Foreign Direct Investment

SEPTEMBER 2022

Offshore Wind Project

In Azerbaijan

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Executive summary

Engie is a French multinational company with a goal to accelerate the transition to a carbon-neutral economy. This company is number one independent power producer globally and seeks to increase its renewables energy portfolio to 80GW by 2030. Increasing demand for renewable energy promotes expansion and encourages the search for attractive investment opportunities outside of Europe. Therefore, this report investigates the Foreign Direct Investment option in the country of Azerbaijan.

The FDI will have a budget of 50€ million. It was decided that the project will take place between the January 2023 and December 2032. Analysis of the current market trends has proven that floating offshore wind is an innovative technology that unlocks new renewable energy potential hidden further from the shore. Therefore, 5 floating wind turbines rated 3MW each were chosen to build in Caspian Sea in Azerbaijan. This project is expected to be a wholly-owned subsidiary of Engie.

The PESTEL analysis reveals that Azerbaijan is an attractive investment area. Although it is a major oil-based economy, their energy security is currently at risk due to technical shortcomings and outdated infrastructure. The government of Azerbaijan is looking to promote the development of renewable energy and has set a goal of 30 per cent for renewable energy sources by 2030. The environmental and geographical aspects of the country also seem very favorable for a renewable energy infrastructure. The bordering Caspian Sea has a very strong wind energy potential, ranking the second in the world. Nevertheless, it is important to take into account the Azerbaijan's' tense political situation and involvement in violent conflicts that pose an increased risk for FDI projects.

Since setting up offshore wind farm infrastructure is capital intensive, the estimated initial investment for the project is high with 49.28€ million. The length of this project is only 10 years and net income expected every year is relatively low. However, with the terminal value added into NPV, the NPV is positive at 4,587,751€. Wind projects usually have a lifetime of 25 years, meaning that the project will have a better overall return if it lasts more than a decade. In addition, the executed sensitivity analysis revealed that the risk tolerance that can be handled is within +-5% range in selling price (base price is 0.06AZN per kWh). With sensitivity cases, the exchange rate changes from 1.56 to 1.72. The lower the exchange rate is, the higher the NPV in Euro.

Since the project development area is highly volatile it is vital to carefully assess and mitigate financial risks. Several major risks identified are political, volume/price variations and exchange rate risks. The risks can be hedged using different techniques that are explained further in the report in more detail.

Three recommendations are listed after a deep research and analysis of capital budgeting: larger initial investment, hedge financial risk in a cost-effective way and more detail and clear data for banks and use new technologies.

Contents

Introduction

With the high self-awareness of environmental degradation, all industries nowadays are making a big shift toward green planet with tons of disruptive and innovative technologies to exploit unlimited sources for example wind, sun, sea… One of them is offshore wind, which is an emerging and potential area of energy industry. With tremendously good effect on social, economic, human life, offshore wind projects are certified as promising industry that will attract international investments. Therefore, this project is all about offshore wind implemented in Azerbaijan as a FDI investment for 10 years from 2023-2032 with €50,000,000 investment.

The report presents PESTEL analysis that describes the Azerbaijan's macro-environmental factors in the investment. Appropriate indicators are chosen to evaluate the business environment. Then this report looks into main industry and market trends. Artificial Intelligence, floating offshore wind turbines and Azerbaijan's decarbonization strategy are analyzed and their impact is assessed. Further, firm analysis including company's strategy and market share is presented and method of investing is described. The report also includes capital budgeting for the FDI. Forecast of revenues, cost of goods sold, and other expenses is made, calculations of annual net income and free cash flow, NPV, IRR and Payback Period are included.

Company profile

Engie as mentioned is a French multinational electric utility company headquartered in France. The company is the world's number one independent power producer with 90% of it being low-carbon energy and 23% of the total being renewables. Engie has plans to install 80GW of wind energy production capacity by 2030 and currently has offshore wind farms in Belgium and Scotland. Engie supplies in over 40 countries, and it has invested in numerous ventures around the world. Engie currently has over 170,000 full time employees. The company is listed on the Euronext exchange of Paris and Brussels. Engie is striving to reduce emissions and produce energy from sustainable sources. The company reduced CO2 emissions by 56% in 6 years between 2012 and 2018. Engie has collaborated with Ocean Winds in a joint venture to speed of development of offshore wind farms, totaling a production of 14.5 GW throughout the world. (Engie, 2021).

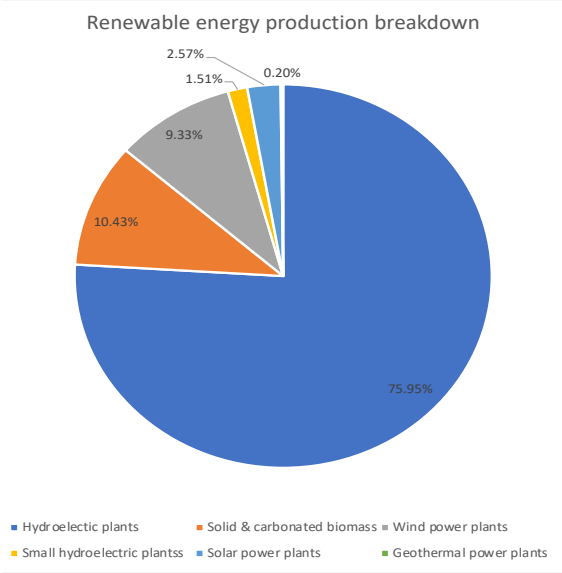

Figure 1 source Statista

Company:	Engie SA
Founded:	22 July 2008
Headquarters:	La Défense, Paris, France
CEO:	Catherine Macgregor (2021-)
Market cap:	29.315B
Revenues:	57,866 million (30/12/2021)
Total Assets:	225,333 million (30/12/2021)
Net income:	3.66B

Project definition

After Azerbaijan has made some commitments with green organizations and set up future goals of a green country, green energy, the country now is heading toward renewable energy sources alongside with their rich available natural energies. After the success of other floating wind projects, we want to continue using our skilled experience in this area in Azerbaijan. This project is to focus on setting up **floating offshore wind farm** in Azerbaijan, which is one of the potential markets in the future.

The company wants to be a leading role in this country when there is no floating offshore wind in Azerbaijan yet. Out of the scope of financial aspect, we want to work hand in hand with government to achieve sustainable development goals in business, which cares about social and environmental aspects. By this project with floating offshore wind farm, we want to help the company reach the green goal. This project is to contribute in **37% of electricity production** by all offshore wind farms in Azerbaijan up to 2040, which is an estimation by (World Bank Group , 2022).

