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An Innovative Model for the Sustainability of Investments in the Wind Energy Sector: The Use of Green Sukuk in an Italian Case Study

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ABSTRACT

In this paper we present the technical-energy-economic feasibility of wind power systems. An Italian 1 megawatt case study was considered to evaluate the importance of incentives in order to achieve the grid parity. Due to the severe reduction of incentives in the last years, in the present work we propose the use of Sukuk, a Shari'ah-compliant instrument used in the Islamic finance, as an alternative financial instrument used to limit the extent of leverage associated with financing. The building cost thresholds necessary to achieve the grid parity and a profitable and bankable project are presented with a sensitivity analysis. In the framework of the efforts against climate change and the emission of greenhouse gas, our results evidenced the importance of incentives and the applicability of the use of Shari'ah-compliant sukuk instruments in order to provide a feasible and sustainable investment in the wind energy sector.

Keywords: Wind Energy, Grid Parity, Green Sukuk
JEL Classifications: Q420, L940, P480

1. INTRODUCTION

Renewable energy is a priority in the framework activities of the European Union (EU) energy policy strategies. Both in the 2020 strategy and in the 2050 objectives, renewables play a crucial role in order to achieve the greenhouse gas (GHG) emission reduction of 80-95% below 1990 levels by 2050 (Campisi et al., 2017; Ciarreta et al., 2014; Gerigk et al., 2012; European Commission, 2011). In this context, EU countries could become model countries proving the feasibility of the transition to renewables, leading innovation, maintaining the leadership in the field, and furthermore generating several employment opportunities (Malizia et al., 2016; Poggi and Singh, 2016; Pacesila et al., 2016). However, a clear methodology to evaluate the feasibility in terms of bankability and profitability of an investment in renewables should consider the so-called country-specific effects, and in particular the regulatory frameworks able to support the use of renewable energy and especially wind energy. A part from the regulatory factors, the economic feasibility is proved by the evolution of the cash flows over time, depending on the price of the electric power and the production cost (Chase, 2012; Ernst and Young, 2015). The state-of-the-art of the European experience suggests that a feed-in tariff offers more cost-effective support than a tradable green certificate, because it is less risky and allows these capital-intensive projects to be viable with a lower cost of capital (Campisi et al., 2016).

In the recent years, similar studies were dedicated to the investment feasibility in the renewable energy sector. Several studies showed that an incentivation policy is needed in order to achieve positive margins and the grid parity, given a fixed building cost of the power system. The goal of achieving the grid parity consist in this case in reaching the parity between the energy purchase cost and the cost of electricity production from the case-study wind energy farm (Campisi et al., 2015). In particular, such findings were presented in the achievement of the solar grid parity with real options in Italy (Biondi and Moretto, 2015), in a long-term analysis of pumped hydro storage to firm wind power (Foley et al., 2015), in an overview of wind energy in the world and assessment of current wind energy policies in Turkey (Kaplan, 2015), in the energy and economic performance of photovoltaic systems in Italy (Campisi et al., 2015; Sgroi et al., 2014; Squatrito et al., 2014), in the cost-competitiveness evaluation of renewable energy technologies in terms of grid parity (Gu Choi et al., 2015), in the wind power investment comparison in Denmark, Finland and Portugal (Monjas-Barroso and Balibrea-Iniesta, 2013), in the investment feasibility of a renewable energy mix in Malaysia (Muzathik et al., 2012), in the generation costs of on-shore and off-shore wind energy farms in Europe (Blanco, 2009) and in the investment feasibility of a hydropower plant in Norway (Kjærland, 2007).

Over the period 2005-2014, wind power generation tripled and has become the second largest contributor to renewable electricity, taking over biomass. The 2014 EU wind power production reached 247 terawatt-hour (TWh), boosted by Germany, Spain and United Kingdom (UK) as the top 3 producers (European Commission, 2015). Due to subside restriction policies in Italy, wind energy market dropped when compared to the last decade, when government incentives were sensibly higher, causing the grid parity of such technology to become more complex and challenging to achieve (Campisi et al., 2016).

