Employment impacts of 40 GW offshore wind in France by 2050

Ministry of Foreign Affairs in Denmark

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Executive summary 1:2

Study purpose and objective
The purpose of the study is two-fold. First, to provide an assessment of the labour input likely to be provided by French-based companies and hence the employment benefits of the 40 GW offshore wind investments in France. Second, through facilitating high detailed assessments of labour inputs, to provide aid for avoiding labour market bottlenecks in terms of labour shortages and skill gaps and for preparing and implementing educational and training programmes to meet labour demand from the offshore wind industry.

This is particularly important with a target of 50% local content. If the offshore wind companies contracted to implement the 40 GW cannot source all of the required labour globally but are forced to source 50% locally in France, the local French labour markets need to be prepared and able to supply the required labour skills in the right amount at the right time. Otherwise, the 50% local content risk increase the costs of the 40 GW offshore wind and delay its commissioning.

The study aims to achieve its purposes by developing two offshore wind farm (OWF) models - one for fixed and one for floating foundation - capable of forecasting labour inputs (convertible to jobs) associated with offshore wind investments in France. To accommodate the purpose of providing aid for preparation of the French labour markets, the model assessments are broken down by job professions and further by year, lifecycle, main components and activities, and French-based and foreign companies.

Model pitfalls
Establishing such models entails various pitfalls capable of undermining the accurateness of the predictions. Some pitfalls can be addressed now while others will have to wait until more information becomes available. Factors such as inflation and global and domestic supply chain bottlenecks are both currently too uncertain and unpredictable to be addressed now and must wait.

Others, such as not correcting for productivity improvements reducing required labour input per GW, particularly for floating foundation and using national statistics multipliers for assessing direct jobs are addressed now based on QBIS (2020) and LCOE/CapEx/OpEx forecasts by leading industry players.

The study finds that ignoring productivity improvements and using national statistics multipliers risk overestimating job potentials significantly. In 2023-2050, not properly correcting for productivity improvements can risk inflating job numbers with by a factor 1.6 for fixed and 2.4 for floating, while using national statistics multipliers for assessing direct jobs risk inflating job numbers by a factor 1.4 for fixed (case Denmark).

Model configuration
The OWF models need to be configured for a number of variables. First, since main study objective is to assess employment impacts of French offshore wind investments, the models need a detailed configuration of labour input and further itemise this input on as many job professions as possible. Based on IRENA (2018), it has been possible to configure the models for up to 40 different job professions.

Second, due to continued productivity improvements, MEUR/GW (CapEx/OpEx) is expected to continue to fall in the coming years, particularly for floating offshore wind. Since this reduction will impact labour input, the models need to take this into consideration. Based on Aegir (2023), NREL (2022) and US DOE (2021), the models assume MEUR/GW to fall by minus 1.6% CAGR for fixed OWF and minus 3.2% CAGR for floating OWF in 2023-2050.

Third, considering the expected continued cost reductions, the OWF models need a dynamic adaptation of assessed labour inputs reflecting the expected productivity improvements in the period 2023-2050. Based on QBIS (2020), Aegir (2023) and US DOE (2021), the models assume a reduction of 0.12 FTE/MW per year for fixed and 0.42 FTE/MW per year for floating.

Executive summary 2:2

Model configuration (continued)
Fourth, also considering expected continued cost reductions and their impact on labour input, the OWF models need to take into consideration the timing of the commissioning of offshore wind farms in France in the period 2023-2050. To accommodate this, the models use RTE (2023) to determine the timing of commissioning of OWF GW in 2011-2035.

Fifth, the French offshore industry has committed to have up to 50% local content in total project costs and creating 20,000 direct and indirect jobs by 2035. To test whether 50% local content would be a plausible configuration of the OWF models, an assessment of the current and future expected state of the French-based offshore wind production capabilities is carried out. Subject to conditions, this assessment indicates that 50% local content can be plausible.

Scenario for 40 GW by 2050
The time from contract award to commissioning is currently around nine years in France. Consequently, to capture full employment impacts of GW commissioned in 2023-2032, the forecast period of the OWF models should ideally go back to 2014. However, due to data limitations, it is only possible to go back to 2019 leaving five years unaccounted for.

In 2019-2075, subject to the above limitation, it is assessed that commissioning of 40 GW offshore wind by 2050 will be associated with a total labour input of around 436,000 FTE, whereof around 158,300 FTE are fixed, and around 277,700 FTE are floating. The distribution of FTE across time reveals the need for a massive build-up of labour supply up to around 2031, where labour supply for peaks with around 6,400 FTE/year for fixed and around 13,600 FTE/year for floating totalling around 20,000 FTE/year.

It is particularly production of wind turbines, balance of plant, and installation that require massive labour supply in the period up to 2031. As offshore wind farms are commissioned and start operating, also labour supply for O&M and decommissioning gradually build up and constitute the sole labour requirement from 2050-2075.

Adding second-tier contractors supplying products and services to the first-tier contractors, and assuming gradual build-up of local content to 50% in 2035 among all first-tier contractors regardless of whether French-based or foreign, the around 436,000 FTE are assessed to increase to around 675,500 FTE, whereof around 243,500 FTE are fixed, and around 432,000 FTE floating corresponding to a 36%-64% split between fixed and floating.

Further assuming a gradual build-up of first-tier French-based contractors to 50% in 2035, the total of around 675,500 direct and indirect FTE are split with around 446,800 FTE from French-based companies and 228,700 FTE yet to be determined. The 446,800 FTE supplied by French-based companies are further assessed to be distributed with around 158,500 FTE on fixed and around 288,300 FTE on floating.

Converting FTE to jobs is always difficult, but annualising it is a good approximation. In 2031, FTE supplied by French-based companies peaks with around 19,300, whereof around 6,200 FTE on fixed OWF and around 13,100 FTE on floating. This is assessed as the maximum number of jobs in French-based companies at any point in time in 2019-2075.

The OWF models calculate the assessed labour input for up to 40 job professions. Hence, they can be a tool for avoiding bottlenecks in terms of labour shortages and skill gaps and for preparing and implementing educational and training programmes to meet labour demand from the offshore wind industry.

This is particularly important in a situation with 50% local content. If the offshore wind companies contracted to implement the 40 GW cannot source the required labour globally but forced to source 50% locally in France, the local French labour markets need to be prepared and able to supply the required labour skills in the right amount at the right time. Otherwise, the 50% local content risk increase the costs of the 40 GW offshore wind and delay its commissioning.

The study consists of three parts

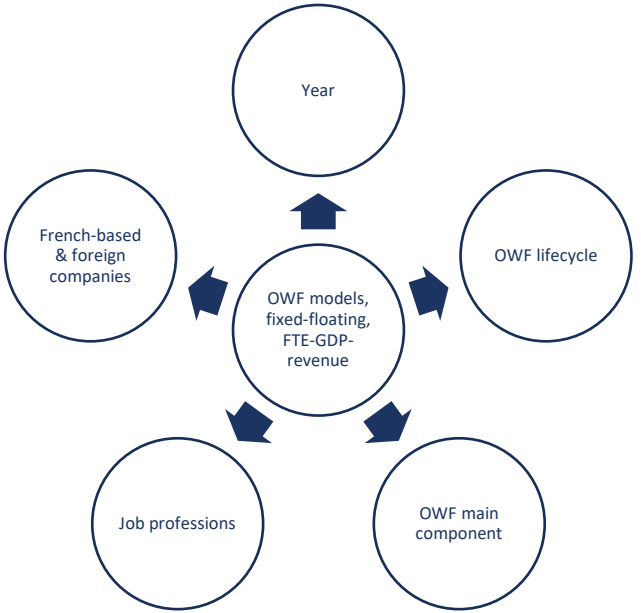
Part 1: Pitfalls

Part 2: Configuration of the OWF models

Part 3: Scenario for 40 GW by 2050

The objectives of the study

- First, to develop two offshore wind farm (OWF) models – one for fixed and one for floating foundation - capable of forecasting labour inputs (convertible to jobs), GDP and company revenue associated with offshore wind investments in France.
- Second, to populate the two OWF models with forecasts and data sufficiently detailed to produce results per year, OWF lifecycles, main OWF components, job professions, and French-based & foreign companies.
- Third, to develop a first scenario for 40 GW by 2050 with particular emphasis on French-based jobs, GDP and company revenue considering the French offshore industry's commitment to create 20,000 jobs and use 50% local content in OWF project costs.
- Fourth, to update and improve the OWF model whenever new and better forecasts and data become available.



Part 1: Model pitfalls

The study faces at least six pitfalls

1: Optimism bias

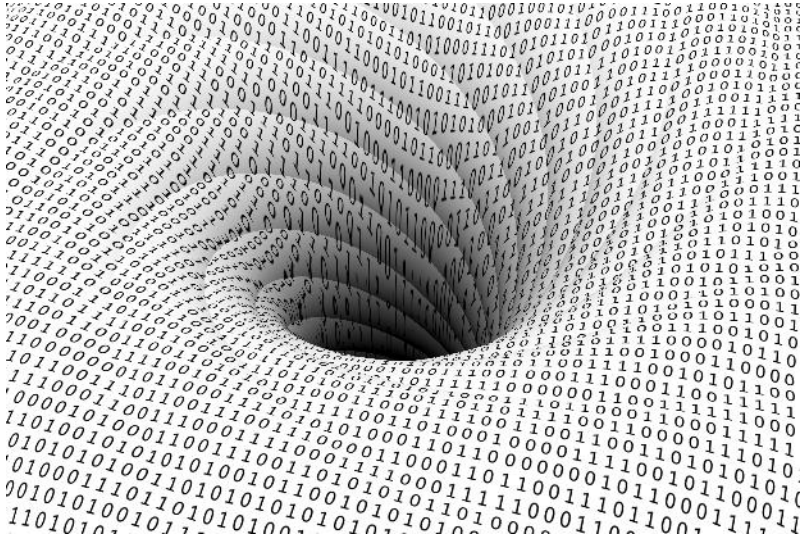
2: Ignoring productivity improvements

3: Using national statistics multipliers for direct jobs

4: Local content target for French-based companies

5: Global and domestic supply chain bottlenecks

6: Inflation and lending costs



Pitfall 2: Ignoring productivity improvements

- The offshore wind industry has been characterised by significant productivity improvements that have increased the economic return measured as MW per Euro invested, but also reduced the labour needed per MW. Not correcting for this reduction will overestimate the employment associated with offshore wind investments.
- For an OWF with fixed foundation, direct labour input is estimated to have been reduced by 0.70-0.92 FTE/MW per year since 2010. From around 19.0 FTE/MW in 2010 to around 7.5 FTE/MW in 2022.
- The estimation is based on QBIS (2020) using existing studies for assessment of FTE associated with OWF investments as well as Wind Denmark's member survey of offshore wind turnover and employment in 2010, 2015 and 2020.
- Due to further productivity improvements (and excluding rising costs from inflation and supply chain constraints), costs of offshore wind are expected to continue to reduce. According to Aegir (2023) and US DOE (2021), LCOE of EU/global fixed OWF are expected to reduce by a CAGR of 2.5%-2.9% in the next 10-15 years.
- On this basis and assuming fixed capital-labour ratio in the period, labour input is forecasted to reduce from 7.5 FTE/MW in 2022 to 5.9 FTE/MW in 2050 corresponding to a CAGR of minus 1.61%.

