MINERVA
Investment Management
Society

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Electricité de France

Equity Research

Price Target: € 13,30

Key Points:

Business. *Électricité de France* is a utility company which operates worldwide but mainly in France, United Kingdom and Italy. Its core activities consist of electricity distribution and production, the latter is generated primarily from the nuclear sector, but attention is also growing on renewables. The company would likely benefit the energy transition to low carbon methods as more countries become interested in using nuclear and renewable energy technology. Especially, if renewable energy does not provide the reliability needed, nuclear can be a source of reliable energy to be used in conjunction with renewables. EDF also announced strong financial results and is set to continue as changes to ARENH will be made by year end. The main risks are: the government become more unsupportive of nuclear, technological advancements in renewables is faster than anticipated and EDF is not able to adopt those technology, new players in renewables and EDF losing market share in France (especially in hydro, through the concession auctions), lower nuclear output and lifespan of nuclear power plants and further cost overruns and delays especially in the UK project.

Valuation. Our analysis is mainly concentrated on the APV model. By observing the industry situation and EDF's overview, we chose to use a single-stage model because the industry is quite mature and we do not expect significant growth in the coming years. We supposed that the growth rate will be the stable stage growth rate for Europe. Therefore, once taken some assumptions in order to determine the most appropriate costs of equity (unlevered and levered), we fixed the provisional balance sheet and income statement. Then, we computed the FCFF for the explicit period 2018-2022 and from 2023-onwards. Finally, we achieved the fair price for EDF that is slightly lower than the current one.
The market multiples methodology is an effective way to control the quality of the analysis developed using the FCFF method. This kind of valuation has a double purpose: first, market sentiment is incorporated in P/E; secondly, we give a value to the competitive advantage EDF has among its peers.

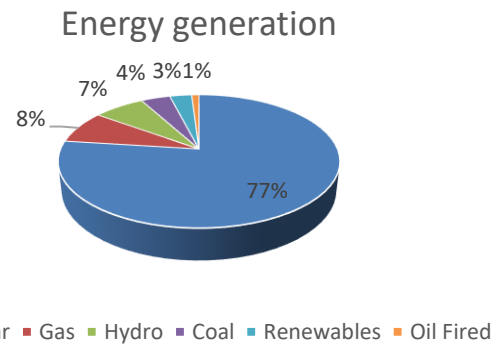
Recommendation: NEUTRAL. Given the results of our valuation and the analysis of the economic and financial characteristics of EDF, we recommend holding shares.

Business description

1. Company background

Électricité de France was born in 1946 after the nationalization of different electricity producers, distributors and marketers. Until 1999, EDF enjoyed a monopoly position in the energy sector but after a European Directive it was forced to open up 20% of its business to competitors in order to improve competition. It was until 2004 an EPIC (a state-controlled entity of an industrial or commercial nature) but then became a limited-liability corporation under private law. In 2005 the IPO bought EDF onto the stock market, since then it is largely owned by the French State. In 2017, EDF undertook a cash capital increase with preferential subscription rights for existing shareholders. In accordance with its commitment, the French State subscribed for an amount of €3 billion or approximately 75% of the capital increase, and after this operation held 83,10% of the Company's share capital. Shares prices fell to an all-time low due to the heavy discount on new shares. During this year, EDF acquired 75,5% for €2,47 billion of Areva business, in a French government sponsored restructuring due to technical and financial problems of Areva. The business has been named Framatome and in concerns activities relating to the design and manufacturing of nuclear reactors and equipment, fuel assemblies and services to the nuclear installed base.

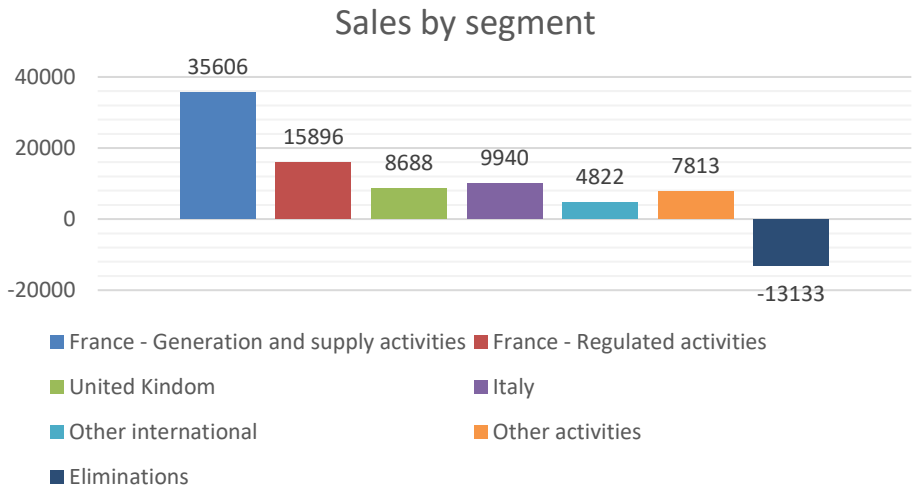
Nowadays EDF is one of the biggest electric utility companies in the world with more than 150.000 employees, its operational activities consist of electricity production and distribution; design, construction and dismantling power plants. As far as it concerns the energy generation, the main source of production is nuclear, which account for 77% of the total, followed by gas (8%), hydro (7%), coal (4%), renewables (3%) and oil-fired (1%).



The huge production of nuclear electricity can be considered a forced choice because France does not have natural resources such as oil, coal or gas. France is the world largest consumer of nuclear power and EDF has 58 nuclear power plants in the country. However, there is a growing interest in renewables energy and EDF's CEO, Jean-Bernard Lévy, stated that they aim to double the production from renewables by 2030.

