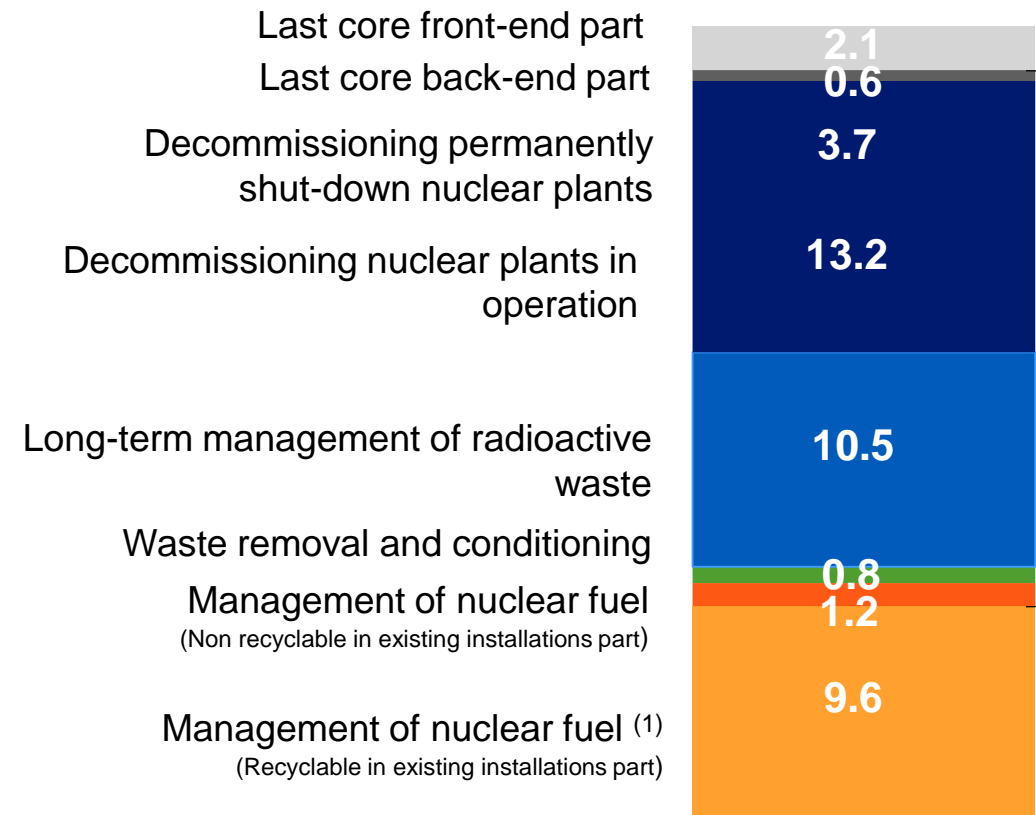


# PROVISIONS RELATED TO NUCLEAR GENERATION IN FRANCE

## PART TO BE COVERED BY DEDICATED ASSETS

In billions of euros

41.7



Total provisions related to nuclear generation in France

30.0

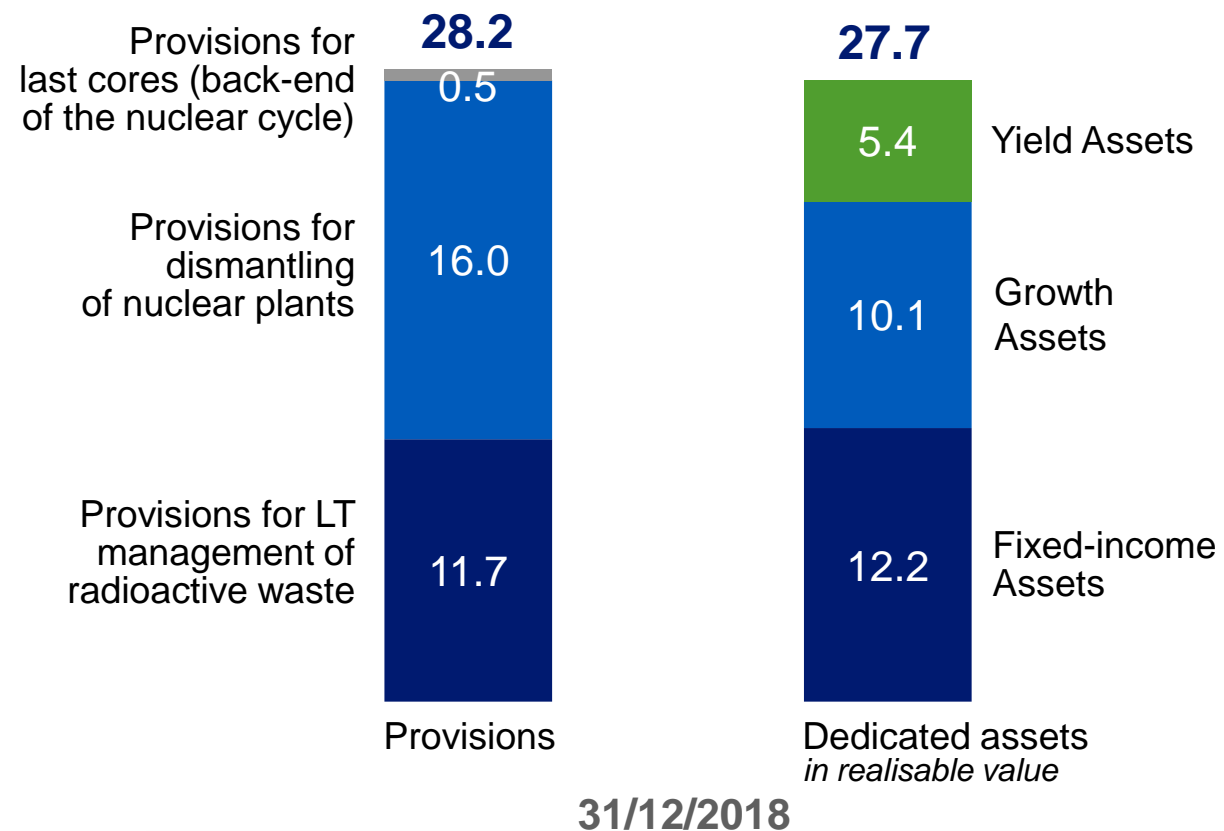


Long-term provisions related to nuclear generation in France to be covered by DA

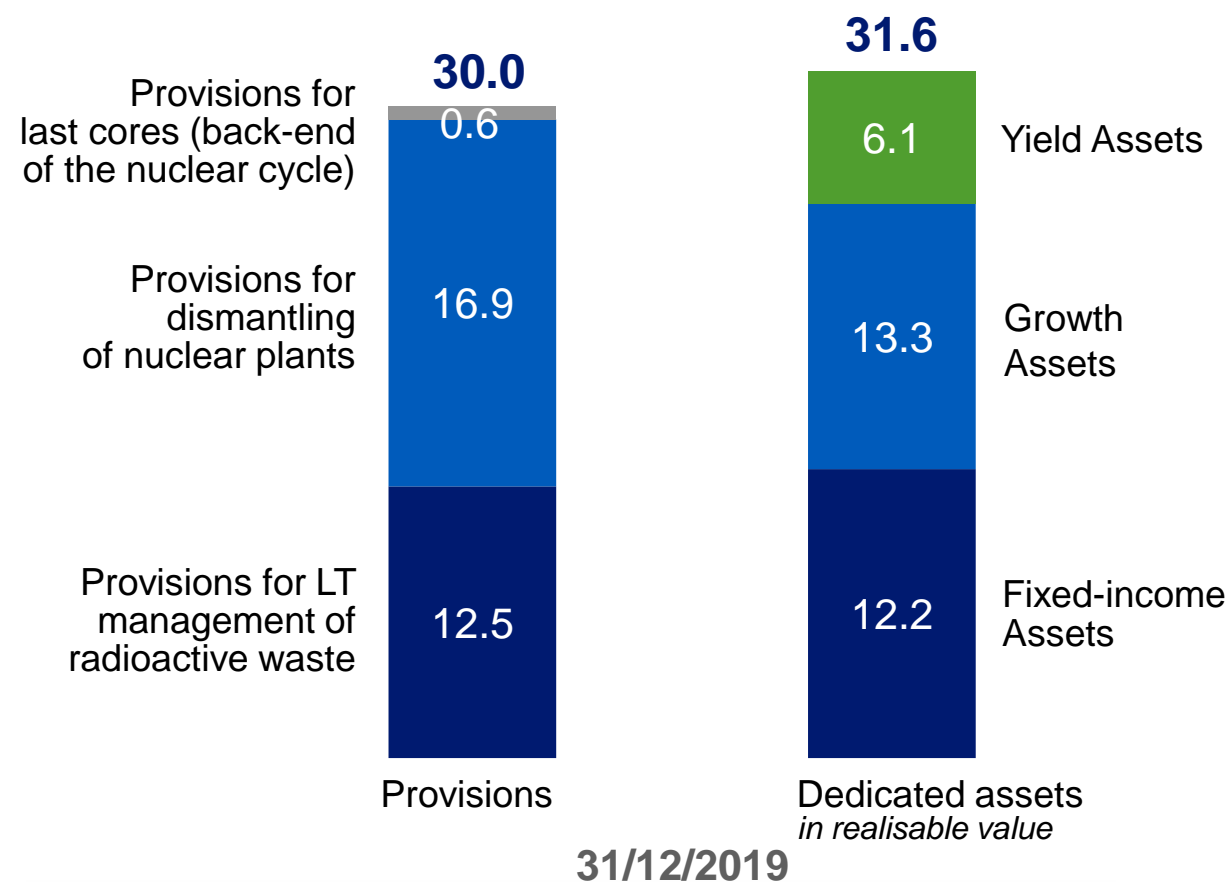
(1) Related to the operating cycle

# EDF SA DEDICATED ASSETS

In billions of euros



- At 31 December 2019, the regulatory coverage ratio for nuclear liabilities eligible for EDF's dedicated assets was 105.5%, versus 98.3% at 31 December 2018.



- The 2020 allocation to dedicated assets amounts to €797 million.

# PERFORMANCE OF EDF SA DEDICATED ASSETS (1)

YIELD ASSETS:  
+8.9%

Yield assets are made of **real estate and infrastructure assets**. In 2019, these assets generated **dividends consistent with expectations**, both in the diversified scope of infrastructure and in real estate assets held in Europe.

