

HINKLEY POINT C: THE LONG MARCH TO FID

ELECTRIC POWER SPECIAL REPORT

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Benjamin Leveau, Editor, France and Belgium, Platts nuclear publications
Oliver Adelman, Managing Editor, EMEA, Platts nuclear publications



INTRODUCTION

Hinkley Point C is set to be the first new nuclear plant to be built in the UK since Sizewell B was commissioned in 1995.

The two-unit facility is forecast to account for around 7% of UK generation once operational in the mid-2020s – assuming the UK government finally approves the project this Autumn, and lead sponsor EDF meets construction deadlines following its positive Final Investment Decision (FID) of July 28.

Supported by a 35-year offtake price guarantee and debt protection, the project represents part of the UK government's ambitious solution to decarbonize the country's energy sector, leading a program for over 16 GW of new UK nuclear capacity.

While Hinkley will use French technology with Chinese investment support, EDF has stressed that UK manufacturers will provide services and equipment equivalent to 60% of the project's £18 billion (\$23 billion) investment cost, with 25,000 jobs on site during construction.

In France, EDF's chief executive Jean-Bernard Levy and the government view the project as critical to the future of the country's nuclear industry, despite opposition from the utility's labor unions to a FID this year.

Other European countries are watching closely to see if the project, which has already absorbed 10 years of management time and £2.5 billion in funds, has any relevance to their own decarbonization plans or is merely a salutary lesson in top-down policy intervention.

THE LONG MARCH TO FID

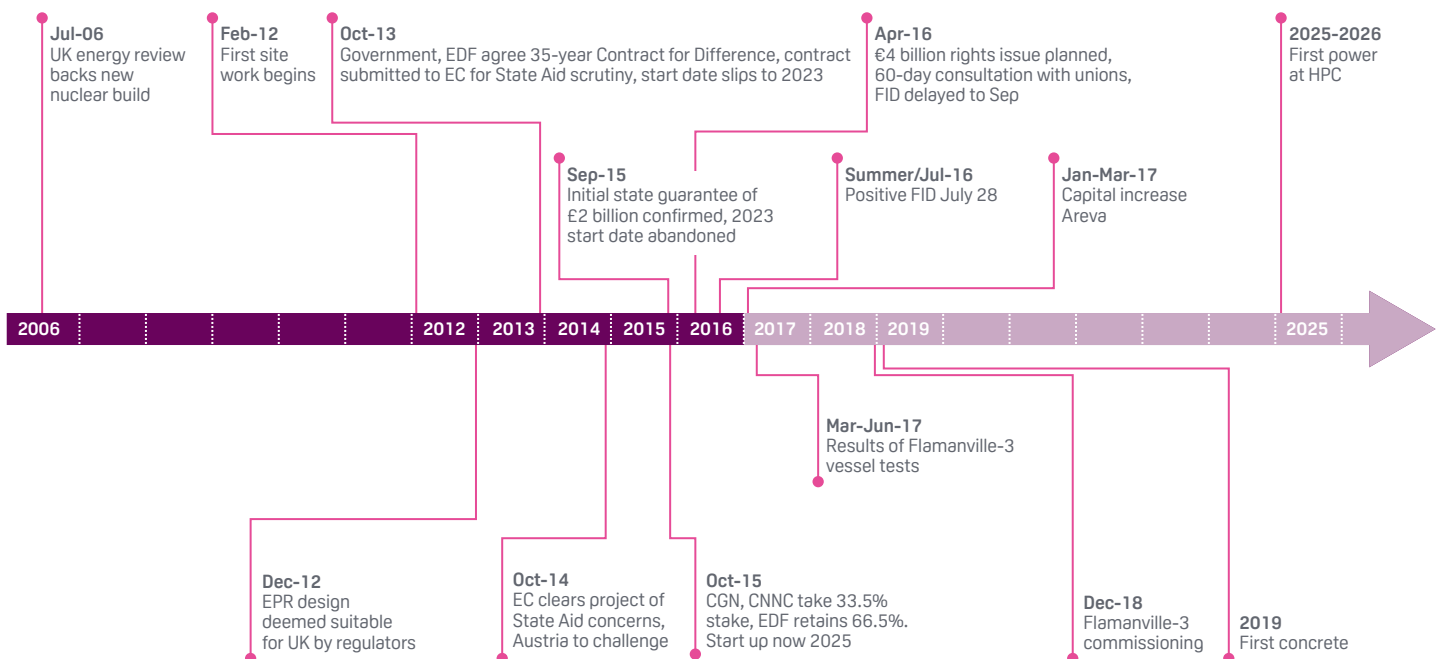
Having concluded a consultation with three labor unions July 4, EDF's board took a positive Final Investment Decision July 28 on its 3,200 MW Hinkley Point C nuclear power station in Somerset, southwest England. Immediately afterwards, however, the UK government said it was not quite ready to sign off on project support. It would scrutinize components of the deal with a view to an agreement in the Autumn. Earlier EDF had confirmed that it still intended to pour first concrete at reactor 1 in mid-2019, coinciding with the start-up of EDF's EPR plant at Flamanville, Normandy.