2. Sales and geography

In 2017 EDF sales amount to €69.632 million with a -2,2% variation compared to the previous year, most of them comes from generation and supply of energy (70,04%) and the rest from distribution (22,04%) and other (7,92%). Excluding the effects of exchange rates and the sales tariff adjustment the organic growth of sales result in a +0.4%.
The division of sales by geographic location is more varied and it is shown in the following chart:



First of all we must specify that the negative column refers to inter-segment eliminations. The biggest segment is that one related to France – Generation and supply activities, which includes also sales of engineering and consulting services. Sales in this segment are equal to €35.606 million, 1.2% more than 2016. This result has been achieved thanks to the new subscriptions to the ARENH scheme despite the changes in regulated sale tariffs for electricity and the decrease in volumes of energy supplied.
The segment France – Regulated activities concerns the transmission, distribution, EDF's island activities and the activities of Electricité de Strasbourg. Sales for this segment amounted to €15.896 million, +1.1% than the previous year. This increase was due to the positive movement in the TURPE's adjustment index although this positive effect was partially offset by the weather factors which decreased the sales value.
United Kingdom's sales amounted to €8.688 million, the decreasing of this value (-6.4%) is a result of lower realized prices for nuclear power and the loss of value of the pound against the euro.
The Italian segment is that one that suffered a major loss, with its €9.940 million of sales it places better than UK but with a decline of -10,7% compared to the previous year. Sales were penalized by the lower volumes sold in the electricity business and also the volumes for gas on the wholesale markets declined.
The segment Other international refers to operations in the USA, Brazil, Asia and Europe (excluding UK and Italy), sales amounted to €4.822 million with a corresponding decrease of -8,8%, but excluding the changes in the scope of consolidation (related to Polish operations) there is an increase of 0.5% in organic terms. However, sales grew up mainly in Belgium (+€147 million) and decreased in Brazil (-€70 million) and Asia (-€27 million).
Other activities comprise mainly Dalkia and the gas activities, EDF Énergies Nouvelles, EDF Trading. This segment contributed for €7.813 million with an increase of +1,0%. The largest share of these sales comes from Dalkia (€4.051 million) and EDF Énergies Nouvelles (€1.280 million) both of them had an increase in the growth of sales. On the other hand, EDF Trading shows an huge decrease (-35,1%) and its sales amounted to €590 million.

3. SWOT analysis

Strengths

EDF specializes in nuclear energy production and operates all 58 reactors in France, which supplies around 72% of the energy needs. The company is working to improve technology used in nuclear reactors. EDF, together with Framatome (formerly AREVA) and Siemens are involved in developing the third generation reactor - EPR (European Pressurised Reactor) which aims to improve safety, environmental protection, and technical and economic performance. These reactors has gained interest from governments and are under construction in France, Finland, China and the UK. EDF therefore has maintained a strong position in building and operating nuclear reactors.

EDF also has parts of their operations in energy distributor, renewable energy especially hydropower and solar, electricity storage and EV charging - with hydro contributing positively to Q3 earnings. It is currently France's largest supplier of renewable energy. This makes it more diversified, but able to leverage their expertise in energy to potentially benefit from the energy transition.

Weaknesses

EDF's profitability relies mainly on nuclear energy and commissioning new nuclear reactors. Despite specializing in building nuclear reactors and being involved in construction of nuclear plants in many countries, the projects often have cost overruns and delays. Construction of nuclear projects still needs to find a more effective way of funding to reduce funding costs. For example, Hinkley Point C which is under construction in the UK, is set to be the most expensive power station in the world, it is delayed and EDF has secured a deal with the government of £92.50/MWh for electricity from the plant, rising with inflation for 35 years. This is gained negative publicity for EDF and nuclear energy.

Nuclear power plants have a lifespan of around 50-70 years, which leave them to be subject to changes in energy prices which effects EDF's profitability.

Opportunities

Many countries around the world is supporting the energy transition towards low carbon. France has been particularly active in this transition and has been relying on nuclear to move away from fossil fuels. Macron has extended the deadline for capping the amount of electricity from nuclear plants to 50% from 2025 to 2030, despite a law passed by the previous government. The French government is working closely with EDF to plan the modernization of the aging nuclear fleets. Moreover, Macron has successfully lobbied for reforms to the ETS (EU emissions trading system), which reinforces the presidents influence and determination in reforming energy production methods.

ARENH, which stands for 'Regulated Access to Incumbent Nuclear Electricity', is a right that entitles suppliers to purchase electricity from EDF at a regulated price, in volumes determined by the French energy regulator (CRE) is to undergo changes this year to remove intra-year arbitrages. This would be positive for EDF's financials.

EDF is working closely with countries around the world to adopt nuclear and renewable energy, such as China, Finland, India and Brazil.

In the electricity distribution space, which has seen a growing number of new entrants in the UK, Ofgem, the UK energy regulator, plans to impose obligations for suppliers to have adequate financial resources to be awarded a license. This is to tackle failed ventures and smaller suppliers with poor customer service.

Threats

The main threat to EDF and to nuclear energy is the speed of technological advancement in renewables. There many small and larger players venturing into the renewables space. Many large oil companies have also made investments in renewables. The faster renewables become competitive to conventional forms of energy, the faster the decline of demand for other energy sources including nuclear would be. Governments, seeing potential of renewable energy, would likely not decide to commission new nuclear

power plants, which require huge investments. However, nuclear may still be in use especially if renewable power cannot be reliable enough. Advances in energy storage technology will play a large role in reliability, posing further threats to nuclear. Renewable energy is also receiving strong support by governments around the world, which makes the industry more attractive. In France, where EDF has its main market, the President is pushing for the electricity demand to shift to renewable forms as seen in its recent effort to privatise hydropower assets through auctioning concessions. This potentially can introduce new players in addition to EDF and Engie who are currently the two companies managing French hydropower capacity.

