LUISS

Department of Corporate Finance

Chair: Structured Finance

ALTERNATIVE INFRASTRUCTURE FINANCING: CATALYSING INSTITUTIONAL INVESTMENTS IN THE ENERGY SECTOR TO HELP MEET THE GREEN ENERGY TARGET IN ASEAN COUNTRIES

Prof. Riccardo Bruno
SUPERVISOR

Prof. Marco Vulpiani
CO-SUPERVISOR

Francesco Migliorati Matr. 704761
CANDIDATE

ACADEMIC YEAR 2019 / 2020

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TABLE OF FIGURES

EXECUTIVE SUMMARY

The thesis was conceived during the last months of 2019, spent in Singapore living the vibrant Southeast Asian region. In this ultramodern city-state - cradle of the Asian infrastructural sector - I developed a particular interest for the infrastructure and sustainable finance sector, as a consequence of academic courses, connections and socio-economic context.

This interest is the backbone of the thesis, that has the aim of identifying financial solutions to the financing gap that afflicts the infrastructure sector of the region. In particular, the focus will be on renewable power plants investments, of strategic importance if considering the growth of the Asian energy demand and the same time the international agreements to reduce CO2 emissions.

Throughout the thesis will be proposed some catalytic financing solutions to be implemented at project level and at fund level in order to leverage private capitals and bridge the financing gap in the renewable energy sector. This would allow a green energy transition and to respect international green energy targets.

To this end, Chapter 1 introduces the renewable energy sector and contextualizes it in Southeast Asia. The current state of the market is illustrated in order to understand whether what is being done is in line with international agreements on CO2 emissions reduction; moreover, it is also analysed the future demand to determine the dynamism of the market and its trend. To complete the sectorial overview, it is assessed the financial profile of a renewable power plant investment through comparison with traditional asset classes, in order to target the investors that can possibly drive the green energy transition.

Chapter 2 identifies a number of barriers for private investors to invest in green energy. These difficulties create a financing gap - understood as a mismatch between infrastructural demand and supply - that the thesis aims to address. In particular, it will be identified the obstacles that are distinctive of the region - still affected by instability - and others specific of institutional investors, identified as the possible drivers of green energy transition.

Chapter 3 tries to propose some instruments to bridge the financing gap and overcome the barriers identified. These “blended finance” structures, i.e. a mix of private and public capital, have the purpose to catalyse private investors in the short term, while in the long term to create a liquid and self-sufficient market. Specifically, it is proposed the use of Guarantees granted by multilateral banks to be implemented at project level to mitigate risks and make the project financially viable. In addition, an alternative indirect investment facility is proposed with the aim of increasing the returns of private investors and allowing access to the market for less sophisticated players.

These proposals aim to catalyse private investors in order to close the financing gap and above all to drive the green energy transition.

The validity of the proposed tools will be examined through a case study. In particular, it has been selected a project that used a Credit Guarantee - one of the tools suggested in the previous section - granted by GuarantCo, a Development Finance Institutions belonging to the World Bank Group. Through a series of interviews with the CFO of the project sponsor, the thesis will investigate the effectiveness of the instrument and its catalytic potential, i.e. leverage of private capital, to understand if it can actually contribute to closing the financing gap.

CHAPTER 1: THE RENEWABLE ENERGY SECTOR

The aim of this Chapter is to introduce the renewable energy sector as an investable asset class, to analyse future energy trends and to define its financial characteristics. At the outset, the features and the dynamics of demand will be considered, underpinning the rationale of this thesis, and then will be presented, without presumption of completeness, the financial profile of a renewable energy investment and the potential categories of investors. This Chapter provides an introduction to the subsequent Chapters, where it will be analysed the reasons behind the existence of a financing gap followed by a discussion of some non-traditional financial solutions. Finally, these tools will be addressed empirically and critically through case studies in order to identify possible areas for improvement.

1.1. Renewable Energy Outlook

1.1.1. Global Roadmap to 2050

Climate change has become one of the greatest concerns of our century. To address the problem, our society must provide an innovative response to energy production and consumption, one of the main causes of carbon emissions. The phenomenon, initially taken with scepticism, is now gaining momentum. Individuals, companies and governments are called upon to give a unique response: without any one of them, the efforts of the other would be in vain. Since the efforts of individuals are now becoming more evident, this thesis analyses what is being done and what can be improved from the point of view of the latter two groups, corporates and governments. In the following Chapters, it will not be discussed how and why to scale electricity usage – i.e. the individual's perspective - but how to catalyse private investments in renewable energy and how to make risky or low-yield projects financially viable – respectively the focus of Governments and Investor.

Two main international agreements are the backbone of our sustainability mission:

- the Paris Agreement, that establishes the target of limiting the global temperature increase to well below 2°C, and ideally 1.5 °C compared to pre-industrial levels, within this century.

- The Sustainable Development Goals, ratified in 2015 by the United Nation General Assembly, which gather 17 global targets to be achieved by 2030. Among them, goal n7 sets to ensure access to affordable, reliable, sustainable and modern energy for all. The plan calls for particular attention to infrastructure support to the least developed countries, small islands and land-locked developing countries.

However, even though in the last decade $3tn have been invested in renewable energy worldwide, the effort is still largely insufficient. To ensure a sustainable future, investments in renewables should double to $737bn per year from now until 2030 (IRENA, 2020).

According to the International Renewable Energy Agency, emissions will have to be reduced by at least 3.8% per year from now until 2050 in order to be in line with the Paris agreements, while in the last 5 years our emissions have increased by 1.3% per year.

The same Agency has developed a model called "Planned Energy Scenario" that takes into account the targets and the implementation strategies claimed by the governments for the renewable energy sector, stretching over time the main underlying trends to which energy consumption is correlated. As a result of the model, emissions will increase every year until 2030, before gradually decreasing in the following two decades to a level slightly lower than what we are currently emitting. The share of renewable energy out of the total would be only 27% compared to the current 14% while the necessary level to be in line with the Paris Agreement would be ca. 65% according to the model.

1.1.2. Future needs in Southeast Asia

From a geographical point of view, sustainability cannot be tackled in a unique way, as each region has peculiarities that deserve specific attention. In many aspects, Asia has become a growth engine for the world economy, with developing Asia currently driving 60% of global economic growth. Moreover, this is the area were several megatrends are intercorrelating: demographic shifts, an evolution in global economic power, and growing urbanization (PwC, 2014).

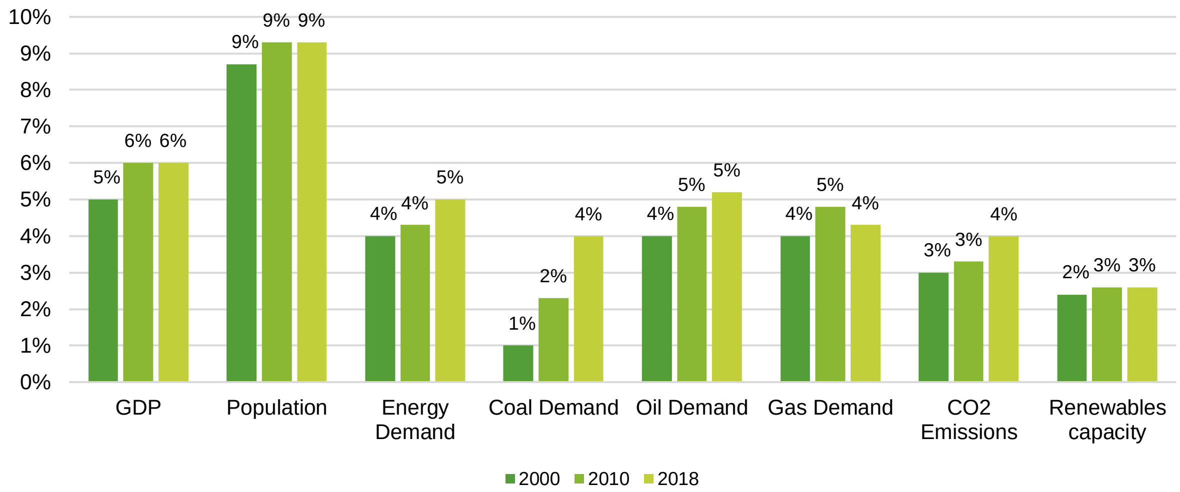
Specifically, Southeast Asia will experience the fastest growth in vehicle ownership globally in 2017 and the broader Asia region as a whole lead in air passenger growth as well (Marsh & McLennan, 2017). Without any surprise, many believe Asia is the political and economic center of the new century. This is not only a geopolitical truth but, as the international energy agency (IEA) as noted, also the centre of gravity of the global energy system is shifting. It is in this area that the thesis is focused, and in particular in the following countries: Brunei, Cambodia, Indonesia, Laos Malaysia, Burma, Philippines, Singapore, Thailand and Vietnam.