Figure 1: FTE/MW, CapEx, fixed, EU, OWF, 2010-2022

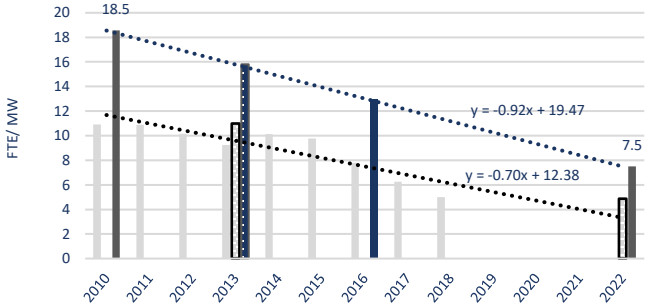
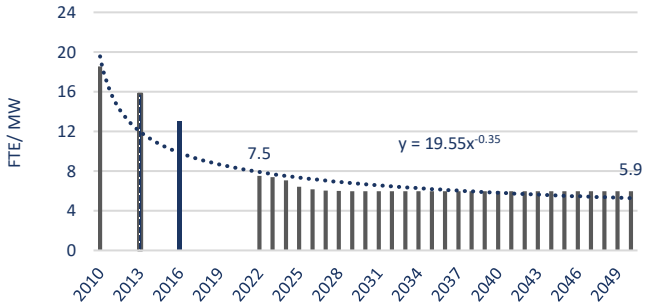


Figure 2: FTE/MW, CapEx, fixed, EU/US OWF, 2010-2050



Source: QBIS based on AE (2013), IRENA (2018), BVG Associates (2019), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), Aegir (2023) and US DOE (2021).

Pitfall 3: Using national statistics multipliers for direct jobs

Reason 1: Mixed multipliers

- Offshore wind is typically not a stand-alone industry in national statistics IO tables, and therefore, its components and activities need to be represented by industries with closest affiliation. Since these industries typically combine several industry activities (In DK, wind turbines are combined with engines and pumps) likely to require more labour input per produced unit than offshore wind, this risk overestimating impacts.

Reason 2: Import shares too low

- Import shares for IO multipliers with the closest industry affiliation to offshore wind are typically lower than for offshore wind, which risk overestimating impacts. In Statistics Denmark's multipliers, import share for "280010 Manufacture of engines, windmills and pumps" is around 30%, while import share for a OWF on Danish soil is assessed to around 40%-45%.

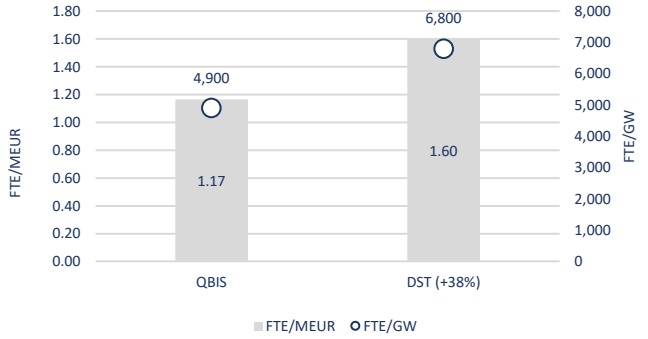
Reason 3: Time lag

- National statistics multipliers are at least 3-5 years old, which means that the latest productivity improvements in offshore wind are not included. Since productivity improvement are significant and often imply lower labour inputs, this risk overestimating impacts. Case in point. Assessing the labour impacts of an OWF in 2022 using 3-5 years old multipliers is assessed to overestimate labour impact by around 33%.

Pitfall 3: Using national statistics multipliers for direct jobs

- In QBIS (2020), the CapEx+Opex of 1 GW offshore wind in Europe was estimated to around 4,225 MEUR and requiring around 9,430 FTE. This corresponds to a weighted average FTE multiplier of 2.23 FTE/MEUR. As the Danish market share was assessed to max. 57% and 4,900 FTE/GW, the average direct FTE multiplier for Denmark is around 1.17 FTE/MEUR.
- In Statistics Denmark's input-output tables, the industry "280010 Manufacture of engines, windmills and pumps" is the closest approximation to offshore wind. In the latest version of these tables (2019), the direct FTE multiplier is around 1.60 FTE/MEUR, which imply around 6,800 FTE/GW.
- The difference between FTE using the multipliers assessed by QBIS (2020) and Statistics Denmark, respectively, corresponds to 38%, i.e., an overestimation in the potential labour input from offshore wind investments of 38%.

Figure 3: FTE/MEUR (multiplier) and FTE/GW, 2022



Source: QBIS based on AE (2013), IRENA (2018), BVG Associates (2019), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), and Wind Denmark (2020).

Part 2: Configuration of the OWF models

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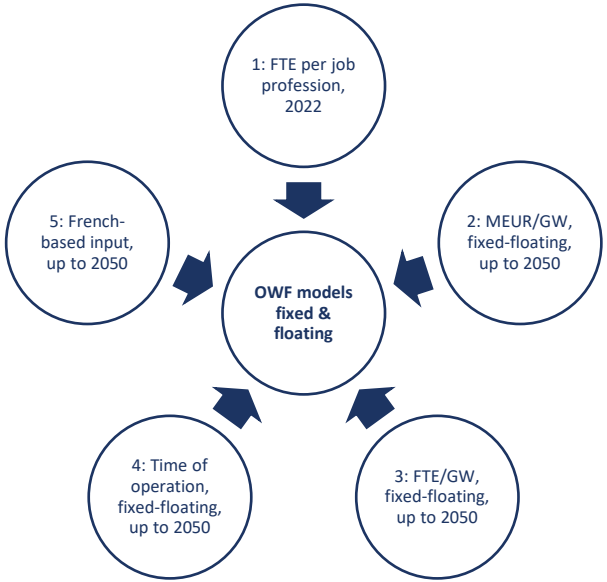
Variable 1: FTE per job profession, fixed-floating, 2022
- The main objective of the study is to assess employment impacts of French offshore wind. Therefore, the OWF models needs a detailed configuration of job professions and OWF phases.

Variable 2: MEUR/GW, fixed-floating, up to 2050
- Due to further productivity improvements, cost of offshore wind is expected to continue to reduce in the coming years. Since this reduction will impact labour inputs, the OWF models needs best possible cost forecast.

Variable 3: FTE/GW, fixed-floating, up to 2050
- Considering expected continued cost reductions, the OWF models needs a dynamic adaptation of assessed labour inputs reflecting the expected productivity improvements.

Variable 4: Time of operation, fixed-floating, up to 2050
- Again, considering expected continued cost reductions and their impact on labour input, the OWF models need forecast of the timing of commissioned offshore wind in France and the split between fixed and floating foundation.

Variable 5: French-based input, up to 2050
- In the “Offshore Wind Energy Pact”, the French offshore industry has committed to 50% local content and creating 20,000 (direct and indirect) jobs in France by 2035. If 50% local content is assessed plausible, the OWF models will apply it as the expected level of French-based input.



OWF model structure fixed, 2022

- The two OWF models differ in the distribution of costs and FTE across the OWF lifecycles reflecting the differences between fixed and floating foundation offshore wind across components and activities as well as required job professions.
- Most significant are the differences in wind turbines and balance of plant, where fixed foundation has higher costs for wind turbines than floating, while floating has higher costs for balance of plant than fixed foundation. But differences are also evident for installation, O&M and decommissioning.
- This means different suppliers and labour inputs with different qualifications are required for the two types of foundation and that is important to consider in order for the industry and labour markets to be able to deliver the required inputs for the two types of offshore wind farms.
- This emphasises the importance of solid forecasts of the split between fixed and floating commissioned offshore wind in the 40 GW as well as the timing of commissioning measured per year.
- The cost structure of each of the OWF models contain up to around 160 costs of components and activities across their five lifecycle phases. To illustrate, the next slide takes a deep dive into the cost structure of the 1 GW OWF model with fixed foundation.

Figure 4: MEUR/GW, CapEx-OpEx, fixed-floating, EU, 2022

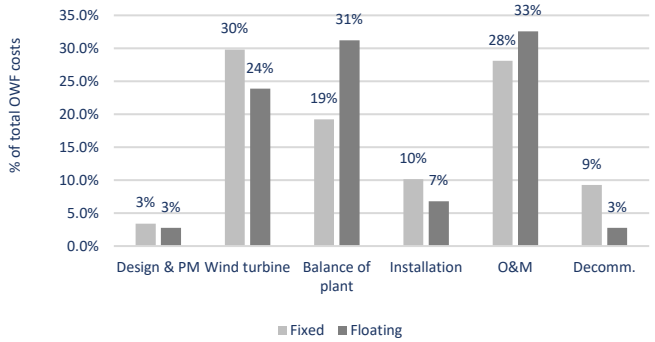
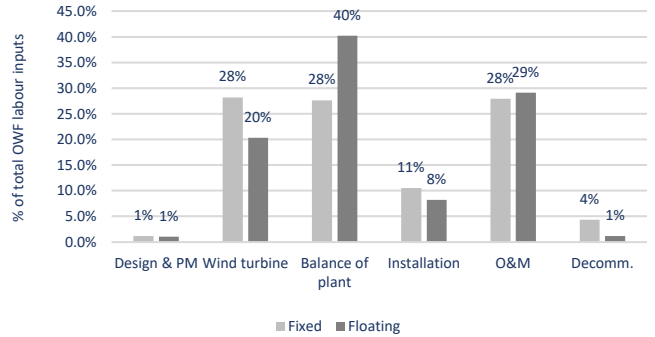


Figure 5: FTE/GW, CapEx-OpEx, fixed-floating, EU, 2022



Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019 and 2023), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), NREL (2022), US DOE (2021) and Aegir (2023).

V1: FTE per job profession, 2022

- IRENA (2018) assesses labour input measured in terms of man-hours per job profession needed for development, production, installation, O&M and decommissioning an 0.5 GW offshore wind farm. The study covers around 40 job professions across 26 OWF components and activities.
- Assuming a fixed capital-labour ratio, the percentage distribution of job professions per Euro across components and activities can make the IRENA (2018) labour input mapping applicable to the two 1.0 GW OWFs without ignoring the differences in other OWF specifications. In 2022, the total labour input for 1.0 GW OWF is assessed to around 9,450 FTE/GW for floating foundation and around 20,750 FTE/GW for floating.
- Table 1 illustrates how the around 40 job professions are distributed across the five lifecycles of an EU 1 GW OWF with fixed foundation. The OWF model is further able to split the five lifecycles into nearly 80 underlying components and activities. A similar split is available for the OWF model with floating foundation.
- On the next slide, to provide overview, the around 40 professions are summarised in six broad categories illustrating that the workers + technicians constitutes the biggest category followed by indoor experts, ship crews, outdoor experts, engineers and operators.