Financial analysis

1. Reclassified annual statement

Consolidated income statement

(in millions of Euros)	2017	2016	2015	2014	2013
Sales	69.632	71203	75006	73383	71916
Fuel and energy purchases	-37.641	-36050	-38775	-37213	-38116
Other external expenses	-8.739	-8902	-9525	-9181	-8287
Personnel expenses	-12.456	-12543	-12529	-11785	-11291
Taxes other than income taxes	-3.541	-3656	-3641	-3593	-3481
Other operating income and expenses	6.487	6362	7066	5668	5358
Operating profit before depreciation and amortisation	**13.742**	**16414**	**17601**	**17279**	**16099**
Net changes in fair value on Energy and Commodity derivatives, excluding trading activities	-355	-262	175	203	14
Net depreciation and amortisation	-8.537	-7966	-9009	-7940	-7154
Net increases in provisions for renewal of property, plant and equiptment operated under concessions	-58	-41	-102	-157	-227
(Impairment)/reversals	-518	-639	-3500	-1189	-617
Other income and expenses	1.363	8	-885	-212	219
Operating profit	**5.637**	**7514**	**4280**	**7984**	**8334**
Cost of gross financial indebtness	-1.778	-1827	-1994	-2243	-2262
Discount effect	-2.959	-3417	-2812	-2996	-2931
Other financial income and expenses	2.501	1911	2218	2688	2251
Financial result	**-2.236**	**-3333**	**-2588**	**-2551**	**-2942**
Income before taxes of consolidated companies	**3.401**	**4181**	**1692**	**5433**	**5392**
Income taxes	-147	-1388	-483	-1839	-1896

Share in net income of associates and joint ventures	35	218	192	179	262
GROUP NET INCOME	**3.289**	**3011**	**1401**	**3773**	**3758**

Consolidated Balance Sheet

ASSETS(in millions of Euros)	2017	2016	2015	2014	2013
Goodwill	10.036	8.923	10.236	9.694	9.081
Other intangible assets	8.896	7.450	8.889	8.884	7.860
Property, plant and equipment operated under French public electricity distribution concessions	54.739	53.064	51.600	50.257	48.796
Property, plant and equipment operated under concessions for other activities	7.607	7.616	7.645	7.851	7.450
Property, plant and equipment used in generation and other tangible assets owned by the Group	75.622	70.573	71.069	69.392	64.561
Investments in associates and joint ventures	7.249	8.645	11.525	10.983	11.479
Non-current financial assets	36.787	35.126	35.238	33.485	29.611
Other non-current receivables	2.168	2.268	1.830	2.024	1.924
Deferred tax assets	1.220	1.641	2.713	2.590	2.171
Non-current assets	**204.324**	**195.309**	**200.745**	**195.160**	**182.933**
Inventories	14.138	14.101	14.714	14.747	14.204
Trade receivables	23.411	23.296	22.259	23.176	21.892
Current financial assets	24.953	29.986	27.019	20.752	17.847
Current tax assets	673	183	1.215	600	554
Other current receivables	9.561	10.652	8.807	8.793	7.239
Cash and cash equivalents	3.692	2.893	4.182	4.701	5.096
Current assets	**76.428**	**81.111**	**78.196**	**72.769**	**66.832**
Assets classified as held for sale	0	5.220	0	18	1.154
TOTAL ASSETS	**280.752**	**281.640**	**278.941**	**267.947**	**250.919**

EQUITY AND LIABILITIES (in millions of Euros)	2017	2016	2015	2014	2013
Capital	1.464	1.055	960	930	930
EDF net income and consolidated reserves	39.893	33.383	33.789	34.316	33.277
Equity (EDF share)	**41.357**	**34.438**	**34.749**	**35.246**	**34.207**
Equity (non-controlling interests)	7.341	6.924	5.491	5.419	4.998
Total equity	**48.698**	**41.362**	**40.240**	**40.665**	**39.205**
Provisions related to nuclear generation - back-end of the nuclear cycle, plant decommissioning and last cores	46.410	44.843	44.825	42.398	40.427
Other provisions for decommissioning	1.977	1.506	1.447	1.297	1.182
Provisions for employee benefits	20.630	21.234	21.511	23.060	18.381

Other provisions	2.356	2.155	2.190	1.841	1.480
Non-current provisions	**71.373**	**69.738**	**69.973**	**68.596**	**61.470**
Special French public electricity distribution concession liabilities	46.323	45.692	45.082	44.346	43.454
Non-current financial liabilities	51.365	54.276	54.159	47.274	41.413
Other non-current liabilities	4.864	4.810	5.126	4.956	5.001
Deferred tax liabilities	2.362	2.272	4.122	4.315	4.242
Non-current liabilities	**176.287**	**176.788**	**178.462**	**169.487**	**155.580**
Current provisions	5.484	5.228	5.354	5.254	4.834
Trade payables	13.994	13.031	13.284	14.864	14.157
Current financial liabilities	11.142	18.289	17.473	14.184	14.647
Current tax liabilities	187	419	506	441	1.340
Other current liabilities	24.960	24.414	23.622	23.052	21.156
Current liabilities	55.767	61.381	60.239	57.795	56.134
Liabilities related to assets classified as held for sale	0	2.109	0	0	0
TOTAL EQUITY AND LIABILITIES	**280.752**	**281.640**	**278.941**	**267.947**	**250.919**

Development Ratios	2013	2014	2015	2016	2017
Sales growth rate	-1,12%	1,33%	2,93%	-5,07%	-2,20%
Cost of goods growth rate	-3,69%	2,19%	3,30%	-5,96%	4,70%
Operating income growth rate	1,08%	-4%	-47,94%	75,70%	-24,98%
Net income growth rate	5,65%	0,40%	-62,87%	114,92%	9,23%
Total assets growth rate	0,32%	6,80%	4,07%	0,96%	0,32%
Debt growth rate	-3,48%	7,40%	4,98%	-0,23%	-2,57%