So far away from the European declining birth rate, rising average age, economic stagnation and flat energy consumption, in the Southeast Asia region socio-economic phenomena are correlating with each other explaining why the attention of economists is increasingly focused on the eastern part of the globe. Whilst this is true from a general point of view, it is even more valid if we discuss energy consumption and polluting emissions.

In order to analyse the energy demand in the coming decades, and consequently the amount of funds that have to be mobilized (Chapter 2), it is necessary to briefly define the underlying trends in this incredibly dynamic region.

- *Demographic Shift.* By 2050 the population of the region is expected to grow by about 25% (PRB, 2017) putting pressure on governments for housing, transportation, water and sanitation.
- *Emerging Middle Class.* In the last two decades, Southeast Asia has grown at a rate of 5-6% per year, with consumption in Malaysia increasing fivefold or fourfold in Thailand (UNSD, 2019). The region, which in the last 20 years has already seen its GDP grow 125% to $2.5tn, is expected to reach $5.4tn by 2030 (World Bank, 2017). The rise of a middle class is leading to massive increases in the use of cars and scooters, which have grown by 89% between 2008 and 2017 (ASEANStats, 2017) – this is one of the sectors with the greatest use of fossil fuels.
- *Urbanization.* Although Southeast Asia is already home of some of the largest megacities in the world, with Jakarta and Manila having more than 10m inhabitants, the urban population, that increased from less than 40% of the total at the beginning of the century to about 50% in 2018, will probably reach a percentage of 64% in 2050 (UNDESA, 2014). Urbanization brings an increase in energy consumption: demand for air conditioners, for example, has tripled in the last 2 decades (The Asean Secretariat, 2018).
- *Industrialization.* The urbanization of the last decades has led countries to move from a system based mainly on agriculture to an industrial one. The most developed countries, including Indonesia, Malaysia, Philippines, Singapore and Thailand were the early movers, but now the recent boomers are the Cambodia, Lao, Myanmar and Vietnam, with industry rising from 28% to 34% of GDP between 2000 and 2016 (ASEANStats, 2017). Industrialization brings strong energy consumption, that between 2000 and 2016 increased by 70% (IEA, 2017).

Figure 1: Share of selected global economic and energy indicators in Southeast Asia, 2000-2018



Source: IEA, 2019

Furthermore, it is worth mentioning that:

- About 80% of the population in Southeast Asia is exposed to fine particulate matter levels that exceed the World Health Organization's limits. Asia as a whole, based on studies conducted from 2009 to 2017, is home to 93 of the 100 most polluted cities in the world (REN21, 2019).
- The cost of renewable energy, which will be discussed in the next paragraph, has been falling in recent years with the cost per solar PV decreasing by 65% in the last 5 years (IEA, 2019).

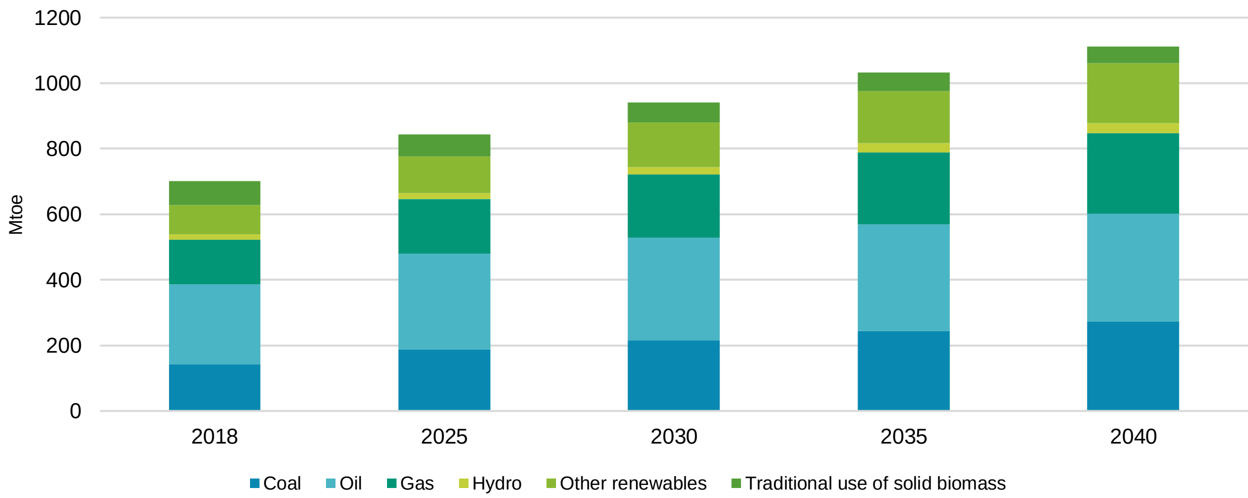
These trends pushed energy demand to almost double since 2000, growing by 3.4% per year and well above the world average of 2% per year. The increase in energy demand has been covered 85% by fossil fuels. Nevertheless, the use of renewable energy has also doubled in the last two decades, but now represents a mere 20% of the total energy demand (IEA, 2019).

Not only sustainability, but an increase in use of fossil fuels can also bring economic issues for the region. In fact, oil production over the last two decades has not been able to balance the increase in demand that was replaced by foreign imports. Considering the three fuel sources - coal, gas and oil - the region has gone from a surplus of more than 120 million tonnes of oil equivalent in 2011 to a surplus of about 30 Mtoe only thanks to coal production, which remains strong especially in Indonesia (IEA, 2019).

Driven by public opinion and Developed Countries, Southeast Asian nations have started to set medium- and long-term national targets for renewable energy and have also formally joined the Paris Agreement by committing to emission reductions. For example, Indonesia has declared that by 2030, 31% of energy demand will be met by renewables, while Thailand has committed to achieving the same percentage by 2036. To date, it appears that all countries in the region have set target levels of renewable energy to be achieved by the next decade, although only a few of them have presented these targets together with a well-defined strategy (IRENA, 2018). In short, something has been done in recent years.

According to a model called "stated policies scenario" the IEA tried to predict future energy demand by assuming the implementation of the public statements and targets defined by the countries of the region. The model also takes into account - with conservative assumptions - trends underlying energy demand such as GDP, population and urbanization. According to this study, by 2040 energy demand will be 60% higher than today, with 62% growth in fossil fuels and 101% in renewables. These figures may seem encouraging, but they have serious consequences from an economic and sustainable point of view.