In this paper, we will give a quantification of the energy performance and study the incentive-dependency of a wind farm evaluating the building cost thresholds that allows the investment to be profitable and bankable and the system to reach the grid parity (Campisi et al., 2016). At the state of the art of the Italian regulatory framework we propose an alternative financing tool: The Islamic finance. For this purpose, we introduce the utilization of green sukuk, that are Shari'ah-compliant instruments potentially applicable to the Italian context. Also, we present the threshold of building cost necessary to achieve the grid parity with no incentives, showing the dependency of such investment to the governmental incentive policy. Results are displayed also to drive the attention of the strategy experts in the field to an alternative financing instrument able to limit the extent of operating leverage associated with financing (Morea and Poggi, 2017), in the framework of energy projects devoted to the reduction of GHG emissions and the consequent negative effects of climate change.

2. ISLAMIC FINANCE FOR INVESTMENT SUSTAINABILITY

Accounting for about the 1% of world total assets in 2014 (about $2 trillion), the Islamic finance has sensibly developed worldwide during the last decades, constantly growing even if the Islamic banking still makes up only a fraction of the total world assets (The Economist Newspaper Limited, 2014; Tahir, 2007; Karim and Archer, 2002). In this kind of finance, there is no separation between religion and socio-political aspects. In fact, the Islamic finance is compliant with the Islamic law, the Shari'ah jurisprudence (Fang, 2014; Bacha, 2013; Taylor, 2002, Zawawi et al., 2014). According to that, the Shari'ah-compliant finance instruments must adhere to the ban on liquor, tobacco and different medications, pork items, betting, erotica, deadly implements and ruinous weapons. Also, other principles states that such instrument and the related exchanges must avoid speculation, gambling, unreasonably uncertain or ambiguous contracts, taking advantage of the counterparty's ignorance, corruption, and more importantly, financial returns not correlated to a real activity with a certain level of risk, i.e. the concept of usury but also intended as interest (Ahmad, 2008; Jensen, 2008). This is the most striking distinction between conventional and Islamic finance is the restriction on usury, which converts into a denial on interest.

In the public debate following the 2007 economic and financial crisis, the Islamic finance was progressively proposed as an attractive basis for changing the worldwide monetary framework. However, the recent developments faced a highly-polarizated debate, making it very hard to create a profound and final comprehension of the Islamic tools and their applicability in the Eastern countries (Nienhaus, 2011; Perry and Rehman, 2011; Koyama, 2010; Aydin, 2011; Warde, 2010; Metwally, 1997). It should also be noted that current studies addressing the applicability of Islamic finance tools to the Eastern economy and their outputs, used heuristic tools and classical profit-maximizing assumptions of conventional finance (Beck et al., 2010; Hayat and Kraeussl, 2011; Musse et al., 2015; Hussain et al., 2016).

The worldwide debate has produced notes and papers tending to particular strategy issues related to the Islamic banking and managing (Diaw, 2015; Manaf et al., 2014; Kammer et al., 2015). Some studies argued that the Islamic banks are less prone to deposit withdrawals and granted more loans during financial crisis and are less sensitive to changes in deposits (Kawawi et al., 2014). Also, according to Manaf et al. (Song and Oosthuizen, 2014) Islamic Banks are more stable than ordinary banks. However, most recent research in the field sensibly differ and it was concluded that the stability of a bank system may dramatically change among various nations and banks (López et al., 2014; Farooq and Zaheer, 2015; Campisi et al., 2015).

Project financing tools have been applied to the Italian renewable energy sector with outstanding achievements in the recent years (Campisi et al., 2016). In Italy, due to the government incentives policy, from 2008 to 2013 the renewable energy production increased by 23 TWh from 2008 to 2013 (Clò et al., 2015). However, such an incentive policy boosted the increase of the diffusion of limited-risk profiles with high interests and eventually caused financial interests to prevail over the industrial and environmental ones. As a result, the persistence of the international economic crisis and the exhaustion of incentives, resulted in the disappearance of financing entities in the field (Campisi et al., 2016).