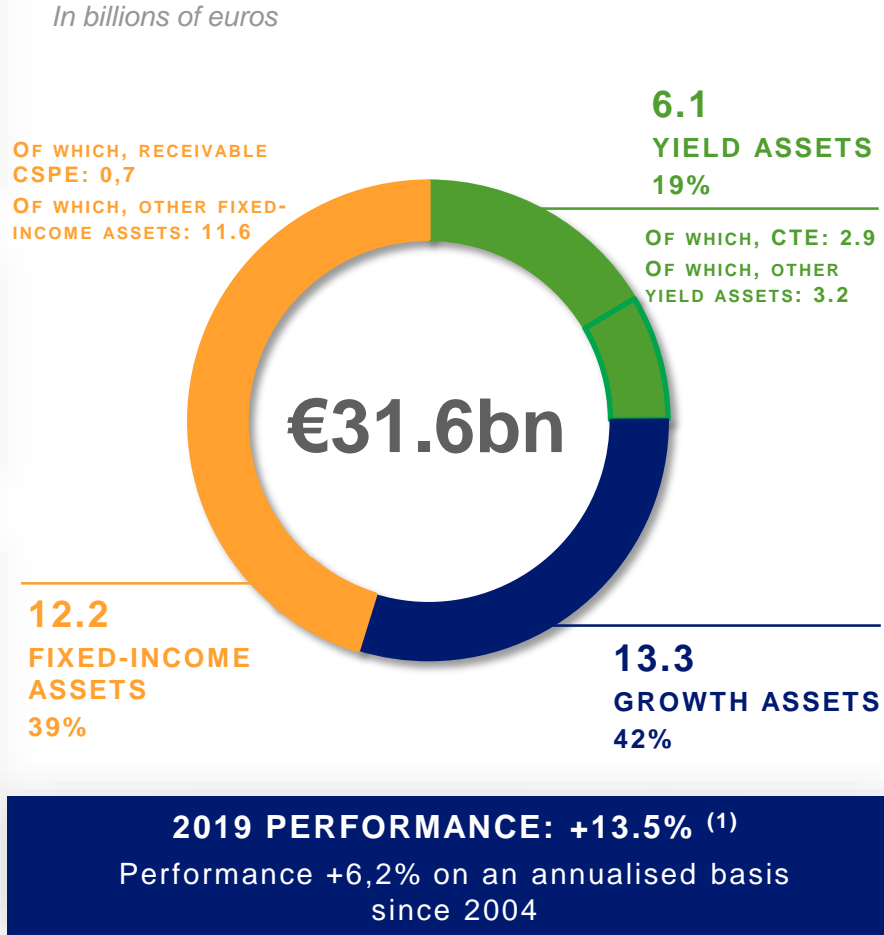
GROWTH ASSETS:  
+25.9%

**Listed portfolio rose by +26.3%** thanks to strong increase in equity markets. However, the portfolio risk has been contained – below market risk – **thanks to the significant allocation of low-volatility funds**. The unlisted growth funds have also given a very satisfactory performance of +9.3%.

FIXED-INCOME ASSETS:  
+5.2%

**The fixed-income portfolio performed very well** in a bearish interest rate environment. **Listed bonds rose by +6.1%**. Unlisted interest-rate funds also recorded an increase of +9.3%, while the receivables and short-term portfolio, consisting mainly of the CSPE receivable, grew by +0.4%.

The CSPE (contribution to electricity public service) debt was reimbursed in accordance with the provisional schedule: €1,353 million in repayment of principal was received in 2019, and reinvested in accordance with the strategic allocation, with the last annual instalment to be repaid in 2020.



(1) Pre-tax, non-annualised performance

# EDF INVEST, THE INVESTMENT PLATFORM FOR NON-LISTED ASSETS

## MANAGEMENT OF DEDICATED ASSETS...

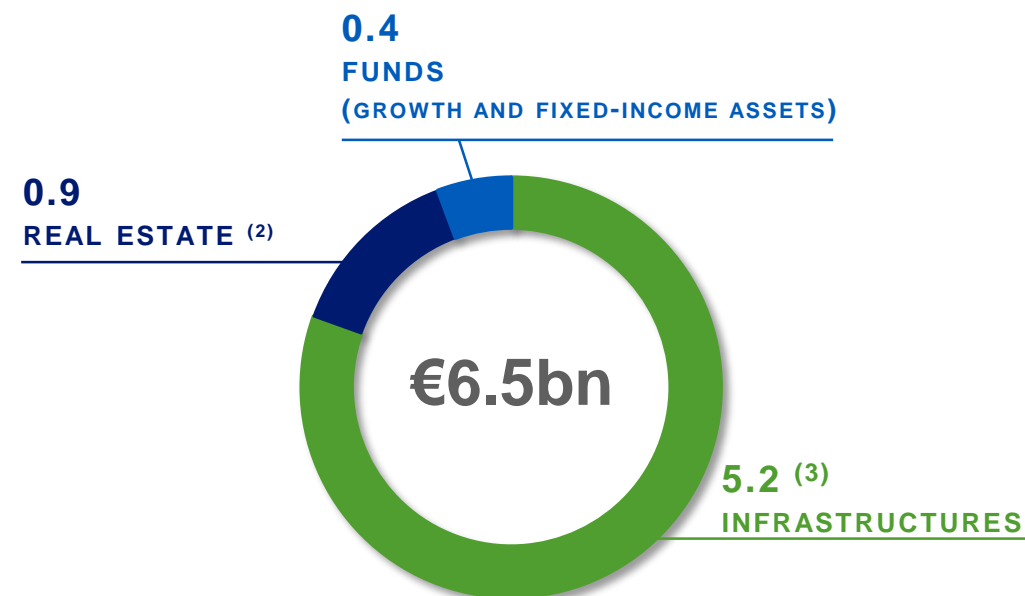
- EDF Invest is **the unlisted investment arm of EDF's Dedicated Assets** ; this portfolio amounts to **6.5 billion euros at 31 December 2019**
- Among Dedicated Assets, unlisted assets contribute to yield assets, growth assets and fixed-income assets: they are invested in Infrastructure, Real Estate and other Funds
- Such unlisted assets are key to improve the Dedicated Assets return / risk profile and are consistent with the long-term nature of provisions to be covered

## ...FOR A DIVERSIFIED PORTFOLIO

- EDF Invest aims at **raising the amount of the non-listed assets portfolio up to the reference target** fixed in the Strategic allocation defined in June 2018.
- In 2019, EDF Invest diversified its portfolio with **the addition of significant infrastructure in energy** (hydro, solar and wind) for 540 million euros

## PORTFOLIO BREAKDOWN AT DECEMBER 31<sup>ST</sup> 2019

In billions of euros



(1) The global portfolio of 6.5 billion euros include yield assets for 6.1 billion euros, growth assets for 0.3 billions euros and fixed-income assets for 0.1 billion euros

(2) Including funds

(3) Including CTE: €2.9bn

# GRADUAL EVOLUTION OF THE STRATEGIC ALLOCATION

- A new strategic allocation was defined in 2018 to improve the fit of the dedicated assets portfolio with the long-term nature of the disbursements to be hedged.

- The targets of the new allocation will be achieved progressively according to the investments, involving a gradual rebalancing of rate assets towards yield assets.

Allocation at 31 December 2019

Target strategic allocation

**Fixed-income assets**

*Bonds, Debt Fund  
Receivables, Cash*  
**~39%**  
(~44% in 2018)

**Yield Assets**

*Infrastructures,  
Real Estate*  
**~19%**  
(~ 19% in 2018)

**Growth assets**

*Equities, Equity funds*  
**~42%**  
(~37% in 2018)

**Fixed-income assets**

*Bonds, Debt Fund  
Receivables, Cash*  
**30 %**

**Yield Assets**

*Infrastructures,  
Real Estate*  
**30 %**

**Growth assets**

*Equities, Equity funds*  
**40 %**

Strengthening the share of  
yield assets

# FINANCE

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# PUBLIC SERVICE COSTS (1/4): STABLE MECHANISM FOR COMPENSATING PUBLIC SERVICE COSTS AND TAXES SINCE 2016

- The 2015 amended French finance act and the 2016 French finance act introduced the principles of a new mechanism for compensating energy public service costs, effective as of 1 January 2016, with the following specific characteristics:
  - The French government budgets the public service costs for energy (electricity and gas) which are still calculated by the French Energy Regulatory Commission (CRE) and divided into two accounts: the "Energy Transition" special purpose account and the "Public Energy Service" account in the French general budget. The 2019 French finance act allocates €6,310 million to the special purpose account (for all operators), funded mainly by the French domestic tax on fuel and diesel (TICPE), and €2,673 million (for all operators) to the general budget.
- As of 1 January 2017, the French government compensates for the cost of purchase obligation contracts, in accordance with the principle of full compensation of costs incurred by operators (€50 million a year).
- Repayment by the end of 2020 of EDF's historical compensation deficit, in accordance with the Ministers' letter of 26 January 2016, enacted in the Decree of 18 February 2016 and the Orders of 13 May and 2 December 2016.
- The CSPE (French contribution to electricity public service) tax is no longer automatically increased (+ €3/MWh per year between 2013 and 2016). It has remained stable at €22.5/MWh since 2016 (full rate). Since early 2017, the tax is paid into the French general budget and not the Energy Transition special purpose account, as was the case in 2016.