Figure 2: Primary Energy Demand in Southeast Asia in the Stated Policies Scenario, 2018-2040

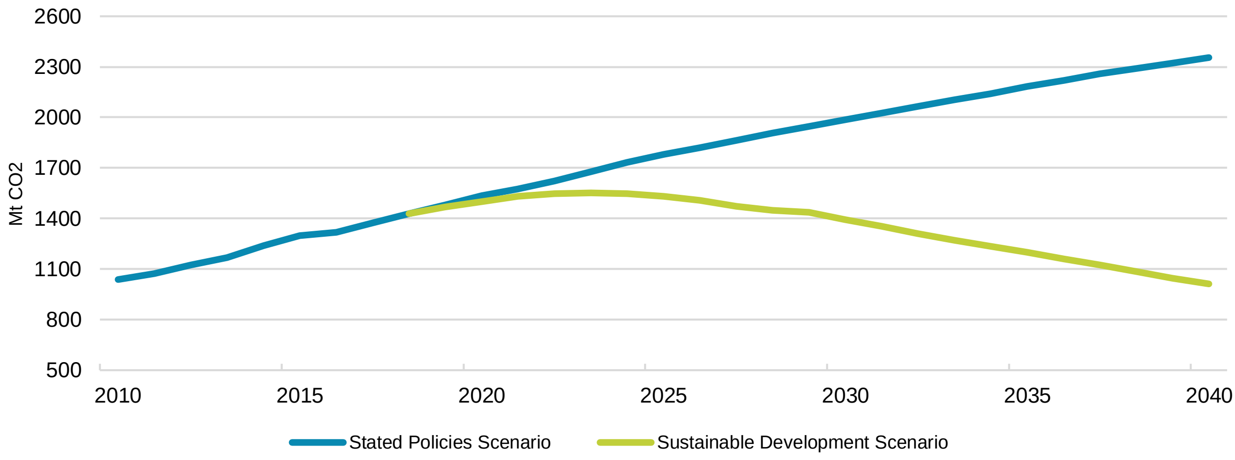


Source: IEA, 2019

From an economic point of view, oil demand would increase to 9 million barrels per day by 2040 from the current 6.5m. Southeast Asia would become increasingly dependent on oil imports with more than 7 million barrels imported per day from the current 4 million barrels.

From a sustainability point of view, assuming the model is realistic, CO2 emissions would increase until 2040 to a level of 2355 Mt CO2 from 1520 Mt CO2 today. This is very far from what is needed. In fact, according to IEA – not famous for being a supporter of green energy transition - in order to reduce global warming by 2040 the emissions should, after a slight increase in the first years of this decade, decrease dramatically to 1000 Mt CO2.

Figure 3: CO2 emissions reductions by scenario in Southeast Asia, 2010-2040



Source: IEA, 2019

To wrap up, the region's energy demand is set to continue growing significantly over the next 20 years. In the most conservative hypothesis, the demand for renewables is expected to double, with huge needs for infrastructure investments. However, much more will have to be done to be in line with the Paris Agreement, and governments will have to scale up even more capital. To further increase investments in renewable power plants, innovative ways of financing need to be explored, able to catalyse private investments by lowering funding costs, mitigating risks and building a strong pipeline of projects. What is being done and what can be improved will be discussed in the last two Chapters.

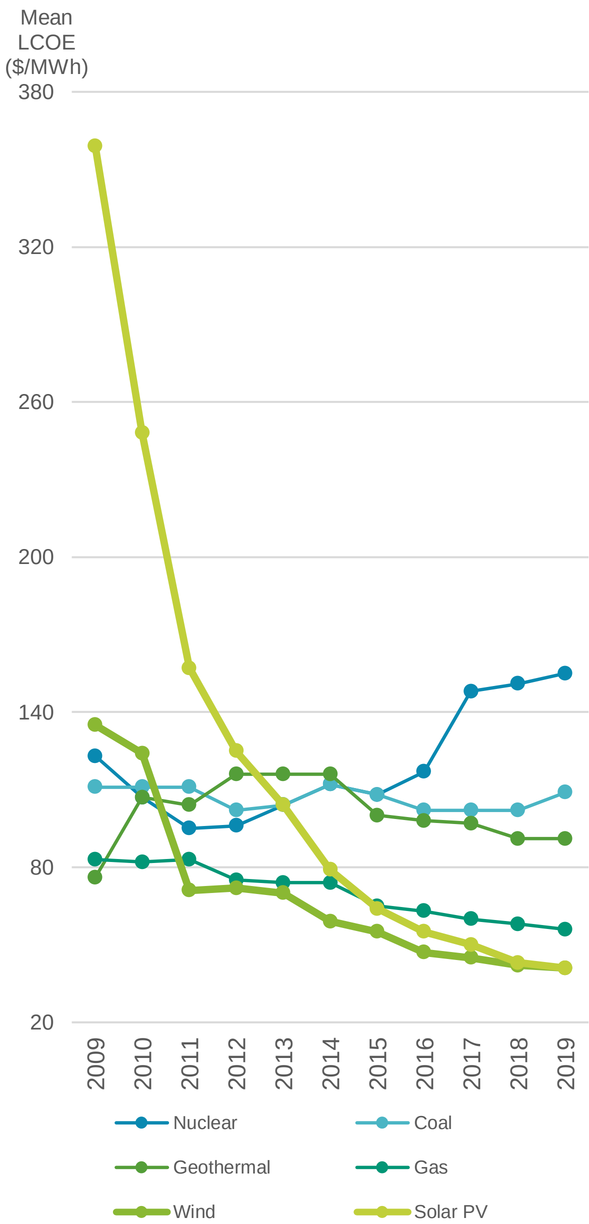
But before doing that, the thesis aims to define the particular asset class of renewables and the ideal investor to be targeted by non-traditional financing solutions.

1.2. Industry Overview

The paragraph defines the characteristics of renewable energy power plants. Even though from a cash flow point of view they are quite similar, the renewable technologies differ so much among them that each one has its own natural habitat. Fortunately, these technologies can be sometimes complementary, like for example certain areas suitable for wind energy but not solar energy and vice versa. In the specific case, the Southeast Asian region has an excellent potential for hydropower, particularly in Indonesia and Myanmar. Global horizontal irradiation, the main consideration with photovoltaic installations, is also very strong. On the other hand, wind resources are more modest, with certain parts of Indonesia, Philippines Thailand and Vietnam reaching the necessary average speeds (IRENA, 2018). Renewables is a very extensive topic and for the sake of brevity this paragraph only describes the main features of renewable technologies.

Solar Energy. While the resource is abundant worldwide and predictable, the intensity, i.e. the amount of solar radiation received on a given amount of surface area, varies geographically and fluctuates during days and nights, creating production peaks. While operating costs are low, being the primary source free, installation costs are very high, due to panel prices and land acquisition. Moreover, panel's life expectancy is short (about 25 years, but increasing) and efficiency, depending also on the quality of the structure, may decline over time. Hail, wind, clouds and extreme temperatures affect the final output volume. In particular, a cell temperature of 50° C decreases the final output by 12%, a cloudy sky by 40-80% and also the wind has a negative effect as it increases the dirt on the panels (Asian Development Bank, 2012). Motivated mainly by the decline in component costs and increased efficiency, the Levelized Cost of Energy[1] has

Figure 4: Global Levelized Cost of Energy - Historical



Source: Lazard, 2019

[1]The LCOE is calculated as the ratio between all the discounted costs over the lifetime of an electricity generating plant divided by a discounted sum of the actual energy amounts delivered

dropped dramatically in the last 10 years from a median cost of 359 $/MWh to 40 $/MWh becoming the cheapest energy source.

Wind Energy. Onshore wind is a well-established technology whose profitability depends mainly by the site accessibility and the location quality (wind intensity and consistency over the years). Onshore wind is not as land intensive as solar energy, but the technology is expensive in terms of capital expenditure but generally cheap in terms of operations. In recent years, an alternative has developed, Offshore Wind, i.e. plants located off the coast and in the middle of the sea. Wind intensity tends to be generally higher, but the installation, construction and operation of turbines is significantly more expensive, complex and therefore risky. Maintenance also requires more attention as wind turbines are exposed to more destructive conditions (salt waves and frost) with maintenance work often requiring boats and helicopters. The construction cost also depends on sea conditions, including, for example, its depth. In general, cold temperatures, rain, snow and hail can damage the blades and reduce the final output. Offshore projects are also affected by sea level and sea loads, which can damage the foundations and corrode the structure. Despite a more established technology than Solar PV, the decline in LCOE has been significant from $135/MWh to $41/MWh in the case of Onshore Wind.

