Supplementary information

Back to the future? What it will take to deliver nuclear energy in the EU

This document presents the datasets and analysed data as part of the '*Back to the future? What it will take to deliver nuclear energy in the EU'* CEPS in-depth analysis. References available in the references section of the report.

Sectoral temperature requirements against reactor outlet temperatures

To determine which reactors could serve non-electric (e.g. thermal) applications, the core outlet temperature of these (both GW-scale and SMRs) was compared against typical thermal requirements (i.e. temperature) by sectors and industries. End-use thermal requirements are presented in Table 1. Typical GW-scale core outlet temperatures were obtained from the literature, whereas SMR core outlet temperatures were obtained from the NEA SMR Dashboard and presented in Table 2. For the latter, these are representative of the maximum temperature achievable by reactor concepts in different reactor 'families'. These depend on reactor specificities and may not be representative of reactors expected to become operational in the EU. Furthermore, it is important to note that core outlet temperatures are not representative of the water/steam temperatures received by end consumers. These are below the reactor core temperatures as the heat undergoes several loops before being delivered to the end consumer.

Table 1. Temperature requirements of non-electric applications and reactor core outlet temperatures.

Application	Temperature requirement range (°C)
Low temperature electrolysis (LTE)	10 – 100
Food & beverages	20 – 200
Textiles	40 – 130
District heating	80 – 140
Seawater desalination	80 – 120
High temperature electrolysis (HTE)	150 – 200
Plastics	120 – 220
Pulp & paper	150 – 400
Petroleum refining	250 – 550
Oil shale and oil sand production	300 – 600
Steam methane reforming	500 – 900
Thermochemical hydrogen production	500 – 890
Petrochemical (ethylene, styrene)	590 – 690
Chemical	600 – 1 000
Steelmaking	600 – 1 000
Coal processing	800 – 1 000
Cement, glass, ceramics	1 000 – 2 000

Table 2. Maximum GW-scale and SMR reactor family core outlet temperatures.

Reactor	Maximum GW-scale core outlet temperature (°C)	Maximum SMR core outlet temperature (°C)	Corresponding SMR design
WCR	325	326	CAREM-25
MSR	750	750	Stellarium
MCR	850	1 000	DF300
GCR	950	1 200	Eskom

LCOE OF DIFFERENT TECHNOLOGIES

As part of the cross-technology techno-economic performance comparison, LCOE figures from various sources were compiled to capture a range of estimates. Estimates are either representative of global/regional/national averages or ranges. Data type and associated source are specified along with identification codes (corresponding to those of Figure 7 in the in-depth analysis report). The complete dataset is presented in Table 3.

Table 3. LCOE average and ranges for selected technologies.

Technology	Identification	LCOE (EUR/MWh)	Data type	Source
Nuclear	N 1 (LTO-20)	31 – 34	Europe; r = 7%; LTO-20	IEA and NEA (2020)
	N 2 (LTO-20)	31 – 36	Global; r = 7%; LTO-20	IEA and NEA (2020)
	N 3 (LTO-10)	34 – 39	Global; r = 7%; LTO-10	IEA and NEA (2020)
	N 4 (LTO-10)	34 – 40	Europe; r = 7%; LTO-10	IEA and NEA (2020)
	N 5	35 – 89	-	JRC (2025)
	N 6	72 – 111	Global; r = 7%	IEA and NEA (2020)
	N 7	78 – 111	Europe, r = 7%	IEA and NEA (2020)
	N 8	93 – 117	UK	DESNZ (2023)
	N 9	155	Current Policy Scenario; EU	IEA (2025a)
	N 10	159	US	Lazard (2025)
	N 11	49 – 179	Global	DNV (2025)
	N 12	140 – 195	US; cf = 89-92%	Lazard (2025)
	N 13	218 – 372	US	BNEF (2026a)
Onshore wind	OnW 1	32	Global	IRENA (2025)
	OnW 2	35	US	BNEF (2026a)
	OnW 3	43	-	NREL (2024)
	OnW 4	54	cf = 30-50%	Lazard (2025)
	OnW 5	57	Current Policy Scenario; EU	IEA (2025a)
	OnW 6	51 – 63	Europe, WACC = 3-5%	WindEurope and ETIP Wind (2021)
	OnW 7	49 – 81	US	BNEF (2026a)