From the table above, we can deduce some information about the company's development. First of all, both sales and cost of goods have contained growth rates and they share the same trend, when sales increase the same happen to cost of goods and vice versa. Only in 2017 this situation does not fit, sales decreased while cost of goods increased by 4,7% due to greater purchases in of fuel and energy.
Operating income (EBIT) and net income growth rate have more volatile growth rates. Focusing on the last three year, which have more significant values, we note that in 2015 there is a huge decrease in both of these values. Operating income was €4.280 million decreased by -47,94% because of an increase in impairment and net depreciation and amortisation, which overall had negative effects for €3.380 million more than the previous year. 2015 net income amounted to €1.401 (-62,87%), this decline is certainly due to that of the EBIT but it is amplified because the cost of gross financial indebtedness and the discount effect remain more or less constant.

On the contrary, 2016 had a completely opposite trend. Operating income was €7.514 million (+75,70%) thanks to the reduction of the impairment, which decreased by almost €3.000 million. As in the previous year, 2016 net income, which was €3.011 (+114,92%), was affected by positive change in EBIT.

2017 was an interesting year since the operating income and the net income show opposite trends. The first one amounted to €5.637 million (-24,98%) this was due to the reduction of sales and the increase of cost of goods that we have seen before. Net income amounted to €3.289 million (+9,23%), this

increase was mainly due to the fact that the company paid taxes for €147 million, that was a significant reduction compared to €1.388 million paid in 2016.

As far as it concerns total assets and debts growth rate, the trend remained almost stable except for 2014 and 2015.

Liquidity Ratios	2013	2014	2015	2016	2017
Quick Ratio	0,94	1	1,05	1,09	1,12
Current Ratio	1,19	1,26	1,3	1,32	1,37
Net Working capital	10698	14877	17957	19730	20661

Liquidity ratios are used to describe a debtor's ability to pay off current debt obligations without using external capital in a short-term time horizon. To do this we use indexes that compare current assets and current liabilities. The current ratio is higher than the quick ratio because it includes inventory among current assets. The two indexes are greater than one and are constantly growing through the years. The same goes for Net Working capital which is the difference between current assets and currents liabilities.

Solvency Ratios	2013	2014	2015	2016	2017
Solvency Ratio	15,63%	15,18%	14,43%	14,69%	17,35%
Debt/Equity Ratio	5,53	5,72	6,08	5,96	4,77

Solvency ratios measure a company's ability to meet its financial obligations in both the long term and the short term. Debt/Equity ratio is useful to understand how a company is using debt to leveraging its assets. This ratio is higher than the average for the market but it usually greater for utility companies compared to other businesses because in this sector companies tend to maintain a stable income and they are able to borrow with lower costs. In 2017 both solvency ratio and debt/equity ratio are better than the previous years.

Profitability Ratios	2013	2014	2015	2016	2017
ROE	8,97%	9,10%	2,95%	6,89%	6,52%
ROA	3,32%	2,97%	1,53%	2,67%	2%
Profit margin	6,92%	6,81%	2,06%	5,34%	4,36%
EBIT margin	12,24%	10,89%	5,51%	10,15%	8,8%

Profitability ratios are used to evaluate a company’s ability in generating earnings and remunerating its shareholders. Profit and EBIT margin are calculated by comparing profits and EBIT with the revenues. A higher ratio means that the company has the ability to generate more profit and operating income from its revenues. From 2013 these ratios are constantly declining with a huge fall in 2015 due to the decrease of operating income and net income analyzed before.

Valuation

Our analysis implements an APV model, with a steady growth period since the firm operates in a mature sector and is already stabilized in its operating procedures. The work will consequently consist of an explicit forecast of the key financial variables for the years 2018-2022 and the terminal value. For both computations, we use the same growth rate, following the consideration stated above. Our choice of such model is due to the advantage the APV provides in using, in the beginning, pre-debt cash flows to obtain the unlevered value of the firm and then considering the net effect of debt (mainly consisting in the counterbalancing forces of tax shield and increased bankruptcy costs). We prefer this model since it provides more flexibility in considering the side effects of debt and tax benefits explicitly, rather than embedding them in the discount rate. We also believe that being the company stable and financially sound (rating A-), the risk of underestimating expected bankruptcy costs for EDF is negligible.
The key inputs for the explicit forecast period are the following: the growth rate in revenues and other items, the future Capex, the future level of debt, the probability of default and the bankruptcy costs.

Projections

We projected revenues and COGS for the explicit forecast period 2018-2022 at a constant growth rate of 2,20%. Furthermore, we converted operating leases into debt (financial leases) and removed R&D from operating expenses and added them to capital expenditure.

	2018	2019	2020	2021	2022
Sales Growth	2,20%	2,20%	2,20%	2,20%	2,20%
Sales	71.163,90	72.729,51	74.329,56	75.964,81	77.636,04
Costs of products sold	48.098,39	49.156,55	50.237,99	51.343,23	52.472,78
Gross profit	23.065,5	23.573,0	24.091,6	24.621,6	25.163,3
Selling, general and administrative expenses	12.730,03	13.010,09	13.296,31	13.588,83	13.887,79
EBITDA	10.335,5	10.562,9	10.795,2	11.032,7	11.275,5
R&D expenses	558,01	570,29	582,83	595,66	608,76
Leases expenses	748,00	480,75	480,75	480,75	480,75
Other oper. Expenses	4.683,83	4.786,87	4.892,18	4.999,81	5.109,81
Adjusted EBITDA	16.325,3	16.400,8	16.751,0	17.109,0	17.474,8