The scope of the project is from **Jan/2023 to Dec/2032** (10 years) with the initial investment is **€50,000,000**. The floating structure is attached to seabed via tree mooring lines with drag anchors. Moring lines length is considered to be equal to 3 times sea depth (Ghigo, Cottura, Caradona, Bracco, & Mattiazzo, 2020). Therefore, for more accurate mooring expenses calculations a potential area for a floating offshore windfarm site was identified. Its distance from the shore is approximately **25 kilometers** and the water depth is around **80 meters** on **Caspian Sea** in Azerbaijan, which ranks the second worldwide for wind energy potential (Lmahamad, 2022).

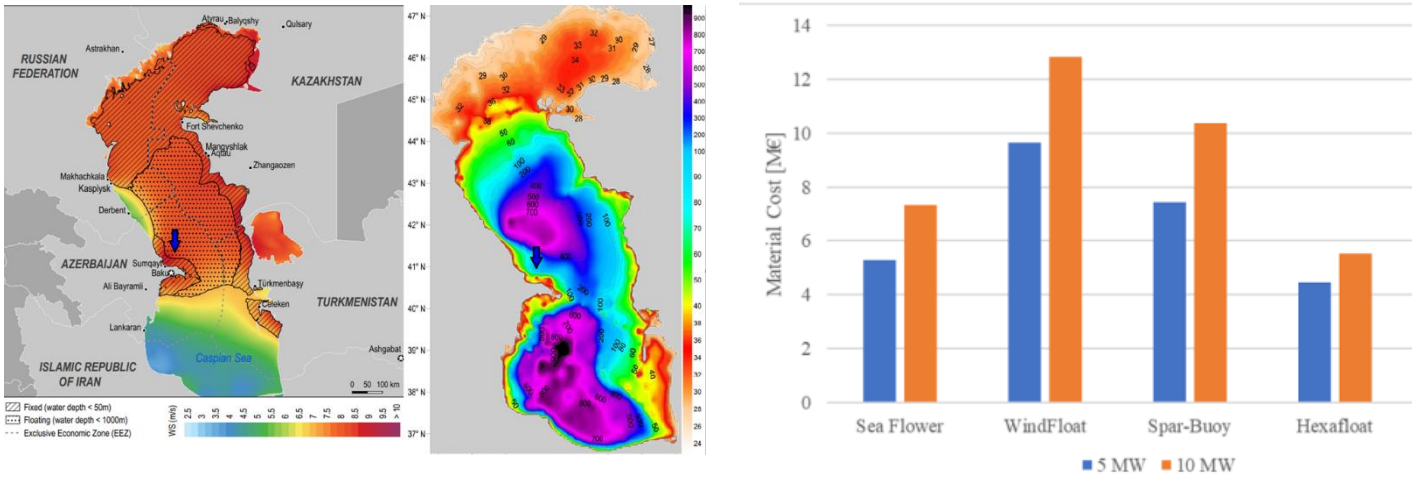

Figure 2

The total amount of wind turbines we use is **5 turbines with 3MW capacity**. Support structure is made of floating platform, moorings and anchors. For the floating platform, a **hexafloat design** has been chosen because of its comparatively lower material costs (Ghigo, Cottura, Caradona, Bracco, & Mattiazzo, 2020). The column chart above compares material cost of different floating platform designs for 5MW and 10MW turbines (Ghigo, Cottura, Caradona, Bracco, & Mattiazzo, 2020). The turbines are connected to a single offshore substation by array marine cables. Distance between each turbine and the substation is 800 meters. Offshore substation raises electrical voltage and is connected to an onshore electrical substation by export cables (Ghigo, Cottura, Caradona, Bracco, & Mattiazzo, 2020). Estimated distance from the between the two substations is 25 kilometers.

PESTEL model

Using the PESTLE model, we will be able to determine the macro-environmental factors surrounding Azerbaijan. Doing a detailed analysis of Azerbaijan is important because it will enable investors to make certain adjustments or simplify decision making. PESTLE covers the following macro-environmental factors: Political, Economic, Social, Technological, Legal and Environmental.

Political

Azerbaijan has a strong presidential system with a weak separation among legislative, executive and judicial powers. The power is heavily concentrated in the hands of the current president Ilham Aliyev. (Freedom House, 2021)

Political environment within the country is non-pluralistic and non-competitive. The ruling New Azerbaijan party is dominant therefore, the opposition parties have very limited ability to operate. This governmental structure has developed into extensive corruption and bureaucracy. (Freedom House, 2021)

The situation in the country became very tense after the renewal of the conflict between Armenia and Azerbaijan over Nagorno-Karabakh region. Azerbaijan launched an armed attack in September 2020 and have recaptured most of the territory lost in the previous conflict with Armenia in 1990s. The hostilities stopped after the involvement of Russian peacekeepers in November 2020. However, in September 2022 the two countries have clashed again and opened fire. Russia and US have called for peace between the countries (BBC, 2022)

Azerbaijan is a member of United Nations and NATO's Partnership for Peace.

Economic

Azerbaijan is known as a major oil-based economy. It has completed this transition since independence from the Soviet Union in 1991. Azerbaijan currently can be defined as a mixed economy, combining aspects of both capitalism and socialism. (Investopedia, 2022)

Azerbaijan being a country rich in natural resources has had an economy based heavily on oil exports. The country also has a very high literacy rate at 99.8%. (Statista, 2022)

GDP and GDP per capita

The GDP of Azerbaijan in 2021 was 54.62 billion U.S. dollars. The growth rate was at 5.6% for 2021 which was a 9.9% increase from 2020. This increase was accounted by the growth in the service and agricultural sector. As non-oil exports increased by 44% which is a record for Azerbaijan since its independence. (Lmahamad, Major acheivments of Azerbaijani economy in 2021, 2021)

Inflation and Unemployment rate

The inflation rate of Azerbaijan was around 6.87% from 2007 to 2022. It also saw in significant increase from 3.89% in 2020 to 6.65% in 2021. The inflation is average to high when comparing to similar countries. (Macrotrends, 2022)

Azerbaijan has a relatively low unemployment rate at 6.58% in 2020 even though it increased by 1.6% from 2019 to 2020. (Statista, 2022)

Social

Azerbaijan has a population of around 10mln. The population is growing and youthful – approximately half of the residents are under 30. Labour force amounts to almost half of the total population. (WorldBank, 2021)

Azerbaijanis make around 90% of the population. Muslim is the predominant religion.

In 2019, total literacy rate in Azerbaijan was 99.8%. (Statista, 2019) In the working population the level of education is 13 years of schooling on average. (Garcia-Moreno & Patrinos, 2020)

Compared to other oil-rich countries inequality in Azerbaijan is considered moderate. (Country Partnership Strategy: Azerbaijan, 2014–2018, 2018)

Technological

Compared to other Eurasian countries the infrastructure of Azerbaijan is relatively high in quality. The countries road and rail networks are in certain need of modernisation. The country does not have a clear action plan on how to approach greenhouse gas emissions including the energy and transport systems. (OECD, 2019)

According to TNA (2022), "Wind power was identified as a priority technology. Following the TNA, the construction of a 48MVt wind power plant is therefore underway near Shurabad. Successful implementation of this technology is projected to reduce GHG emissions by 3.96 tCO_2."