In this scenario, a steady progression of the green economy would be ensured by reconsidering the subsidizing systems, and the financing tools, extending the examination to the diverse social and financial models available (Rarasati et al., 2014; Markom et al., 2012). In that sense, the instruments proposed by the Islamic finance could represent valuable tools for the renewable energy sector financing (Adelekan et al., 2013; Lai, 2015; Gheeraert and Weill, 2015; Suzuki and Uddin, 2016; Maurer, 2010). Several projects have been recently financed with the issuance of green sukuk, Islamic finance securities of equal denomination representing individual ownership interests in a portfolio of eligible existing or future assets (Morea and Poggi, 2017), for example the One Solar Watt Per Person project in Indonesia and Orasis project in France.

Such instruments represent interest-free loans used for the realization of real assets that provide a reasonable and fair remuneration for the investment in the form of a fixed share (i.e. a commission). That means sukuk are closely linked to the real economy, not a mere liquidity retrieval tool that does not the utilization of the liquidity itself. In the renewable energy sector, an special purpose vehicle could be capitalized issuing sukuk bonds (Kordvani, 2009). Numerous future renewable energy sector investments could be facilitated using Islamic sukuk, encouraging the expansion of the investor base and increasing resources. Keeping in mind the end goal to make this model proposed reasonable and lawfully attainable in Europe and in Italy, a preliminary examination of the legislation framework and several amendments are needed, and it is likewise that this tasks would be addressed by means of political decisions (GSE, 2016c).

3. ITALIAN GOVERNMENT INCENTIVES

Currently, the "Gestore Servizi Energetici" (GSE), the Italian company responsible for the subsides for renewable energy production and energy efficiency, has offered a feed-in tariff system. In fact, government incentives devoted to helping renewables to achieve grid parity ceased in Italy with Ministerial Decree of 5 July 2012 (the "Quinto Conto Energia"), after a decade of steady growing from its introduction in the Italian legislator framework (Legislative Decree n. 387/2003 receiving the Europe Directive 2001/77/EC) (GSE, 2016a). In the feed-in tariff system, a reward is provided for the electricity production from renewable sources, that is a single regulated tariff (€/Megawatt hour [MWh]). However, even if it was evidenced, on the one hand, the easy implementation of such system, the low costs associated with it compared to a national trading scheme, and the possibility to continuously revise it according to new technological breakthroughs, on the other hand it was also shown how difficult is to set the tariff at an appropriate level, trading-off the effects of excessive rents increase when tariffs are too generous and stifling development when tariffs are too mean (Campisi et al., 2016; Green and Vasilakos, 2011; Haas et al., 2011).

In this regulatory framework, a large wind energy capacity was installed in Italy. Wind energy accounted for about 8.7 GW of installed power in 2014 (+1.7% respect 2013) and about 5.44% of the total Italian generation with 14,897 GWh produced (Terna, 2014), increasing by 23 TWh from 2008 to 2013 (Clò et al., 2015). The subsides policy over the last years boosted the technological development, leading to falling costs and increasing efficiency. Today, grid parity for a wind farm is possible to achieve. Producers can sell the electricity according to the Ministerial Decree (D.M.) 23 June 2016 (GSE, 2016c). The incentive mechanism is represented by the "Tariffa Onnicomprensiva," an alternative to the "Green Certificates," consisting in a fixed tariff applicable to the electricity sold by producers operating qualified plants powered by renewable sources. This tariff remains fixed and applicable for all plants that came into operation after 1 January 2013, extending the criteria stated in the Ministerial Decrees 6 July 2012 and 23 June 2016 (GSE, 2016; GSE, 2016c). The rate is called "comprehensive" because its value includes an incentive component and a component taking into account the electricity actually fed into the grid. Until the end of the incentive period, the "Tariffa Onnicomprensiva" should be the only source of income from selling such electricity. Once the incentive period is over, the economic conditions stated on the Italian Law no. 387/2003, article 13, should be applied (GSE, 2016; GSE, 2016a; GSE, 2016b; GSE, 2016c). For wind power, the different tariffs according to the wind farm size are presented in Table 1, according to the Annex 1 of Ministerial Decree 23 June 2016 (GSE, 2016c). Please note that in the current study we consider the "Tariffa Onnicomprensiva" reported in Table 1 as the only component of the selling price of the electricity produced by the wind farm.