Cost of equity

We computed the cost of equity unlevered and levered (4,77% and 7,00%) and we used them as a discount rate for the explicit forecast period 2018-2022. However, the cost of equity levered is equal to the industry average of 7%, so we did not make any assumption about the fact that cost of equity levered needs to converge to the industry average in the long term (7% as industry average comes from a Credit Suisse report).
Going more in detail with the calculations, for the unlevered cost of equity we adopt the formula

$$K_u = r_f + \beta_u * ERP + CRP$$

As risk-free rate we select the 30-year zero coupon German Bund, being the company based in Europe and hence consistent with the currency of the security selected. We prefer this to the 10-year bund because of the EU policy influence on the shorter-term maturities which are expected to increase anyway. To this rate, we add a portion of the equity risk premium and country risk premium to which the company is exposed, where beta and lambda coefficients express the magnitude of this exposure. The equity risk premium is derived from a mature US Equity market index (S&P500). We prefer to use such an index since the equity risk premium for the European market embeds additional risks not easily detectable.
We also take into account the exposure to the country risk premium. We computed the country risk premium as a weighted average of the geographies in which EDF operates in and the percentage of

revenues it generates in the considered geography. We obtained roughly 1%. As an additional hypothesis, we state *lambda to be 1*. This following some considerations: since the firm does not operate in any developing market nor it is in the early stages of its life, we preferred not to infer a particular lambda for each geography to avoid errors that might bias the valuation.

Country	Risk premium	Weight
France	0,57%	53,31%
United Kingdom	0,57%	12,83%
Germany	0,00%	11,62%
Italy	2,19%	9,40%
Rest of Europe	3,50%	11,88%

Finally, our beta unlevered estimate follows Damodaran's estimate for the sector (0,45). This is consistent with the average unlevered beta of the industry (0,41) derived from 3 years weekly betas modified through Hamada's formula, and assuming a beta of debt equal to zero.

Growth rate

The steady-state growth rate has been selected consistently with the long-term growth rate of the economy. The figure we used in the model results from a weighted average of the long-term growth rates of the countries in which the company operates, where the weights are, as usual, represented by the % of sales in each of them. The growth rate was not calculated using the alternative method of *reinvestment rate * ROIC* since the resulting growth rate was too small and unrealistic.

Tax rate

In the long-term, the effective tax rate converges to the marginal one. We follow this line of reasoning in making the effective tax rate progressively adjust toward the value of 28% (evidence from a PwC report) in our explicit period. It has to be noticed, however, that the past figures of the effective tax rate show relevant volatility: the lowest effective tax rate (4,38%) is observed in 2017, whereas the highest happens to be in 2016 (34,49%). As observed in the previous section, we cannot provide a stable trend in taxes, due to the volatility in EBIT growth rates.

Depreciation and amortization

The assumption we made about depreciation is that it will be constant at the 2017 level (6,60% of net PPE). Moreover, the amortization for the company is null (goodwill is not amortized). Since we used a steady state model, our main assumption is that the company will only substitute existing assets.

Working capital

Essentially, for the working capital, we made adjustments for leasing and R&D assets (taking into account also the depreciation effect) and we forecasted depreciation as a fixed percentage of property, plant and equipment.

	2015	2016	2017	2018	2019	2020	2021	2022
Beginning balance			123.096,00	129.356,00	135.059,60	140.072,58	145.061,11	150.033,54
Capital expenditure	14.789,00	14.397,00	14.797,00	14.240,60	13.926,40	14.232,78	14.545,90	14.865,91
Ammortization	-	-	-	-	-	-	-	-
Leases amortization				163,41	159,80	163,32	166,91	170,59
Leased assets capex				163,41	159,80	163,32	166,91	170,59
R&D amortization				358,28	366,16	374,22	382,45	390,87
R&D assets capex				358,28	366,16	374,22	382,45	390,87
Depreciation	9.009,00	7.966,00	8.537,00	8.537,00	8.913,42	9.244,25	9.573,48	9.901,64
Ending balance			129.356,00	135.059,60	140.072,58	145.061,11	150.033,54	154.997,81

Operating lease

For the operating leases, we converted them into financial one, in order to consider them as an asset. Therefore, we split them into interest and capital component for the explicit period 2018-2022 and for 2023-onwards. Since the interest rate on lease contract is not known, we applied the cost of long term debt and we assumed the useful period to be 20 years.

R&D expenses

R&D expenses have been capitalized, according to IAS 9, considering a useful life of the R&D asset of 10 years. The first step in the reclassification of R&D expenses is to remove it from operating expenses and show it as a capital expenditure. Secondly, capital expenses create assets, and R&D is not an exception. The after-tax R&D expense has to be cumulated over time to create an asset that we can

loosely call the research asset. Third, as the research asset loses value over time and as a consequence, we needed to account for amortization over its useful life. Even though the amortization that is generated is not tax deductible, it has an impact on operating income.

	2017	2018	2019	2020	2021	2022
R&D expenses to be capitalized	546	558	570	583	596	609
R&D ammortization	351	358	366	374	382	391
Estimated useful life	10					
R&D asset	3506					

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Past R&D	402	389	375	375	438	486	518	527	543	550	555	572	546
Portion concurring to R&D asset			38	75	131	194	259	316	380	440	500	572	601

Costs

The components of COGS are the following: Fuel repurchased for resale, Cost of revenue and Fuel expense. After analyzing the trend of these costs for the last five years, we projected them as a fixed percentage of sales considering the 2017 level (67,59%).

Debt dynamic

We assumed debt repayment as % of initial long-term debt to be constant at 20,95% and new debt issuance at 26,87% (these percentages come from 2017 statement of financial position and balance sheet).