The country's energy security is also at risk due to technical shortcomings and obsolete infrastructure. But Azerbaijan does have huge potential in solar energy and wind energy potentially producing around 8 GW and 15 GW per year respectively. (Cholewa, Mammodov, & Nowaczek, 2021)

Legal

BP and Ministry of Energy of the Republic of Azerbaijan signed a memorandum of understanding (MOU) about the development of renewable energy in Azerbaijan in 2018. This can have some effects on country's regulatory framework for renewable energy for example: reducing RES technologies import fee…

The government of Azerbaijan wanted to increase more shares of renewable energy sources by the Law on the Use of Renewable Energy Sources (RES) and is currently developing a five-year RES strategy for 2022-2026 (Mammadili, 2022).

The legal regulations related to RES (renewable energy sources) are still weak and not favourable for international organizations as well as governments who want to invest their technologies and sources into Azerbaijan. Cholewa, Mammodov, & Nowaczek (2021) also mentioned this in their articles about the obstacles and challenges in Azerbaijan. Moreover, "RES technologies are expensive investments and, considering that Azerbaijan imports them from other countries, technical procedures need to be facilitated and simplified" according to Aydin (2019).

Environmental

The government of Azerbaijan set a goal of 30 percent for renewable energy sources by 2030. It is reported by Mammadili (2022) "In May 2021, the Energy Ministry of Azerbaijan signed an agreement with the Japanese company TEPSCO to create a "green energy" zone in the territories of Azerbaijan liberated from Armenian occupation".

Azerbaijan has a large amount of natural gas restorage. The European countries are considering of exploiting natural gas from this country after Russia stopped supplying. Last year, the country

exported 18.9 bcm of natural gas, including 8.5 bcm to Türkiye and 8.2 bcm to Europe, via the Trans-Adriatic Pipeline (TAP), a European section of the Southern Gas Corridor, data from the ministry shows (Morrow, 2022).

The weather in Azerbaijan is very favourable for renewable energy. According to IEA (2020), Azerbaijan has a significant untapped potential for renewable energy, as it is relatively sunny and windy and also has sizable and hydro, biomass and geothermal resources.

Industry market

In this industry market section, we will analyze latest trends in the energy industry. These trends could be specific to Azerbaijan or more general trends for the industry. The trends analyzed are based on 3 main subjects: energy trends in Azerbaijan, trends in offshore wind and trend in energy industry. The former two being directly relevant to the investment project and the latter being an additional trend which may be of importance in the near future.

Azerbaijan's decarbonization strategy

As mentioned above in the PESTLE model with the section environmental analysis, Azerbaijan is looking ahead to a green growth country by accelerating the integration of RES (renewable energy resources) technologies. In addition to that, Azerbaijan is a high potential country in emerging markets. Their strong competitiveness is deeply analyzed below at the part "success factors".

On 27 May this year, BP just announced their development of Master Plan on supporting the country toward decarbonized-energy plans: "This follows the signing of a Memorandum of Understanding (MOU) by the Ministry and bp in February 2021 on cooperation in assessing the potential and conditions required for large-scale decarbonized and integrated energy and mobility systems, including renewable energy projects in the regions and cities of Azerbaijan" (bp, 2022). Besides, a renewable energy in Abu Dhabi called Masdar also announced its development plans for the renewable energy production in Azerbaijan. With the support of US$ 21.4 million from European Bank for Reconstruction and Development (EBRD) for the collaboration between Masdar and Azerbaijan, the organization believes that this loan package can help Azerbaijan fulfill their goal of decarbonization strategy, but it also helps boosts Europe's energy security according to Bitsadze (2022).

According to (Orucu, Whittaker, & Leybourne, 2022), the high scenario for OSW (offshore wind) project in Azerbaijan on Caspian Sea can reach up to 7.2GW, which supplies of 37% Azerbaijan's electricity needs by 2040. With the investment of Masdar company, the plan is expected to reduce CO2 emissions by up to 265,000 tons with 558 Gigawatt hours of electricity produced by renewable energy (Bitsadze, 2022). Along with lots of support from other countries or Banks, with this new goal for upcoming years, Azerbaijan will be on the top list of RES investments from other leading renewable energy companies like Masdar.

To fully maximize Azerbaijan's goal of a transition to a sustainable energy development country, some success factors should be considered and enhanced. Research from Vidadili, Suleymanov, Bulut, & Mahmudlu (2017) stated that Azerbaijan is abundant with its renewable energy sources (solar, wind, geothermal, hydro and biomass energy). When it comes to the wind energy, the wind here can reach to 2.5 billion kWh of electricity annually. Along with that, the government of Azerbaijan took an action on increasing the prices of utilities to encourage citizens of attractiveness of renewable energy market.

Technological development: floating offshore wind

Currently most of the wind turbines depend on bottom fixed foundations. These foundations are made out of steel and concrete base that attach turbine to the seabed. Therefore, they can only be based in the shallow waters – up to 60meters deep (Toulotte, 2022).

The vast majority of oceans and seas have waters that exceed 60 meters in depth – and this is where the highest and most consistent winds are found in (Toulotte, 2022).Meaning that wind resources are currently untapped in large areas.

Floating wind turbines is the solution for this issue. Floating wind turbines are mounted of a floating structure and then moored to the seabed with multiple mooring lines and anchors. These turbines can

be deployed in waters up to 1000 meters deep. Therefore, they have a better capacity factors and improved energy efficiency because of the stronger wind further offshore.

Floating costs are currently at a premium compared to fixed-bottom projects at over $200/MWh, however costs are reducing as projects increase in size and lessons are learned (Ury & Kyle-Spearman, 2021). Upcoming projects in UK and France will have a maximum price of $141/MWh. Floating wind will develop into a cost competitive renewable energy source with further deployment.