4. ITALIAN ON-SHORE WIND FARM CASE STUDY: TECHNO-ECONOMIC PROJECT CHARACTERISTICS

An Italian on-shore wind farm for the production of electrical energy with an installed capacity of 1 MW is the case study. It represents a common type of wind farm present at the state of the art in Italy, composed by 50 small generators JIMP of 20 kW each.

Assuming an average wind speed of 4.85 m/s on a tower of 18 m and a Weibull distribution of the probability density distribution over the wind speed (Ibrahim et al., 2014), we have estimated the energy production by means of a software simulation. The inputs of the software were: Average wind speed (m/s) = 4.85; Weibull K = 2.00; site altitude (m) = 0; wind shear = 0.20; anemometer height (m) = 10.00; tower height (m) = 18.00; turbulence factor = 10.00%. As a result of the analysis the producibility was quantified as follows:

- Hub average wind speed (m/s) = 5.46;
- Air density factor = 0%;
- Average output power (kW) = 3.48;
- Daily energy output (kWh) = 83.60;
- Annual energy output (kWh) = 30,514;

Table 1: Regulated tariff ("Tariffa Onnicomprensiva") for electricity generated by wind farms in Italy according to the Italian Ministerial Decree 23 June 2016 (Source: GSE, 2016c)

Type of plant	Power (kW)	Tariff (€/MWh)	Useful life (years)
On-Shore	$1<P \leq 20$	250	20
	$20<P \leq 60$	190	20
	$60<P \leq 200$	160	20
	$200<P \leq 1000$	140	20
	$1000<P \leq 5000$	130	20
	$P>5000$	110	20
Off-shore	$1<P \leq 5000$	-	-
	$P>5000$	165	25

- Monthly energy output = 2,543;
- Percent operating time = 72.2%.

The net annual energy production of a single wind turbine resulted about 30.5 MWh. Therefore, the annual wind farm energy production accounted for about 1500 MWh. However, it should be noted that this is a hypothetical case study, while in the case of a real investment, the site location should be chosen according to wind speed data over a long period of at least one year. Disregarding the uncertainty on the production costs and price of electricity, subsidies and other regulatory aspects, we assume that the wind farm would generate cash flows from its implementation (construction set to 2016, start-up on 2017) until the end of the average life expectancy of the turbines assumed to be 20 years. Furthermore, to evaluate the sustainability and profitability of the investment, the following parameters were taken into account in the analysis.

- Regulated tariff ("Tariffa Onnicomprensiva") for electricity generated by the wind farm (1 MW): 140 €/MWh (GSE, 2016c).
- Construction cost: € 2,000,000 (€/kilowatt [kW] 2,000); this cost is based on market values.
- Annual operation, maintenance and insurance costs is estimated at 70,000 €/year.
- About the sources of financing, we assume a 20% of the investment as equity and the remaining (80%) as debt, following other studies (Campisi et al., 2015).
- Fixed equity: € 400,000 (20% of the investment).
- Green sukuk issued (the remaining of investment [80%]): € 1,600,000 (equal to the bank loan in the conventional finance case) (Morea and Poggi, 2017).
- According to the Italian civil law, amortization is assumed equal to 4.5% of the building cost in the first year (2017), 9% of the building cost for the following 10 years (from 01/2018 to 12/2027), and the remaining is accounted in the last period (2028).
- Weighted average cost of capital (WACC) is set to be equal to 5%, according to the market values and previous studies (Campisi et al., 2015; Monjas-Barroso and Balibrea-Iniesta, 2013).
- Corporate income tax in Italy (i.e. IRES) is estimated at 27.5% of earnings before taxes and it is assumed to be constant over the period examined (Morea, 2005).
- Annual Islamic finance commission: 2% of the green sukuk investment, according to the Islamic interbank benchmark rate and the London interbank offered rate (Morea and Poggi, 2017).

5. METHODOLOGY

Indicators and parameters taken into account were the net present value (NPV), the internal rate of return (IRR), the WACC, the annual debt service cover ratio (ADSCR) and the annual loan life cover ratio (ALLCR). It should be noted that the WACC can remarkably vary depending on the company capital structure, the sources that they use to raise money, the project type, and the regional legislation (Campisi et al., 2014; Campisi and Costa, 2008; Campisi and Nastasi, 1993; Mondol and Hillenbrand, 2013; Gatti, 2012; Thusen and Fabrychy, 1993).