# CSPE (2/4) : CHARGES FOR EDF

Article L121-6 of the Energy Code stipulates that the charges attributable to the public service tasks assigned to the electricity operators are fully compensated by the State

In millions of euros	2017		2018		2019	
Purchase obligations <sup>(1)</sup>	4,681	71 %	4,856	74 %	5,699	74 %
Other <sup>(2)</sup>	1,866	29 %	1,698	26 %	1,963	26 %
<b>Total EDF CSPE</b>	<b>6,547</b>	<b>100 %</b>	<b>6,554</b>	<b>100 %</b>	<b>7,662</b>	<b>100 %</b>

Increase in public service costs in 2019, largely due to two factors:

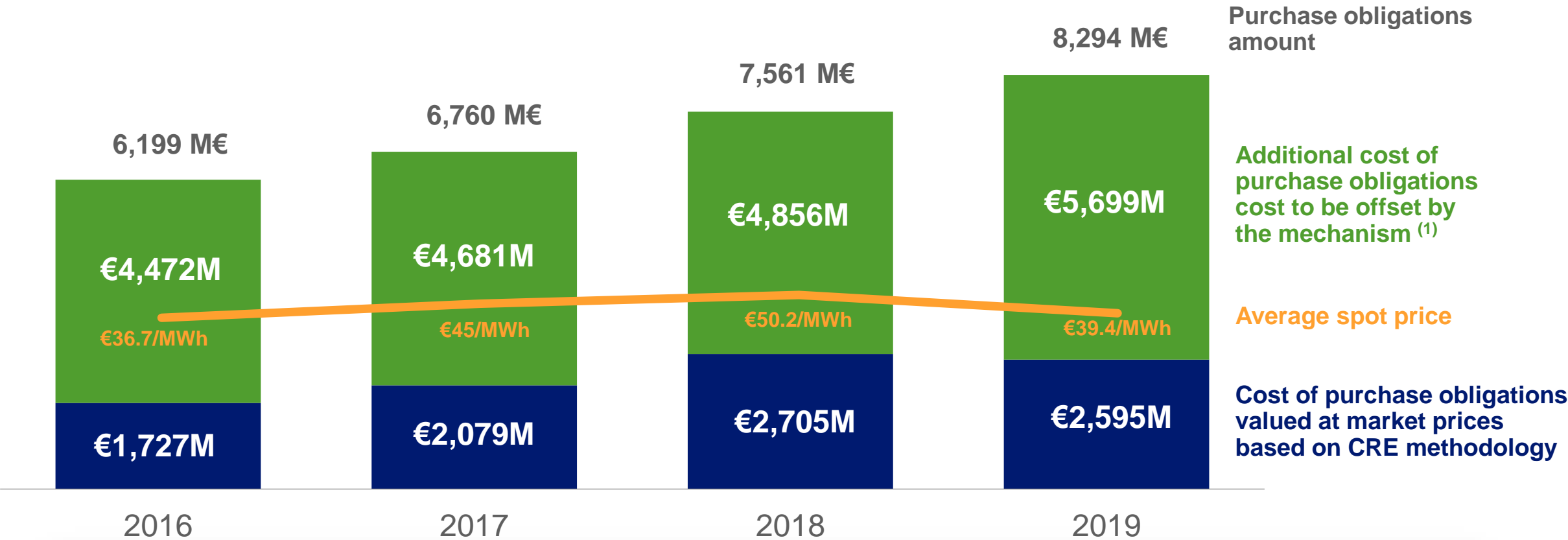
- The increase in purchase obligation costs in mainland France in 2019 is linked to the favourable weather conditions for wind and photovoltaic generation, as well as to the development of the renewable generation fleet in France. This increase in volumes was accompanied by a drop in spot electricity market prices of €10.8/MWh observed between 2018 (€50.2/MWh) and 2019 (€39.4/MWh), a drop in spot prices which, similar to the volume effect, increased costs by amplifying the gap between the price of the purchase obligation and its valuation on the wholesale market.
- The costs associated with ZNI<sup>(3)</sup> also increased compared to 2018, due, on the one hand, to the higher cost of energy purchases in 2019 due to the lower availability of SEI power plants, which would require the use of additional fossil fuel-fired generation facilities in a context of rising CO<sub>2</sub> prices, and, on the other hand significant energy demand management (EDM) expenses in 2019.

(1) Purchases obligations include electricity generated from: hydropower (less than 12MW), biomass, wind power, PV power, cogeneration, recovery of household waste and energy recovery, with the exception of ZNI <sup>(3)</sup>

(2) Additional generation costs and purchase obligations in ZNI<sup>(3)</sup>, the TPN (First Necessity Tariff) and the FSL (Housing Solidarity Fund)

(3) ZNI: Zones non interconnectées corresponding to overseas departments and Corsica and some of the Breton islands

# CSPE (3/4): CHANGE IN PURCHASE OBLIGATIONS IN MAINLAND FRANCE FOR EDF



**Principle:** The compensation mechanism of public energy services <sup>(2)</sup> charges offsets the difference between the cost of purchase obligations in mainland France and market prices

(1) EDF SA excluding island activities  
(2) The compensation mechanism of public energy services charges also covers the tariff equalization costs in the ZNI (*Zones Non Interconnectées*), and the solidarity programs.

# CSPE (4/4): OVERALL REIMBURSEMENT SCHEDULE <sup>(1)</sup>

Repayment of the compensation deficit in accordance with the Decree of 2 December 2016 adopted pursuant to Article 4 of the Decree of 13 May 2016, adopted pursuant to Article R. 121-31 of the French Energy Code:

- Confirmation of the debt due to EDF and recognised by the French government at end-2015 at €5.9 billion, including the deficit recorded up to 2015 and related interest, and confirmation of the repayment schedule to 2020
- The annual payment and related interest (1.72%) will first be offset against EDF's other costs, in accordance with Article R. 121-33 of the French Energy Code

In millions of euro	Compensation deficit remaining due at 31 December of year N (excluding 2015 interest)	Repayment of the principal of the above deficit by the special purpose account (overall portion)	Repayment of the principal of the above deficit by the special purpose account <sup>(1)</sup>	Payment of future interest related to the above deficit by the French general budget (overall portion)	Payment of related future interest by the French general budget <sup>(1)</sup>
2015	5,779.8	-	-	-	-
2016	5,585.8	194.0	194.0	99.3	99.3
2017	4,357.8	1,228.0	903.8	99.5	73.2
2018	2,735.8	1,622.0	1,193.8	87.2	64.2
2019	896.8	1,839.0	1,353.5	62.5	46.0
2020	-	896.8	660.0	40.6 <sup>(2)</sup>	29.9 <sup>(3)</sup>
<b>Total</b>	<b>-</b>	<b>5,779.8</b>	<b>4,305.1</b>	<b>389.1</b>	<b>312.6</b>

The payment schedule remains unchanged: the only change since 2017 is the fact that EDF now receives only 73.6% of the payments from the French government, with the remaining 26.4% being paid to Société Générale and the Common Securitisation Fund to which part of the financial debt was transferred at end-2016.

Repayment of 2016 to 2019 annual payments were made by the French government as per the schedule. At end-December 2019, the French government paid EDF €1,353.5 million from the purpose account provided for the principal amount of the financial debt for 2019. In addition, the French government paid EDF €46 million from the French general budget in respect of interest on the 2019 debt. At end-2019, the French government still owes EDF €684 million, including €660 million in principal and €24 million in accrued interest not yet due.

<sup>(1)</sup> EDF now holds only 73.6% of the debt since the December 2016 sale, and therefore receives 73.6% of the scheduled payment flows

<sup>(2)</sup> Of which €32.3 million due for 2019 and €8.3 million due for 2020

<sup>(3)</sup> Of which €23.8 million due for 2019 and €6.1 million due for 2020



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# GREAT BRITAIN CAPACITY AUCTION RESULTS FOR EDF ENERGY <sup>(1)</sup>

All capacity agreements for 1 year unless otherwise stated

	Clearing price £/kW/year	Nuclear	Coal	CCGT <sup>(2)</sup>	OCGT <sup>(3)</sup>	Battery	Demand-Side Response (DSR)
2017 Q-1 (2017/2018)	6.95 (no indexation)	All 16 units (7.9GW)	All 8 units (3.5GW)	All 3 units (1.2GW)	All 2 units (38MW)	N/A	2 units (9.6MW)
2014 Q-4 (2018/2019)	19.4 (2012/2013 prices)	All 16 units (7.9GW)	7 of 8 units <sup>(4)</sup> (3.1GW)	All 3 units (1.2GW)	All 2 units (37MW)	N/A	N/A
2018 Q-1 (2018/2019)	6.0 (no indexation)	N/A	1 unit (0.4GW)	N/A	N/A	1 unit (10.5MW) <sup>(5)</sup>	2 units (12.8MW)
2015 Q-4 (2019/2020)	18.0 (2014/2015 prices)	All 16 units <sup>(6)</sup> (7.6GW)	0 unit	All 3 units (1.2GW)	All 2 units (37MW)	N/A	N/A
2016 Q-4 (2020/2021)	22.5 (2015/2016 prices)	All 16 units (7.9GW)	3 of 8 units (1.3GW)	All 3 units (1.2GW)	All 2 units (38MW)	1 unit <sup>(7)</sup> (47MW)	N/A
2018 Q-4 (2021/2022)	8.4 (2016/2017 prices)	All 16 units (7.9GW)	0 unit	All 3 units (1.2GW)	0 unit	N/A	5 units (32.1MW)
2020 Q-3 (2022/2023)	6.4 (no indexation)	12 units (5.9GW)	0 unit	All 3 units (1.2GW)	0 unit	N/A	0 unit

*The slide includes capacities that agreements were awarded for (de-rated capacity)  
For DSR this equates to bidding capacities*

(1) Following a judgment by the General Court of the Court of Justice of the European Union which removed the European Commission's State aid approval of Great Britain's Capacity Market (CM) on 15 November 2018, the UK Government has suspended the operation of the scheme until the scheme can be reapproved.

