EDF GROUP'S VIEW ON THE LONG TERM EMISSIONS REDUCTION STRATEGY OF THE EUROPEAN UNION

- **EDF welcomes the EU's initiative** to develop a long term strategy so as to design a de-carbonisation path towards 2050 in line with the ambition of the Paris Agreement. EDF Group, which is **committed to pursue carbon neutrality by 2050**, intends to be a major player in this policy.

1. Cost effective decarbonisation

- EDF Group shares the Energy Union's philosophy that is at the root of the Long Term Strategy: **cost-effective decarbonisation of the European economy**. Such a vision that reconciles sustainable development and economic efficiency will contribute both to the EU's leadership in the fight to preserve the planet and to its competitiveness against other regions of the world. EDF also believes that an essential pre-requisite for cost-effectiveness is that **policy and investment decisions are based on a carbon price signal**.

- EDF Group shares the main ideas that structure the Commission's long term view: the right way to implement cost-effective decarbonisation is **to decarbonise electricity, which can be achieved at an affordable cost, and to significantly electrify the economy,** in other words to substitute fossil energy by efficient uses of electricity.

- EDF Group also agrees that the EU should define **ambitious milestones on its way to 2050**: the later the efforts, the more severe the damages and the higher the final costs. In particular **the 2030 ambition should be in line with the 2050 target**. In this regard the current emissions reduction target does not appear to be up to the conclusions of the Paris Agreement. EDF Group supports **a target significantly higher** than the current 40% and welcomes Commissioner Cañete's statement that opened the discussion by proposing 45%.

- A higher economy-wide target should translate into a **higher ambition in the power sector**, given the crucial contribution of electricity to the whole process. This means further reforms of the ETS. According to numerous studies as a consequence of overlapping national and European policies **the carbon price in 2030 could be too low**, possibly as low as 20 €/t, to drive decarbonisation in investment and operation. Not only a more efficient MSR but also **further initiatives to strengthen the price signal and limit its volatility will be needed**.

2. A Increasing the electrification rate to 40-60%

- The expected double move towards decarbonised electricity and a more electrified economy will logically result in **new electricity demand**:

  - Some existing uses like those induced by the development of IT will increase.
  - New uses will emerge as a consequence of growing electrification of transport and heating & cooling.

  Electrification however will be gradual and kept under control. There are several reasons to that:

- Through energy efficiency policies that are now a first-ranking priority of energy policies, **any use will become more efficient**.
- **Electrification as such generates more efficiency**: heat pumps and electric engines are more efficient (by about a factor 3) than boilers and combustion engines.
- **In some areas electrification will remain limited**: some industrial processes and modes of transport (heavy, long range) are not well adapted to direct electrification for the time being.

It seems thus likely that **the electrification rate of the European economy currently low at 22% of final energy consumption will progressively increase to 40 to 60% in 2050** depending on the ambition of the EU's policy. Combined with energy efficiency this would translate into moderate growth rates of electricity demand, far lower than what was common in the past decades and has proven rather easy to deal with, be it on the generation or on the infrastructure side.

3. Decarbonised power generation and flexible demand: a new balance

- In order to meet very ambitious emissions reduction targets, **electricity will have to be fully or very close to 100% decarbonised by 2050**. This means a power mix that will be completely different from the current one. Since in the short and medium term we cannot expect demand side and storage to provide a full and affordable compensation for the variability of solar and wind, a cost-effective transition will require **a share of dispatchable generation** (hydro, nuclear, biomass, CCS depending on policy choices and available indigenous resources in the different member-states) that remains significant while **the share of variable generation** (wind, solar) **increases** from now to 2050.

  Regarding nuclear in the first part of the 2020-2050 period **life extension of existing nuclear plants,** currently the cheapest way of producing carbon-free electricity (32 €/MWh in France[1]), **will be key**. In the long run the learning curves open up a prospect of developing new nuclear at an affordable investment cost of less than 3500 €/kW (source: IEA). Some member-states will wish to rely on nuclear to decarbonise, so nuclear will be part of the European mix in 2050.

- Decarbonisation along with electrification will thus **greatly enhance the EU's security of supply,** not to mention the induced improvement of air quality in particular in cities.

- Since the share of variable electricity is bound to increase, **much more flexibility will be needed in** power systems. In order to preserve competitiveness this flexibility should be made available **at best cost**. A revolution brought about by the energy transition is that much more is going to happen downstream: thanks to information technologies **demand side is going to be able to provide much of the needed flexibility**.

  - As a consequence of the deployment of smart systems at affordable cost it will become very often **easier and cheaper to defer power consumption than to convert electricity into another energy carrier**.

[1] for the fleet in operation, including life extension.

- In particular the potential **for deferral of use is already proven for equipment like water boilers and can be extended in future to more devices** thanks to the internet of things. **The expected development of electric vehicles will contribute one more flexibility mean**, first through smart charging (**grid to vechicle**) and later through advanced use of vehicle batteries for the benefit of the system (**vehicle to grid),** with a huge storage capacity
- The potential for flexibility delivered by demand will be gradually **reinforced by storage** as more and more technologies and uses reach economic maturity.

- In the new context of a carbon-free mix **seasonal variability should not be a problem** given that some dispatchable carbon-free generation will remain available and an optimised mix of solar and wind can help cope with differences between summer and winter.

- As opposed to using direct demand side or mature storage technologies **converting electricity into another energy vector (hydrogen, methane) is likely to prove a more costly way of generating flexibility**: an affordable power-to-gas process requires both extremely cheap electricity and a high number of full load hours (around 5000). Renewable power in excess will not be available often enough to meet these pre-requisites.

- Whenever a direct use of electricity is possible, it is much more efficient in terms of energy than a conversion into hydrogen, let alone a double conversion into methane.This is why **conversion of electricity into hydrogen is likely to focus on some sectors** where electricity cannot easily provide decarbonisation for technological or economic reasons: **industrial processes using hydrogen as an input and long range heavy transport will be the main area of development for decarbonised electrolytic hydrogen.** A double conversion is clearly even less efficient.

- Conversely, the same reasoning applies to solid biomass. Direct use, e.g. through district heating or CHP, is far more efficient than conversion into electricity or gas. Sustainable resources of biomass are limited and their use must be optimised taking into account competing land uses.

4. Towards a differentiated energy mix

- Since the share of electricity should be around 50% the future mix will combine different energy carriers. We can expect **different combinations of technologies in the main sectors of the economy**:

  - Electricity and hydrogen (generated from carbon free electricity) will be the two main technologies competing in the **transport** sector with better perspectives for the latter in sea and non-electrified rail-transport.
  - In the **building** sector both heat pumps and direct use of renewables, in particular in district heating, will coexist. The prospect of renewable natural gas (RNG) seems limited by high cost and conversion losses. The potential of biogas in the decarbonisation process is real but as already mentioned direct use of limited resources is more efficient.
  - Decarbonisation in the **industry** will depend on the characteristics of the different processes and rely on electricity, hydrogen and the limited available quantity of RNG.

- Quite a few technologies needed for the expected transition are already available at industrial stage and at an affordable price, like electric mobility. But a lot of progress is needed in some sectors at R&D (e.g. storage) or industrialisation (e.g. smart solutions) stage. **A strong R&D&I EU policy is essential** to ensure that improvements happen timely, breakthroughs are made possible and the winners are European.