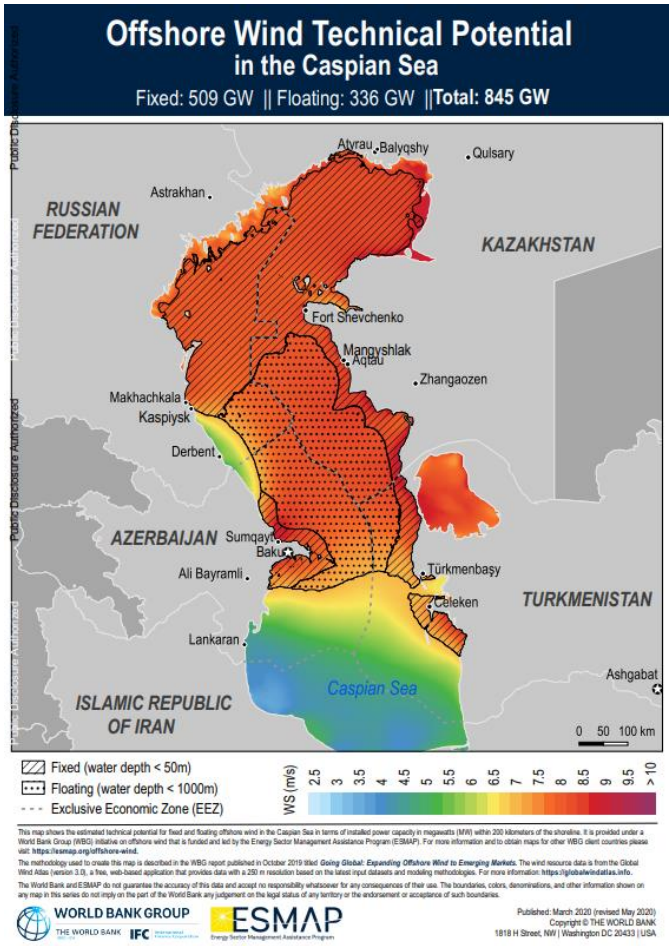

Figure 3

Artificial Intelligence in the energy industry

With the constant push for green/sustainable energy sources there comes a need for implementation of new technologies in order to adapt to the changing environment of the energy industry. According to McKinsey (2022), "Renewables are projected to account for 80-90% of power generation globally by 2050." As of 2020 the share of renewable energy is at 29%, with projection of tripling the share of energy industry in 3 years new technologies like AI are being implemented in energy systems around the world. (IEA, 2021)

Machine learning assists the AI by using big data to predict the likelihood of a certain outcome, this technology will be able to forecast things like weather more accurately which will help wind/solar energy systems to perform optimally. Another use case for Ai is in grid management, accurate predictions can be made of energy consumptions during certain times of year making sure that the energy is required is available and no energy has gone to waste. (Forbes Technology Council, 2021) Companies like Siemens AG and Vestas Wind Systems AS are recruiting AI specialists heavily. With

over 1300 jobs at Siemens alone specialised in AI it is clear to see that big companies are pushing for AI advancements in the energy sector. (Power Technology , 2021)

AI also enables energy companies to detect faults faster, which will save resources, money, time and even lives. The amount of meteorological data artificial intelligence systems can gather and analyse are enormous. Automating the decision of when to gather, store and distribute wind or solar energy. AI systems can also assist in disaster recovery, reducing the time it takes to provide power reserves to places where it is needed the most without negatively impacting the entire system. (Makala & Bakovic, 2020) It is clear that AI is already playing a significant role in the energy sector, and it will grow exponentially over the coming decade enabling the growth of sustainable energy all over the world.

Engie and AI: Engie has already started using AI to predict wind power using Google AI. This AI predicts wind power 36 hours in advance and enables Engie to make more accurate predictions. While this technology is being tested it is not in wide use yet (Moss, 2022). As for the investment plan in Azerbaijan it may give a competitive edge to Engie to be able to effectively make predictions with the help of AI. As AI is not within the scope of this investment plan or essential, we believe that implementation of AI can be a recommendation for the project.

Company analysis

In order to get a clearer understanding of the possibilities in an investment, the analysis of Engie was necessary as well. The general strategy of Engie is important to understand to determine what the company focuses on and what the company has experience in. Also, looking at the market share will make it clearer in which regions Engie has a high market share and in which it does not. Finally, concluding this section with the method of investment most viable for this project.

Strategy

Engie is a global leader in low carbon energy supply domain. Their 4 core businesses include renewables, energy solutions, development of gas and electricity networks and thermal energy generation.

Engie aims to strengthen its position as a market leader. Their key strategic objectives in the renewable's domain:

- Achieving a portfolio of 50GW by 2025
- Reducing the cost by 2%-4% per MWh produced

Current strategy target is simplifying and refocusing on the core activities. Company expects to improve their efficiency through standard processes and systems and increase in the data and digital capabilities. Implementing software systems such as DataWind and Darvin is one of the steps towards optimization of operations.

Company has also set an ambitious Net Zero Carbon target related to strengthening their commitment to the energy transition. By 2045 Engie aims to reduce the carbon intensity of its energy production and greenhouse gas emissions on use of sold products to zero. This also means that the company will completely phase out coal as a source of energy.

SWOT analysis

Strengths	Weaknesses
Strong reputation Diverse product portfolio Long years of experience and expertise	Capital intensive business

High level of customer satisfaction Research and development capabilities	
Opportunities	**Threats**
Increasing demand for green energy Environmental policies favoring the renewables New technologies	Intense and increasing competition in the green energy sector Volatile political climate in many markets globally

Table 1

Market share

Market Capitalization

Engie currently has a market capitalization of 30.714B, placing them on the 59th position of top energy companies in terms of market cap. Giving them a share of around 0.3% amongst the top 413 companies. When looking at electricity only companies Engie sits at 25th position with an overall share of 1.2% (Companies Market Cap, 2022).

Market Share

Engie posted a revenue of 3.6 billion in in 2021 for renewables alone, while total revenues were 57.866 billion. The market share in renewables therefore being around 0.38% as industry renewable revenues reached 966 billion (Engie, 2021).

Geographical revenue share

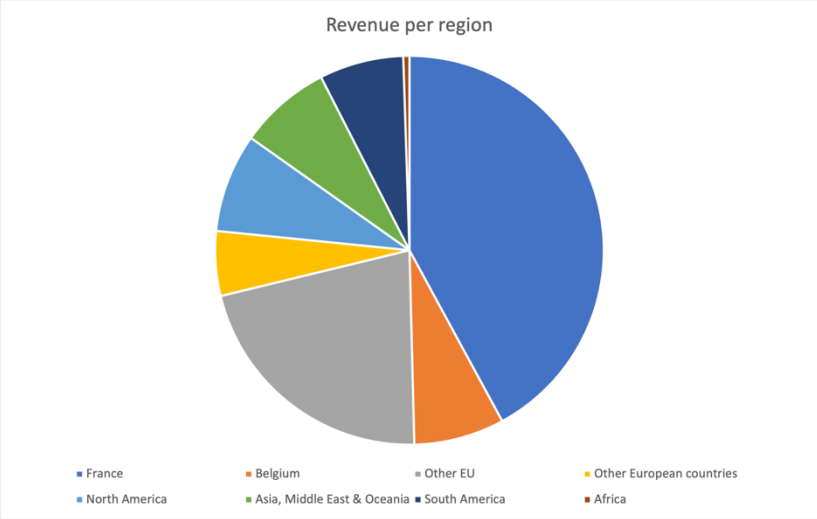

Figure 4

As mentioned above Engie had revenues of €57.8 billion in 2021. 42% of which came from France alone, the country where it is headquartered. While EU accounted for 72% of total revenues, North America comprises of 8.2% of total revenues. Countries outside EU had a revenue share of only 5.38%, indicating that there is still huge potential in those regions where Engie has not invested as expansively (Engie, 2021).