(2) Combined Cycle Gas Turbine

(3) Open Cycle Gas Turbine

(4) 3 year refurbishing agreements that were reverted to 1 year agreements

(5) Battery further de-rated to 21% from 96%

(6) T-4 2015 had a lower total connection capacity for Nuclear units

(7) 15 year capacity agreement for new build battery

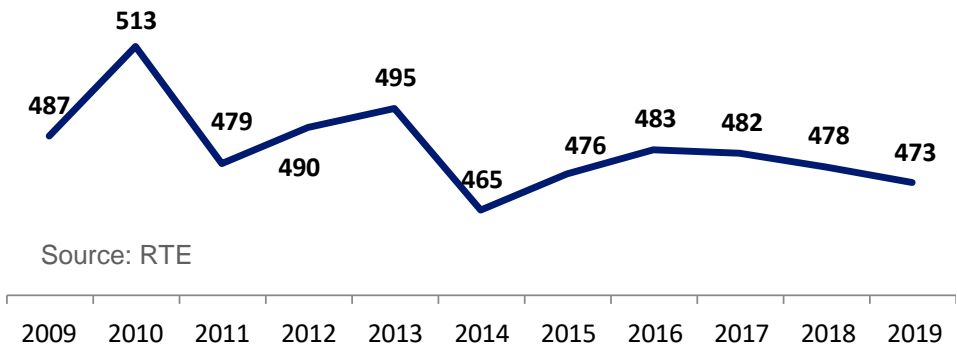
N/A: Not applicable

# MARKETS: ELECTRICITY CONSUMPTION

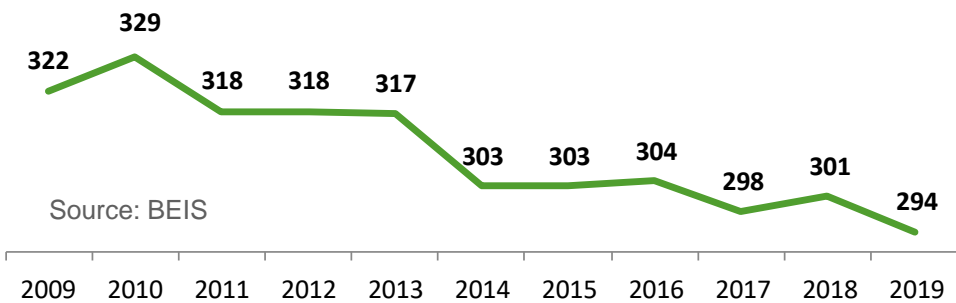
(DATA NOT ADJUSTED FOR WEATHER AND CALENDAR)

In TWh

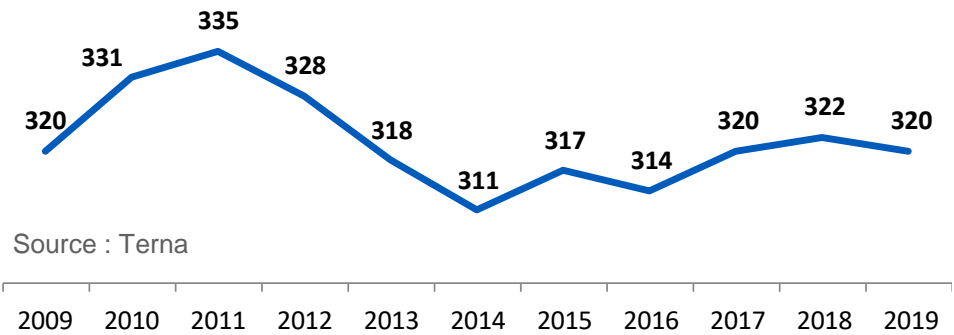
## France



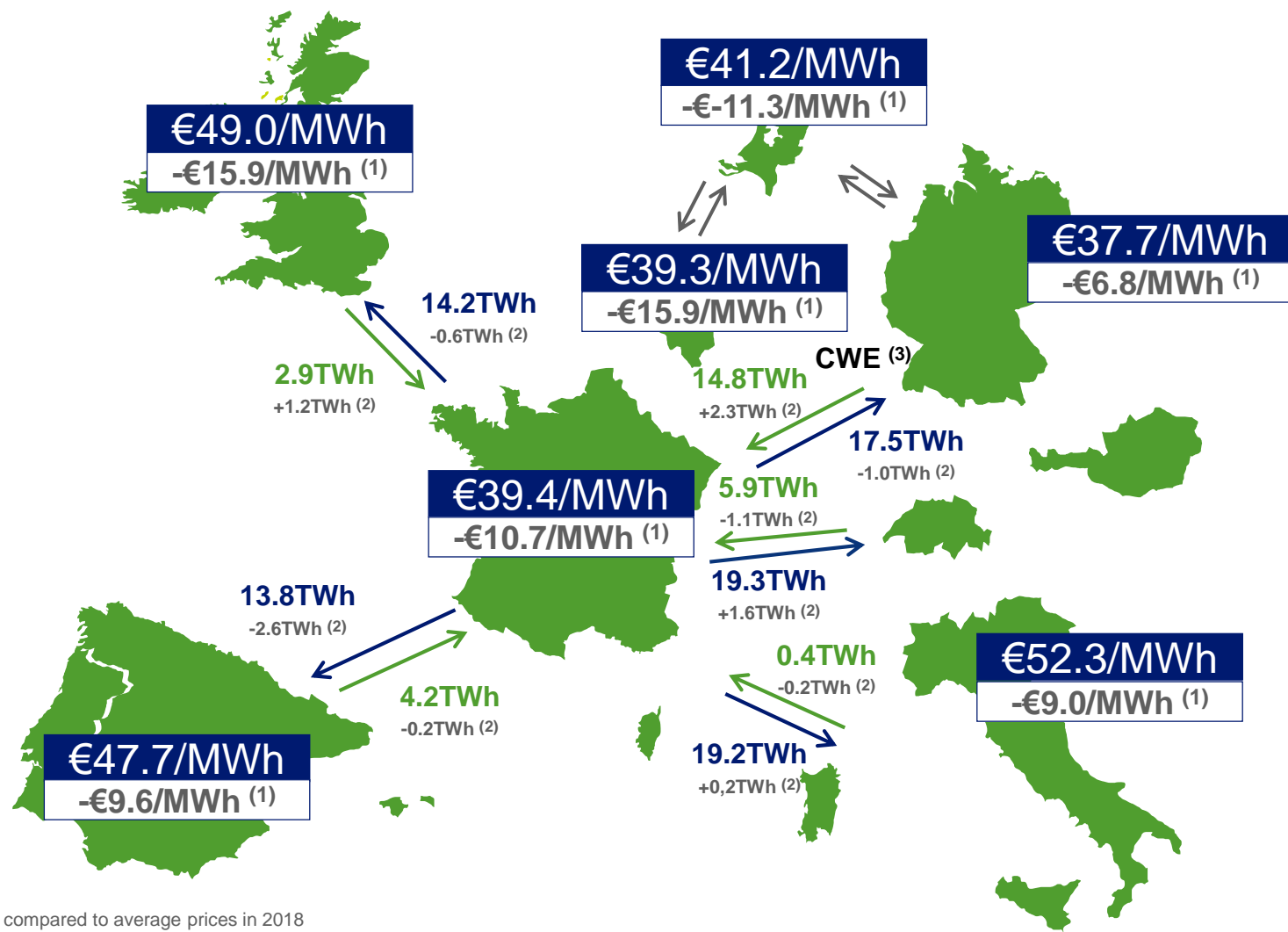
## The United Kingdom



## Italy



# AVERAGE SPOT PRICES IN 2019



Spot prices are declining across Europe due to a less tight supply-demand balance and to historically low gas prices:

- A greater production in renewables and milder temperatures than 2018 contributed to drive the spot prices down across Europe;
- A sharp decrease in gas spot prices in the spring owing to mass arrivals of LNG, drawing prices downwards in countries where gas resources are frequently marginal, such as the UK, Spain and Italy.

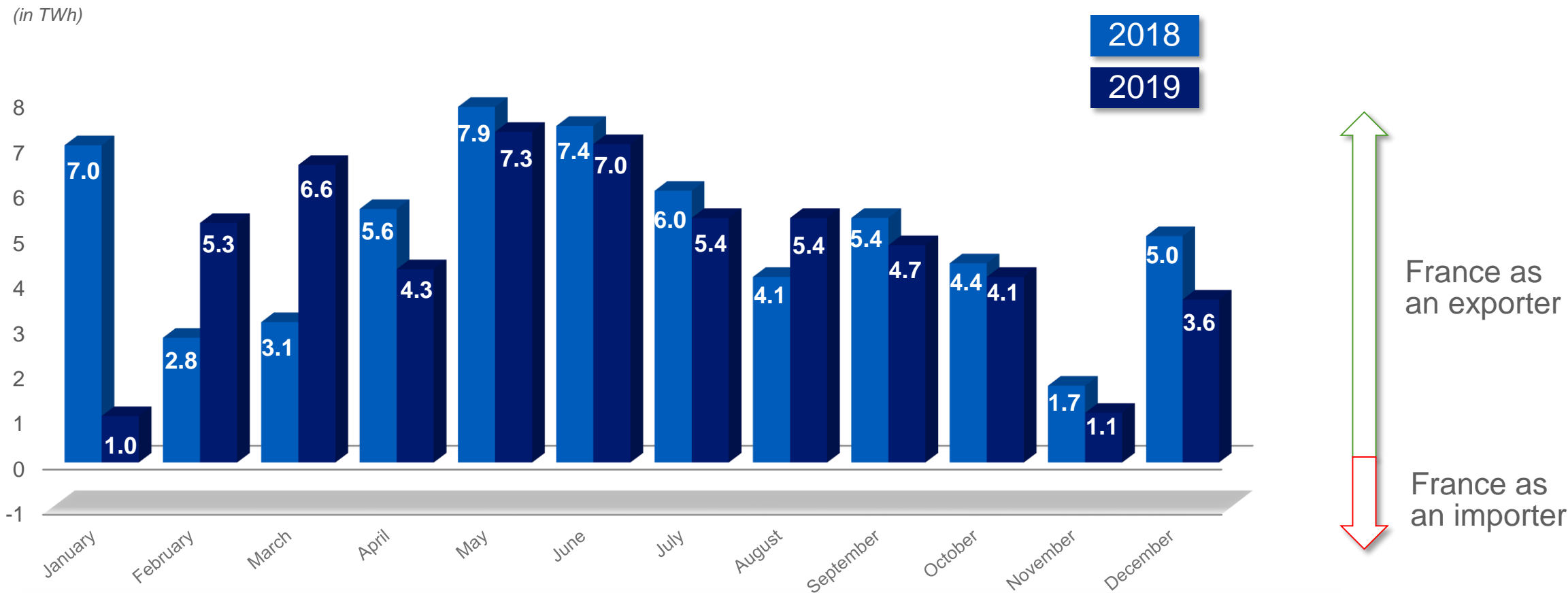
Market coupling remains limited by available cross-border capacities

Average observed spot market price for 2019:

- EPEXSPOT: France & Germany
- N2EX: United-Kingdom
- OMIE: Spain
- GME: Italy (Prezzo Unico Nazionale)
- APX: Netherlands
- BELPEX: Belgium