A decision was originally scheduled for 2013 but has been delayed by a variety of factors, the foremost being a lengthy hunt for investment partners, EDF's deteriorating financial state, negotiation of UK support and State aid clearance of the support by the European Commission.

With Centrica and then Areva failing to take up options to participate, in October 2015 EDF finally committed to take a 66.5% stake in the project, with Chinese state-owned nuclear concern CGN taking the remaining 33.5%. This ownership structure will not be formalized prior to final investment decision and it is possible that further partners will enter the consortium at a later stage.

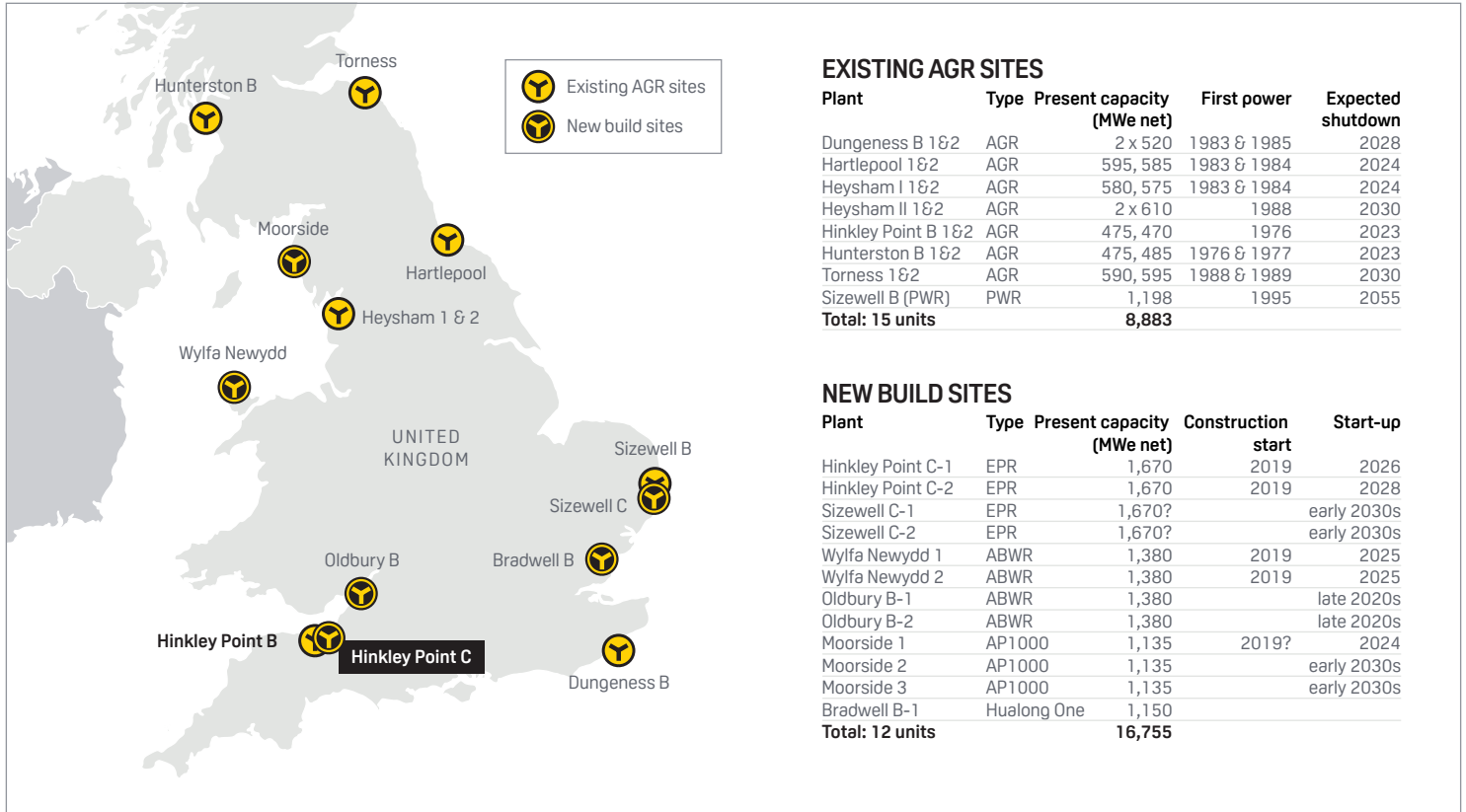
Hinkley's technology choice, meanwhile, remains a concern. There is still no operating reference plant for Areva's European Pressurized-water Reactor (EPR) design, after multi-year delays and massive cost overruns at EPR construction sites in Finland and France (two more EPRs are being built in China). Reactor pressure vessel quality issues at EDF's Flamanville site rank high