Hydroelectric Energy. This is the most traditional renewable energy source and therefore has less potential for cost improvement. It requires a significant investment in the construction phase and operating costs are relatively low when compared to fossil fuels. Life expectancy is also very long, up to several centuries although they must be subject to periodic renovations. The cost in recent years has not decreased as drastically as the new renewables since it is a mature technology (IRENA, 2018). However, the focus of the thesis will not be on hydroelectric power for two main reasons:

- Since this is a strategic infrastructure, investments are often sponsored and financed by governments, especially in the case of large facilities.
- More importantly, the social and environmental impacts of many projects can be highly controversial and calamitous. A prime example is the Three Gorges Dam, the largest hydroelectric plant in the world located in China. Since the beginning of its construction, about 1.5 million people were relocated against their will due to the submersion of the villages in which they lived, and over 5,000 areas around the basin are constantly monitored due to meltdowns and landslides. This dam has now become the emblem of the impact that

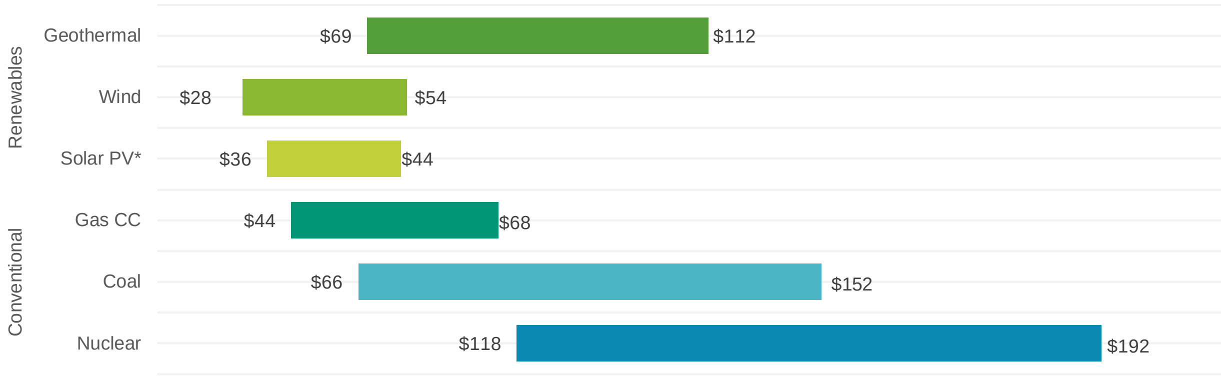
some of these plants can have: human costs, violation of citizens' rights, biological and geological damage.

Others. Geothermal, Biomass and Marine Energy are considered additional renewable sources. These, due to their limited use, will not be discussed in the thesis.

A common characteristic of renewables, and one of their main weaknesses, is production volatility. As a matter of fact, once the energy is produced, it goes through grids that reach the final consumer. However, solar energy and wind energy have production peaks that do not necessarily correspond to consumption peaks, creating storage problems. To solve the problem and encourage private investors, many countries have adopted a "priority dispatch" systems, where renewable energy is the first to be used while fossil fuels set to fill the remaining demand. Nonetheless, it appears that a possible solution to this problem are Smart Grids, which replace the one-way communication flow of traditional grids (energy flowing from production plants to the final consumer regardless of the quantity actually needed) with a two-way communication. They connect producers and consumers, not only by providing energy to the latter, but also absorbing consumption information. By doing so, smart grids are able to rationalize and distribute energy efficiently, avoiding overloads and voltage variations. However, while Southeast Asia is one of the most active in the implementation of this technology, with a plan of €9.8bn investment until 2027 (Northeast Group, 2018) grids and investments still represent a huge problem in the region.

Finally, is worth pointing out that the Levelized Cost of Energy of renewables has fallen dramatically in recent years, reaching new records every new project and becoming cheaper than fossil fuels themselves. This factor, net of problems such as the production volatility just discussed, leads to the question of why there are still investments in fossil fuels, which at this point are inefficient from both an economic and sustainability perspective. Among the answers, it is true that private investors are not only interested in the LCOE, which in practice means lower production costs for the same amount of energy produced, but also in the overall risk/return investment profile. Here, we are making a first step towards one of the motivations that, if properly addressed, can change the renewable investment landscape: the risk perception of the private investor.
With the aim of providing possible mitigants for private investors, the Chapter is going to identify the renewable investment profile in the following paragraph and the ideal target investor in the last one.

Figure 5: Global Levelized Cost of Energy - Comparison



**Crystalline Utility Scale*

Source: Lazard. 2019

1.3. Renewable Energy Sector Characteristics (… and opportunities)

Whilst from a preliminary analysis it seems clear that the renewable energy market is experiencing growing demand and requires quantifiable investment, what needs to be addressed is the type of investment needed for the energy infrastructure sector, what are its financial characteristics and therefore what type of investors should be targeted.

At this time of low and sometimes negative interest rates, long-term investors have considered alternative asset classes to allocate capital. In particular, the very long holding period and the search for steady low-risk cash flow over time have prompted investors to look with interest at infrastructure investments. Specifically, Australian and Canadian institutional investors (pension funds and life insurance companies) were among the first to gain expertise in this sector, accounting for more than 15% of their invested capital. However, despite the growing interest, a real track record is still lacking to attract investors and to present itself as a viable alternative asset class. This paragraph aims to summarize the few studies available and to address investments in renewable energy from the perspective of an investor: Risk profile, Return profile, Diversification, Cash Flow profile, Investment Horizon.

1.3.1. Risk-Return Profiles

What return can an investor in renewable power plants expect? Is the risk-return profile comparable to an investment in the stock or bond market?

To answer the question, it is necessary to consider historical returns, volatility, correlation and default rates. Stock market data, where there are public and historical series easily available, can provide some indications. Looking at the renewable sector, a first answer could be to consider

YieldCos performance. YieldCos are a listed alternative investment instrument that developed around 2013 - before losing almost all of momentum in recent years. The idea behind their operation is quite intuitive. They are listed but majority owned subsidiaries of large energy companies and designed to hold only operational renewable projects built – most of the time but not always - by the parent developer. The parent energy company/developer, once the asset is operational (hence with low volatility and constant cash flow) sells it to the listed YieldCo which benefits from liquidity of the financial market and its daily-pricing structure. Hence, these vehicles can provide an expected indication of the performance profile of renewable power plants, since their price are traded daily and the dividend yields is publicly available. However, the initial enthusiasm in the industry faded away as investors in YieldCos quickly realized that buying shares of these facilities was much riskier than investing directly in Power Plants. The complex structure, significant conflicts of interest leading to unreasonable asset acquisition prices and overly aggressive growth strategies have turned YieldCos into everything that a direct investment in infrastructure is not: overly risky and market correlated (Climate Policy Initiative, 2016).

Therefore, the performance of these stocks does not provide a useful indication in assessing the risk-return profile of infrastructure investments, and thus “off-market" approach appears necessary, which however suffers from the availability of data. Most infrastructure investments are made through unlisted funds that raise institutional investors' capital and directly or indirectly invest in Renewable Assets. These unlisted funds usually have low transparency and their portfolios and performances are often not disclosed to third parties. In addition, renewable energy is a sub-sector of infrastructure investments and is quite new, so it lacks a real track record necessary to define a trend. Therefore, it will be necessary to focus on the returns of unlisted infrastructure funds that have in their portfolio not only the renewable sector but also other subcategories (Rails, Toll Roads, Airports...). This approach, even though can give us only a rough indication of the real performance, can be considered valid since the risk-return profile of an infrastructure asset is not predominantly determined by the sub-sector but it depends in large part on the stage and contractual structure in which it is embedded (Weber, 2016). So far, one of the most relevant academic studies on these unlisted infrastructure funds has been done in Australia - one of the few countries to have unlisted data series longer than 15 years - by Newell et al. (2011). The methodology involves the study of five large unlisted infrastructure funds: AMP Diversified Infrastructure Equity Fund, CFS Infrastructure Income Fund, Perpetual Diversified Fund, Hastings Infrastructure Fund and Hastings Utilities Trust of Australia. These funds had more than 40 infrastructure assets in their portfolio, representing around 30% of the entire unlisted infrastructure sector in Australia. Furthermore, as they are non-listed funds, the returns are not calculated on the basis of daily traded prices, but through a valuation-based analysis by discounting all the future cash flows. Table 1 presents the risk-adjusted performance analysis for the period 1995-2009 where the return of the infrastructure of 14.07% is only exceeded by the performance of the listed infrastructure index (16.74%), an UBS listed composite index comprising 20 major Australian listed infrastructure companies. The performance was significantly better than both the equity and bond markets, showing a Sharpe ratio of 0.25 and 0.30 respectively versus 1.34 of unlisted infrastructures.