Method of investment

According to World Bank Group (2021), "offshore wind is one of the few technologies that can provide clean power at a large-scale; generate with high-capacity factors and availability; be cost-competitive with fossil fueled generation; and provide a strong stimulus for investment, offering considerable opportunities for economies and communities." Engie company has operated lots of renewable

energy around the world as joint-ventures as well as wholly-owned subsidiaries. However, offshore wind is still not the company's main revenue. On the "OceanWinds" page (OceanWinds, n.d.), we predicted that offshore wind will be the fastest-growing renewable technology in the next decade. By this project, we want to operate wholly-owned subsidiary of floating offshore wind farm in Azerbaijan with €50,000,000 initial investment as a horizontal FDI.

We will build 5 turbines. The total capital expenditure for 5 turbine is calculated as €49.28mil. The revenue from these turbines is estimated at 20 million kwh per turbine per year at price 0.06 Manat (AZN). The lifetime of wind turbine is 25 years (Wood, 2021). Therefore, we will use the initial investment divided by the 25 years to have the straight-line depreciation volume for each year. After 10 years, we calculate the terminal value based on cash flow at period 10 as well as the required rate of return and the terminal growth rate.

For administration cost, we use 15 employees for back office and asset management and 60 more for site operations. The facility rental is expected to reach around 160,000 Manat(AZN) per year with 19,000 Manat (AZN) for energy cost. As it is said in World Bank group (2022), "by 2032 Azerbaijan will have 53% local content in its OSW farms". We will make sure that this is a priority in our plan.

The combination of cost of equity at 10.33% and cost of debt at 4.05% result in WACC at 6.02%. Required rate of return (RRR) is determined as WACC. Because this is the project outside home country, the exchange rate is converted with "foreign currency approach". With this method, we only need to find difference in inflation rate in two countries (foreign and home countries) and add it into the RRR.

Capital Budgeting for FDI

The essential part of an investment plan is the breakdown of the capital budget. This section covers important financial information like revenues, capital expenditure and operation costs. Making careful estimations for each part is important as this provides a clear overview of the cost of undertaking such an investment. Therefore, using publicly available data from many sources and making careful estimations with some assumptions it was possible to create a detailed overview of the capital budgeting. Also discussed is the terminal value indicating the price of the investment after 10 years. As Azerbaijan has a different currency (AZN) to Engie's home currency (Euro), the method of conversion is also mentioned.

Revenue

The revenue of the project is 6,000,000 Manat (AZN) with 20 million kwh volume per turbine every year. In our project, we use 5 wind turbines. Average unit price in kwh is 0.06 in Azerbaijan (Hajiyeva, 2021). The revenue is equal the multiplication of these three elements for each year. With this revenue, the operation and maintenance cost will be covered enough to have positive net income for each year. With the selling price per unit (kwh) 0.06, we have sensitivity cases for this in range between -5% decrease in the selling price to 0.057 to 5% increase in the selling price to 0.063. The explanation for this as well as the results outcome of these sensitivity analysis will be discussed in more detail below.

Capital expenditure

Main capital expenditure components of a floating wind turbine farm are the turbines, support structures consisting of floating platforms, moorings and anchors, electrical infrastructure including cables and electrical substations, and installation costs.

Standard wind turbine price rate is 1.3€ million per MW (Ghigo, Cottura, Caradona, Bracco, & Mattiazzo, 2020). In this project we consider investing in five turbines rated 3MW each. The total amount is 19.5€ million for 5 turbines.

Support structure includes floating platform, moorings and anchors. As mentioned above, hexafloat turbine is chosen for floating platform. The price for this is charged per MW as turbine itself. For moorings, The location is 25 kms far away from Caspian Sea and the water depth is 80m. Anchor costs are constant per turbine and are approximately 80000€ for three drag-embedded anchors.

Main cost items of an electrical infrastructure are two types of cables and substations. These are included in the electrical infrastructure cost. The only cost left is installation is calculated from 0,5€ million per turbine (Buljan, 2020).

Capex items	Estimated price in m€	Unit	Other assumpions
Turbine	**1.3**	per MW	
Platform	**0.894**	per MW	Hexafloat turbine
Moorings	**0.0005**	per meter	Moorings cost = 3*sea depth*3mooring lines for each turbine
			Estimated sea depth - 80 meters
Anchors	**0.04469**	per turbine	Estimated price for 3 anchors
Array marine cables	**0.0003**	per meter	Turbines are connected to the offshore substantion by array marine cables
			Estimated distance between turbines and offshore electrical substantion - 800 meters
Export marine cables	**0.0004**	per meter	Export marine cables connect offshore electrical substantion with onshore electrical substantion
			Estimated distance betweet two electrical substantions - 25km
Offshore electrical substantion	**0.0311**	per MW	
Onshore electrical substantion	**0.012**	per MW	
Installation	**0.5**	per turbine	

Total investment is 49.28€ million and converted to 80.74 Manat million with the spot exchange rate 1.6384 Manat/Euro. This number is used as initial value for depreciation part.

Operation and maintenance expenditure

Insurance

Insurance cost can vary heavily with the value of property and the income of the business, and the equipment used for the protection from breakdown. Generally, insurance cost range between 13600-25500 AZN per year for each turbine. Insurance costs are usually included in the annual operation and maintenance budget at 2-3% of the capital costs. (Daniels, 2007)

The varying insurance costs makes it difficult to estimate exact numbers without knowing the technical aspects of individual wind turbines. Companies like Allianz provide renewable power insurances that cover numerous operational risks such as, debris removal, fire extinguishing, repairs. The insurances also include optional covers that include terrorist, business interruptions and legal liabilities. (Allianz, 2022)

We decided to go for a baseline 15000AZN per year per turbine. The reason behind this being the lack of data available from Allianz on actual pricing of insurances made it difficult to realise how much more optional coverages may cost. Additionally, we decided to split maintenance and insurance cost due to the reason mentioned above. Insurance companies can be contacted for more detailed quotes on sustainable energy insurances. As this restricts us from deciding a concrete amount, we used estimations based upon other sources.

Administration costs

In administration costs we will mainly focus on average salaries to be paid to employees, the roles required to operate an offshore wind farm and leasing costs that include indoor/outdoor facilities. Using the important roles in the recommended organizational structure mentioned by World Bank Group (2022), we can estimate the average cost of salaries.