TIMELINE FOR CONSTRUCTION OF HINKLEY POINT C EPRS



Source: Platt's

EXISTING AND PLANNED UK NUCLEAR UNITS



EXISTING AGR SITES

Plant	Type	Present capacity (MWe net)	First power	Expected shutdown
Dungeness B 1&2	AGR	2 x 520	1983 & 1985	2028
Hartlepool 1&2	AGR	595, 585	1983 & 1984	2024
Heysham I 1&2	AGR	580, 575	1983 & 1984	2024
Heysham II 1&2	AGR	2 x 610	1988	2030
Hinkley Point B 1&2	AGR	475, 470	1976	2023
Hunterston B 1&2	AGR	475, 485	1976 & 1977	2023
Torness 1&2	AGR	590, 595	1988 & 1989	2030
Sizewell B (PWR)	PWR	1,198	1995	2055
Total: 15 units		8,883		

NEW BUILD SITES

Plant	Type	Present capacity (MWe net)	Construction start	Start-up
Hinkley Point C-1	EPR	1,670	2019	2026
Hinkley Point C-2	EPR	1,670	2019	2028
Sizewell C-1	EPR	1,670?		early 2030s
Sizewell C-2	EPR	1,670?		early 2030s
Wylfa Newydd 1	ABWR	1,380	2019	2025
Wylfa Newydd 2	ABWR	1,380	2019	2025
Oldbury B-1	ABWR	1,380		late 2020s
Oldbury B-2	ABWR	1,380		late 2020s
Moorside 1	AP1000	1,135	2019?	2024
Moorside 2	AP1000	1,135		early 2030s
Moorside 3	AP1000	1,135		early 2030s
Bradwell B-1	Hualong One	1,150		
Total: 12 units		16,755		

Note: Start-up dates based on best estimates by Platts of current time frames for construction.
Source: EDF Energy, Platts Analytics' Eclipse Energy

amongst these concerns, but problems with documentation, subcontractor management and concrete pouring have all played a part in an inglorious history to date. Indeed EDF has already decided to redesign the reactor to simplify its construction.