QBIS

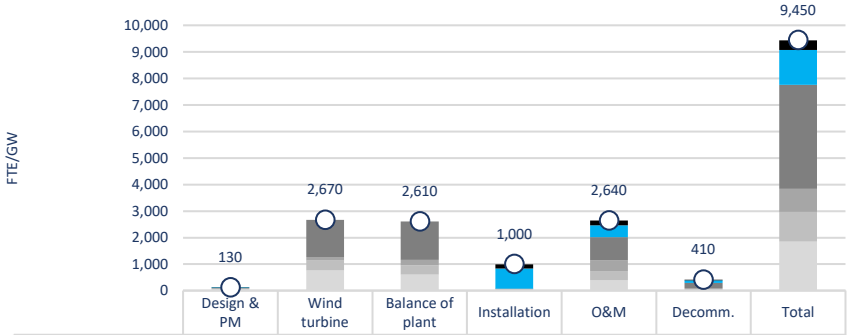
Table 1: FTE per job profession, 42 categories, 1 GW, fixed, 2022

		Design and development	Wind turbines	Balance of Plant	Installation and grid connection	O&M (25 years)	Decommis-sioning	Total
1	Administrative and accounting personnel	0	253	233	0	0	0	486
2	Administrative personnel	0	0	0	0	268	0	268
3	Cable ploug operators	0	0	0	18	0	0	18
4	Civil engineers (foundation experts)	3	0	0	0	0	0	3
5	Civil workers	0	0	0	0	440	0	440
6	Crane operators	0	0	0	74	88	19	181
7	Design and R&D engineers	0	0	30	0	0	0	30
8	Drilling system operators	3	0	0	42	0	0	45
9	Electric engineers	3	0	30	0	0	0	33
10	Electronic engineers	3	0	0	0	0	0	3
11	Energy, electric, electronic, mechanical, telecom and computer engineers	10	0	0	0	0	0	10
12	Environmental experts	0	0	0	0	67	0	67
13	Environmental and regulation experts	0	0	0	0	0	23	23
14	Environmental, sociological, marine/biology experts and fishers	3	0	0	0	0	0	3
15	Factory workers	0	1,399	1,442	0	0	0	2,841
16	Financial analysts	9	0	0	0	0	0	9
17	Geotechnical experts	5	0	0	0	0	0	5
18	Helicopter pilots	0	0	0	0	88	0	88
19	Industrial engineers	1	127	146	0	0	0	274
20	Industrial, mechanical and electric engineers	0	0	0	0	222	0	222
21	Industrial, mechanical, electric, electronic, naval and civil engineers	0	0	0	0	0	61	61
22	Jetting systems operators	0	0	0	9	0	0	9
23	Legal experts	0	0	0	0	134	0	134
24	Legal, energy regulation and taxation experts	20	0	0	0	0	0	20
25	Logistics experts	18	127	116	0	0	2	263
26	Marketing and sales personnel	0	253	233	0	0	0	486
27	Material engineers	3	0	0	0	0	0	3
28	Mechanical engineers	3	0	0	0	0	0	3
29	Naval engineers	3	0	0	0	44	0	47
30	Naval, electric and electronic engineers	0	0	0	38	0	0	38
31	Physicists and weather data experts	1	0	0	0	0	0	1
32	Quality, health and safety experts	0	253	233	21	0	0	507
33	Regulation and standardisation experts	0	127	30	0	0	0	156
34	Regulation experts	7	0	0	20	0	0	27
35	Safety experts	0	0	0	0	88	11	99
36	Ship crew	33	0	0	753	440	97	1,323
37	Site security and cleaning personnel	0	0	0	0	176	0	176
38	Taxation experts	0	127	116	0	0	0	243
39	Technicians	2	0	0	3	440	101	546
40	Telecommunication and computer engineers	0	0	0	0	145	0	145
41	Trenching ROV operators	0	0	0	18	0	0	18
42	Truck drivers	0	0	0	0	0	97	97
	Total	131	2,666	2,608	996	2,640	410	9,451

Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020).

V1: FTE per job profession, 2022

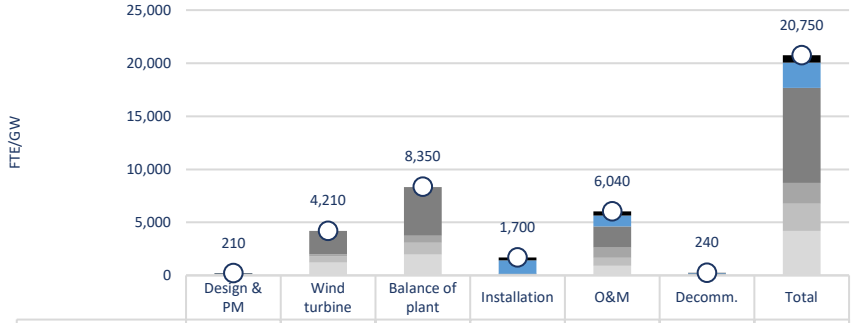
Figure 6: FTE per job profession, 6 categories, 1 GW, fixed, 2022



	Design & PM	Wind turbine	Balance of plant	Installation	O&M	Decomm.	Total
Operators	3	0	0	161	176	19	360
Ship crews	33	0	0	753	440	97	1,320
Workers + technicians	2	1,399	1,442	3	880	198	3,920
Engineers	30	127	205	38	411	61	870
Outdoor experts	26	380	349	21	331	13	1,120
Indoor experts	36	760	612	20	402	23	1,850
Total	130	2,670	2,610	1,000	2,640	410	9,450

Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), and Wind Denmark (2020).

Figure 7: FTE per job profession, 6 categories, 1 GW, floating, 2022



	Design & PM	Wind turbine	Balance of plant	Installation	O&M	Decomm.	Total
Operators	4	0	0	289	403	11	710
Ship crews	53	0	0	1,262	1,006	57	2,380
Workers + technicians	4	2,209	4,613	5	2,013	116	8,960
Engineers	48	200	658	64	940	36	1,950
Outdoor experts	42	600	1,118	41	758	7	2,570
Indoor experts	57	1,200	1,958	40	920	13	4,190
Total	210	4,210	8,350	1,700	6,040	240	20,750

Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019 and 2023), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), NREL (2022), US DOE (2021) and Aegir (2023).

V2: MEUR/GW, fixed-floating, up to 2050

- According to RTE (2022), France is expected to implement as much floating and fixed-bottom foundation OWF by 2050. This means that the costs of floating OWF is just as essential as for fixed OWF.
- Leading industry experts such as BVG Associates (BVGA), National Renewable Energy Laboratory (NREL), U.S Department of Energy (US DOE) and Aegir Insight Analysis (Aegir), all unanimously estimate costs of floating foundation to drop significantly within the coming years.
- These experts estimate an around 60% drop in LCOE within the next 8-15 years, which in turn will reduce the floating-fixed ratio to around between 1.3-1.6, down from up to 2.1 in 2023.
- **Cost reductions will come with deployment.** To cut down costs, floating OWF must be planned and built in such a way that allows a supply chain to be established, and industry to build factories that produce relevant components on a large scale. This will contribute to industrialisation and increased volume production. The commitment by the French government to build 20 GW floating OWF by 2050 is important for facilitating such a process.

Figure 8: LCOE index, floating, 2019-2040

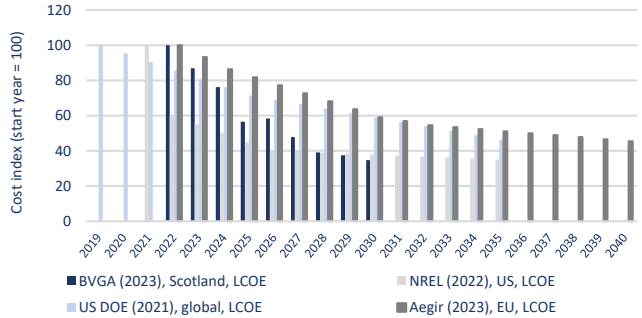
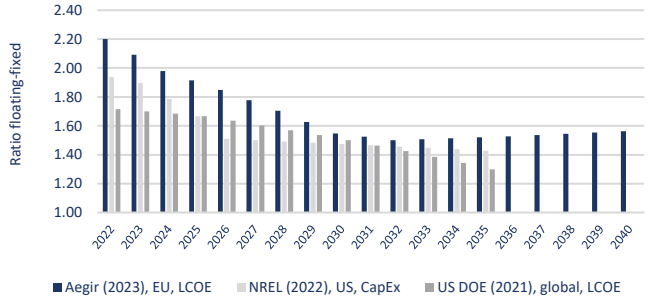


Figure 9: LCOE-CapEx ratios, floating-fixed, 2022-2040



Source: QBIS based on BVGA (2023), NREL (2022), US DOE (2021) and Aegir (2023).

V2: MEUR/GW, fixed-floating, up to 2050

- Due to further productivity improvements, cost of offshore wind is expected to continue to reduce in the coming years. Since this reduction will impact labour inputs, the OWF models need best possible cost forecast.
- For North Europe, Aegir (2023) estimates LCOE reductions of around 36% for fixed OWF and 55% for floating OWF by 2040 resulting in 32 EUR/MWh for fixed and 50 EUR/MWh for floating. Globally, US DOE (2021) estimates LCOE reductions of around 38% for fixed OWF and 54% for floating OWF by 2030 resulting in 50 USD/MWh for fixed and 65 USD/MWh for floating.
- In Compound Average Growth Rate (CAGR), Aegir (2023) estimates minus 2.5% for fixed OWF and minus 4.3% for floating OWF, while US DOE (2021) estimates minus 2.9% for fixed OWF and minus 4.7% for floating OWF. I.e., high degree of agreement in estimates for Northern Europe and globally. In comparison, BVGA (2023) estimates minus 12.4% for floating OWF in Scotland, while NREL (2022) estimates minus 3.5% for floating OWF in the US.
- Since LCOE contains CapEx and OpEx and since Aegir (2023) and US DOE (2021) roughly corresponds, the LCOE estimates by Aegir (2023) for Northern Europe are used to forecast the CapEx and OpEx in the OWF models. For the period 2040-2050 not covered by Aegir (2023), the forecast assumes lower growth rate from 2040-2050 than for 2023-2040, resulting in a forecast for MEUR/GW of minus 1.6% CAGR for fixed and minus 3.2% CAGR for floating in 2023-2050.

Figure 10: LCOE, fixed-floating, EU-global, 2019-2040

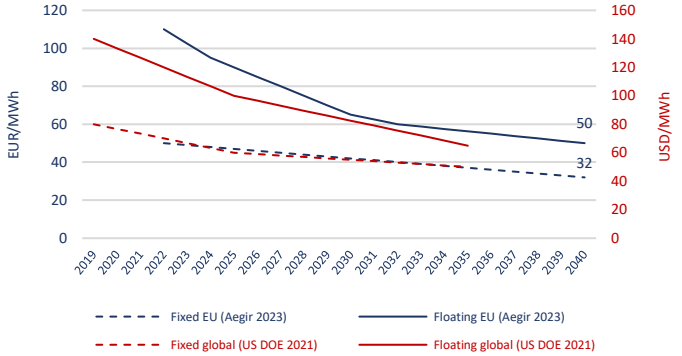
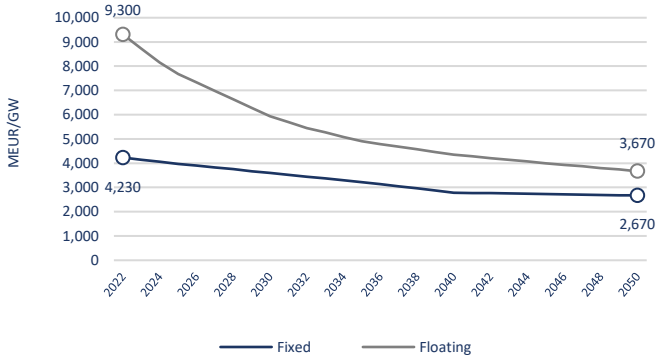


Figure 11: CapEx-OpEx, fixed-floating, EU, 2022-2050



Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), Aegir (2023) and US DOE (2021).