The evaluation of profitability and bankability of the proposed wind farm project was carried out identifying the regulatory frameworks, estimating the cash flows and the uncertainties for the project. The following conditions were taken into account (Gatti, 2012; Campisi and Costa, 2008; Campisi and Nastasi, 1993; Thusen and Fabrychy, 1993).

- NPV > 0(1)
- IRR > WACC(2)
- ADSCR > 1(3)
- ALLCR > 1(4)

6. RESULTS AND DISCUSSION

The NPV analysis highlighted negative levels of available cash flow during the period from 2029 to 2036, and the indicators are out of the admissibility range. Therefore, the investment should be rejected. In particular, as shown in Table 2, it was evidenced a negative level of NVP, as well as ADSCR and ALLCR indicators out of the desirable range. Investment recovery could be guaranteed only decreasing the parametric cost of building the wind farm. Using the green sukuk instruments as a financing tool of the investment in order to reach the grid parity in the current Italian legislation and electricity market constraints, such building cost was progressively reduced from € 2,000,000 (Table 3). The cost threshold corresponding to NPV = 0 and IRR = WACC = 5% consisted of € 1,240,290 (Tables 3 and 4). It should be noted that the analysis was also repeated using the conventional models of interests on the traditional bank loan instead of supposing to use the green sukuk. In fact, in the conventional finance scenario the threshold of parametric cost which would guarantee the investment recovery was € 1,197,834, producing the same negative results expected. The Islamic finance case produced better bankability indicators, reducing the gap between the current situation and that of a profitable and bankable project. Further analysis about the Islamic finance scenario imposing the above-mentioned profitability and bankability criteria (ADSCR > 1 and ALLCR > 1) produced as a result that the construction cost should be lower than € 1,215,000 as shown in Table 3 in order to make the investment profitable and bankable. To summarize, it was evidenced that the investment may be recovered when the cost of building the wind farm is approximately 62% of the start-up cost of the case study (€ 2,000,000). Table 3 evidenced how until the breakeven point is reached, the ratio of fixed equity on total costs increases while the costs in the parametric analysis decreased. Furthermore, Table 5 presents the WACC sensitivity analysis assuming values from 3% to 7%. Several scenarios were depicted by this variation: The results evidenced a negative level of NVP for WACC from 6% to 7% (Table 5).

7. CONCLUSIONS

In this paper we have presented the economic and financial analysis of an Italian on-shore wind farm case study investment, in order to evaluate its profitability and bankability according to the above-mentioned criteria, showing the strong dependency from incentives in order to reach the grid parity. An alternative financing model was introduced, based on the use of the Islamic finance green sukuk instruments. The most striking difference between such banking

Table 2: Actual building cost of the wind farm (NPV<0): Financial and economic analysis

Reference years and time points	2016	2017	2018	…	2035	2036
	t=0	t=1	t=2	…	t=19	t=20
Net annual energy production (MWh)	0	1500	1500	…	1500	1500
Development of revenues (€): "Tariffa Omnicomprensiva"	0	210,000	210,000	…	210,000	210,000
Development of costs (€): Operations, maintenance and insurance costs		70,000	70,000	…	70,000	70,000
Investment (€): Cost of building the wind farm	2,000,000	-	-	…	-	-
Coverage (€): Equity	400,000	-	-	…	-	-
Loan (€)	1,600,000	-	-	…	-	-
Annual payment	-	112,000	112,000	…	112,000	112,000
Income statement (€)						
Total revenues		210,000	210,000	…	210,000	210,000
Total costs		70,000	70,000	…	70,000	70,000
EBITDA		140,000	140,000	…	140,000	140,000
Amortisation		90,000	180,000	…	0	0
Net operating margin		50,000	−40,000	…	140,000	140,000
Islamic commission		32,000	32,000	…	32,000	32,000
EBT		18,000	−72,000	…	108,000	108,000
Corporate income tax (IRES)		4950	0	…	29,700	29,700
Profit/Loss		13,050	−72,000	…	78,300	78,300
Cash flow (€)						
EBITDA		140,000	140,000	…	140,000	140,000
Corporate income tax (IRES)		4950	0	…	29,700	29,700
Cash flow for debt service		135,050	140,000	…	110,300	110,300
Islamic commission		32,000	32,000	…	32,000	32,000
Repayable capital		80,000	80,000	…	80,000	80,000
Repayable capital+islamic commission		112,000	112,000	…	112,000	112,000
Available cash flow		23,050	28,000	…	−1700	−1700
NPV (€)	−1,297,773					
IRR (%)	-					
DSCR	-	0.21	0.25	…	−0.02	−0.02
LLCR	-	0.17	0.16	…	−0.01	−0.01
ADSCR	0.14					
ALLCR	0.06					