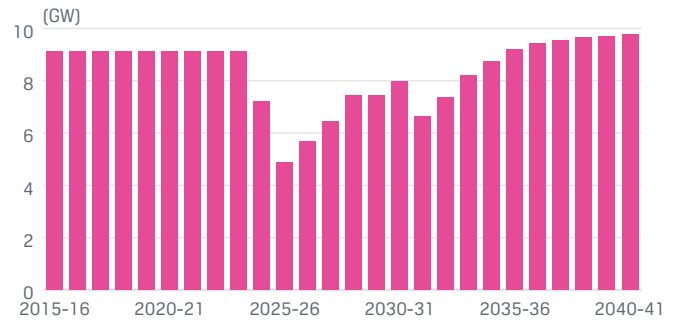
Meanwhile EDF is facing significant headwinds at home in the shape of falling wholesale prices, a \$56 billion bill for reactor lifetime extensions and the purchase of reactor vendor Areva NP. All put pressure on the utility's finances and credit rating (see chart - bottom page 3). In late April, EDF said the French government would recapitalize the utility by up to \$4.4 billion as part of a broad financial package to shore up its finances.

Against this backdrop, EDF and the government see Hinkley Point C as essential to the future of an industry that is France's third biggest employer. The belief is that failure to deliver would have long-term ramifications on EDF, Areva and the entire French nuclear industry.

FADING AGRS AND SLIPPING SCHEDULE

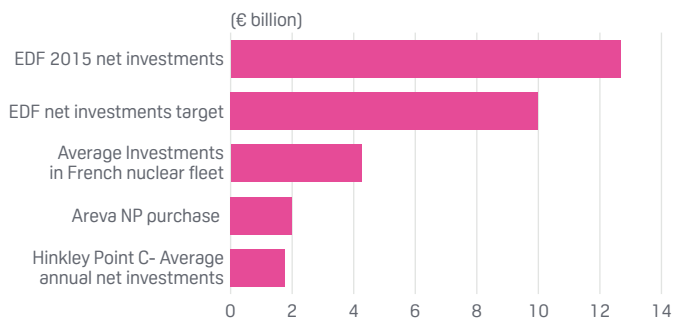
On the client side, the UK has ambitious plans to decarbonize electricity generation, notably through an extensive deployment of new nuclear capacity. In July 5 forecast scenarios, transmission system operator National Grid says the least-cost route to decarbonizing the UK economy by 2050 is to clean up electricity generation first, and then use low-carbon power to support the greening of heat and transport (see table, chart - page 4).

UK NUCLEAR CAPACITY FORECAST



Source: Platts Analytics' Eclipse Energy

EDF'S CURRENT AND FUTURE NUCLEAR INVESTMENTS 2017-25



Source: Platts Analytics' Eclipse Energy

NATIONAL GRID'S 2030 FORECASTS

	2015	2030			
		Gone Green	Slow Progression	No Progression	Consumer Power
Electricity					
Annual demand (TWh)	334	346	318	322	331
Peak demand (GW)	61	67	59	61	63
Total installed capacity (GW)	97	165	131	114	157
Low carbon capacity (GW)	39	103	78	53	87
Interconnector capacity (GW)	4	23	15	11	23
Total storage capacity (GW)	3	8	4	3	11
Gas					
Annual demand (TWh)	880	603	633	808	746
1-in-20 peak demand (GWh/day)	5,194	4,714	4,906	5,640	5,261
Residential demand (TWh)	326	189	251	299	275
Gas imports (%)	58	72	80	62	25
Shale production (Bcm/yr)	0	0	0	15	30
Decarbonisation					
Renewable energy (%)	~81	31	27	21	23
Reduction in carbon emissions (%)	~371	58	53	48	49

Note: Actual 2015 data not available at the time of writing. This estimate is based on DECC's 2014 figures. All numbers rounded to the nearest whole number.