V3: FTE/GW, fixed-floating, up to 2050

- The forecasts of LCOE are assessed as one of the best indicators for how labour input measured in terms of FTE/GW is going to develop in the coming years.
- Thus, the forecasted reductions in LCOE are due to system engineering improvements such as upsizing of generator, larger rotor, higher hub weight, integrated turbined design, wind farm layout optimization, turbine reliability, wind farm supportability and maintainability, standardisation of interfaces, installation methods and grid connection.
- As many of these improvements implicitly will reduce labour input per GW, the LCOE forecasts are proxies for the future development in labour input per GW. On this basis, the LCOE forecasts are used to forecast the labour input per GW
- On this basis, labour input for CapEx+OpEx is expected to reduce from 9.240 FTE/GW in 2023 to 5,960 FTE/GW in 2050 for OWF with fixed foundations, while labour input is expected to reduce from 19,460 FTE/GW in 2023 to 8,200 FTE/GW in 2050 for OWF with floating foundation.
- It follows that the employment impact of France's offshore investments will depend on the timing of the implementation in the period 2023-2050.

Figure 12: FTE/GW, CapEx-OpEx, fixed, EU, 2019-2050

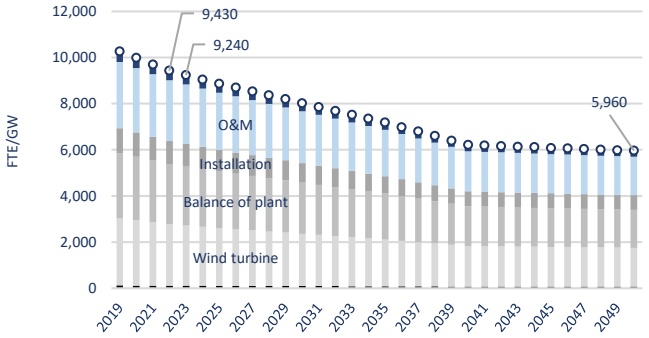
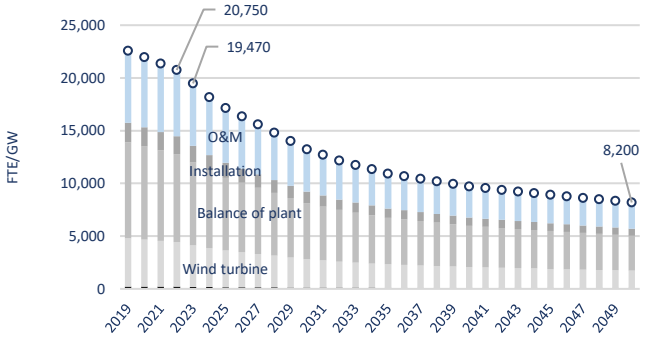


Figure 13: FTE/GW, CapEx-OpEx, floating, EU, 2019-2050



Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019 and 2023), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020) and Aegir (2023) and US DOE (2021).

V3: FTE/GW, fixed-floating, up to 2050

Table 2: FTE/GW, job professions, 1GW, fixed, 2022-2050

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Total	9,430	9,240	9,050	8,860	8,690	8,530	8,360	8,190	8,020	7,850	7,680	7,520	7,350	7,180	6,980	6,790	6,600	6,400	6,210	6,180	6,160	6,130	6,110	6,080	6,060	6,030	6,010	5,980	5,960
Administrative and accounting personnel	485	475	466	456	447	439	430	421	413	404	395	387	378	369	359	349	340	329	319	318	317	315	314	313	312	310	309	308	307
Administrative personnel	268	262	257	251	247	242	237	232	228	223	218	213	209	204	198	193	187	182	176	175	175	174	173	173	172	171	171	170	169
Cable ploug operators	18	18	17	17	17	16	16	16	15	15	15	14	14	14	13	13	13	12	12	12	12	12	12	12	12	12	12	12	11
Civil engineers (foundation experts)	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Civil workers	439	430	421	412	404	397	389	381	373	365	357	350	342	334	325	316	307	298	289	288	287	285	284	283	282	281	280	278	277
Crane operators	181	177	174	170	167	164	160	157	154	151	147	144	141	138	134	130	127	123	119	119	118	118	117	117	116	116	115	115	114
Design and R&D engineers	30	29	28	28	27	27	26	26	25	25	24	24	23	23	22	21	21	20	19	19	19	19	19	19	19	19	19	19	19
Drilling system operators	45	44	43	42	41	41	40	39	38	37	36	36	35	34	33	32	31	30	30	29	29	29	29	29	29	29	29	28	28
Electric engineers	33	32	32	31	30	30	29	29	28	27	27	26	26	25	24	24	23	22	22	22	22	21	21	21	21	21	21	21	21
Electronic engineers	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Energy, electric, electronic, mechanical, telecom and computer engineers	10	10	10	9	9	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6
Environmental experts	67	66	64	63	62	61	59	58	57	56	54	53	52	51	50	48	47	45	44	44	44	43	43	43	43	43	43	42	42
Environmental and regulation experts	23	22	22	21	21	20	20	20	19	19	18	18	18	17	17	16	16	15	15	15	15	15	15	15	15	14	14	14	14
Environmental, sociological, marine/biology experts and fishers	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Factory workers	2,834	2,777	2,720	2,663	2,612	2,564	2,513	2,462	2,410	2,359	2,308	2,260	2,209	2,158	2,098	2,041	1,984	1,924	1,866	1,857	1,851	1,842	1,836	1,827	1,821	1,812	1,806	1,797	1,791
Financial analysts	9	9	9	9	8	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6
Geotechnical experts	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3
Helicopter pilots	88	86	84	83	81	79	78	76	75	73	72	70	68	67	65	63	61	60	58	58	57	57	57	57	56	56	56	56	56
Industrial engineers	273	268	262	257	252	247	242	237	232	227	223	218	213	208	202	197	191	185	180	179	178	178	177	176	176	175	174	173	173
Industrial, mechanical and electric engineers	222	217	213	208	204	201	197	193	189	185	181	177	173	169	164	160	155	150	146	145	145	144	144	143	142	142	141	141	140
Industrial, mechanical, electric, electronic, naval and civil engineers	61	60	58	57	56	55	54	53	52	51	50	49	47	46	45	44	43	41	40	40	40	40	39	39	39	39	39	39	38
Jetting systems operators	9	9	9	9	8	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6
Legal experts	134	131	128	126	123	121	119	116	114	111	109	107	104	102	99	96	94	91	88	88	87	87	87	86	86	86	85	85	85
Legal, energy regulation and taxation experts	20	19	19	19	18	18	18	17	17	17	16	16	16	15	15	14	14	14	13	13	13	13	13	13	13	13	13	13	13
Logistics experts	262	257	252	246	242	237	232	228	223	218	214	209	204	200	194	189	184	178	173	172	171	170	170	169	168	168	167	166	166
Marketing and sales personnel	485	475	466	456	447	439	430	421	413	404	395	387	378	369	359	349	340	329	319	318	317	315	314	313	312	310	309	308	307
Material engineers	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mechanical engineers	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Naval engineers	47	46	45	44	43	42	41	41	40	39	38	37	36	36	35	34	33	32	31	31	31	30	30	30	30	30	30	30	30
Naval, electric and electronic engineers	38	37	37	36	35	35	34	33	32	32	31	30	30	29	28	28	27	26	25	25	25	25	25	25	25	24	24	24	24
Physicists and weather data experts	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quality, health and safety experts	506	495	485	475	466	457	448	439	430	421	412	403	394	385	374	364	354	343	333	331	330	329	328	326	325	323	322	321	320
Regulation and standardisation experts	156	153	150	147	144	141	138	135	133	130	127	124	122	119	115	112	109	106	103	102	102	101	101	101	100	100	99	99	99
Regulation experts	27	26	26	25	25	24	24	23	23	22	22	22	21	21	20	19	19	18	18	18	18	18	18	17	17	17	17	17	17
Safety experts	99	97	95	93	91	89	87	86	84	82	80	79	77	75	73	71	69	67	65	65	64	64	64	64	63	63	63	63	62
Ship crew	1,320	1,294	1,267	1,241	1,217	1,194	1,171	1,147	1,123	1,099	1,075	1,053	1,029	1,005	977	951	924	896	870	865	863	858	856	851	849	844	842	837	835
Site security and cleaning personnel	176	172	169	165	162	159	156	153	149	146	143	140	137	134	130	126	123	119	116	115	115	114	114	113	113	112	112	111	111
Taxation experts	243	238	233	228	224	219	215	211	206	202	198	193	189	185	180	175	170	165	160	159	158	158	157	156	156	155	155	154	153
Technicians	545	534	523	512	502	493	483	473	463	453	444	434	424	415	403	392	381	370	359	357	356	354	353	351	350	348	347	345	344
Telecommunication and computer engineers	144	141	138	136	133	130	128	125	123	120	117	115	112	110	107	104	101	98	95	95	94	94	93	93	93	92	92	91	91
Trenching ROV operators	18	17	17	17	16	16	16	15	15	15	14	14	14	13	13	13	12	12	12	12	12	11	11	11	11	11	11	11	11
Truck drivers	97	95	93	91	89	87	86	84	82	80	79	77	75	74	72	70	68	66	64	63	63	63	63	62	62	62	62	61	61