	2017	2018	2019	2020	2021	2022	2023-onwards
Debt (Long term)	49.734,00	52.677,00	55.794,15	59.095,76	62.592,74	66.296,65	67.755,18
Leasing		2.589,68	2.217,39	1.823,79	1.408,90	951,41	972,34
Debt (short term)	7.112,00	6.973,17	6.779,78	6.536,20	6.239,71	5.887,81	6.017,34
Other non current liabilities	124.191,00	126.923,20	129.715,51	132.569,25	135.485,78	138.466,46	141.512,73
Total Debt	181.037,00	189.163,05	194.506,82	200.025,00	205.727,12	211.602,34	216.257,59
Taxes	25,00%	19,00%	22,00%	24,00%	26,00%	28,00%	28,00%
kus	3,77%	3,77%	3,77%	3,77%	3,77%	3,77%	
Average cost of debt	1,88%	1,88%	1,88%	1,88%	1,88%	1,88%	1,88%

Present value of Bankruptcy Costs

The present value of bankruptcy costs is computed according to the following formula:

$$PV(BC) = \pi_a\,(BC)$$

where the probability of default multiplies the value of bankruptcy costs, computed as a percentage of the value of unlevered firm plus the present value of tax benefits.

There are two components to the estimation of the present value of bankruptcy costs, that are the probability of default and the bankruptcy costs themselves. Firstly, we defined the probability of default according to the indirect methodology, hence anchoring our estimate to the bond rating issued by the company and then using the empirical estimates of default probabilities for that rating. Secondly, we searched for studies that reported the magnitude of this costs in actual bankruptcies. According to the literature, the total bankruptcy costs (indirect plus direct ones) should be the 25-30% of the firm's value. Nevertheless, there are two main flaws to these figures: the papers that report them are quite dated (Shapiro, 1989; Titman 1984), hence they might not be reliable in their empirical observations if compared to the current times; besides, the papers do not provide any direct evidence of these figures.

Following these considerations, we looked for more recent evidence that could confirm the 25-30% estimation. Analyzing more recent literature (article by A. Rosen, 2016) and empirical cases of bankruptcy (such as Energy Future Holdings, PG&E, Enron, etc.) we came to the conclusion that costs of bankruptcy can be estimated as 2-3% of assets for the direct ones, and 25-30% of assets in the case of indirect ones. It has to be noticed that in a valuation framework, it is correct to specify the bankruptcy costs as of % of the value of unlevered firm plus the present value of tax benefits, and not as % of the total asset. The latter is standard practice after the bankruptcy declaration when the firm files for Chapter 11.

Finally, as a probability of default, we follow the results of a study by Altman: since EDF rating is A- (according to S&P and Fitch, A3 for Moody's), the corresponding probability of default is estimated to

be 2,50%.

Present Value of Tax Benefit

$$PV(TB) = \sum_{t=1}^{n} \frac{E(t_c * k_d * D_t)}{(1+\rho_u)^t} + \frac{t_c * k_d * D_{n+1}}{(1+\rho_u)^n * (\rho_u - g_n)}$$

Since the debt level of the firm is high, we used the above formula to compute the expected tax benefits. In particular, we have the explicit forecast period 2018-2022 and then we have 2023-onwards. As we have no access to a market value of debt - being absent a mark to market value of it - we estimate a cost of debt consistently with the rating of the company in the following way:
The cost of debt for short-term debt, long-term debt, and lease debt are taken from FRED website and then the cost of other non-current liabilities (ONCL) is assumed to be equal to the short-term rate.
Being the company financially sound, we choose to use as a proxy for the cost of its debt "high quality" security rates. These rates are equal to:
- short-term debt/ revolver and ONCL: 1.87% (FRED High-Quality Market (HQM) 1 year)
- long-term debt: 4.43% (FRED HQM 30 year Corporate Bond Spot rate)
- leasing interest rates: 4.43%

As observed in the section of the cost of equity, there is no necessity to state a short-term cost of equity different from the long-term one, since the company already expresses a rate in line with the industry average (7%).
As stated above, the effective tax rate converges to the marginal one in perpetuity, and the growth rate is assumed to be 2,20%.

Cost of debt LT		4,43%	4,43%	4,43%	4,43%	4,43%	4,43%
Tax benefit LT		443	544	628	721	822	840
Cost of debt leasing		4,43%	4,43%	4,43%	4,43%	4,43%	4,43%
Tax benefit Leasing		21,80	21,61	19,39	16,23	11,80	12,06
Cost of debt ST		1,65%	1,65%	1,65%	1,65%	1,65%	1,65%
Tax benefit ST		22	25	26	27	27	28
Cost of debt ONCL		1,65%	1,65%	1,65%	1,65%	1,65%	1,65%
Tax benefit ONCL		397,90	470,87	524,97	581,23	639,72	653,79
Discount rate	1	0,95	0,91	0,87	0,83	0,79	
Discounted TB		844,64	966,42	1.042,13	1.116,34	1.188,98	
Discounted TB (2018-2023)	5.158,52						
TB (2023-onwards)	18.339,51						
Discounted TB (2023-onwards)	14.526,56						
Present Value Tax Benefit	19.685,07						

Result of the model

We obtained an Equity Value of 46.343,60, that divided by the number of shares outstanding gives us a target price of 13,30. In order to obtain the equity value, we subtracted from the total Adjusted Present Value the following items:
- Cash & Cash Equivalents: 25.618,00;
- Minority interests: 7.341,00;
- BV of debt: 106.101,00.

It is fundamental to point out that the market value of debt should be taken out instead of the book value. However, since we do not have a reliable measure of the market value of debt, we assumed it to be equal to the book value. Furthermore, the BV of debt includes short-term debt, long-term debt and 50% of non-current liabilities, since these are assumed to be interest bearing (pension benefits and reserves compose the remaining 50%).