Source: National Grid

Hinkley Point C is seen as a material first step in the process, leading to the construction of up to 16,000 MW of new nuclear capacity by 2030. The construction schedule of individual units, however, is already showing considerable signs of slippage, with a potential nuclear gap opening up around 2025 if Hinkley itself is not completed on time. To offset this effect EDF Energy has been working hard to extend the lives of its ageing Advanced Gas-cooled Reactors, but impending closures still cluster through the 2020s.

The enclosed map shows the sites for the UK's existing fleet of AGRs and single PWR, which have a combined capacity of 8.883 MW. The last of the AGRs is set to close in 2030, while the Sizewell-B PWR is likely to run until 2055. Meanwhile the first new units could start as early as 2026, but this schedule remains tentative.

A negative decision on Hinkley Point C cannot be discounted. This could force a reassessment of the UK's nuclear strategy. Eclipse Energy, an analytics unit of Platts, suggests that a mix of wind, solar, biomass, gas-fired capacity and subsea interconnection would be called on in the event that Hinkley is shelved or massively delayed.

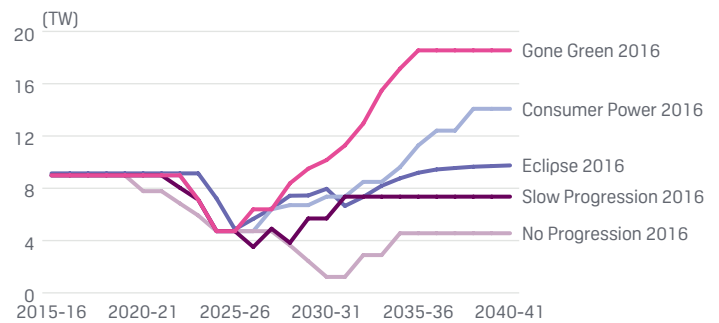
THE CONTRACT FOR DIFFERENCE

The financing of the project has been viewed by the nuclear industry and other European countries intent on developing nuclear capacity as a potential model to follow.

Hinkley Point C will be financed through a 35-year Contract for Difference, or CFD, that guarantees an electricity producer a strike price over a fixed period of time (see chart - bottom page 4).

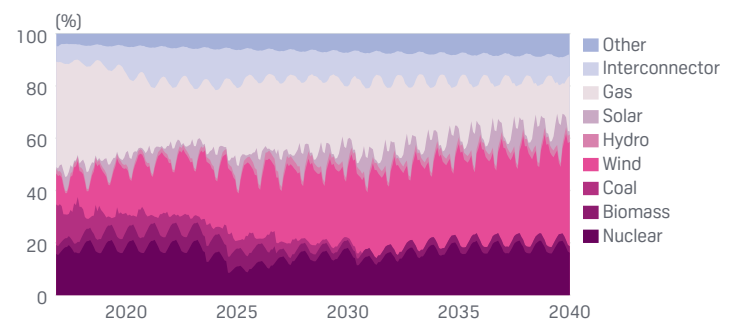
If the CFD reference price, based on forward contracts in the UK wholesale electricity market, dips below the strike price over the period of the contract, the generator will be compensated via a levy on consumer bills. If the wholesale price exceeds the strike price, the generator reimburses consumers.

NUCLEAR CAPACITY FORECASTS: NATIONAL GRID, ECLIPSE



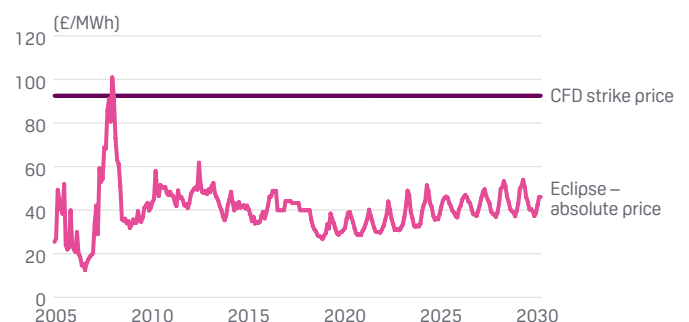
Source: National Grid, Platts Analytics' Eclipse Energy

ECLIPSE UK GENERATION SHARE FORECAST



Source: Platts Analytics' Eclipse Energy

PLATTS AND ECLIPSE WHOLESALE POWER FORECAST



Note: CFD is in 2012 money and index linked to the CPI.