V3: FTE/GW, fixed-floating, up to 2050

Table 3: FTE/GW, job professions, 1GW, floating, 2022-2050

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Total	20,746	19,460	18,180	17,130	16,360	15,580	14,800	14,020	13,230	12,690	12,160	11,750	11,340	10,930	10,680	10,440	10,200	9,960	9,710	9,550	9,390	9,230	9,080	8,930	8,780	8,630	8,480	8,340	8,200
Administrative and accounting personnel	1,145	1,074	1,004	946	903	860	817	774	730	701	671	649	626	603	590	576	563	550	536	527	518	510	501	493	485	476	468	460	453
Administrative personnel	614	576	538	507	484	461	438	415	391	375	360	348	335	323	316	309	302	295	287	282	278	273	269	264	260	255	251	247	243
Cable ploug operators	24	23	21	20	19	18	17	16	15	15	14	14	13	13	12	12	12	12	11	11	11	11	11	10	10	10	10	10	10
Civil engineers (foundation experts)	5	4	4	4	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Civil workers	1,006	944	882	831	794	756	718	680	642	616	590	570	550	530	518	506	495	483	471	463	456	448	440	433	426	419	411	405	398
Crane operators	359	337	315	297	283	270	256	243	229	220	211	203	196	189	185	181	177	172	168	165	163	160	157	155	152	149	147	144	142
Design and R&D engineers	95	89	83	78	75	71	68	64	61	58	56	54	52	50	49	48	47	46	44	44	43	42	42	41	40	40	39	38	38
Drilling system operators	87	82	77	72	69	66	62	59	56	54	51	50	48	46	45	44	43	42	41	40	40	39	38	38	37	36	36	35	35
Electric engineers	100	94	88	83	79	75	72	68	64	61	59	57	55	53	52	51	49	48	47	46	45	45	44	43	42	42	41	40	40
Electronic engineers	5	5	5	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2
Energy, electric, electronic, mechanical, telecom and computer engineers	16	15	14	13	13	12	11	11	10	10	9	9	9	8	8	8	8	8	7	7	7	7	7	7	7	7	7	6	6
Environmental experts	153	144	134	127	121	115	109	104	98	94	90	87	84	81	79	77	75	74	72	71	69	68	67	66	65	64	63	62	61
Environmental and regulation experts	13	12	12	11	10	10	9	9	8	8	8	8	7	7	7	7	7	6	6	6	6	6	6	6	6	6	5	5	5
Environmental, sociological, marine/biology experts and fishers	4	4	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Factory workers	6,822	6,399	5,978	5,633	5,380	5,123	4,867	4,610	4,350	4,173	3,998	3,864	3,729	3,594	3,512	3,433	3,354	3,275	3,193	3,140	3,088	3,035	2,986	2,936	2,887	2,838	2,788	2,742	2,696
Financial analysts	15	14	13	12	11	11	10	10	9	9	9	8	8	8	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6
Geotechnical experts	8	8	7	7	7	6	6	6	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3
Helicopter pilots	201	189	176	166	159	151	144	136	128	123	118	114	110	106	104	101	99	97	94	93	91	90	88	87	85	84	82	81	80
Industrial engineers	669	628	587	553	528	503	478	452	427	409	392	379	366	353	345	337	329	321	313	308	303	298	293	288	283	278	274	269	265
Industrial, mechanical and electric engineers	508	477	445	420	401	382	363	343	324	311	298	288	278	268	262	256	250	244	238	234	230	226	222	219	215	211	208	204	201
Industrial, mechanical, electric, electronic, naval and civil engineers	36	34	31	30	28	27	26	24	23	22	21	20	20	19	18	18	18	17	17	16	16	16	16	15	15	15	15	14	14
Jetting systems operators	12	11	11	10	10	9	9	8	8	7	7	7	7	6	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5
Legal experts	307	288	269	253	242	230	219	207	196	188	180	174	168	162	158	154	151	147	144	141	139	137	134	132	130	128	125	123	121
Legal, energy regulation and taxation experts	32	30	28	26	25	24	23	21	20	19	19	18	17	17	16	16	16	15	15	15	14	14	14	14	13	13	13	13	13
Logistics experts	602	565	528	497	475	452	429	407	384	368	353	341	329	317	310	303	296	289	282	277	272	268	263	259	255	250	246	242	238
Marketing and sales personnel	1,145	1,074	1,004	946	903	860	817	774	730	701	671	649	626	603	590	576	563	550	536	527	518	510	501	493	485	476	468	460	453
Material engineers	5	5	5	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2
Mechanical engineers	5	5	5	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2
Naval engineers	105	99	92	87	83	79	75	71	67	64	62	60	57	55	54	53	52	50	49	48	48	47	46	45	45	44	43	42	42
Naval, electric and electronic engineers	64	60	56	53	51	48	46	43	41	39	38	36	35	34	33	32	32	31	30	30	29	29	28	28	27	27	26	26	25
Physicists and weather data experts	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quality, health and safety experts	1,186	1,113	1,039	979	935	891	846	802	756	726	695	672	648	625	611	597	583	569	555	546	537	528	519	511	502	493	485	477	469
Regulation and standardisation experts	295	277	259	244	233	222	210	199	188	180	173	167	161	155	152	148	145	142	138	136	134	131	129	127	125	123	121	119	117
Regulation experts	51	48	45	42	40	38	36	35	33	31	30	29	28	27	26	26	25	25	24	24	23	23	22	22	22	21	21	21	20
Safety experts	208	195	182	172	164	156	148	140	132	127	122	118	114	109	107	105	102	100	97	96	94	92	91	89	88	86	85	84	82
Ship crew	2,378	2,231	2,084	1,964	1,876	1,786	1,697	1,607	1,517	1,455	1,394	1,347	1,300	1,253	1,224	1,197	1,169	1,142	1,113	1,095	1,076	1,058	1,041	1,024	1,007	989	972	956	940
Site security and cleaning personnel	403	378	353	333	318	302	287	272	257	246	236	228	220	212	207	203	198	193	189	185	182	179	176	173	170	168	165	162	159
Taxation experts	573	537	502	473	452	430	408	387	365	350	336	324	313	302	295	288	282	275	268	264	259	255	251	246	242	238	234	230	226
Technicians	1,074	1,008	942	887	847	807	767	726	685	657	630	609	587	566	553	541	528	516	503	495	486	478	470	462	455	447	439	432	425
Telecommunication and computer engineers	331	310	290	273	261	248	236	224	211	202	194	187	181	174	170	166	163	159	155	152	150	147	145	142	140	138	135	133	131
Trenching ROV operators	23	22	21	19	19	18	17	16	15	14	14	13	13	12	12	12	12	11	11	11	11	10	10	10	10	10	10	9	9
Truck drivers	57	53	50	47	45	43	41	38	36	35	33	32	31	30	29	29	28	27	27	26	26	25	25	24	24	24	23	23	22

V4: Time of operation, up to 2050

- By 2035, RTE (2023) predicts a total of 17.8 GW offshore wind to be in operation, whereof 11.0 GW are expected to be fixed and 6.8 GW are expected to be floating.
- In 2035-2050, the difference (40.0 GW minus 17.8 GW = 22.2 GW) is assumed to be commissioned equally per year with 0.6 GW/year fixed and 0.9 GW floating.

Foundation	OWF	GW	Year
Fixed	Base	1.19	2021
Fixed	St-Nazaire	0.48	2022
Fixed	St-Brieuc	0.50	2023
Fixed	Fécamp	0.50	2023
Fixed	Courseulles	0.45	2024
Fixed	Yeu Noirmoutier	0.50	2025
Fixed	Dieppe Le Tréport	0.50	2026
Fixed	Dunkerque	0.60	2028
Fixed	Centre Mache 1	1.25	2031
Fixed	Centre Mache 2	1.25	2032
Fixed	Oléron	1.25	2033
Fixed	TBD	1.25	2034
Fixed	TBD	1.25	2035
Fixed	To-come	9.03	2036-2050
Floating	Faraman	0.03	2024
Floating	Leucate	0.03	2024
Floating	Gruissan	0.03	2024
Floating	Sud Bretagne	0.75	2031
Floating	Occitanie	0.75	2032
Floating	PACA	0.75	2032
Floating	TBD	1.50	2033
Floating	TBD	1.50	2034
Floating	TBD	1.50	2035
Floating	To-come	13.17	2036-2050
Total		**40.00**	

Figure 14: GW offshore wind in operation, fixed, 2021-2050

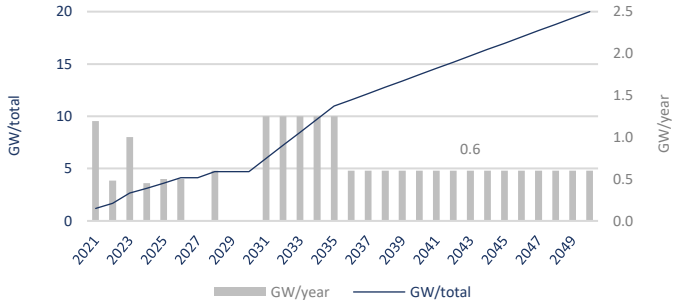
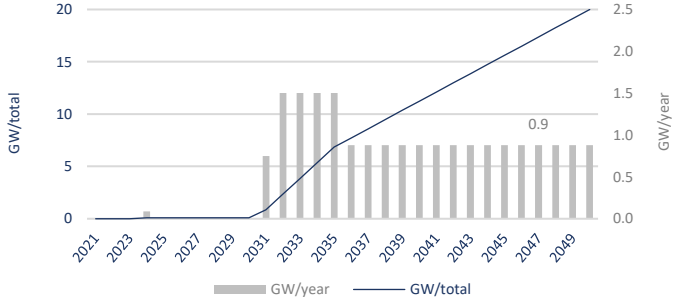


Figure 15: GW offshore wind in operation, floating, 2021-2050



Source: QBIS based on RTE (2023).

V4: Time of operation, up to 2050

- To allocate a volume of at least 2 GW/year from 2025, allocate 20 GW in 2030, having 18 GW in operation in 2035 and 40 GW in 2050.
- Among others, this requires reducing the overall time between the designation of the winner and the commissioning of the OWF by two years from 9 to 7 years.
- Therefore, it is assumed that GW commissioned in year x has been designed in year x-8 with the technology available at that time including FTE/GW.

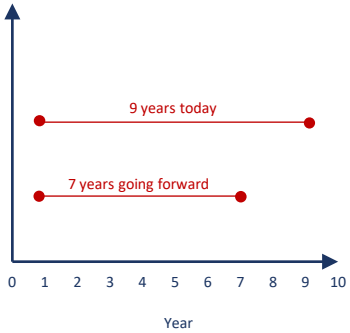


Figure 16: GW in operation, fixed, 2019-2050

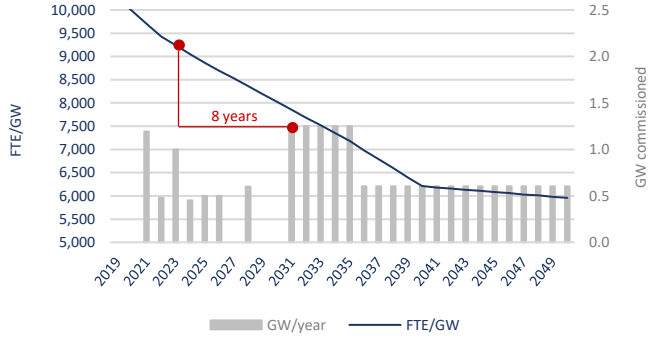
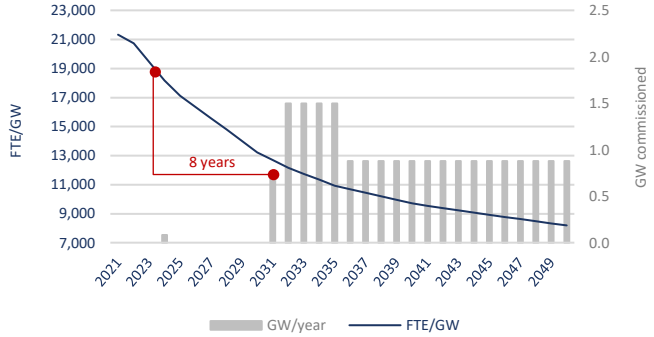


Figure 17: GW in operation, floating, 2021-2050



Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019 and 2023), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), Aegir (2023), US DOE (2021) and RTE (2023).

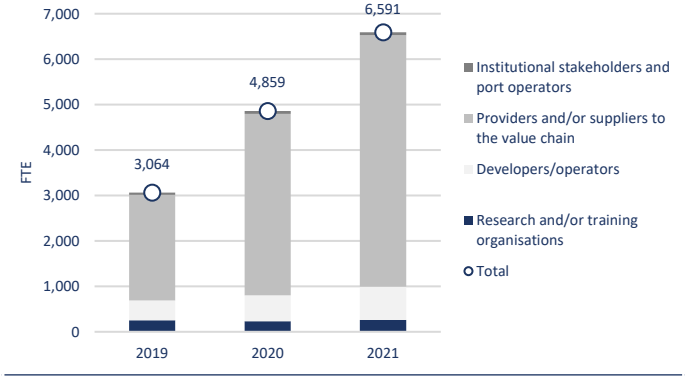
V5: French-based input, up to 2050

- According to Pacte éolien en mer entre l'Etat et la filière (the offshore wind pact), signed by the French government and the industry represented by the Renewable Energy Union (SER), France Energie Eolienne (FEE) and the Strategic Committee for New Energy Systems (CSF-NSE) in March 2022, the industry has committed to creating 20,000 (direct and indirect) jobs in France by 2035 and "by 2035 to achieve up to 50% local content in project costs, at the time of commissioning, for each offshore wind project".
- In 2019-2021, the French offshore wind industry increased FTE from around 3,100 FTE to around 6,600 FTE corresponding to a CAGR 47%. To reach the target of 20,000 (direct and indirect jobs) in 2035, FTE need to grow with a CAGR of around 8%.
- Considering the further commitment by the French industry to invest EUR 40 billion and the current investments in ports (Brest, La Nouvelle, Cherbourg, Le Havre, Saint-Nazaire and Marseilles-Fos) as well as existing production and assembly facilities, the objective of 20,000 (direct and indirect) jobs by 2035 seems plausible.
- Most jobs are expected to be created primarily in production, installation and O&M. Partly because these lifecycles require relatively most labour input per GW, and partly because of the current and future investments.