Source: Own elaboration. EBITDA: Earnings before interest, taxes, depreciation and amortization, NPV: Net present value, IRR: Internal rate of return, DSCR: Debt service cover ratio, LLCR: Loan life cover ratio, ADSCR: Annual debt service cover ratio, ALLCR: Annual loan life cover ratio, EBT: Earnings before taxes

Table 3: Parametric cost thresholds for the investment recovery and for profitable and bankable project

Wind farm building cost (€)	Equity (€)	Annual payment (€)	WACC (%)	NPV (€)	IRR (%)	ADSCR	ALLCR
2,000,000	400,000	112,000	5	−1,297,773	−	0.14	0.06
1,500,000	400,000	77,000	5	−428,885	−1.28	0.63	0.51
1,300,000	400,000	63,000	5	−91,077	3.56	0.97	0.83
1,250,000	400,000	59,500	5	−14,811	4.76	1.07	0.93
1,240,290	400,000	58,820	5	0	5	1.09	0.95
1,225,000	400,000	57,750	5	23,323	5.38	1.13	0.98
1,215,000	400,000	57,050	5	38,576	5.64	1.15	1.01
1,100,000	400,000	49,000	5	213,988	8.85	1.46	1.30
928,000	400,000	36,960	5	476,344	15.25	2.17	2.00

Source: Own elaboration. NPV: Net present value, IRR: Internal rate of return, ADSCR: Annual debt service cover ratio, ALLCR: Annual loan life cover ratio, WACC: Weighted average cost of capital

procedures and conventional ones is that the Islamic model do not include interest, but a commission (2% of the sukuk investment in the case study). This model is presented as a possible tool available for renewable energy projects financing. In this way, according to the International Shari'ah Research Academy for Islamic finance, profit-loss sharing is fairly distributed between contracting parties, and the bank using such instruments acts like an intermediary by serving the interests of the community promoting value creation (Ismail, 2010). However, also using sukuk instead of the traditional finance instruments, the achievement of the grid parity for an on-shore wind farm comparable to that of the case study, according to the Italian regulatory framework (GSE, 2016c), is strongly dependent from the incentives, as well as from the wind availability, the amount of investments, the taxation system, the use of the produced energy, and the electricity market prices. However, it is argued that the increasing innovation and development in the renewable energy field could lead to a reduction of building costs so that would be possible to partially compensate the reduction of the incentives (Adelekan et al., 2013; Lai, 2015). According to this study, as well as other studies (Blanco, 2009; Biondi and Moretto, 2015; Campisi et al., 2015), the results underlined that grid parity is still not achieved in Italy for such technologies. According to the analysis presented, it is possible to identify the gap between the actual cost of wind energy technology and what should it cost to be economically

Table 4: Threshold of the parametric cost for NPV=0: Financial and economic analysis