Back office and asset management	Average salary in Azerbaijan py(AZN)	Number of employees	Total cost per year(AZN)
General manager	56,880.00 ₼	2	113,760.00 ₼
Finance Manager	73,020.00 ₼	1	73,020.00 ₼
Accountant	24,860.00 ₼	3	74,580.00 ₼
Legal	46,840.00 ₼	1	46,840.00 ₼
Procurement Manager	23,980.00 ₼	2	47,960.00 ₼
Contract Manager	41,820.00 ₼	1	41,820.00 ₼
Insurance manager	33,400.00 ₼	1	33,400.00 ₼
Project administration	31,660.00 ₼	3	94,980.00 ₼
Performance Engineer	36,500.00 ₼	2	73,000.00 ₼
Total	**368,960.00 ₼**	**16**	**599,360.00 ₼**

Site Operations	Average salary in Azerbaijan py(AZN)	Number of employees	Total cost per year(AZN)	Sources
Site Manager	62,460.00 ₼	1	62,460.00 ₼	Source
Control Room operator	10,080.00 ₼	5	50,400.00 ₼	Source
Shift Supervisor	36,000.00 ₼	3	108,000.00 ₼	Source
Admin Support	12,000.00 ₼	4	48,000.00 ₼	Source
Plant Technicians	12,600.00 ₼	8	100,800.00 ₼	Source
WTG Technicians	32,700.00 ₼	5	163,500.00 ₼	Source
Store room operator	15,800.00 ₼	4	63,200.00 ₼	Source
Offshore engineer manager	42,960.00 ₼	3	128,880.00 ₼	Source
Subsea enginner	39,000.00 ₼	5	195,000.00 ₼	Source
Turbine platform engineer	14,760.00 ₼	7	103,320.00 ₼	Source
Electrical Engineer	36,700.00 ₼	8	293,600.00 ₼	Source
Control system manager	31,000.00 ₼	2	62,000.00 ₼	Source
System engineer	31,001.00 ₼	3	93,003.00 ₼	Source
HV Switching technicians	17,900.00 ₼	2	35,800.00 ₼	Source
Total	**394,961.00 ₼**	**60**	**1,507,963.00 ₼**	

Source: WorldSalaries, GlassDoor & Salaryexplorer

With the help of these calculations, we can estimate the average costs Engie will incur in paying operational salaries to its employees. Bear in mind that these estimations do not account for the actual number of employees required, for example Engie might require 3 to 4 contract managers which will lead to an increase in the salaries Engie has to pay. Engie can expect salary payment of upwards of 2,500,000 AZN per year depending on the requirement of additional staff or not requiring the staff as the joint venture already fulfils it.

Facility rental

Similarly, facility rental can be calculated using the recommendations by World Bank Group (2022). This is another aspect which requires estimations, we assume in this case Engie rents all its facilities instead of outright purchasing them or using facilities owned by the joint venture company.

Logistics/operational base	Size m2	Avgerage Cost per month AZN	Average cost per year AZN	Energy consumptio	Energy cost py
Indoor facility/office	300	2,000.00 ₼	24,000.00 ₼	49800	5,478.00 ₼
Indoor warehouse facilities	500	1,700.00 ₼	20,400.00 ₼	33550	3,690.50 ₼
Outdoor storage space	800	5,100.00 ₼	61,200.00 ₼	53680	5,904.80 ₼
Parking space	500	4,500.00 ₼	54,000.00 ₼	33550	3,690.50 ₼
Total			**159,600.00 ₼**		**18,763.80 ₼**

Source: Instantoffice, Azeremlak,

The total cost per year on rental would be around 160,000 AZN. The average pricings of rent being averaged from rental properties in Baku and neighbouring cities. Prices definitely vary a lot as location is important for an offshore wind farm operation therefore these estimates just give a bare idea of what Engie could to expect in terms of rental costs. In addition to rent there are utility costs which were calculated using average business energy costs in Azerbaijan based on per m2 usage of space. The costs could lead to an average utility cost of 20,000 AZN per year.

Maintenance costs

Maintenance costs have been falling over the years as parts become standardized and easy to manufacture. Maintenance takes place at predetermined intervals usually once or twice a year (Renolit, 2022).

The average yearly maintenance cost range between 51,000 to 85,000 AZN (Weather Guard, 2021).

Terminal value

For the discounted cash flow analysis, terminal value is very important to determine NPV of a project. This is used to estimate project's value beyond the forecasted period when future cash flows can be estimated (Ganti, 2022). There are two ways to calculate terminal value: the perpetuity growth model and exit multiple model. The former is used for this project for simplified calculations. This approach assumes that the project will last indefinitely in the future. The growth rate and required rate of return are used to calculate. Required rate of return as mentioned above is 6.02%. The conservative perpetuity growth rate is supposed to be 10-year-government bond rate in France at 2.7%, which must be below the GDP growth rate of Azerbaijan. "A terminal growth rate higher than the average GDP growth rate indicates that the company expects its growth to outperform that of the economy forever" (CFI, 2022). This terminal value is then discounted with discount rate at the period 10 so it is added into cash flow of period 10.

Required rate of return

To determine required rate of return (RRR), we use the WACC. WACC is a common way to determine required rate of return (RRR) because it expresses, in a single number, the return that both bondholders and shareholders demand to provide the company with capital (Hargrave, 2022). In the WACC sheet, cost of equity is calculated as 10.33%. For the cost of debt, average debt is average total debt of Engie company in 2021, 2010 based on data retrieved from Yahoo!finance. Market capitalization and total debt are also data from Yahoo!finance. Total debt is always higher than total equity. WACC is finally calculated as 6.02%.

Exchange rate

The **foreign currency approach** is used to convert foreign currency (AZN) into home currency (Euro).

Based on the international Fisher effect, the real interest rates are equal across countries. The difference between inflation rate between two countries is added into the required return to compensate for the greater Azerbaijani inflation rate. With the inflation rate 12.3% in Azerbaijan and 9.1% in Euro zone, the real return rate is equal 9.22%.

The NPV in Manat with the return rate 9.22% is then converted into Euro with the spot exchange rate 1.6384 according to central bank of Azerbaijan.

Sensitivity cases

We calculate sensitivity cases for selling price per Mwh, total expenses and exchange rate. The selling price per kwh is 0.06 so the selling price per Mwh is 60,000 Manat (AZN). The expenses we use the

number from total expenses of year 1 in “income statement” sheet as a model to calculate. The same idea is well applied for total expenses of a whole period of the project. The exchange rate used is spot exchange rate at 1.6384. The range of sensitivity case is within -5% decrease and 5% increase. This is the risk tolerance we can handle.

The selling price will be fallen between 57,000 Manat (AZN) and 63,000 Manat (AZN). The total sensitivity cases here are 1000 cases with random number within this range. With 11 base sensitivity ranges as shown in the excel sheet (from -5% to 5% including 0%), we want to check which range each sensitivity case is in by looking up each selling price to find a match and return the range closest to that number. Then we calculate the frequency of each sensitivity range of 1000 samples and present it with column chart. With expenses, we do the same as selling price.