Table 4: FTE, actual/expected, single companies and investments

lifecycle	Activity	Company	Location	Jobs
Design & PM				
	Engineering, quality, purchasing, project management and service	GE Renewable Energy	Nantes	200
Wind turbine				
	Blades, nacelles and generators (Saint-Brieuc and Fécamp OWF)	Siemens	Le Havre	750
	Blades	GE Renewable Energy	Cherbourg	750
	80 nacelles for Saint-Nazaire	GE Renewable Energy	Montoir-de-Bregtagne	450
Balance of plant				
	Foundation, transition pieces and substations for Saint-Nazaire	Chantiers de l'Atlantique	Saint-Nazaire	280
Installation/O&M				
	Port of Brest		Brest	450
	Port-La Nouvelle		La Nouvelle	3,000
	Port of Cherbourg		Cherbourg	
	Port of Le Havre		Le Havre	
	Port of Saint-Nazaire		Saint-Nazaire	
	Port of Marseille-Fos		Marseille-Fos	

Figure 18: FTE, actual, total across supply chains



Source: QBIS based on FEE (2022) and OEM (2022).

Part 3: Scenario for 40 GW by 2050

Direct FTE, fixed and floating, 2019-2075

- In 2019-2075, 40 GW offshore wind by 2050 is estimated to be associated with a total of 436,000 FTE whereof 158,300 FTE are fixed, and 277,700 FTE are floating.
- FTE is not the same as jobs. To assess number of jobs, annualising the FTE is a reasonable approximation. This suggests an average of 7,650 FTE per year in 2019-2075 with a peak of around 20,000 FTE in 2031.
- These FTE are the direct FTE, i.e., the labour input associated with the first-tier contractors of the OWF. To assess the total labour input, the second-tier contractors, i.e., the suppliers to the first-tier contractors, need to be added as well. This is achieved by applying an input-output model of the French economy.

Configuration

1) LCOE, fixed, 2023-2050 = -1.61% CAGR
2) LCOE, floating, 2023-2050 = -3.15% CAGR
3) LCOE CAGR = FTE CAGR
4) Job professions across components & activities for fixed foundation = IRENA (2018)
5) Job professions for 500 MW = 1 GW
6) Fixed capital-labour ratio, 2022-2050
7) Costs across components & activities for fixed foundation = BVGA (2019) and QBIS (2020)
8) Costs across components & activities for floating foundation = BVGA (2023)
9) Commissioning GW as predicted by RTE (2023)
10) Average implementation period, 2023-2050 = 8 years

Figure 19: Direct FTE, fixed-floating, total, 2019-2075

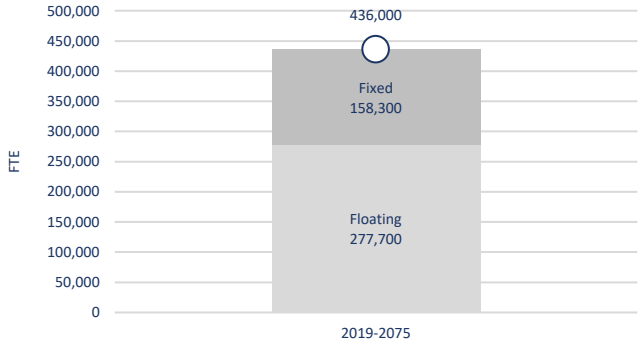
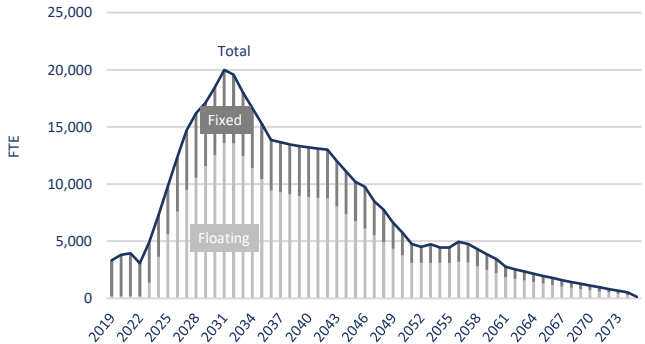


Figure 20: Direct FTE, fixed-floating, per year, 2019-2075



Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019 and 2023), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), Aegir (2023), US DOE (2021) and RTE (2023).

Direct FTE, lifecycles, 2019-2075

- The distribution of FTE across OWF lifecycles reveals the need for a massive build-up of labour supply up to around 2031, where fixed OWF peaks with around 6,400 FTE/year and floating with around 13,600 FTE/year totalling around 20,000 FTE/year.
- It is particularly production of wind turbines and balance of plant as well as installation that requires massive labour supply in the first part of the period. As offshore wind farms are commissioned and starts operating, also labour supply for O&M and decommissioning gradually build up and constitute the sole labour requirement from 2051-2075.
- Floating OWF has a steeper build-up curve that fixed OWF, which means that securing the required labour supply will be more challenging not least considering that the production techniques for floating is less developed and hence is the knowledge of the types of labour input required.

Figure 21: FTE, lifecycles, fixed, 2019-2075

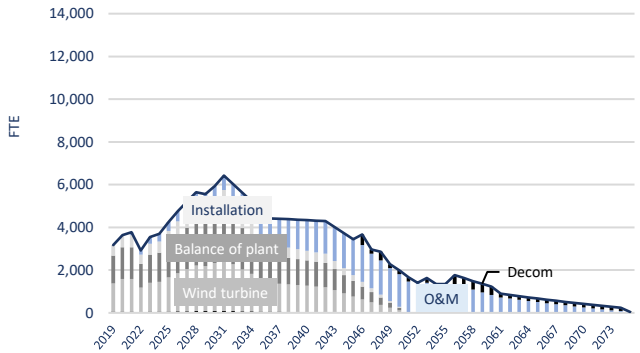
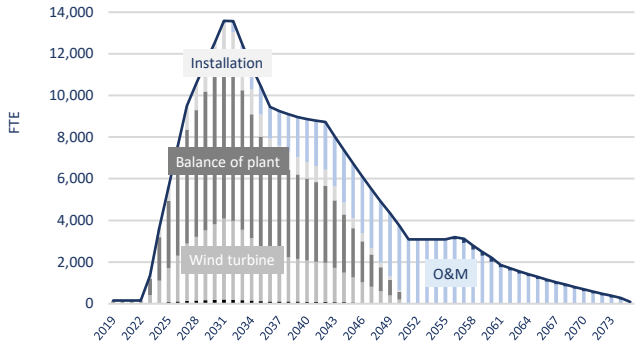


Figure 22: FTE, lifecycles, floating, 2019-2075



Source: QBIS based on AE (2013), IRENA (2018), BVGA (2019 and 2023), Statistics Denmark's FTE multipliers, Wind Denmark's member survey, WindEurope (2019 and 2020), Wind Denmark (2020), Aegir (2023), US DOE (2021) and RTE (2023).

Direct FTE, job professions, fixed, 2022-2075

Table 5: Direct FTE, job professions, fixed, 2022-2075

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051-2075
Total - all lifecycles	**2,914**	**3,545**	**3,693**	**4,254**	**4,759**	**5,190**	**5,643**	**5,559**	**5,929**	**6,421**	**6,017**	**5,621**	**5,232**	**4,851**	**4,416**	**4,401**	**4,384**	**4,365**	**4,344**	**4,320**	**4,301**	**4,010**	**3,724**	**3,445**	**3,663**	**2,966**	**2,855**	**2,272**	**1,997**	**22,593**
Design & PM	**46**	**55**	**57**	**65**	**73**	**80**	**87**	**85**	**92**	**98**	**89**	**80**	**71**	**63**	**54**	**53**	**52**	**51**	**50**	**48**	**47**	**41**	**36**	**30**	**25**	**20**	**14**	**10**	**5**	**0**
Ship crew	12	14	14	17	19	20	22	22	23	25	23	20	18	16	14	14	13	13	13	12	12	11	9	8	6	5	4	2	1	0
Legal, energy regulation and taxation experts	7	8	9	10	11	12	13	13	14	15	14	12	11	10	8	8	8	8	8	7	7	6	5	5	4	3	2	1	1	0
Energy, electric, electronic, mechanical, telecom and computer engineers	4	4	4	5	6	6	7	7	7	8	7	6	5	5	4	4	4	4	4	4	4	3	3	2	2	2	1	1	0	0
Financial analysts	3	4	4	5	5	6	6	6	6	7	6	6	5	4	4	4	4	4	3	3	3	3	2	2	2	1	1	1	0	0
Logistics experts	6	7	8	9	10	11	12	12	12	13	12	11	10	9	7	7	7	7	7	7	6	6	5	4	3	3	2	1	1	0
Geotechnical experts	2	2	2	3	3	3	4	3	4	4	4	3	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	0	0	0
Drilling system operators	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Civil engineers (foundation experts)	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Naval engineers	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Environmental, sociological, marine/biology experts and fishers	1	1	1	1	1	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Technicians	1	1	1	1	1	1	2	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Physicists and weather data experts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regulation experts	2	3	3	3	4	4	4	4	5	5	5	4	4	3	3	3	3	3	3	2	2	2	2	2	1	1	1	0	0	0
Electric engineers	1	1	1	2	2	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Electronic engineers	1	1	1	2	2	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Material engineers	1	1	1	2	2	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Mechanical engineers	1	1	1	2	2	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Industrial engineers	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind turbine	**1,138**	**1,353**	**1,394**	**1,604**	**1,791**	**1,971**	**2,132**	**2,097**	**2,252**	**2,404**	**2,182**	**1,964**	**1,751**	**1,542**	**1,336**	**1,307**	**1,277**	**1,247**	**1,217**	**1,186**	**1,157**	**1,015**	**876**	**740**	**608**	**480**	**355**	**234**	**117**	**0**
Factory workers	597	710	731	842	940	1,034	1,119	1,101	1,182	1,261	1,145	1,031	919	809	701	686	670	655	639	622	607	533	460	389	319	252	186	123	61	0
Marketing and sales personnel	108	129	132	152	170	187	203	199	214	228	207	187	166	147	127	124	121	119	116	113	110	96	83	70	58	46	34	22	11	0
Administrative and accounting personnel	108	129	132	152	170	187	203	199	214	228	207	187	166	147	127	124	121	119	116	113	110	96	83	70	58	46	34	22	11	0
Quality, health and safety experts	108	129	132	152	170	187	203	199	214	228	207	187	166	147	127	124	121	119	116	113	110	96	83	70	58	46	34	22	11	0
Industrial engineers	54	64	66	76	85	94	101	100	107	114	104	93	83	73	63	62	61	59	58	56	55	48	42	35	29	23	17	11	6	0
Logistics experts	54	64	66	76	85	94	101	100	107	114	104	93	83	73	63	62	61	59	58	56	55	48	42	35	29	23	17	11	6	0
Taxation experts	54	64	66	76	85	94	101	100	107	114	104	93	83	73	63	62	61	59	58	56	55	48	42	35	29	23	17	11	6	0
Regulation and standardisation experts	54	64	66	76	85	94	101	100	107	114	104	93	83	73	63	62	61	59	58	56	55	48	42	35	29	23	17	11	6	0
Balance of plant	**1,113**	**1,324**	**1,364**	**1,569**	**1,752**	**1,929**	**2,086**	**2,052**	**2,203**	**2,352**	**2,135**	**1,922**	**1,713**	**1,509**	**1,307**	**1,279**	**1,250**	**1,220**	**1,190**	**1,160**	**1,132**	**993**	**857**	**725**	**595**	**470**	**348**	**229**	**114**	**0**
Factory workers	615	732	754	867	968	1,066	1,153	1,134	1,218	1,300	1,180	1,062	947	834	723	707	691	674	658	641	626	549	474	400	329	260	192	127	63	0
Marketing and sales personnel	99	118	122	140	156	172	186	183	197	210	191	172	153	135	117	114	112	109	106	104	101	89	77	65	53	42	31	20	10	0
Administrative and accounting personnel	99	118	122	140	156	172	186	183	197	210	191	172	153	135	117	114	112	109	106	104	101	89	77	65	53	42	31	20	10	0
Quality, health and safety experts	99	118	122	140	156	172	186	183	197	210	191	172	153	135	117	114	112	109	106	104	101	89	77	65	53	42	31	20	10	0
Industrial engineers	62	74	76	88	98	108	117	115	123	132	120	108	96	85	73	72	70	68	67	65	63	56	48	41	33	26	19	13	6	0
Logistics experts	50	59	61	70	78	86	93	92	98	105	95	86	76	67	58	57	56	54	53	52	51	44	38	32	27	21	16	10	5	0
Taxation experts	50	59	61	70	78	86	93	92	98	105	95	86	76	67	58	57	56	54	53	52	51	44	38	32	27	21	16	10	5	0
Regulation and standardisation experts	13	15	16	18	20	22	24	23	25	27	24	22	20	17	15	15	14	14	14	13	13	11	10	8	7	5	4	3	1	0
Electric engineers	13	15	16	18	20	22	24	23	25	27	24	22	20	17	15	15	14	14	14	13	13	11	10	8	7	5	4	3	1	0
Design and R&D engineers	13	15	16	18	20	22	24	23	25	27	24	22	20	17	15	15	14	14	14	13	13	11	10	8	7	5	4	3	1	0