Table 1: Unlisted Infrastructure performance analysis: Q3 1995 - Q2 2009

Asset Class	Average annual return	Annual Risk	Sharpe Ratio
Unlisted Infrastructure	**14,1%**	**6,3%**	**1,34**
Listed Infrastructure	16,7%	24,6%	0,45
Stocks	9,1%	13,9%	0,25
Bonds	7,1%	4,6%	0,30

Source: Newell et al. (2011)

The findings thus seem to highlight the high return potential of this alternative asset class over the traditional ones, both in terms of returns and volatility.

However, one should note that the period was of significant growth in the Australian infrastructure sector and therefore the figures can only be indicative. In fact, from a subsequent study on a global portfolio made by JP Morgan, the performance of unlisted infrastructure funds in the period 1995-2014 had more modest results (annual return 7%, volatility 7.5%). (JP Morgan, 2015).

As this analysis has highlighted, there is a lack of comprehensive studies on the performance of infrastructure as an asset class and this is one of the first critical issues for investors when they decide to invest in this sector. This challenge will be further discussed in Chapter 2, where it will be analysed the difficulties of a private investor in evaluating an investment in renewable energy plants.

Nevertheless, although the results of the study conducted by G. Newell et al. are indicative, and only partially supported by a subsequent research of JP Morgan, what can be useful to highlight in this section is not only the (at least) similar performance with the traditional asset classes, but also the unique resilience of infrastructure performance to financial market shocks. Indeed, as one can perceive, the value of an infrastructure such as a renewable energy power plant has its own intrinsic value given by the amount of future cash flows it is capable of generating. The demand for energy is only partially correlated to economic shocks as it is an essential resource. Moreover, many of these projects include long term (20+ years) off-take agreements with a utility or power distributer as a revenue risk hedge, which makes the cash flows highly probable even in the event of demand shocks and subject only to the counterparty default risk. Therefore, given these characteristics, this asset class should in theory be more resilient than a financial markets investment.

In support of this, G. Newell et al. compared infrastructure returns with other asset classes in the GFC period and specifically in the period Q2 2007 - Q2 2009.

While the impact of the crisis is particularly evident in all the asset classes, unlisted infrastructure was clearly the best performing asset class with a Sharpe ratio of 0.32. Both the listed infrastructure sector and the stock market delivered negative returns during this highly negative period. These results empirically show what was rationally already intuitive, i.e. the resilience of the sector in case of financial shocks. In addition, the study also confirms that listed infrastructure entities acquire a correlation with the market that makes them particularly risky and decorrelated from the financial profile of an investment in unlisted infrastructures. From this perspective, the above mentioned YieldCos for renewables, as well as other structures such as listed REITs for the real estate (such as the ones listed in Singapore), tend to address issues by providing exposure of unlisted investments, but change their risk profile and create problems of their own.

Table 2: Impact of the GFC on Infrastructure performance: Q2 2007 - Q2 2009

Asset Class	Average annual return	Annual Risk	Sharpe Ratio
Unlisted Infrastructure	**8%**	**7%**	**0,32**
Listed Infrastructure	-24%	23%	-1,3
Stocks	-13%	21%	-0,9
Bonds	7%	7%	0,15

Source: Newell et al. (2011)

To conclude, while the risk profiles of an unlisted investment cannot be defined with certainty, they seem to be at least comparable to other traditional asset classes and generate resilient returns. Hence, the financial profile of an infrastructure investment seems particularly suitable for those looking for a non-volatile investment with a long holding period. For completeness, further variables should be taken into account in the investment process that can deeply affect the risk-return profile, such as the investment phase (i.e. construction period or operational period) and the geographic location (i.e. developed or emerging country). As will be discussed in Chapter 2, the risk profile of two identical investments in Australia and in the Philippines are not the same.

This paragraph has also introduced an issue that will be further discussed in the following Chapter: the need for greater unlisted renewable energy track record in Southeast Asia so that investors can make a more informed investment decision.

1.3.2. Portfolio Diversification

In addition to the risk return profile of an infrastructure investment, another point of interest for investors is the diversification that an investment brings to a portfolio. In practice, when identifying a possible investment, it is necessary to analyse its correlation with those already held in the portfolio. If to some extent the resilience to economic shocks has already been covered in the previous paragraph, here we want to understand whether investing in this alternative asset class can bring benefits to the overall portfolio even in non-exceptional periods. As noted above, it is not ideal to use listed infrastructure indices, although the frequency and data quality are enticing. The approach adopted must once again be based on the basis of quarterly valuations, tracking returns and comparing them to equities and bonds. According to the analysis undertaken by Newell et al. (2011) unlisted infrastructures show a low correlation with other asset classes, with r = 0.15 against equity, r = 0.06 against bonds and a partial correlation with the listed infrastructures index r = 0.37.

Table 3: Infrastructure Inter-asset correlation matrix Q3: 1995 - Q2: 2009

	Unlisted Infrastructure	Listed Infrastructure	Stocks	Bonds
Unlisted Infrastructure	**1,00**			
Listed Infrastructure	**0,37***	1,00		
Stocks	**0,15**	0,48*	1,00	
Bonds	**0,06**	0,09	-0,41*	1,00
**Significant correlation (P<5%)*				

Source: Newell et al. (2011)

If the latter was predictable, the high correlation found between listed infrastructures and the stock market of r = 0.48 confirms the need for an off-market approach when evaluating a direct and unlisted investment in infrastructures, hence the listed infrastructure market is not a good proxy for the unlisted one. JP Morgan (2015) largely confirmed the results of this study by finding a zero correlation with listed equity (r = 0.0 vs r = 0.15 of Peng and Newell) and a very low correlation with the bond market (r = -0.2 vs r = 0.06 of Peng and Newell).

In addition to an inter-asset approach, the cross-asset correlation is certainly higher although again marginal. (RARE, 2013). From this point of view, if the electricity sector is as predictable highly

correlated with the gas and utilities sector, the same cannot be said of their correlation with other infrastructures such as toll roads, railway, airports and seaports (Table 4).
In conclusion, the results highlight the high diversification potential of unlisted infrastructures, especially with respect to traditional asset classes such as stocks and bonds.

Table 4: Cross-sector correlation matrix (2000-2012)

Asset Class	Electric	Gas	Utilities	Railway	Seaport	Toll Road	Airport
Electric	**1,00**						
Gas	**0,77**	1,00					
Diversified Utilities	**0,79**	0,75	1,00				
Railway	**0,59**	0,62	0,49	1,00			
Seaport	**0,62**	0,64	0,45	0,61	1,00		
Toll Road	**0,64**	0,61	0,46	0,58	0,69	1,00	
Airport	**0,63**	0,52	0,41	0,55	0,65	0,69	1,00

Source: RARE (2013)

1.3.3. Investment Horizon

While investments in renewable power plants have a stable performance profile over time due - as illustrated - to good risk-adjusted returns and high diversification potential, if part of a portfolio composed of traditional asset classes, prudent considerations must be made from the point of view of the investment's liquidity. Like most infrastructure assets, a renewable energy plant is at its riskiest during the construction period that generally lasts 6-18 months, and a subsequent period of operations in which the asset produces stable cash flows over long time periods of years/decades. However, considering only unlisted assets, there is no liquid market in which it is possible to trade them on a daily basis and seek daily prices. Today, many purchases and sales of renewable energy plant takes place through M&A transactions involving long and detailed negotiations on prices and conditions involving many types of advisors. Therefore, the investment horizon of a renewable energy investment is not only longer than the traditional bond and strategic equity investments, but also of investments in Private Equity funds and Real Estate assets. (Climate Policy Initiative, 2013)
This peculiarity requires careful consideration and analysis for two main reasons.
The first concerns the estimate of a liquidity risk premium, i.e. the correct remuneration of the additional risk of a cash shortfall, that is not the easiest risk to price.
The second is the need of prudent asset liability management, i.e. the need to have a financial structure whose duration between assets and liabilities matches. One of the various consequences

of a mismanagement of the ALM is the difficulty in repaying the company's obligations causing an imminent need for liquidity. As a result, the investor could face one of the major risks: the need to liquidate its assets quickly and below market prices, incurring losses.