Applying this risk tolerance, we want to check how it can affect net income. We use “what-if analysis” in excel to come up with a matrix 11x11 with 11 different expenses and 11 different selling price for 121 results for net income.

With sensitivity cases, the exchange rate changes from 1.56 to 1.72. The lower the exchange rate is, the higher the NPV in Euro.

Results

In general, the initial investment for the project is quite high with 49.28€ million. The characteristics of offshore wind farm itself requires a lot of capital expenditure for its complicated set-up. On the other hand, they can generate better electricity production with richer resources, especially for the floating offshore wind farm compared to traditional fixed ones.

Operational expenses on the other hand were as expected. As industry averages were used to estimate the operational expenses. As the income statement shows total expenses excluding depreciation were 2.3 million AZN, with maintenance having some variability.

With offshore wind project, it has lifetime up to 25 years. If the project is only 10 years, the low net income is expected per year. However, with the terminal value added into NPV, the NPV is positive at 7,516,572 in Manat(AZN) and converted into Euro at 4,587,751. The reason for this is explained by The Investopedia Team (2022) that terminal value is included around 70%-80% in NPV. Therefore, calculation terminal value is very important for discounted cash flow analysis. The inflation rate is quite high in Azerbaijan which partly contributes to pull up the real return rate and make the NPV lower. The IRR calculated is 10.35%, which is quite close to discount rate (9.22%). The higher the IRR is, the better. In this case, as being explained above, the project will have better overall performance if it lasts longer than 10 years.

In the 1000 sensitivity cases, the frequency of each range is quite similar. Because these numbers are used by random function, the numbers keep changing. However, overall, with the combination of -2% to 0% range for selling price and -5% decrease of expenses can lead to negative net income. It is the same with the combination of 4% range of expenses with -2% to 0% range of selling price. With 5% increase in expenses, the probability of negative net income is the highest. With different exchange rates, the NPV is partly affected. In the opposite way, the lower the exchange rate is, the higher the NPV in Euro is. This means that the depreciation of Euro against Manat can increase the NPV in Euro for the foregin currency approach to convert the foreign profit into home currency.

Financial risk

Analyzing risks of a big investment is equally as important as analyzing the costs incurred during an investment. These risks can be related back to the PESTLE analysis performed and the overall risks that come with an offshore wind farm. Ways of hedging these risks will also enable Engie to make prior arrangements which may take time and some additional costs.

Political risk

Political risk is an important element concerning foreign direct investments. Political risk refers to the underlying risk factors (corruption, country's involvement in international conflicts, terrorism, government branches constraints, etc.) and fragility of a country's political system. Azerbaijan is considered to be a country with an increased political risk. It's lack of transparency in the political regime and renewed conflict with Armenia over Nagorny Karabakh region has worsened Azerbaijan's political outlook. What is more, renewable energy investments are usually long-term in nature which heightens the uncertainty. Commodities of renewable resources development, in this particular project floating wind turbines, hold a lot of value. Meaning that they could be very valuable in the hands of a different owner, this way increasing the risk of confiscation. (Hillier, Clacher, Ross, Westerfield, & Jordan, 2017) Although expropriation of companies' assets in foreign lands is not so common nowadays, companies have to recognize the fluctuating nature of such political risks.

Hedging the political risk

1. **Financing from local government**

Political risks can be hedged by using the local financing from Azerbaijan's government. Multinational companies operating in high-risk areas often adopt strategies that are responsive to the host country. "Local debt is viewed as crucial to the management of political risk by harnessing local participants in the ownership structure of the firm." (Hooper, 2004)

2. **Insurance**

Another way to mitigate political risk is well structured insurance policies. Political risk insurance enables investors to transfer the political risks to a third party and allows them to alleviate the risk such as political violence, breach of contract and expropriation (OECD, n.d.). Political risk insurance can be provided by multilateral agencies, export-import banks and private insurance companies.

Volume/Price Variation

Wind farms in general pose a greater volume/price risk when compared to other sustainable energy sources. As wind turbines have a minimum and maximum wind speed requirement to generate electricity. A wind turbine requires a minimum of 12-14 km/h wind speeds to generate electricity, full capacity electricity is generated at 50-60 km/h. Wind speeds beyond 90 km/h will not generate electricity as the turbines must be stopped to avoid damage (HydroQuébec, 2022).

These requirements cause what we call a volume risk, making it difficult to estimate the volume at which a wind farm will operate and subsequently the revenues an investment into wind energy will generate because prices cannot be pre-determined due to volume differences. We will focus on the long-term variability of volume output of a wind farm. These long-term variabilities mainly are called monthly or seasonal variations. Note on short term variability: Daily power generation can vary from 0% to 100%, these daily variations are usually not a cause of concern as the total output is smoothed by these daily variations in the long run.

Investors in wind farms need to cope with +/-10% variation in annual wind production. Additionally, due seasonal variation 30-45% more power output is expected during winter than during summer. As the production levels are high in winter the volume risk is higher too, with a variance that can be double of the summer production. Income variations are affected by these seasonal changes and unexpected volumes, during summer an income could have a variance between -87% and +110% and in winter between -96% and 150% (WindEurope, 2017).

Hedging the volume/price risk

1. **Wind energy investment across different regions**

One simple yet costly way of hedging volume risk is to make investments in wind energy across different regions. For example, winters in Azerbaijan last between November to March and in Australia between June to August. Having investments in regions with opposing seasonal variations will enable revenues to be stabilised.

2. **Forward contracts**

This method of hedging does not require massive investments in other countries. Through creating an agreement for the delivery of power at a fixed price and quantity in the future, companies can hedge against price and volume risks. A company like Engie will benefit from a forward contract if price/volume of energy reduces significantly and conversely will lose if price/volume increase (Hillier, Clacher, Ross, Westerfield, & Jordan, 2017).

3. **Options (Put)**

While in forward contracts the two parties are obligated to follow the contract requirements, options transactions occur only when the owner of the option choses to exercise it. Engie will certainly benefit more from a put option as it gives more control to the company to decide if it is necessary to sell at the option contract amount due to fluctuations in volume output during that period. Options do come with option premium which have to paid to the seller of the contract which is not the case in forward contracts (Hillier, Clacher, Ross, Westerfield, & Jordan, 2017).