The determinants are the following:

1. Value of unlevered firm:

FCFF 5	7.823,98
Discount 5	79,21%
Kul	7,00%
g	2,20%
TV (not discounted)	166.585,55
TV	131.950,91
Kus	4,77%
VU	167.166,62

2. PV of tax benefits:

Discounted TB (2018-2023)	5.158,52
TB (2023-onwards)	18.339,51
Discounted TB (2023-onwards)	14.526,56
Present Value Tax Benefit	19.685,07

3. PV of bankruptcy costs:

Probability of default	2,50%
Direct Bankruptcy Costs*	2,75%
Indirect Bankruptcy Costs*	28,25%
Total assets (FY 2017)	186.852
PV of Bankruptcy Costs	**1.448,10**

**as a % of value of unlevered firm + pv of tax benefit.*

Market multiples approach

We used this kind of valuation in order to have an immediate comparison between FCF method and the market sentiment in this actual moment and a projection of the value of EDF in the future.
In order to set up this kind of valuation, we considered seven listed peers: Engie SA, Enel S.p.A, E.On SE, Innogy SE, Albioma SA, Futuren SA and China Energy Engineering Corp Ltd.

	Stock exchange	Market Cap (1/12/18) € billion	Sales (2017) € billion	EBITDA Margin (2017) %	EBIT Margin (2017) %
EDF	Paris Stock Exchange	43,6	69,63	22,5	8,8
Engie	Paris Stock Exchange	30,2	66,03	13,9	7,4
Enel	BorsaItaliana	48,7	72,66	19,4	12,6
E.On	Frankfurt Stock Exchange	19,8	37,97	12,5	7,7
Innogy	London Stock Exchange	22,4	0,04	10,2	6,7
Albioma	Paris Stock Exchange	0,5	0,04	33,0	20,3
Futuren	Paris Stock Exchange	0,3	0,06	48,3	13,2
Ch.Energy	Hong Kong Stock	28,5[1]	30,4	53,8	43,8

[1] CNY billion.

Mean[2]			29,6	27,3	16,0
Median[3]			30,4	19,4	12,6

Source: Eikon and Google Finance, Minerva estimates

It is worth to take in account that many of the main competitors are not listed (Direct Energie, Orano, Vattenfall).
Engie SA structures its activities around electricity, natural gas and energy services. The group is focused on: low-carbon power generation, global networks expansion and customer solutions development. ENGIE mainly operates in France and other EU countries. Headquartered in La Défense, Courbevoie, France.
Enel is a multinational energy company and one of the world's leading integrated electricity and gas operators. It works in 35 countries across 5 continents, generating energy with a managed capacity of more than 89 GW, selling gas and distributing electricity across a network spanning approximately 2.2 million km.
E.on is a European holding company based in Essen, North Rhine-Westphalia, and Germany. It runs one of the world's largest investor-owned electric utility service providers. E.ON is organized into the following business areas: Customer Solutions, Energy Networks and Renewables.
Innogy SE is Germany's leading energy company, with revenue of around €44 billion (2016), more than 40,000 employees and activities in 16 countries across Europe. With its three business segments (Grid & Infrastructure, Retail and Renewables) Innogy addresses the requirements of a modern, decarbonized, decentralized and digital energy world.
Futuren SA is an independent producer of electricity from onshore wind energy. The Company develops, builds and operates wind farms in the four main countries of Germany, France, Morocco and Italy. The company has chosen to focus its activity on onshore wind energy because it considers it the most advanced (excluding hydro) of renewable energies. Generating wind power in 4 countries with different wind characteristics enables the Group to reduce the impact of unfavorable wind conditions in one country over a given period.
China Energy Engineering Corp Limited is a comprehensive power industry solutions provider. The Company surveys, designs, and constructs power projects. China Energy Engineering also manufactures various power industry related equipment. It is one of the largest comprehensive solutions providers for the power industry in China and globally.

In order to evaluate EDF group, the sample has been selected because of similar business model and operating resources.
China Energy Engineering Corp Limited has been excluded because of its geographic focus. Operating in Asia country, the company can rely on different growth rate and expansion opportunities.
Futuren SA has been excluded due to data insufficiency. There are not available information on forecasted figures.
Albioma has been excluded because it's dimension in term of market capitalization and revenues.

The remaining includes the following companies: Engie SA, Enel SpA, E.On SE and Innogy SE.
We decided to conduct the analysis using forecasted multiplies (2018-2019-2020) because of the particular business environment. Specifically, utilities sector is not expected to experience significant and/or unexpected events in terms of growths or competition.
We used both equity side and asset side multiples, in order to have a double check on our results.
The equity side multiples we considered are PE and PBV. PE is one of the most diffused tools as regard relative valuation. PBV let the investors appreciate the investments and other tangible assets held by the company. In fact, profit is strictly related to investments.

[2] Excluded EDF.
[3] Exluded EDF.

The asset side multiples we considered are EV/Revenues, EV/EBITDA and EV/EBIT. The first factor highlights the market appreciation of company franchising power.
The second one and the third one show the market appreciation of different capital and revenues-costs structure.