	OnW 8	44- 94	Germany	Fraunhofer (2026)
	OnW 9	32- 100	Europe; >1 MW; r = 7%	IEA and NEA (2020)
	OnW 10	33- 111	UK	ARUP (2024)
	OnW 11	136	Europe	IRENA (2025)
	OnW 12	32 – 170	Global, 1 MW; r = 7%	IEA and NEA (2020)
Offshore wind	OfW 1	61	Current Policy Scenario; EU	IEA (2025a)
	OfW 2	74	Global	IRENA (2025)
	OfW 3	75	Europe	IRENA (2025)
	OfW 4	89	US	BNEF (2026b)
	OfW 5	49 – 104	Europe, r = 7%	IEA and NEA (2020)
	OfW 6	56 – 105	Germany	Fraunhofer (2024)
	OfW 7	96 – 119	Europe; Bottom-fixed; WACC = 4-5%	WindEurope and ETIP Wind (2021)
	OfW 8	124	Global; Bottom-fixed	DNV (2025)
	OfW 9	68 – 152	UK	ARUP (2024)
	OfW 10	110 – 171	Bottom fixed and Floating	NREL (2024)
	OfW 11	49 – 219	Global, r = 7%	IEA and NEA (2020)
	OfW 12	206 – 253	Europe; Floating; WACC = 7-8%	WindEurope and ETIP Wind (2021)
	OfW 13	345	Global; Floating	DNV (2025)
Solar PV	PV 1	35	Global; Fixed Axis PV	BNEF (2026b)
	PV 2	37	Global; Tracking PV	BNEF (2026a)
	PV 3	41	Global	IRENA (2025)
	PV 4	47	Current Policy Scenario; EU	IEA (2025a)
	PV 5	41 – 51	Northern Germany; Ground-mounted; >1 MW	Fraunhofer (2024)
	PV 6	51	Utility-scale; cf = 20-30%	Lazard (2025)
	PV 7	57	Europe	IRENA (2025)
	PV 8	61 – 71	Southern Germany; Ground-mounted; >1 MW	Fraunhofer (2024)
	PV 9	37 – 80	UK	ARUP (2024)

	PV 10	38 – 93	Europe – south to north range	Becquerel Institute (2023)
	PV 11	37 – 99	Global; utility-scale, r = 7%	IEA and NEA (2020)
	PV 12	37 – 99	Europe; utility-scale, r = 7%	IEA and NEA (2020)
Coal	C 1	77 – 160	Global; cf = 85%; r = 7%	IEA and NEA (2020)
	C 2	217	Current Policy Scenario; EU	IEA (2025a)
	C 3	190 – 294	US	BNEF (2026b)
	C 4	177 – 299	Germany	Fraunhofer (2024)
CCGT	G 1	69	2025	Lazard (2025)
	G 2	49- 83	Europe; cf= 85%; r = 7%	IEA and NEA (2020)
	G 3	46 – 87	US	BNEF (2026b)
	G 4	90	US	BNEF (2026a)
	G 5	44 – 123	Global; cf = 85%; r = 7%	NEA (2025)
	G 6	111 – 185	Germany	Fraunhofer (2024)
	G 7	193	Current Policy Scenario; EU	IEA (2025a)

Note: cf = capacity factor, r = discount rate, WACC = weighted average cost of capital. Full details in assumptions found in respective sources.

Historical construction timelines

As part of the assessment of nuclear newbuild construction period length in Europe, projects completed since 2000 and those under construction (Table 4) were plotted against the global average construction length, obtained from Global Energy Monitor (2025b). Global average data was digitised using webplotdigitizer. Individual reactor construction periods were calculated using data from the IAEA Power Reactor Information System (PRIS).

Table 4. Period from construction initiation until reactor grid-connection for specific reactors in Europe.

Reactor	Country	End of construction	Construction period (years)
Olikuoto 3	Finland	2023	18
Mochovce 3	Slovakia	2023	36
Flamanville 3	France	2024	17
Hinkley Point C	UK	2030*	11
Mean	*Europe*	-	*20.5*

Source: data from IAEA PRIS.

From this, the average construction period of power plants in Europe was calculated to be 20.5 years for those that commenced operations after 2020. This figure assumes that Hinkley Point C (UK) will begin operating in 2030 – the latest estimate made by EDF. Data considered includes reactors in EU Member States and the UK.

CHINA LEARNING RATES

To estimate the learning rate of nuclear power plants in China, the gradient of the relationship between cumulative installed capacity and the associated cost of developing additional capacity was calculated. The data were obtained from Liu et al. (2025). Nuclear power plants commissioned before 2000 were excluded from the analysis, as they were considered outliers. The dataset is presented in Table 5.

Table 5. Data set for variables used to derive the learning rate of new nuclear power plants in China.

Capacity (MW)	Cumulative capacity	Entry of operation date	Overnight capital cost (USD billions/GW)
984	1.0	01/02/1994	8.2
310	1.3	01/04/1994	2.4
984	2.3	06/05/1994	8.2
650	2.9	15/04/2002	2.2
990	3.9	28/05/2002	3.2
728	4.6	31/12/2002	3.1
990	5.6	08/01/2003	3.2
728	6.4	24/07/2003	3.1
650	7.0	03/05/2004	2.2
1 060	8.1	17/05/2007	2.7
1 060	9.1	16/08/2007	2.7
1 086	10.2	15/09/2010	2.2
660	10.9	05/10/2010	1.9
1 086	12.0	07/08/2011	2.2
660	12.6	30/12/2011	1.9
1 089	13.7	15/04/2013	1.9
1 119	14.8	06/06/2013	1.8
1 086	15.9	25/03/2014	1.7
1 089	17.0	04/05/2014	1.9
1 119	18.1	13/05/2014	1.8