Exchange rate risk

When it comes to foreign direct investment, the company needs to trade in foreign currency. To convert the foreign currency to home currency, they use the exchange rate. The exchange rate can be spot exchange rate or forward exchange rate. When calculating NPV with foreign currency approach, we use spot exchange rate for conversion. Because of the unexpected changes in rate, the loss or profit will be happening at some points in the future. Exchange rate risk is a common one when the company has foreign investment. No matter what industry the company is, they all have to deal with this risk. The foreign currency for our project is Manat (AZN) and the home currency is Euro. The spot exchange rate we use is 1.67 according to central bank of Azerbaijan. But in the long run, with external factors which can be described as war or ongoing inflation, the Euro currency is expected to be depreciated. According to Ward-Glenton (2022), “the euro traded at a two-decade low of 0.9903 against the U.S. dollar Tuesday morning, with analysts predicting the single currency will continue to slide”. Besides, the inflation rate in Azerbaijan is quite high and unstable for many years. This can also affect the return rate when using foreign currency approach to convert the foreign currency to domestic currency. Managing exchange rate risk is very complicated because of the company’s subsidiaries in many countries. The net exposure is more concerned. Because of the immense effect of this risk on the overrall performance, we also have sensitivity case of different exchane rates included in ths excel sheet. However, there are many ways to hedge this foreign exchange risk:

Hedging the exchange rate risk

1. **Currency swap:**

With this method, the two parties exchange their domestic currencies with their desired foreign currencies at an agreed-upon rate. For example, Engie wants to borrow money in Manat (AZN) and another company in Azerbaijan also plans to expand their business in Eurozone. These two companies can swap their currencies with lower interest rates they have in their home countries. The only problem is that Engie has to find out which companies to agree to swap.

2. **Options**

With the currency option, the company has the right to buy or sell at a currency at a fixed rate for a period of time. This seems to be one of the most common ways to hedge this kind of risk. With this method, Engie company only pays for the premium to buy the options. In good conditions, the company can exercise the options. However, this can also come with another risk. The cost of premium is high and might lose more than premium if you sell according to FX options explained (n.d.)

Conclusion

As we all know countries and companies are shifting towards greener ways of producing and consuming energy. Offshore wind is one of those sustainable energy sources, a rapidly growing industry, offshore wind has the potential to provide green energy and sustainability focused jobs. Throughout this project it was clear that offshore wind will be the best investment for Engie in Azerbaijan. Even though this is the country that has a lot of risk itself, World Bank group has proved that there is a pathway for offshore wind to expand in this country. The country has done so far a lot of effort for a better future as a green country. Engie, a company specialised in sustainable energy could benefit greatly from the commitments Azerbaijan has made towards sustainability goals. Offshore wind is an expensive endeavour, meaning that most or if not all of the €50,000,000 was expected to be used in capital expenditures. The PESTLE analysis showed the great potential Azerbaijan holds in terms of being an emerging market for sustainable energy, even though some political issues still exist. Current sustainable energy trends were covered during this report giving a clearer picture of the latest developments in Azerbaijan or the energy industry as a whole. While a wind turbine's life span is around 25 years the investment will be calculated for a 10-year period, ending with the calculation of terminal value for the remaining lifespan of the wind farm. The investment is straightforward, but the costs incurred are high, €49.28 million must be spent on 5 wind turbines. Other fixed and variable expenses were calculated in detail to provide a clear picture on how general operations will look like during the 10-year period. While careful estimations and some necessary assumptions were made throughout the project, we believe that this report will act as a great basis for an investment project down the line with its good net income per year and the great electricity production the offshore wind can produce along with the high potential of floating offshore wind recognised by many researchers and engineers. Assessing risk was an important part of this project as well and ways to hedge these risks were also mentioned. While we believe that this investment in Azerbaijan will bring enough revenues making it a worthy investment, we also see that the investment will bring some expected and unexpected risks too. It is important to manage these risks and to make careful estimations before, during and after the 10-year period.

Recommendations

1. **Increase capital expenditure**

While an initial windfarm can be set up consisting of 5 wind turbines with 50 million euros. It might be a good idea to invest more over the years to expand the wind farm. The limited capital available makes it difficult to set up higher rating wind turbines which will produce more energy per year. We had to make cutbacks in the rating of the wind turbine being at 3MW if the investment would have been higher there would be possibility of investing in 5MW turbines or even as high as 15MW. Within the limited investment value, it was most logical to go for 5 turbines rated at 3MW.

2. **Use hedging to mitigate risks**

As discussed in the financial risk segment of this report, it is important to mitigate financial risks in a highly volatile market. We identified 3 major risks: political, volume/price variations and exchange rate risks. These risks can be managed using different hedging techniques. These risks may make or break the entire investment therefore the importance of mitigation cannot be understated.

3. **Create data banks and use new technologies**

During the project one of the main issues faced was the availability of detailed data. Engie should create a data bank of their own in regard to required manpower, insurance expectations and other

costs which may vary per country. This will enable Engie to independently look at the data instead of relying on publicly available information. In addition to that Engie should look at opportunities to use new technologies like AI (discussed in latest energy trends) to further reduce unexpected risks of changing weather types. In addition to that AI will enable Engie to make better forecasts in energy production and in turn enable the better hedging of future risks.

Reflection

Capital budgeting part required extensive research into the renewable energy domain especially floating wind turbine field. It was essential to gain knowledge about the nature of similar projects and understand the composition of wind farms. Since floating wind projects are somewhat new and innovative in the renewables industry, resources on the topic available to public are very limited. Therefore, we had to rely on limited information and make assumptions and estimations.

Capital expenditure part was quite exacting. Having a very limited FDI budget and choosing a wind farm installation project which is expensive in its nature, posed a great challenge. Instead of choosing a high-power rating turbines that are commonly used in the floating offshore wind farms, we had to go for a lower power rating turbines of 3MW. Since capital expenditure costs are strongly impacted by the location of the windfarm (length of mooring lines and electrical cables has a major effect on the total costs) a determination of a potential area of floating offshore wind farm was fundamental. This required a thorough analysis of Caspian sea's bathymetry and its offshore wind technical potential. Understanding the different floating platform design types and composition was important in order to choose the most cost-efficient option and estimate the material costs as accurately as possible. In addition, information on the floating wind farm installation was very limited and varying in different sources. Looking at our tight budget we decided to choose the lowest starting cost.

Calculating the administration costs also posed some difficulties related to the lack of publicly available information on employee requirements such as the exact number of employees needed. Therefore, we had to rely on some recommended organizational structure to estimate the number of employees required. We made some assumptions based on average workforce in other windfarm projects and used the World Bank recommendations as a basis for the overall employee requirements.

After calculating NPV without terminal value, we misleadingly see the big difference between the initial investment the present value of 10 periods, which was negative. Terminal value is indispensable that we can't omit when using discounted cash flow analysis. In addition to that, for foreign investment, exchange rate is another important element which can determine how much profit the company will get. Even though the difference in exchange rate is small, it can affect NPV in general. Along with that, with this project, we have to be careful about finding real return rate with inflation rate between countries. In 1000 sensitivity cases, it needs a data analytic skills to retrieve the useful information from the outcomes we have from different ranges of sensitivity. The idea of clarification of the result of sensitivity cases is easy to understand but how we present it through excel to make it readable require much more work.

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