Source: Platts Analytics' Eclipse Energy

Hinkley's strike price was agreed at £92.50/MWh, or £89.50/MWh (indexed to CPI, 2012 money) if a positive FID is taken on further EPR units at Sizewell C.

EDF estimates that it will make a rate of return on the project of around 9% over a 60-year lifetime. The sensitivity of this rate of return to construction delays is 20 basis point for every six months' delay, it said in June.

The CFD mechanism was approved as legal state aid by the European Commission after an in-depth investigation, although it is still the subject of a legal appeal by Austria to the European Court of Justice, or ECJ.

It remains to be seen what impact this appeal will have, even were it to be successful, following the UK's planned exit from the EU.

EDF has repeatedly said that the UK's future exit from the EU would not impact the project, although a drop in the pound could somewhat increase the overall costs for the sourcing of materials outside the country.

Some 60% of the project's contracts with suppliers are intended to be awarded to UK companies, with companies including ABB, Laing O'Rourke, Clyde Union and Balfour Beatty having already been awarded key work.

The perceived strategic importance of the project to France, EDF, the UK and also the European nuclear industry is putting increasing pressure on the French utility to make its decision soon despite union opposition and other uncertainties.

EPR TRAVAILS

As noted, key amongst these is the fact that there is no reference EPR in operation yet. Two Chinese units are scheduled for operation at Taishan in 2017, while TVO's Olkiluoto-3 project in Finland is heading for 2018 operation after what would be a 13-year construction period disfigured by errors, cost overruns and compensation claims.

Perhaps most pertinent to Hinkley, however, is EDF's Flamanville-3 EPR project.

Started in 2007, the reactor was originally scheduled to enter service in 2012. The unit has suffered repeated delays and cost increases, having to adapt to enhanced post-Fukushima regulatory requirements and deal with project management and equipment issues – the most serious of which concerns the quality of steel in the unit's reactor vessel heads.

Extended test results on the heads are due to be submitted in November this year, with French nuclear safety authority ASN taking between four and six months to arrive at its final decision on the components.

The relevance of this to Hinkley Point C is both specific and general. Specific because the Hinkley reactor vessel is likely to come from Areva's Le Creusot forge, where the Flamanville components were made. General because it is just one example of the many lessons EDF Energy says it must learn from if Hinkley Point C is to be delivered on time and to budget.

PLANNED EPRS GLOBALLY

	Olkiluoto-3	Flamanville-3	Taishan-1	Taishan-2	Hinkley Point C
Capacity (MWe)	1,600	1,630	1,660	1,660	2 x 1,638
First concrete	Oct-05	Dec-07	Oct-09	Apr-10	2019*
Initial commissioning date	May-09	Jun-12	Dec-13	Sep-14	2023*
Expected commissioning date	Dec-18	Dec-18	Jun-17	Dec-17	2026*
Expected construction time (months)	160	123	94	94	84
Costs (\$ billions)	9.5	11.7	Unknown	Unknown	24.0
Cost per kW (\$/kW)	5,938	7,091	Unknown	Unknown	6,556

*Unit 1

Source: Areva, EDF, Platts

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www.platts.com | support@platts.com

NORTH AMERICA

+1-800-PLATTS8 (toll-free)

+1-212-904-3070 (direct)

EMEA

+44-(0)20-7176-6111

LATIN AMERICA

+55-11-3371-5755

ASIA-PACIFIC

+65-6530-6430

RUSSIA

+7-495-783-4141