Reference years and time points	2016	2017	2018	…	2035	2036
	t=0	t=1	t=2	…	t=19	t=20
Net annual energy production (MWh)	0	1500	1500	…	1500	1500
Development of revenues (€): "Tariffa Omnicomprensiva"	0	210,000	210,000	…	210,000	210,000
Development of costs (€): Operations, maintenance and insurance costs		70,000	70,000	…	70,000	70,000
Investment (€): Cost of building the wind farm	1,240,290	-	-	…	-	-
Coverage (€): Equity	400,000	-	-	…	-	-
Loan (€)	840,290	-	-	…	-	-
Annual payment	-	58,820	58,820	…	58,820	58,820
Income statement (€)						
Total revenues		210,000	210,000	…	210,000	210,000
Total costs		70,000	70,000	…	70,000	70,000
EBITDA		140,000	140,000	…	140,000	140,000
Amortisation		55,813	111,626	…	0	0
Net operating margin		84,187	28,374	…	140,000	140,000
Islamic commission		16,806	16,806	…	16,806	16,806
EBT		67,381	11,568	…	123,194	123,194
Corporate income tax (IRES)		18,530	3,181	…	33,878	33,878
Profit/loss		48,851	8,387	…	89,316	89,316
Cash flow (€)						
EBITDA		140,000	140,000	…	140,000	140,000
Corporate income tax (IRES)		18,530	3,181	…	33,878	33,878
Cash flow for debt service		121,470	136,819	…	106,122	106,122
Islamic commission		16,806	16,806	…	16,806	16,806
Repayable capital		42,014	42,014	…	42,014	42,014
Repayable capital+Islamic commission		58,820	58,820	…	58,820	58,820
Available cash flow		62,650	77,999	…	47,302	47,302
NPV (€)	0					
IRR (%)	5					
DSCR	-	1.07	1.33	…	0.80	0.80
LLCR	-	1.14	1.15	…	0.81	0.81
ADSCR	1.09					
ALLCR	0.95					

Source: Own elaboration. EBITDA: Earnings before interest, taxes, depreciation and amortization, NPV: Net present value, IRR: Internal rate of return, DSCR: Debt service cover ratio, LLCR: Loan life cover ratio, ADSCR: Annual debt service cover ratio, ALLCR: Annual loan life cover ratio, EBT: Earnings before taxes

Table 5: WACC sensitivity analysis results

Wind farm building cost (€)	Equity (%)	Annual payment (€)	WACC (%)	NPV (€)	Δ NPV (€)	IRR (%)	ADSCR	ALLCR
1,215,000	33	57,050	3	184,001	+145,425	5.64	1.15	0.99
1,215,000	33	57,050	4	106,219	+67,643	5.64	1.15	1.00
1,215,000	33	57,050	5	38,576	-	5.64	1.15	1.00
1,215,000	33	57,050	6	−20,407	−58,983	5.64	1.15	1.01
1,215,000	33	57,050	7	−71,569	−110,145	5.64	1.15	1.01

Source: Own elaboration. NPV: Net present value, IRR: Internal rate of return, ADSCR: Annual debt service cover ratio, ALLCR: Annual loan life cover ratio, WACC: Weighted average cost of capital

independent, not considering any government incentives, evidencing how a significant reduction of the initial investment costs will be the main force for the development of wind energy, because it is a capital-intensive technology (Campisi et al., 2016).

This study can represent a wide variety of possible scenarios and could be useful to perform a comparative evaluation of alternatives that makes investment attractive. Also, it could be useful in shaping government policies to reward those systems reducing GHG emissions and that provide a valuable contribution to contain the negative effects of climate change particularly regarding the reduction of GHG emissions (Kanudia et al., 2013). In fact, incentives, are at the state of the art still key factors in meeting the EU 2020 objectives (Campisi et al., 2015). Academic studies, like this presented, can highlight the sustainability criteria and applicability constraints of the Islamic finance instruments in different contexts, but effective interactions of economic agents and professionals with policy makers, utility decision makers, investors and consulting services, is crucial to obtain an effective introduction of such instruments in the global financial system. Familiarity of conventional investors and companies with Islamic finance instruments increased in the past few years (Bokhari, 2000; Goud, 2007; Joliffe, 2003). However, the extent of the standardization of such structures and support from governments of non-Muslim countries, also by means of tax reduction, is still limited (Musse et al., 2015). Features like asset-backing, bans on uncertainty and interest, and risk and profit sharing makes the Islamic finance instruments tied to a tangible and identifiable asset, and therefore more resilient and sustainable (Askari et al., 2012; Gharbi, 2016; Hanif, 2016; Salim et al., 2016).

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