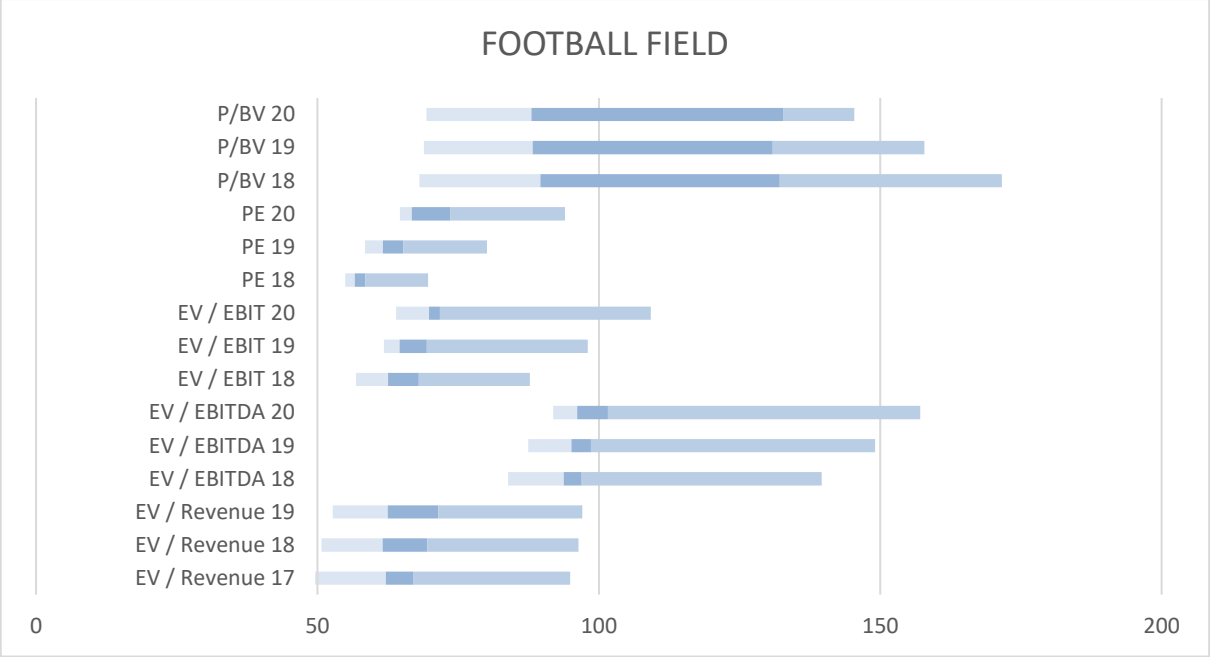
	EDF			Engie			Enel			E.on			Innology		
	EDF: PA			EPA: ENGI			BIT: ENEL			ETR: EOAN			ETR: IGY		
	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
EV / Revenue	1,1	1,06	1,02	0,89	0,85	0,83	1,36	1,33	1,29	0,71	0,7	0,7	0,96	0,96	0,95
EV / EBITDA	5,04	4,69	4,34	6,16	5,82	5,44	6,37	6,03	5,75	5,51	5,35	5,2	9,17	9,12	8,89
EV / EBIT	12,34	11,11	9,7	10,95	10,06	9,08	10,07	9,36	8,84	9,16	8,96	8,1	14,13	14,21	13,83
PE	25	18,88	13,91	12,72	11,68	10,16	11,8	10,39	9,54	13,73	13,18	12,22	19,71	19,23	18,37
P/BV	1,06	1,03	0,99	0,8	0,8	0,78	1,29	1,23	1,18	3,16	2,78	2,41	2,26	2,18	2,14

Source: Eikon, Minerva estimates

Multiples					
EV / Revenue	2018	0,71	0,89	0,96	1,36
	2019	0,70	0,85	0,96	1,33
	2020	0,70	0,83	0,95	1,29
EV / EBITDA	2018	5,51	6,16	6,37	9,17
	2019	5,35	5,82	6,03	9,12
	2020	5,20	5,44	5,75	8,89
EV / EBIT	2018	9,16	10,07	10,95	14,13
	2019	8,96	9,36	10,06	14,21
	2020	8,10	8,84	9,08	13,83
PE	2018	11,80	12,72	13,73	19,71
	2019	10,39	11,68	13,18	19,23
	2020	9,54	10,16	12,22	18,37
P/BV	2018	0,80	1,29	2,26	3,16
	2019	0,80	1,23	2,18	2,78
	2020	0,78	1,18	2,14	2,41

Such multiples have been used to conduct a football field analysis which results are shown below.

EV According to (€ Billion):				
EV / Revenue 17	49,56	62,12	67,01	94,93
EV / Revenue 18	50,72	61,59	69,56	96,37
EV / Revenue 19	52,68	62,47	71,50	97,09
EV / EBITDA 18	83,86	93,76	96,95	139,57
EV / EBITDA 19	87,47	95,16	98,59	149,11
EV / EBITDA 20	91,88	96,12	101,60	157,09
EV / EBIT 18	56,88	62,53	68,00	87,75
EV / EBIT 19	61,82	64,58	69,41	98,05
EV / EBIT 20	63,99	69,84	71,73	109,26
PE 18	54,95	56,66	58,54	69,66
PE 19	58,46	61,62	65,29	80,11
PE 20	64,67	66,73	73,57	93,99
P/BV 18	68,09	89,59	132,14	171,62
P/BV 19	68,93	88,24	130,90	157,85
P/BV 20	69,39	88,04	132,83	145,42



As can be seen from the football field structure and considering the plausible EV, no relevant outliers can be seen.
The EDF enterprise value reasonably ranges from 64,4 € billions (25th percentile) to 96,5 € billions (75th percentile).
Given the high dispersion of the results we decided to continue the analysis assuming an enterprise value ranging from 72,7 € billions (median) to 86,0 € billions (average).

Share Price Calculation			
	EV	Equity Value	Share Price
MIN	49,6	16,6	5,5
Q1	64,4	31,4	10,4
MEDIAN	72,7	39,7	**13,2**
Q3	96,5	63,5	21,1
MAX	171,6	138,6	46,0
AVG	86,0	53,0	**17,6**
Current Share Price:			14,7

To conclude, the average price per share is expected to range from 13,2 to 17,6; suggesting a hold recommendation.

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