# CROSS-BORDER ELECTRICITY TRADE BALANCE



France's export balance came out at 55.8TWh in 2019 (-4.4TWh vs. 2018). Exports were indeed down (-2.4TWh vs. 2018), while imports increased (+2.0TWh vs. 2018). In 2019, France was a net exporter across all borders: +18.9TWh to Italy, +11.2TWh to the UK, +9.6TWh to Spain, +13.3TWh to Switzerland and +2.7TWh to CWE

Source: RTE, except for December 2019 that comes from ENTSO-E

# FRENCH POWER TRADE BALANCES AT ITS BORDERS

in TWh <sup>(1)</sup>		2018					2019				
		Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
CWE <sup>(2)</sup>	exports	2.6	7.7	5.3	3.0	18.5	2.3	6.7	5.1	3.4	17.5
	imports	6.3	1.5	1.7	2.9	12.4	6.0	2.3	2.1	4.9	14.8
	balance	-3.7	6.1	3.6	0.0	<b>6.1</b>	- 3.6	4.7	3.2	-1.5	<b>2.7</b>
United Kingdom	exports	3.8	3.7	3.8	3.5	14.7	4.0	3.1	3.8	3.4	14.2
	imports	0.2	0.3	0.5	0.8	1.8	0.4	0.4	1.1	1.0	2.9
	balance	3.59	3.39	3.31	2.68	<b>13.0</b>	3.6	2.7	2.6	2.4	<b>11.2</b>
Spain	exports	4.0	4.9	4.7	2.9	16.4	4.9	3.6	3.0	2.3	13.8
	imports	1.6	0.4	0.6	1.9	4.4	1.1	0.3	0.4	2.3	4.1
	balance	2.4	4.5	4.1	1.0	<b>12.0</b>	3.9	3.3	2.6	0.0	<b>9.7</b>
Italy	exports	5.8	4.8	4.3	4.2	19.1	5.2	4.6	4.8	4.6	19.2
	imports	0.1	0.0	0.1	0.3	0.5	0.1	0.0	0.0	0.2	0.4
	balance	5.7	4.8	4.2	3.9	<b>18.5</b>	5.1	4.6	4.8	4.4	<b>18.9</b>
Switzerland	exports	6.3	4.2	2.3	4.8	17.6	5.4	4.8	4.2	4.9	19.3
	imports	1.4	2.1	2.1	1.3	7.0	1.4	1.3	1.8	1.4	5.9
	balance	4.9	2.0	0.2	3.4	<b>10.6</b>	4.0	3.5	2.4	3.5	<b>13.3</b>
TOTAL	exports	22.5	25.2	20.4	18.3	<b>86.3</b>	21.7	23.0	21.0	18.6	<b>83.9</b>
	imports	9.6	4.4	4.9	7.2	<b>26.1</b>	8.8	4.3	5.4	9.8	<b>28.1</b>
	balance	12.9	20.8	15.5	11.1	<b>60.2</b>	12.9	18.7	15.6	8.8	<b>55.8</b>

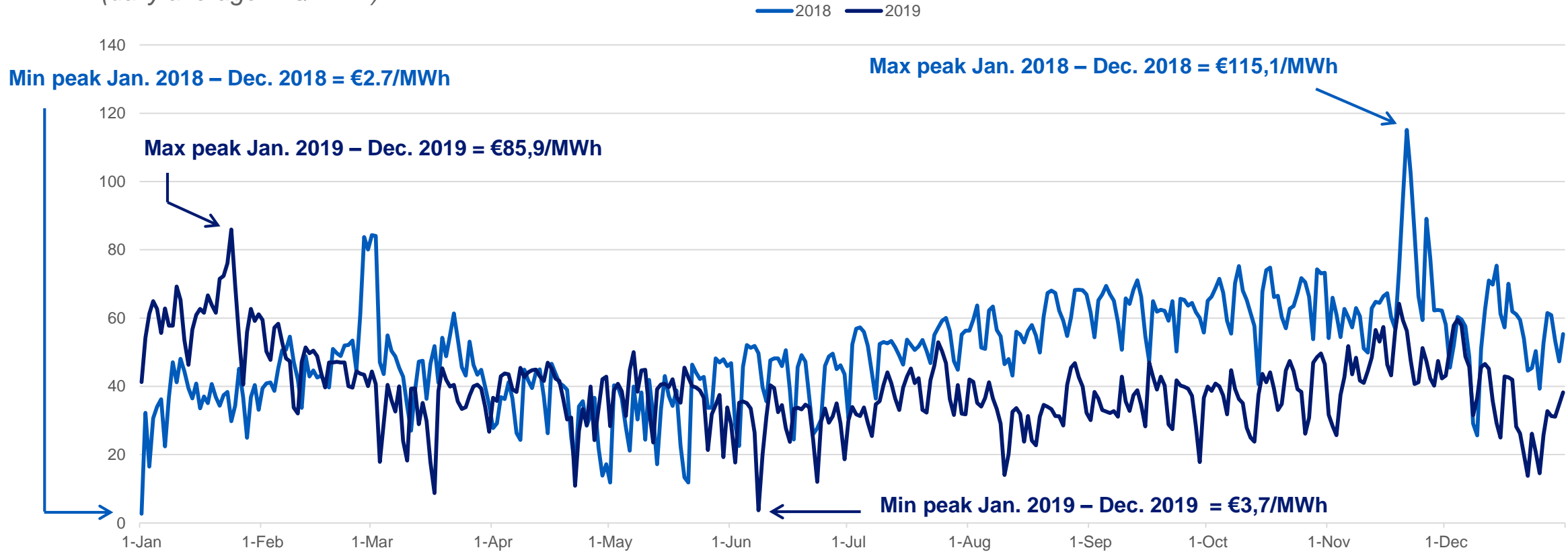
Source: RTE

(1) Rounded to the nearest tenth

(2) CWE flow-based coupling zone composed of Germany, Belgium, France, Luxembourg and Netherlands, set up in May 2015

# FRANCE: BASELOAD ELECTRICITY SPOT PRICES

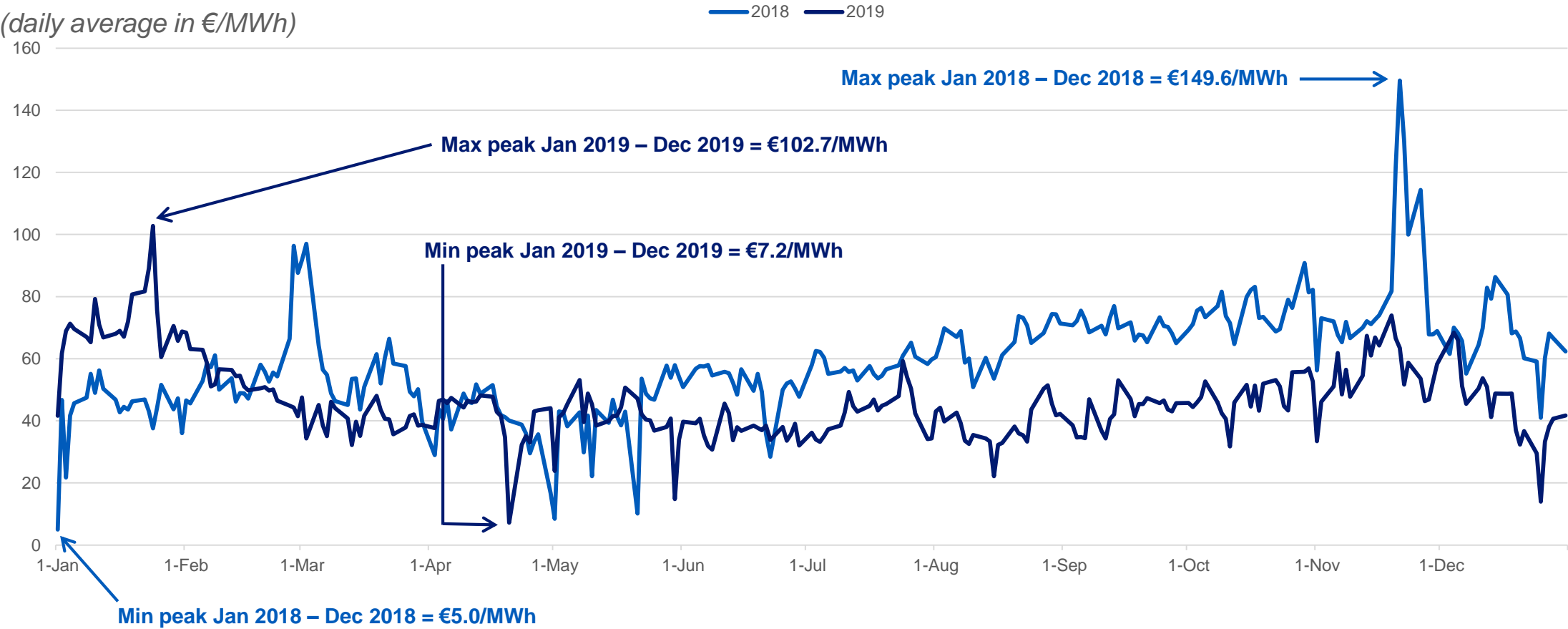
(daily average in €/MWh)



In 2019, electricity spot prices averaged €39.4/MWh (-€10.7/MWh vs. 2018). After a sharp rise in January (+€26.2/MWh vs. January 2018) due to less mild temperatures than last year, leading to a global decrease in prices over the rest of the year. The drop was greater starting in June (decrease of more than €20/MWh on average) due to a decrease in gas and coal prices and to a windy year combined with strong hydro conditions at the end of the year.