Direct FTE, job professions, fixed, 2022-2075

Table 5: Direct FTE, job professions, fixed, 2022-2075 (continued)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051-2075
Total - all lifecycles	**2,914**	**3,545**	**3,693**	**4,254**	**4,759**	**5,190**	**5,643**	**5,559**	**5,929**	**6,421**	**6,017**	**5,621**	**5,232**	**4,851**	**4,416**	**4,401**	**4,384**	**4,365**	**4,344**	**4,320**	**4,301**	**4,010**	**3,724**	**3,445**	**3,663**	**2,966**	**2,855**	**2,272**	**1,997**	**22,593**
Installation	**425**	**506**	**521**	**599**	**669**	**737**	**797**	**784**	**842**	**898**	**815**	**734**	**654**	**576**	**499**	**488**	**477**	**466**	**455**	**443**	**432**	**379**	**327**	**277**	**227**	**179**	**133**	**88**	**44**	**0**
Ship crew	321	382	394	453	506	557	603	593	636	679	617	555	495	436	378	369	361	352	344	335	327	287	248	209	172	136	100	66	33	0
Crane operators	32	38	39	45	50	55	59	58	63	67	61	55	49	43	37	36	35	35	34	33	32	28	24	21	17	13	10	7	3	0
Drilling system operators	18	21	22	25	28	31	34	33	35	38	34	31	28	24	21	21	20	20	19	19	18	16	14	12	10	8	6	4	2	0
Naval, electric and electronic engineers	16	19	20	23	26	28	31	30	32	35	31	28	25	22	19	19	18	18	17	17	17	15	13	11	9	7	5	3	2	0
Quality, health and safety experts	9	10	11	12	14	15	17	16	17	19	17	15	14	12	10	10	10	10	9	9	9	8	7	6	5	4	3	2	1	0
Regulation experts	9	10	11	12	14	15	16	16	17	18	17	15	13	12	10	10	10	10	9	9	9	8	7	6	5	4	3	2	1	0
Cable ploug operators	8	9	9	11	12	13	15	14	15	16	15	13	12	10	9	9	9	8	8	8	8	7	6	5	4	3	2	2	1	0
Trenching ROV operators	8	9	9	11	12	13	14	14	15	16	14	13	12	10	9	9	8	8	8	8	8	7	6	5	4	3	2	2	1	0
Jetting systems operators	4	5	5	5	6	7	7	7	8	8	7	7	6	5	5	4	4	4	4	4	4	3	3	3	2	2	1	1	0	0
Technicians	1	1	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
O&M	**192**	**307**	**359**	**416**	**474**	**474**	**541**	**541**	**541**	**670**	**797**	**921**	**1,042**	**1,162**	**1,218**	**1,273**	**1,327**	**1,380**	**1,432**	**1,483**	**1,532**	**1,581**	**1,628**	**1,674**	**1,718**	**1,624**	**1,611**	**1,538**	**1,528**	**17,924**
Technicians	35	56	66	76	87	87	99	99	99	123	146	168	191	212	223	233	243	252	262	271	280	289	298	306	314	297	295	281	279	3,278
Civil workers	35	56	66	76	87	87	99	99	99	123	146	168	191	212	223	233	243	252	262	271	280	289	298	306	314	297	295	281	279	3,278
Ship crew	35	56	66	76	87	87	99	99	99	123	146	168	191	212	223	233	243	252	262	271	280	289	298	306	314	297	295	281	279	3,278
Administrative personnel	21	34	40	46	53	53	60	60	60	75	89	103	116	130	136	142	148	154	160	165	171	176	181	187	192	181	180	171	170	1,998
Industrial, mechanical and electric engineers	7	11	13	15	17	17	20	20	20	25	29	34	38	43	45	47	49	51	52	54	56	58	60	61	63	59	59	56	56	656
Site security and cleaning personnel	14	22	26	30	35	35	40	40	40	49	58	67	76	85	89	93	97	101	105	109	112	116	119	122	126	119	118	113	112	1,312
Telecommunication and computer engineers	4	6	7	8	9	9	10	10	10	12	15	17	19	21	22	23	24	25	26	27	28	29	30	31	31	30	29	28	28	328
Legal experts	11	17	20	23	26	26	30	30	30	37	44	51	58	65	68	71	74	77	80	83	85	88	91	93	96	91	90	86	85	1,000
Helicopter pilots	7	11	13	15	17	17	20	20	20	25	29	34	38	43	45	47	49	51	52	54	56	58	60	61	63	59	59	56	56	656
Crane operators	7	11	13	15	17	17	20	20	20	25	29	34	38	43	45	47	49	51	52	54	56	58	60	61	63	59	59	56	56	656
Safety experts	7	11	13	15	17	17	20	20	20	25	29	34	38	43	45	47	49	51	52	54	56	58	60	61	63	59	59	56	56	656
Environmental experts	5	9	10	12	13	13	15	15	15	19	22	26	29	32	34	36	37	38	40	41	43	44	45	47	48	45	45	43	43	500
Naval engineers	4	6	7	8	9	9	10	10	10	12	15	17	19	21	22	23	24	25	26	27	28	29	30	31	31	30	29	28	28	328
Decommissioning	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**489**	**193**	**394**	**174**	**189**	**4,669**
Technicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	48	97	43	47	1,149
Ship crew	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115	46	93	41	45	1,102
Truck drivers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115	46	93	41	45	1,102
Industrial, mechanical, electric, electronic, naval and civil engineers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	29	59	26	28	694
Environmental and regulation experts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	11	22	10	10	258
Crane operators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	9	19	8	9	220
Safety experts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	5	10	5	5	123
Logistics experts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	1	21

Indirect FTE from suppliers

- The indirect labour input from companies supplying products and services to the first-tier offshore wind suppliers can be determined using an input-output (IO) model of the French economy. The publicly available IO table by INSEE covers 64-industries. However, upon request, it has been possible to obtain a 138-industry IO table from INSEE, otherwise only used for internal purposes.
- Though the 138-industry IO table does not have an actual offshore wind industry or a general wind industry, it has closer industry affiliation to the components and activities of an OWF than the 64-industry IO table
- An OWF requires lots of steel for the turbines and towers and fibreglass but also rather advanced electronics for e.g., the substations and transmission as well offshore services.
- Subject to this, industry 8 “Extractive industry support services” has been selected as the closest approximation to installation, O&M and decommissioning, industry 39 “Manufacture of metal parts for construction” has been selected as the closest approximation to balance of plant, industry 44 “Manufacture of electronic components and boards“ as the closest approximation to substations, and industry 53 “Manufacture of general-purpose machinery and equipment” as the closest approximation to wind turbines.