1 089	19.2	22/11/2014	1.9
1 089	20.3	15/12/2014	1.9
1 089	21.4	12/02/2015	1.9
1 086	22.5	05/06/2015	1.7
1 089	23.6	10/06/2015	1.9
1 119	24.7	16/08/2015	1.8
1 089	25.8	16/10/2015	1.9
650	26.4	25/12/2015	2.7
1 086	27.5	01/01/2016	1.7
1 086	28.6	01/01/2016	2.0
1 119	29.7	08/06/2016	1.8
1 089	30.8	21/07/2016	1.9
650	31.5	12/08/2016	2.7
1 086	32.5	01/10/2016	2.0
1 089	33.6	24/10/2016	1.6
1 086	34.7	15/03/2017	1.7
1 089	35.8	17/09/2017	1.6
1 126	36.9	14/02/2018	2.8
1 086	38.0	12/07/2018	1.7
1 251	39.3	21/09/2018	3.0
1 250	40.5	22/10/2018	2.7
1 251	41.8	05/11/2018	3.0
1 750	43.5	13/12/2018	3.4
1 126	44.6	22/12/2018	2.8
1 250	45.9	09/01/2019	2.7
1 086	47.0	24/07/2019	1.7
1 750	48.7	07/09/2019	3.4
1 118	49.9	08/09/2020	1.9
1 150	51.0	29/01/2021	2.3

1 118	52.1	02/06/2021	1.9
1 119	53.2	31/07/2021	1.9
1 150	54.4	25/03/2022	2.3
1 119	55.5	23/06/2022	1.9
1 180	56.7	25/03/2023	2.0
1 180	57.9	25/05/2024	2.0
1 212	59.1	16/10/2024	2.1
1 534	60.6	19/10/2024	1.8
1 200	61.8	26/02/2025	2.3
1 534	63.3	21/08/2025	1.8
1 212	64.6	04/09/2025	2.1
1 200	65.8	17/12/2025	2.3

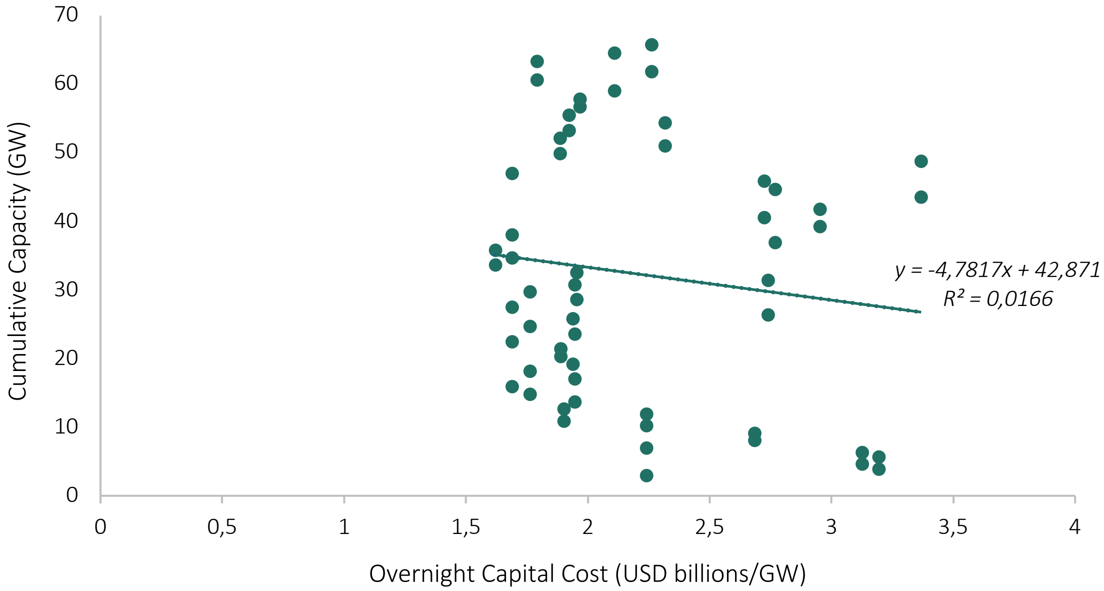
Source: Liu et al. (2025).

Note: data is expressed in 2020 USD terms.

The data were plotted on a scatter plot, and linear regression was fitted to estimate the gradient, as shown in Figure 14. This assumes a linear relationship between the variables. The estimated gradient reflects the average learning rate, indicating a reduction of approximately 4.78 billion USD in overnight capital costs for each additional gigawatt (GW) of capacity deployed in China.

Although the regression line exhibits a negative trend, the coefficient of determination ($R^2 = 0.0166$) displayed on the graph indicates a weak relationship between the variables, suggesting substantial variability in the data. Consequently, this regression model is not suitable for predicting future costs associated with the development of new nuclear power plants in China. Rather, the outcome should be interpreted as a preliminary indication of observed cost reduction trends only.

Figure 1. Learning rate of new nuclear power plants in China.



Note: learning rate is represented by the gradient in linear regression, represented by the relationship between upfront capital costs and the cumulative capacity of delivering successive projects.