Source : EPEX

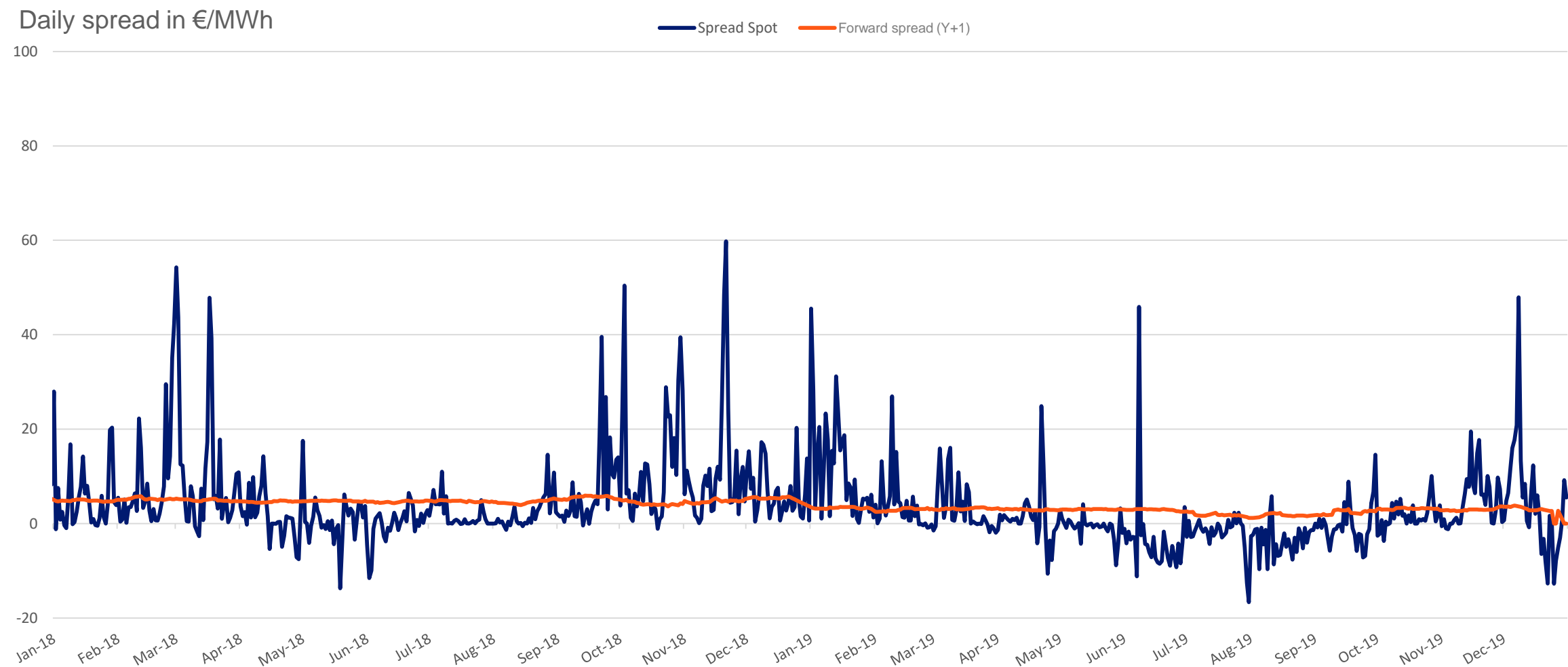
# FRANCE: PEAKLOAD ELECTRICITY SPOT PRICES



In 2019, spot peak electricity prices averaged €46.3/MWh (-€12.8/MWh vs. 2018). They evolved in a similar way to baseload prices: January was €27.8/MWh more expensive than January 2018 due to less mild temperatures, March was €16.4/MWh lower than last year due to the milder end of winter. Since June, peak spot prices have fallen by an average of €23/MWh as a result of lower gas and coal prices, higher renewable generation in France and Germany, and a slight decrease in consumption due to cooler temperatures than in 2018 followed by a mild start to the winter.

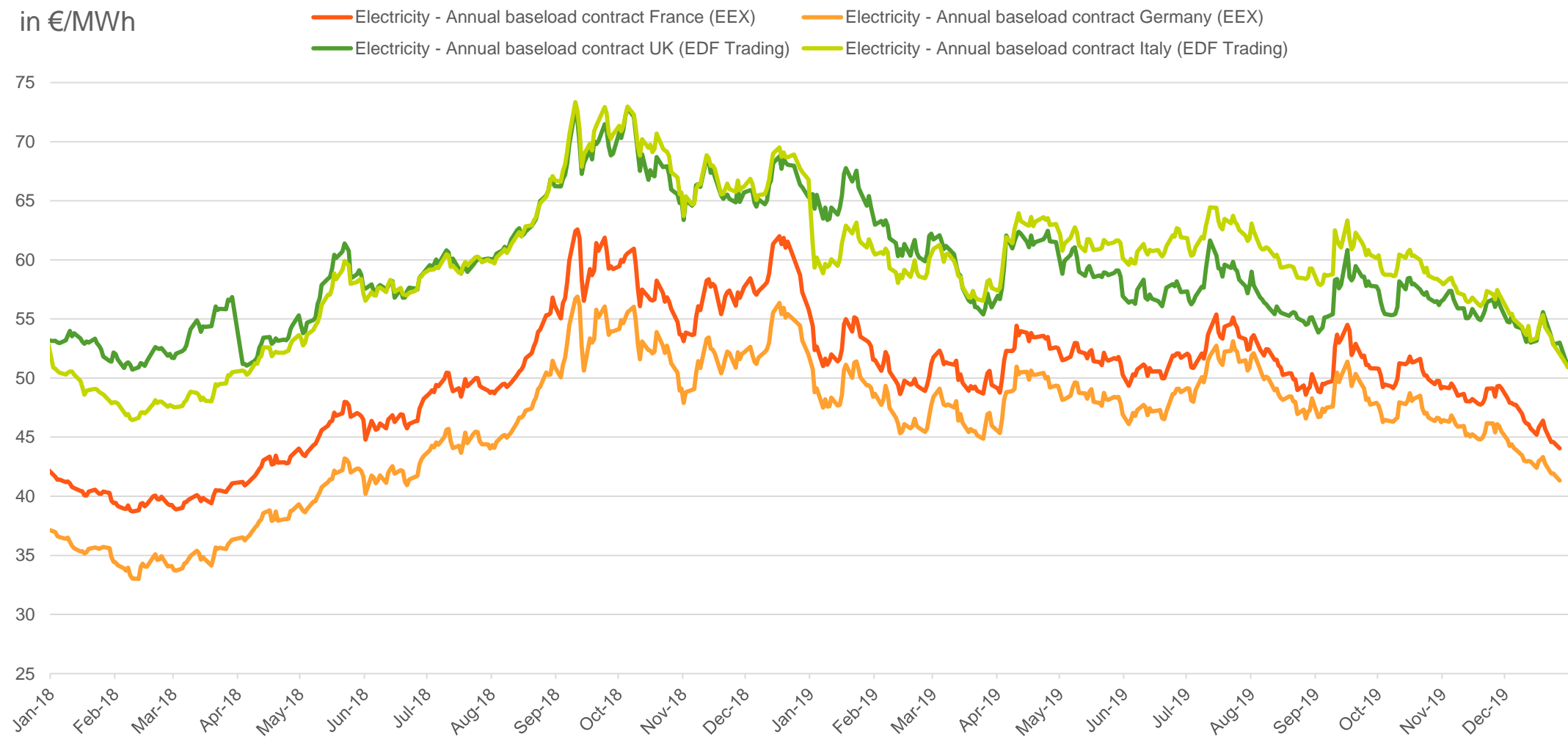
Source : EPEX

# FRANCE/GERMANY SPREAD FROM 01/01/2018 TO 31/12/2019



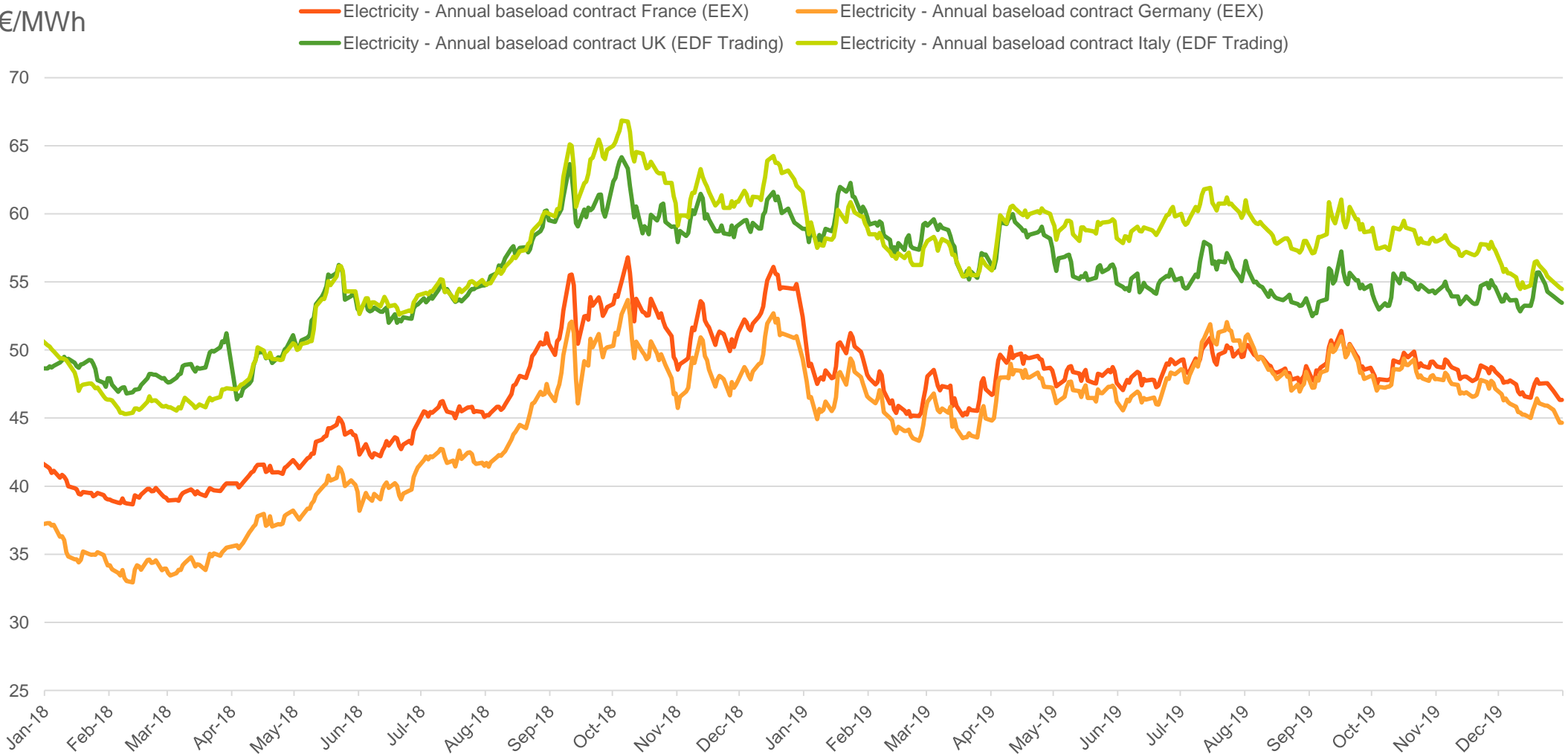
Note: Over the period, the France/Germany spread reached its minimum on 31 July 2019 at -€16.67/MWh, and its maximum on 21 November 2018 at €59.77/MWh