1.3.4. Differences with traditional Power Plants

In addition, renewable energy's equity investment profile is different from traditional ones, to the extent that these assets can paradoxically have a bond-like cashflow structure. The main financial differences with traditional power plants, and the reasons why the cash flow structure could be similar to bond, are the following.

- *Low operating costs.* The final cost of renewable energy is only a small part due to the fixed and variable operating costs of the plant, and amount to a maximum of 30% of the final costs of wind energy and 15% of the final costs of solar energy. (Climate Policy Initiative, 2016; Climate Policy Initiative, 2016; Climate Policy Initiative, 2016)
- *Low operating risks*. Renewable plants are not operated with expensive fossil fuels as in the case of gas, coal or oil plants, but from free, clean and endless sources. This makes operating costs less exposed to the price risk, i.e. the price volatility of raw materials needed to operate the asset. In addition, other operational risks can be managed through operations and maintenance contracts with reliable counterparties. Nevertheless, wind energy presents higher operating risks than solar energy, although in any case they are lower than traditional plants. In fact, while insolation is easy to predict and not very variable on an annual or long-term basis, this cannot be the case for wind energy, where wind forecasts are still imperfect and subject to significant variables. Even the maintenance costs, although minimal, could be higher due to possible malfunctions of the gearbox turbine or wind blades.
- *High up-front capital costs and front-loaded risk profile.* The majority of costs and risks in a renewable power plant are concentrated in the initial phase of the investment: construction and early operations. The different riskiness of the construction phase and operational phase makes the early stages more attractive for capital with greater risk capacity. On the other hand, once the plant is set up, it starts being more attractive for investors with long term holding period and risk aversion preferences that are looking for constant and low risky cash flow generation.
- *Long-term, fixed-price, take-or-pay offtake agreements.* The low degree of price risk and operational risk allows the asset owner to offer long-term, fixed-price offtake contracts more easily than traditional plants, thus creating constant and secure cash inflows over time.

- *Predictable long-term cash flows with bond-like risks and returns.* If the project involves the execution of offtake agreements[2] and operation contracts, a pipeline of payments is generated whose residual risk is exclusively represented by the default risk of the two counterparties, respectively the offtaker and the operator. In this case, the revenue risk exclusively lies in the chance of default of one of these two counterparties, a risk that can be assimilated to the credit risk of an obligation.

To these aspects, which make an investment in renewable power plants ideally similar to the bond's financial profile and in some ways differentiate them from traditional power plants, is worth mentioning the profound difference with the latter not only from the financial structure viewpoint, but also from a more qualitative one. The growing awareness of the private sector to sustainable investments, makes them profoundly different from a traditional gas or coal-fired plant even in case of identical financial profile. In fact, nowadays more and more private investors are allocating a mandatory percentage of capital to sustainable investments, as well as on the lending side banks may have lower costs of funding for green projects. In this sense, not only part of the capital is allocated to sustainable projects partly regardless of their financial profile, but these can give the project sponsor indirect and barely measurable benefits due to the holding of green assets. Just think, for example, to the lower reputational or environmental impact risks that the company may face, as well as the lower technological risk and lawsuit risk from employees, customers and shareholders.

1.4. Investor's Profiles

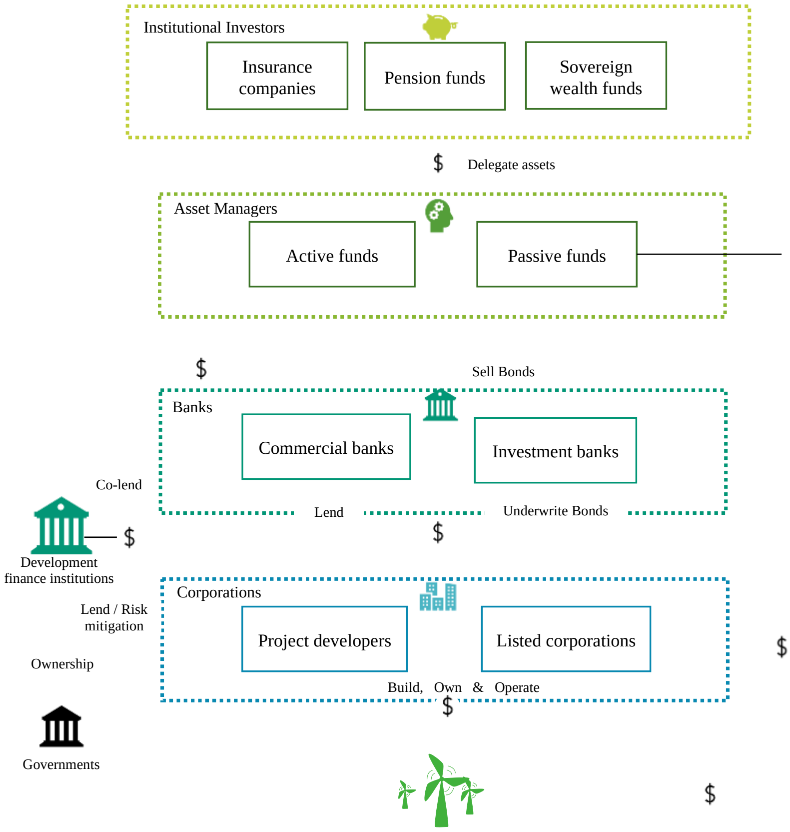
The paragraph highlights for the first time the critical role that the financial sector plays in driving the energy transition and explores its main players with the aim of identifying the ideal players that can drive the energy transition. The private sector plays an essential role in supporting the real economy through financing, investment and management of investment portfolios and loan books. Indeed, while from an economic point of view the energy transition can represent a source of opportunities for innovative products and markets, as well as triggering corporate modernization, it also needs to catalyse necessary capital to meet the increased renewable energy demand as

[2] An offtake agreement is essentially a binding contract between the company that produces energy and the company that needs to buy that resource. It formalizes the buyer's purchase of a certain amount of the producer's future output, thus creating a certain cash inflow.

discussed in section 1.1. Accordingly, the financial sector will need to become a vital partner for private industry and local governments.

This section describes the different roles and risk profiles of financial institutions and aims to identify the investors that need to be targeted by financial innovation as the basis of an energy transition process. In fact, as a prelude to the full discussion of challenges and solutions that follows, the paragraph aims to identify how private investors participate in an energy deal and, more specifically, what role they play in structuring a renewable plant direct investment. The whole investment chain presented in the following paragraphs is wrapped up in Figure 6.

Figure 6: Investment chain for a renewable power plant



Source: Autor's representation

1.4.1. Corporations and project developers

Corporations and project developers are those who directly invest in the real economy. Project Developers, whose business generally focuses on the development and construction phase, accept development risks and usually look for additional financing to build the power plant. Once the construction phase is finished, which generally lasts around 6-12 months, the developer may or may not remain the asset owner. Often, however, these entities are highly specialized in these very specific early phases and in mitigating development risks therefore, once the early phases are completed, they usually prefer to sell the ownership to other investors and free up capital for a new development.

On the other hand, Corporations (for example utilities, power producers) continue to own the asset throughout its life, since they are naturally a holding owner and operator of power plants. While they maintain the asset's ownership, they can choose to minimize the operational risks of the plant through O&M contracts, i.e. an agreement with a third-party company that takes over the daily operations of the asset as well as its risks.