1	A01Z	Cultivation and animal production, hunting and related services
2	A02Z	Silviculture and logging
3	A03Z	Fishing and aquaculture
4	B05Z	Coal and lignite mining
5	B06Z	extraction of hydrocarbons
6	B07Z	Metal ore mining
7	B08Z	Other extractive industries
8	B09Z	Extractive industry support services
9	C10A	Process and preserve meat and meat-based product preparation
10	C10B	Process and preserve fish, crustaceans and molluscs
11	C10C	Processing and preservation of fruits and vegetables
12	C10D	Manufacture of vegetable and animal oils and fats
13	C10E	Manufacture of dairy products
14	C10F	Grain processing - manufacture of starch products
15	C10G	Manufacture of bakery-pastry and pasta products
16	C10H	Manufacture of other food products
17	C10K	Manufacture of animal feed
18	C11Z	Beverage manufacturing
19	C12Z	Manufacture of tobacco products
20	C13Z	Textile manufacturing
21	C14Z	clothing industry
22	C15Z	Leather and footwear industry
23	C16Z	Woodwork - fab art wood cork (sf mbles) - basketwork and esparto
24	C17A	Manufacture of pulp, paper and cardboard
25	C17B	Manufacture of paper or cardboard articles
26	C18Z	Printing and reproduction of records
27	C19Z	Coking and refining
28	C20A	Fab prod chemical base, nitrogen, fertilizer, plast, and synthetic rubber
29	C20B	Manufacture of soaps, cleaning products and perfumes
30	C20C	Fab aut chemicals and artificial or synthetic fibres
31	C21Z	Pharmaceutical industry
32	C22A	Manufacture of rubber products
33	C22B	Manufacture of plastic products
34	C23A	Manufacture of glass and glassware
35	C23B	Manufacture of other non-metallic mineral products excluding glass
36	C24A	Iron and steel industry and first transformation of steel
37	C24B	Production of precious metals and other non-ferrous metals
38	C24C	Foundry
39	C25A	Manufacture of metal parts for construction
40	C25B	Fab tank, tank and metal container - steam generator fab
41	C25C	Manufacture of arms and ammunition
42	C25D	Forging, metal processing, machining
43	C25E	Fab cutlery, tools, hardware and other metal works
44	C26A	Manufacture of electronic components and boards
45	C26B	Manufacture of computers and peripheral equipment
46	C26C	Manufacture of communication equipment
47	C26D	Consumer Electronics Manufacturing
48	C26E	Fab instrument and apparatus for measurement, testing and navigation - watchmaking
49	C26F	Fab radiation eqpts medic electromedicine and electrotherapist
50	C26G	Fab optical and photo equipment - fab magnetic and optical supports
51	C27A	Manufacture of household appliances
52	C27B	Manufacture of other electrical equipment
53	C28A	Manufacture of general-purpose machinery and equipment
54	C28B	Manufacture of agricultural and forestry machinery
55	C28C	Manufacture of metal forming machines and machine tools
56	C28D	Manufacture of other specific purpose machines
57	C29A	Motor vehicle construction - fab bodies and trailers
58	C29B	Manufacture of automotive equipment
59	C30A	Shipbuilding
60	C30B	Construction of locomotives and other railway rolling stock
61	C30C	Aircraft and space construction
62	C30D	Construction of military combat vehicles
63	C30E	Manufacture of transport equipment n c a
64	C31Z	furniture manufacturing
65	C32A	Fab artic jewellery, jewelery and the like and musical instruments
66	C32B	Manufacture of instruments and supplies for medical and dental use
67	C32C	Fab art sports, games and toys and other manufacturing activities
68	C33Z	Repair and installation of machinery and equipment
69	D35A	Generation, transmission and distribution of electricity
70	D35B	Gas, steam and air conditioning production and distribution
71	E36Z	Collection, treatment and distribution of water
72	E37Z	Wastewater collection and treatment
73	E38Z	Collection, treatment and disposal of waste - recovery
74	E39Z	Remediation and other waste management services
75	F41A	Real estate development
76	F41B	Construction of residential and non-residential buildings
77	F42Z	civil engineering
78	F43Z	Specialized construction work
79	G45Z	Sale and repair of automobiles and motorcycles
80	G46Z	Wholesale trade, except of motor vehicles and motorcycles
81	G47Z	Comm retail, sf automobiles and motorcycles
82	H49A	Rail transport
83	H49B	Other land passenger transport
84	H49C	Freight and pipeline road transport
85	H50Z	Water transport
86	H51Z	Air transport
87	H52Z	Warehousing and ancillary transport services
88	H53Z	Post and courier activities
89	I55Z	Accommodation
90	I56Z	Restoration
91	J58Z	Editing
92	J59Z	Prod films cinemat video and prog TV- sound recording and musical ed
93	J60Z	Programming and broadcasting
94	J61Z	Telecommunications
95	J62Z	Programming, consulting and other computer activities
96	J63Z	information services
97	K64H	Financial services activities, excluding insured and cash withdrawn (excluding FISIM)
98	K64S	Financial services activities, excluding insured and retiring funds (SIFIM)
99	K65Z	Assurance
100	K66Z	Activities auxiliary to financial services and insurance
101	L68A	Real estate property merchant act and real estate act on behalf of third parties
102	L68I	Rental and operation of real estate (imp rents)
103	L68R	Rental and operation of real estate (actual rents)
104	M69Z	Legal and accounting activities
105	M70Z	Head office activities - management consultancy
106	M71Z	Activ architecture and engineering - control and technical analysis
107	M72M	Scientific research and development (commodity)
108	M72N	Scientific research and development (non-commercial)
109	M73Z	Advertising and market research
110	M74Z	Other professional, scientific and technical activities
111	M75Z	Veterinary activities
112	N77Z	Rental and leasing activities
113	N78Z	employment related activities
114	N79Z	Activ travel agencies, tour operators, reservation services and related activities
115	N80Z	Investigations and security
116	N81Z	Services related to buildings and landscaping
117	N82Z	Administrative and other business support activities
118	O84Z	Public administration and defense - compulsory social security
119	P85M	Education (merchant)
120	P85N	Education (non-market)
121	Q86M	Activities for human health (market)
122	Q86N	Activities for human health (non-market)
123	Q87M	Medico-social and social accommodation (commercial)
124	Q87N	Medico-social and social accommodation (non-commercial)
125	Q88M	Social action without accommodation (market)
126	Q88N	Social action without accommodation (non-market)
127	R90M	Creative, artistic and performing activities (market)
128	R90N	Creative, artistic and performing activities (non-market)
129	R91M	Libraries, archives, museums and other cultural activities (merchants)
130	R91N	Libraries, archives, museums and other act cult (non market)
131	R92Z	Organization of games of chance and money
132	R93M	Sporting, recreational and leisure activities (market)
133	R93N	Sporting, recreational and leisure activities (non-market)
134	S94M	Activities of associative (market) organizations
135	S94N	Activities of associative organizations (non-profit)
136	S95Z	Repair of computers and personal and household goods
137	S96Z	Other personal services
138	T97Z	Activities of households as employers of domestic staff

Direct & indirect FTE, fixed & floating

- According to the “Offshore wind energy pact”, the French industry has committed itself to achieving up to 50% local content by 2035 regardless of whether the project owner/operator is French-based or foreign.
- For the up to 50% French-based suppliers to the first-tier companies directly contracted by the OWF, the indirect FTE multipliers for the selected industries apply. The multipliers are weighted according to the approximate cost share of the OWF components and activities they are assessed to represent. This result in a weighted indirect FTE multiplier of 2.58 FTE/MEUR.
- In 2019-2075, assuming gradual build-up of local content to 50% in 2035, this suggests a total of around 206,800 direct FTE from first-tier French-based companies directly contracted by the OWF and around 240,000 indirect FTE from second-tier French-based suppliers. Around the peak in 2031, this implies around 9,300 direct FTE/year and around 10,000 indirect FTE/year. These around 19,300 FTE are the maximum number of jobs per year in French-based companies assessed to be associated with the 40 GW in 2050.

INSEE (partly based on NACE)		OWF components and activities	Weight	FTE/MEUR
8	Extractive industry support services	Installation, O&M and decom	40%	0.55
39	Manufacture of metal parts for construction	Balance of plant	20%	4.35
44	Manufacture of electronic components and boards	Substations	10%	2.80
53	Manufacture of general-purpose machinery and equipment	Wind turbines	30%	4.00
	Weigthed average			**2.58**

Figure 23: FTE, direct-indirect, fixed-floating, total, 2019-2075

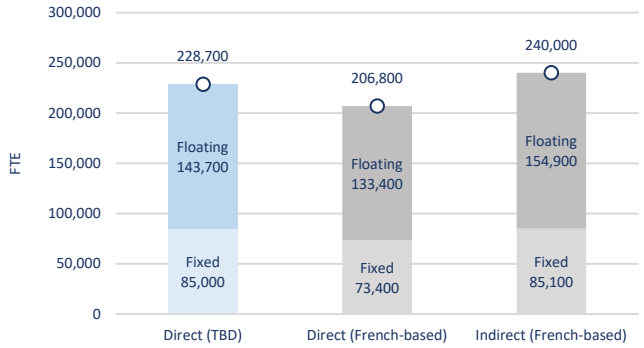
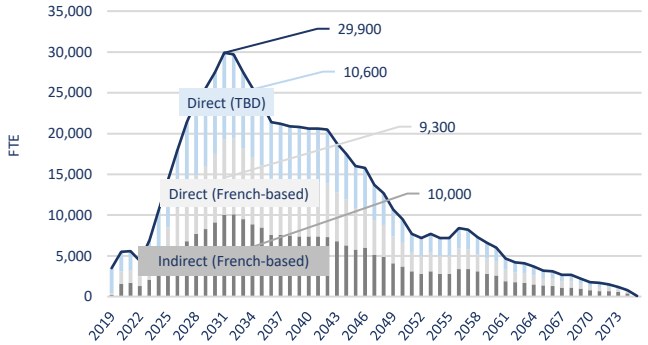


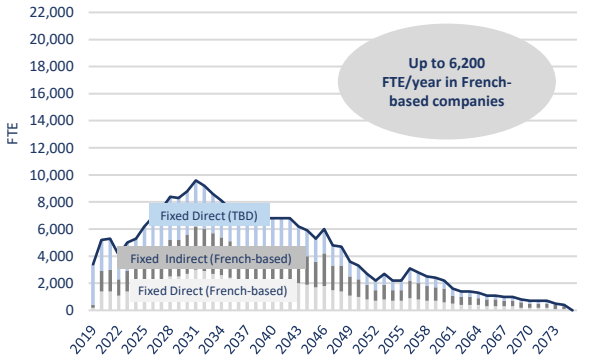
Figure 24: FTE, direct-indirect, per year, 2019-2075



Source: QBIS based on QBIS (2020), Aegir (2023), US DOE (2021), FEE (2022), RTE (2023) and INSEE 138-industry input-output table.

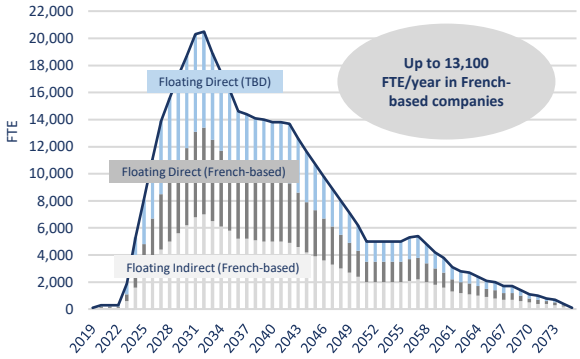
Direct & indirect FTE - fixed & floating – lifecycles

Figure 25: Direct & indirect FTE, fixed, 2019-2075



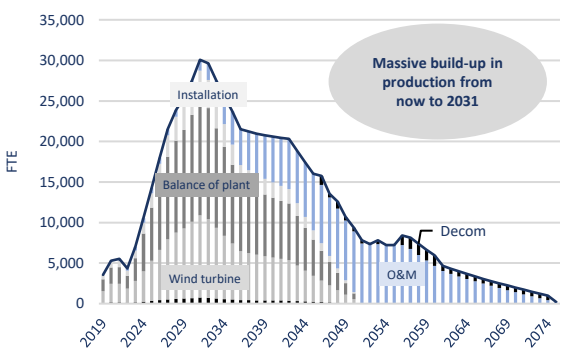
Source: QBIS based on QBIS (2020), Aegir (2023), US DOE (2021), FEE (2022), RTE (2023) and INSEE 138-industry input-output table.

Figure 26: Direct & indirect FTE, floating, 2019-2075



Source: QBIS based on QBIS (2020), Aegir (2023), US DOE (2021), FEE (2022), RTE (2023) and INSEE 138-industry input-output table.

Figure 27: Direct-indirect FTE, lifecycles, 2019-2075



Source: QBIS based on QBIS (2020), Aegir (2023), US DOE (2021), FEE (2022), RTE (2023) and INSEE 138-industry input-output table.

Employment impacts of 40 GW offshore wind in France by 2050

MODEL PITFALLS	**1** Ignoring productivity Improvements	**2** Using national statistics multipliers for direct jobs	**3** Local content target for French-based companies	**4** Global and domestic supply chain bottlenecks	**5** Inflation and lending costs
MODEL CONFIGURATION	**40** Models contain up to 40 job professions in their labour input predictions	**-1.6%/-3.2%** OWF cost reduction of -1.6% CAGR for fixed and -3.2% CAGR for floating	**0.12/0.42** Labour input reduction of 0.12 FTE/MW/year for fixed and 0.42 FTE/MW/year for floating	**18/22** Timing of commissioning follows RTE (2023) with 18 GW by 2035 and 22 GW in 2036-2050	**50%** Gradual build-up of local content to 50% from 2025 to 2035
SCENARIO FOR 40 GW BY 2050	**436,000 FTE** In 2019-2075, 436,000 FTE from 40 GW with 158,300 FTE fixed and 277,700 FTE floating	**675,500 FTE** Adding suppliers 675,500 FTE from 40 GW with 243,500 FTE fixed, and 432,000 FTE floating	**446,800 FTE** In 2019-2075, 446,800 FTE from French-based companies and 228,700 FTE to be determined	**36%/64%** In 2019-2075, labour input of 675,500 FTE is split with 36% fixed and 64% floating	**19,300 jobs** Max no jobs in French-based companies in a single year are assessed to around 19,300 in 2031

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Thanks for listening

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Quantifying Business Impacts on Society (QBIS) is a specialised research consultancy solely dedicated to socio-economic impact and feasibility studies of corporate business and investment activities.

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