# FORWARD ELECTRICITY PRICES IN FRANCE, THE UK, ITALY AND GERMANY (Y+1) FROM 01/01/2018 TO 31/12/2019



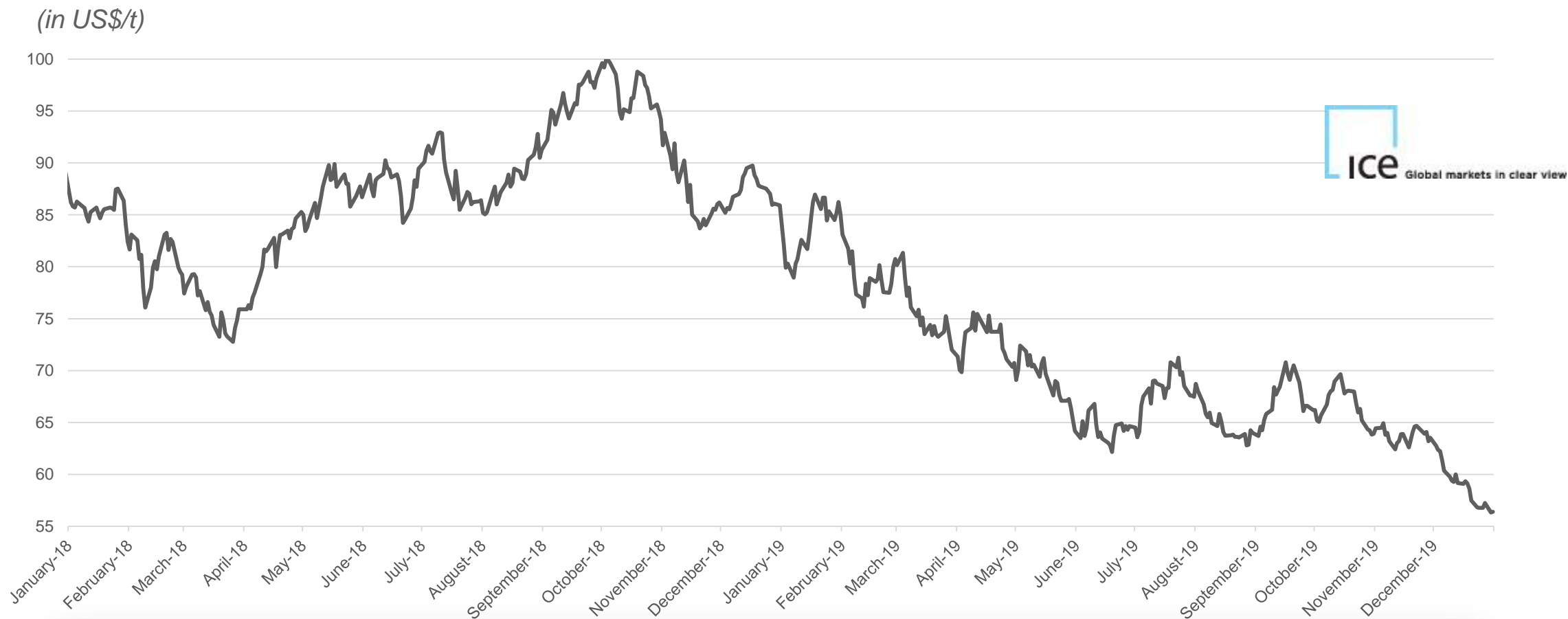
# FORWARD ELECTRICITY PRICES IN FRANCE, THE UK, ITALY AND GERMANY (Y+2) FROM 01/01/2018 TO 31/12/2019

in €/MWh





# COAL PRICES (Y+1) FROM 01/01/2018 TO 31/12/2019



The coal price for delivery in Europe Y+1 averaged \$69.5/t in 2019 (-20.1% or -\$17.5/t vs. 2018). This was due to sluggish Asian demand, high inventories from the beginning of the year, and the improved competitiveness of gas thanks to a CO<sub>2</sub> price that was much higher than in 2018. Confidence in coal is flagging because of its climatic and health impacts, reflected in various announcements of short- or medium-term closures. In September, the price experienced a short-lived increase, attributable to the peak reached by oil prices and announcements relating to manufacturing discrepancies identified by Framatome on the SRHT process concerning a certain number of equipment installed on the French nuclear fleet, which led to fears of increased demand on thermal resources. Prices dropped again in the fourth quarter, driven by the anticipation of mild temperatures and the prospect of temporary shutdowns of coal-fired power plants in South Korea this winter.

# BRENT PRICES <sup>(1)</sup> FROM 01/01/2018 TO 31/12/2019

(in US\$/bbl)



The price of Brent averaged \$64.2/barrel in 2019 (-10.5% or -\$7.5/barrel vs. 2018). Over the year, the price was driven mainly by the prospect of abundant supply and anemic demand. Riding on global growth, the market modulated this bearish tone in line with announcements on the progress of the Sino-US trade agreement. US shale oil production grew throughout the year: in September, the United States became the world's largest oil producer. Faced with the influx of oil, OPEC confirmed its willingness to support prices by reducing production at its summits on 1 July and 6 December. Against this backdrop, fears about production remained contained, despite certain phases of price increases during incidents in the Middle East - notably during the attack on Saudi oil installations on 14 September..

(1) Brent spot price (M+1)

# GAS PRICES<sup>(1)</sup> (Y+1) FROM 01/01/2018 TO 31/12/2019

(in €/MWh)



The price of the annual gas contract for Y+1 delivery on gas exchange points (PEG) averaged €18.4/MWh in 2019 (-11.8% or -2.5 €/MWh vs. 2018). It decreased almost steadily over the year, driven by three main factors: inventory levels, mild temperatures and LNG arrivals in Europe. The massive LNG influx into Europe is linked in particular to the boom in North American generation and the preference given to the European market rather than the Asian market to sell some of this output, due to the geographical proximity and price levels in the two zones. At the same time, European demand remained moderate with a milder end to the winter than in the previous year. Inventory levels rose to saturation in October, maintaining record levels throughout the last quarter (95% on average in the fourth quarter compared to 86% the previous year).

(1) Price of France PEG Nord gas

# CO2 PRICES (Y+1) FROM 01/01/2018 TO 31/12/2019



The price of the quota for delivery in December Y+1 averaged €25.2/t in 2019 (+55.9% or + €9.0/t vs. 2018). The price of CO<sub>2</sub> decreased until mid-February, reaching the lowest level of the year at €18.8/t. This was related to the announcement of possible closures of coal-fired power plants in Germany and the prospect of a hard Brexit as early as 2019, which would have brought an influx of quotas onto the market. The price rose to reach €29.8/t in mid-July, the highest level for ten years, and then stabilised at around €25/t in the last quarter while remaining volatile.



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# FINANCIAL CALENDAR

7 May 2020



**General Shareholder's meeting**

14 May 2020



**Q1 2020 sales**

30 July 2020



**2020 half-year results**

# A TEAM DEDICATED TO ANALYSTS AND INVESTORS

To understand better the EDF group, you can also visit our web page **dedicated to investors and analysts**:  
<https://www.edf.fr/en/the-edf-group/dedicated-sections/investors-shareholders>

...on which you can download our **Kit Investisseur** including:

- **The Analyst Pack**, with all the main financial and extra-financial data in an Excel format  
<https://www.edf.fr/en/the-edf-group/dedicated-sections/finance/investors-analysts/essential>
- **The Universal Registration Document**  
<https://www.edf.fr/en/the-edf-group/dedicated-sections/investors-shareholders/financial-information/regulated-information/reference-documents>
- All the data relative to our **annual results**  
<https://www.edf.fr/en/the-edf-group/dedicated-sections/investors-shareholders/financial-information/regulated-information/financial-results>

For more information, our team is available to you at this address: [EDF-IRTeam@edf.fr](mailto:EDF-IRTeam@edf.fr)



# GLOSSARY (1/6)

- **IAEA:** International Atomic Energy Agency based in Vienna (Austria).
- **ANDRA:** the French law of 30 December 1991 established a public industrial and commercial body, the French National Radioactive Waste Management Agency (*Agence Nationale pour la gestion des Déchets Radioactifs* – “ANDRA”), responsible to find, implement and guarantee safe management solutions for all French radioactive waste. The Agency notably runs the storage centers based in the Aube region of France: the industrial facility for grouping, storage and disposal *Cires* and the waste disposal facility *CSA*
- **APE:** the French State Shareholding Agency is a national department controlled by the Minister of Economy and Finance. Its mission is to act as a shareholder for the French Government in order to develop its assets to maximise the value of its stakes
- **Architect-Assembler:** for EDF, the architect-assembler has control over the design and operation of its power plants; the organization of development projects; the schedule for completion and costs of construction; relations with the Nuclear Safety Authority; and the integration of feedback from operational experience. EDF’s role as architect-assembler ensures control over its industrial policy with respect to the design, construction and operation of its fleet of power plants
- **ARENH:** Regulated Access to Historical Nuclear Energy
- **ASN (Autorité de Sûreté Nucléaire) :** the French Nuclear Safety Authority controls nuclear safety and radioprotection in France, on behalf of the French government, to protect workers, patients, the public and the environmental risks associated with the use of nuclear energy. It is notably in charge of the external control of nuclear facilities in France. The ASN is an independent administrative authority with a staff of more than 300. It is represented at the national level by the General Agency for Nuclear Safety and Radioprotection (or “DGSNR”)
- **Clean Dark Spread:** difference between power price and variable generation cost (mainly coal cost and CO<sub>2</sub> cost)
- **Cogeneration:** generation technique for combined electricity and heat generation. The advantage of cogeneration is the ability to capture the heat produced by the fuel, whereas in traditional electricity generation this heat is lost. This process also allows the same facility to meet the heating (hot water or steam) and electricity needs of both industrial and local authority customers. This system improves the energy efficiency of the generation process and reduces fuel use by an average of 20%