On the financing side, project developers usually obtain capital through banks or project bonds. Since individual SPVs are often created for the construction of the asset, the financing is done through Project Finance. In this case, the creditworthiness depends not only on the credit standing of the sponsor, but in large part on the asset's ability to generate viable cash flows (i.e. the credit of the offtaker). In this type of transaction, the project is "ring fenced" and the financing is on a non-recourse base, meaning that lenders rely on the future cashflows generated by the asset to pay back interest and principal.

Corporations may finance the development in additional ways - cash in hand, generally from retained earnings, or financing from the financial sector. Smaller corporations can generally only access financing from banks, while larger corporations can raise capital through the issuance of bonds and shares. The cost of financing depends on various circumstances, including the company's credibility and its relationship with financial institutions.

1.4.2. Commercial and Investment banks

Banks can be part of a renewable energy deal as a source of capital as well as a financial intermediary. Banks lend directly to the SPVs that hold the asset or to the corporate developer, and their exposure on the sector is their loan books. Alternatively, investment banks can act as intermediaries between private investors and corporations or project developers, underwriting bonds or equity offerings. They generally play a crucial role, especially in the development phase of renewable power plants when large amounts of capital are required. In addition, having expertise in project financing, they play a key role in complementing equity tranches, also thanks to their disciplining role through the constant monitoring of the investment. Banks can provide funding during the construction phase but may not be natural holders of very long dated loans, because it can increase maturity mismatches on their balance sheet.

Banks are unlikely to drive an energy transition, since they are traditional institutions that historically do not innovate industrial trends but follow actual socio-economic developments. On a more positive note however, banks have been arranging an increasing number of green bonds and granting green loans, i.e. direct financing of green projects. From this perspective, these institutions are clearly interested in financing sustainable projects because they are increasingly assessed for their support of sustainability and the amount of funding given/provided to green deals. However, the terms and conditions requested on a green deal are generally similar to those of a 'grey' deal and therefore the different classification remains only as a sign of interest of the issue which doesn't lead to a real commitment. Moreover, as a consequence of the GFC, banks are now required to increase the proportion of equity in relation to their total risk-weighted assets, effectively reducing the amount of structured finance transactions. (Climate finance leadership initiative, 2019). Moreover, the most recent rules, such as Basel III, which determines new, higher liquidity requirements for banks, prevents them from being excessively exposed to illiquid assets, such as infrastructure. While these regulations are only partially applicable to local banks in Southeast Asia, they rarely promote or underwrite large structured finance transactions, since they have limited balance sheets and insufficient know-how.

In summary, while we can acknowledge that banks can have a significant role in the structuring of a renewable energy deal, it is difficult at this stage to identify them as the main driver of the energy transition.

1.4.3. Asset Managers

They are intermediaries who manage the capital of an organization or private individuals. Asset managers can run small companies specialized in a specific sector such as clean energy or can manage trillions of dollars across multiple asset classes and locations. Although they generally invest in traditional asset classes, there is an increasing number of firms that directly invest in assets in the real economy, whether in the infrastructure or real estate sectors. They have a legal obligation to manage their assets in the interest of the quota-holders, in accordance with the "fiduciary duty". These firms can invest in renewable energy through active or passive funds, such as index tracking, as well as through listed or unlisted funds. Specialized asset managers may have the necessary know-how to deal with the development stage of a renewable energy plant, although they often deal with core or value-added operations on brownfield infrastructures, i.e. already built and in the operation phase.

1.4.4. Institutional Investors

The term institutional investors not only include pension funds and insurers, but also sovereign wealth funds, family offices and endowments. These investors, who can also be identified as the asset owners, invest in two ways: either by giving their funds to an asset manager or managing their available funds themselves. In the first case, their capital is allocated to a variety of investments (active or index tracking, etc.) and is under the asset managers' control for a variable period of time. In addition, they can decide whether to subscribe quotas of listed or unlisted funds, which in the second case have a predefined duration of usually 5-10 years. Once the capital is allocated, the investment target depends on the characteristics of the fund and on the expertise of the asset manager, who may be more or less specialized in alternative asset classes such as renewable energy. Alternatively, if the institutional investor has the internal expertise, it is possible for him to directly invest his capital without any asset managers, in which case achieving investment transparency and eliminating asset managers' remuneration. Generally, Institutional Investor's horizon is longer than the average life of an unlisted fund, and up to 40-50 years in the case of pension funds and life insurance, reflecting the need for long-term income for their beneficiaries.

Institutional assets are generally managed in a very conservative way without taking excessive risks, especially if the investment is in developing countries. As a consequence of the low interest rates environment of our decade, more and more institutional investors are looking for low risk investments outside of traditional asset classes, allocating part of their resources to infrastructures or real estate projects, looking for higher returns and greater asset diversification. In this respect, renewable energy assets can provide the opportunity to diversify their portfolios and benefit from good, stable and long term "bond-like" returns, which allows them to match their long-term liabilities.

Therefore, as they are generally interested in long-term, low-risk investments, they have a strong preference for renewable power plants that are already operational and have passed the development and construction phase and its associated risks. Accordingly, 75% of all renewable energy deals carried out by institutional investors in the period 2009-2019 involved brownfield assets and generally Core operations, i.e. with low value added and less risky. (IRENA, 2020).

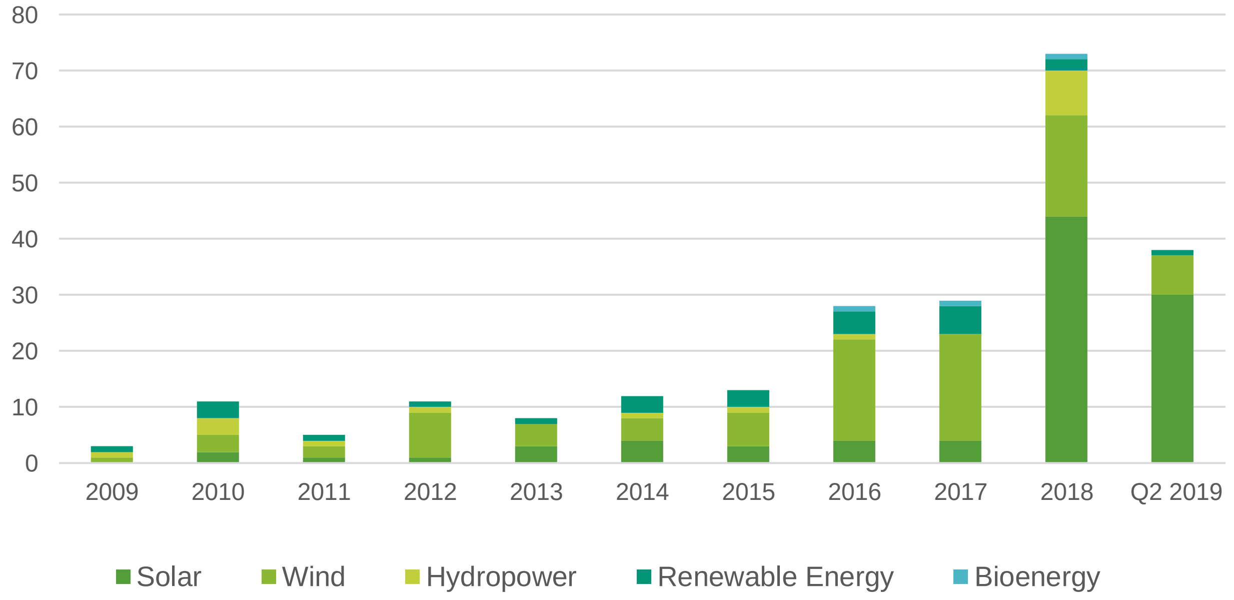
In terms of capital amount, these investors have enormous potential for this type of investment. As of 2019, insurance companies were managing $33tn, pension plans $44tn, SWFs $8tn, Endowments $2tn for a total asset of $85tn, and on top of that, strongly growing, at an annual rate of around 4-7% over the past decade (Preqin, 2019). In particular, double digit growth rates have been recorded in Asia due to the economic and demographic growth, pension plan expansion and insurance coverage (IRENA, 2020).