## GLOSSARY (2/6)

- **Combined-Cycle Gas Turbine (CCGT):** The most recent technology for generating electricity in a natural gas-fired plant. A combined cycle is made up of one or more combustion turbines and a steam turbine allowing for an improved yield. The syngas is routed to the combustion turbine, which generates electricity and very hot exhaust gases (effluents). The heat from the exhaust gases is recovered by a boiler, thus producing steam. Part of the steam is then recovered by the steam turbine to generate electricity
- **CRE (*Commission de Régulation de l'Énergie*):** created on 30 March 2000. The CRE, an independent body, regulates the process of the energy market opening. It ensures that all of the generators and eligible customers have non-discriminatory access to the network. Within its jurisdiction, this body supervises and authorizes, settles any disputes and, if required, imposes sanctions. Since 2016, the CRE is in charge of proposing the evolution of the regulated tariffs for the sale of electricity
- **Distribution networks:** downstream of the transmission network, medium- and low-tension distribution networks that serve end-users (individuals, Groups, SMEs, SMLs, etc.)
- **Electricity supply:** can be broken down into four types of consumption: “basic” (or “ribbon”) supply of electricity generated and consumed throughout the year; “semi-basic” electricity supply, which is generated and consumed over the winter period; “peak” electricity supply, which corresponds to periods of the year when electricity generation or consumption is significant; and “lance” supply which is a complement to the “ribbon” supply
- **EPIC:** Industrial and Commercial state-owned Company
- **EPR (European Pressurized Reactor):** latest generation of reactors currently under construction (known as generation 3), it is the result of Franco-German cooperation, and offers advanced safety, environmental and technical performance
- **ETS :** Emission Trading System
- **Fuel cycle:** the nuclear fuel cycle encompasses all industrial operations in France and abroad which enable the supply of the fuel to generate energy in a reactor, then to unload and process it. The cycle can be broken down into three stages: 1) upstream: the processing of concentrates from uranium ore, the conversion, enrichment and production of fuel (which takes more than two years); 2) the core of the cycle corresponding to the use of fuel in the reactor: receipt, loading, operation and discharging (which takes three to five years); 3) downstream: pool storage, reprocessing of spent fuel in reactors of recoverable material, vitrification of highly radioactive waste, then temporary storage of the waste before storage

# GLOSSARY (3/6)

- **Greenhouse gases:** Gas that retains a portion of the solar radiation in the atmosphere and for which an increase in emissions due to human activity (man-made emissions) causes an increase in the earth's average temperature and plays an important role in climate change. The Kyoto Protocol covers the seven following principal greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrogen protoxide (N<sub>2</sub>O), hydrofluorocarbons (HFC), perfluorated hydrocarbons (PFC), sulfurhexafluoride (SF<sub>6</sub>) and, since 2013, nitrogen trifluoride (NF<sub>3</sub>)
- **Hydropower generation:** maximum power energy that can be produced from hydraulic sources in normal conditions
- **Interconnection:** electricity transmission infrastructure that allows for exchanges of energy between different countries, by connecting the transmission network of one country to that of a neighboring country
- **LDC:** Local Distribution Companies that provide for distribution of gas and electricity to the end-customers on a delimited geographical area
- **LNG (Liquefied Natural Gas):** natural gas turned into liquid form by reducing its temperature to -162°C allowing for a reduction by 600 in its volume
- **MEDEF:** French companies association ("*Mouvement des entreprises de France*")
- **Metering:** a system allowing for the recording, at a given network connection point, of the volumes of electricity transmitted or distributed (power, frequency, active and reactive energy)
- **MW – MWh:** The megawatt-hour (MWh) is the energy unit generated by a facility and is equal to the facilities' power, expressed in megawatts (MW), multiplied by the duration of operations in hours. 1MW = 1,000 kilowatts = 1 million watts 1MWh = 1MW produced for 1 hour = 1 megawatt-hour 1GW = 1,000MW = 1 billion watts 1TW = 1,000GW
- **Midstream:** all assets of the gas business, allowing for its availability, transportation and management. These might be infrastructures (gas pipelines, storage facilities, LNG terminals, etc.) or contractual (rights relating to predetermined capacity, procurement contracts, etc.). The midstream segment includes the trading and negotiating activities

# GLOSSARY (4/6)

- **National Allowances Allocation Plan:** this plan defines the total quantity of greenhouse gas emission allowances that the French state plans to grant for the allowances exchange system for each multi-year period (NAP1 2005-2007, NAP2 2008-2012) and the allocation method used to allocate allowances to the industrial facilities in question
- **Non-interconnected zones:** Zones in France which are not connected (by power lines) to metropolitan France (Corsica and overseas departments)
- **NO<sub>x</sub>:** nitrogen oxide
- **Nuclear safety:** nuclear safety includes all of the technical, organizational and human measures which are intended to prevent accident risks and to limit the effects of an accident, and which are taken at every stage of the life of a nuclear power plant (from design to operation and finally to decommissioning)
- **Nuclear tranche:** electrical generation unit consisting of a nuclear boiler and a turbo-alternator generator. A nuclear tranche essentially consists of its reactor type and the power of its turbo-alternator generator. EDF nuclear plants include two or four tranches, and occasionally six
- **Ofgem:** Ofgem is the Office of the Gas and Electricity Markets in the UK. Its main missions consist of protecting consumers, regulating gas and electricity monopoly companies, helping to secure Britain's energy supplies by promoting and regulating competitive gas and electricity markets. It also contributes to the drive to curb climate change and promote sustainable development
- **Plant availability:** fraction of power available, out of theoretical maximum energy, counting only technical non-availability. The availability coefficient (Kd) is defined as the ratio between annual actual generation capacity (or amount producible annually) and maximum theoretical generation capacity, where maximum theoretical generation capacity = installed capacity x 8,760h. The Kd, which includes only technical non-availability, i.e. scheduled shutdowns, unplanned outages and testing periods, characterizes a plant's industrial performance
- **PPA:** Price Purchase Agreement
- **PWR:** in a Pressurized Water Reactor, the primary coolant (water) is pumped under high pressure to the reactor core where it is heated by the energy generated by the fission of atoms. The heated water then flows to a steam generator where it transfers its thermal energy to a secondary system where steam is generated and flows to turbines which, in turn, spin an electric generator. In contrast to a boiling water reactor (BWR), pressure in the primary coolant loop prevents the water from boiling within the reactor

## GLOSSARY (5/6)

- **Radioprotection:** At a power plant, ionising radiation sources are numerous: the fuel itself, equipment activated by neutron flux (particularly that which is close to the core, such as tanks or lids) and particles from corrosion of the primary circuit of reactors and carried by the primary fluid. The level of exposure of a person is quantified by the dose equivalent in Sieverts (Sv). The total dose equivalents, called “collective dosimetry” and expressed in man-sieverts, is used as an indicator of dose received by all participating persons. The mobilisation of ground players has allowed a continuous improvement of performance on the protection of employees against the effects of ionising radiation.
- **Renewable energies:** energies for which generation does not require extinction of the initial resource. They largely derive from geothermal, water, air, fire and solar sources. They include hydro, wind, solar (the energy produced by marine waves and currents), geothermal (energy derived from the heat of the earth’s magma) energies, and bio-mass (energy derived from living matter, particularly wood and organic waste). They often include energy from the incineration of household or industrial waste
- **Reprocessing:** reactor burnt fuel reprocessing aimed at separating materials that can be recycled (uranium and plutonium) from final waste
- **RTE:** RTE is the operator of the French electricity transmission system. RTE, a public service company, operates, maintains and develops the high and very high voltage network
- **Series:** In the nuclear field, a series of plants means a set of nuclear plants with identical generation capacity. EDF’s PWR model is divided into three series of available electrical power: the 900-MW series (34 tranches of approximately 900MW each), the 1,300-MW series (20 tranches) and the 1,450-MW series (4 tranches)
- **SO<sub>x</sub>:** sulfur oxide
- **STEP:** Pumped-storage hydropower plant. Power plant with two tanks, an upper and a lower one, connected by pumps that allow the water to be pumped up once turbinéd and located in the lower tank, towardsthe upper tank.
- **Storage:** storage consists in placing packages of radioactive waste in a facility, ensuring their long-term management, i.e. under safe conditions allowing for long-term risks control

# GLOSSARY (6/6)

- **Storage center:** low or medium-level short-life radioactive waste from nuclear plants, the Hague or CENTRACO facilities are sent to ANDRA's Soulaïnes storage center in the Aube region, which has been operational since 1992. This center has a capacity of 1,000,000cm, and an acceptance capacity of approximately 60 years. Very low-level short-life radioactive waste is sent to ANDRA's Morvilliers storage center (also in the Aube region). This center was commissioned in October 2003 and has an operating life of about 30 years
- **Transmission networks:** networks providing for the transmission of electrical power at high and very high voltages from the generating sites to the distribution networks or industrial sites directly connected to it; this includes the major interconnection transmission network (400,000 volts and 225,000 volts) and the regional distribution networks (225,000 volts, 150,000 volts, 90,000 volts and 63,000 volts)
- **Uranium:** In its natural state, uranium is a mix containing three main isotopes (elements whose atoms have the same number of electrons and protons, thus the same chemical properties, but a different number of neutrons): ■ uranium 238, 99.3% fertile ; ■ uranium 235, 0.7% fissile ; ■ uranium 234. ■ Uranium 235 is the only natural fissile isotope, a quality which justifies its use as an energy source.
- **Enriched uranium:** Uranium, whose isotope 235 content, the only fissile material, has been increased from its low natural level (0.7%) to approximately 4% for pressurised water reactor fuel.
- **Waste:** nowadays, the nuclear generation of 1MWh of electricity (equivalent to the monthly consumption of two households) produces around 11g of total waste across all categories. Short-life waste represents more than 90% of the total waste, but contains only 0.1% of the total radioactivity of those 11g