However, this vast potential remains largely untapped so far. In fact, according to a survey conducted by Preqin (2019) on a sample of 5,800 institutional investors on their investments in the last two decades, 37% of them have invested in infrastructure and only 20% in renewable energy-focused funds, and only 1% have made investments directly in renewable energy projects. Asset owners who allocate capital to renewable energy projects are generally larger than average. In fact, the average AUM of such investors amounts to $30bn, more than double the average of the total sample of $12bn. In addition, those who directly invested in renewable power plants, i.e. without passing through asset managers, have an average AUM of $34bn, vs $24bn of those who indirectly invested in renewable energy (Preqin, 2019).

This analysis shows that only large players invest in alternative asset classes, and only a percentage of them composed of even larger investors have the opportunity - or ability - to directly invest in renewable energy projects without having to hire fund managers, gaining in terms of investment suitability and transparency.

However, the number of direct investments in renewable energy has increased significantly in recent years, from only 3 direct investments in 2009 to 78 in 2018 and 38 in the first two quarters of 2019 (Figure 7).

Figure 7: Number of renewable energy projects that involved institutional investors, by technology, 2008 - Q2: 2019

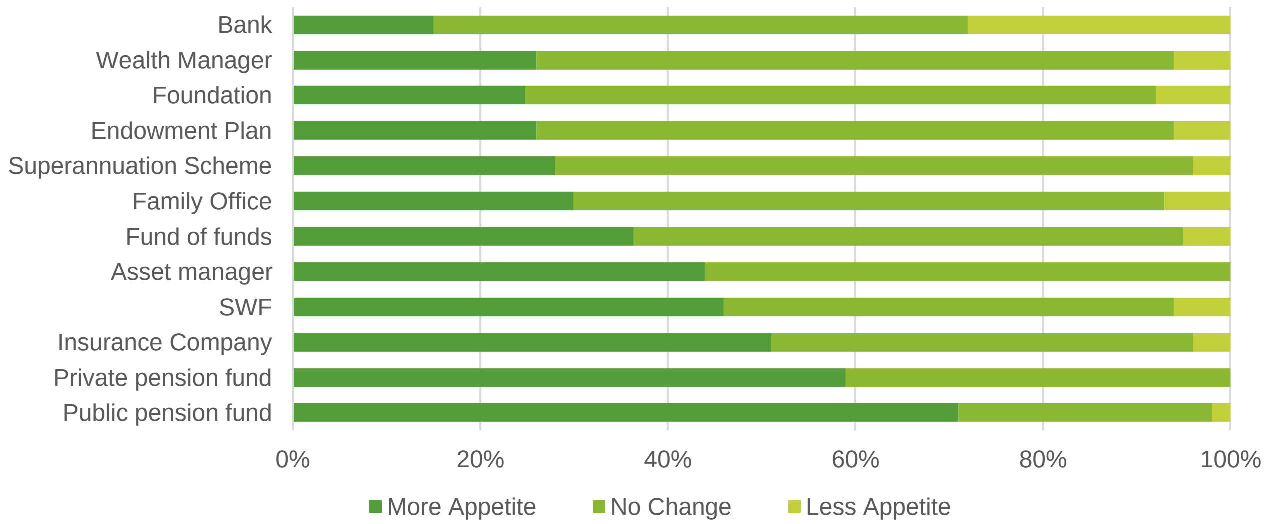


Source: IRENA (2020)

In total, institutional investors were involved 231 times in renewable direct financing transactions, representing only 1.8% of all renewable energy projects, for a total amount of $6bn in each of 2017 and 2018 (Climate Policy Initiative, 2019). While these numbers represent significant growth over the $2bn invested in each of the years 2015 and 2016, this represents only 2% of total renewable energy investment in 2018 (Frankfurt School-UNEP Centre/BNEF, 2019).

Therefore, a growing trend of interest is clear, as also evidenced by various surveys carried out by Preqin over the years.

Figure 8: Fund manager views on Infrastructure investment appetite, 2017



Source: Preqin Fund Manager Survey, November 2017

In light of the growing interest and given that they are of the largest capital pools in the world, institutional investors can play a major role in the renewable sector and become a significant contributor to the global capital shift towards low-carbon solutions. To achieve this goal, however, it is necessary to understand the barriers that institutional investors face for this type of investment and implement tools that can overcome them.

1.4.5. Development finance institutions

In a more general sense, this term can include not only multilateral development banks (MDBs), but also national development banks, bilateral development banks and revolving loan funds. Among the most important, and subject of analysis in the following Chapters, the World Bank and its subsidiaries IFC, IDA and MIGA and regional development banks such as the European Investment Bank. Particularly in Asia, they have an increasingly important role in sponsoring infrastructure projects, not only thanks to the role of the Asian Development Bank, but also to the more recent Asian Infrastructure Investment Bank (AIIB) and New Development Bank (NDB), that in 2016 funded $800bn and $1bn of Asian infrastructure projects respectively, their first year of operation (Marsh & McLennan, 2017).

In addition to these, there are other national institutions with countries such as the Netherlands and Germany particularly active through their respective Netherlands Development Finance Company, the Dutch Investment Fund for developing countries or the German KfW.

All of these institutions are largely owned by governments and capitalized with public funds that improve their creditworthiness - often AAA or AA – which is critical to their Guarantee and capital market fundraising activities. Although institutional investors can be identified as possible drivers of energy change, it is impossible to conclude this Chapter without introducing these institutions that play a key role especially in developing markets. Indeed, these entities have a general mandate to contribute to sustainable development and fight poverty especially in emerging markets. In the wake of the adoption of the 2030 Agenda, these institutions are called upon to accelerate the efforts needed to achieve the Sustainable Development Goals, including by catalysing private investment and prioritizing green finance.

In practice, they can provide resources through grants, loans, Guarantees and equity investments, some of which will be discussed in more detail in Chapter 3. Crucial in developing countries, private investors are more comfortable when operating with the support of one of these agencies for their general involvement in the economy of the Host Country. This gives the Project Company an umbrella to mitigate political risk to which the investment is exposed. However, their resources are not endless, and they are called upon to apply market-driven commercial principles, along with impact measurement and monitoring. In fact, since they are publicly funded, although they often operate in emerging markets with the task of being the pathfinder for private investment, they must remain self-sufficient.

CHAPTER 2: CURRENT CHALLENGES AND BARRIERS TO GREEN ENERGY INVESTING

"The infrastructure story is tantalizing – trillions of dollars needed in infrastructure upgrades and a global wall of money seeking yield. Yet the Investable universe is small and funds take a long time to invest…" (BlackRock 2014).

The aim of this Chapter is to analyse the total amount of resources that must be mobilized in order to meet a sustainable energy production, and to assess the reasons of the existing financing gap. The barriers that hamper investments in renewable energy by institutional investors, identified as possible drivers of energy transition, will be defined and analysed. Once the resources to be mobilized and the obstacles to overcome have been identified, possible solutions will be addressed in Chapter 3; subsequently, their practical applications will be analysed in Chapter 4 through Case Studies in order to highlight areas for improvement.

2.1. Determining the financing gap in ASEAN Countries

If we look at infrastructure spending in Southeast Asia, we see that there is a chronic shortage of capital not just in the renewable energy sector, but more generally in the entire infrastructure space. If we take into account the strong growth factors of the region mentioned in Chapter 1, the region requires more infrastructure investments than any other asset class. Since infrastructure investments reflect the degree of socioeconomic progress of a region, the primary needs of Southeast Asia are not comparable to those of developed countries that have growing focus on social infrastructures such as education, healthcare or social housing, but respond to primary needs like efficient transportation and, above all, energy access for everyone. If at the beginning of Chapter 1 we outlined the growing demand for renewable energy, the question now is whether the current investment volumes are able to meet the growing demand, starting from a macro analysis of the infrastructure sector, where there is greater data availability, and then moving on to the renewable energy sector.

According to that, the Asia Pacific region has seen total investment in infrastructures almost double over the last decade, from $1.7tn in 2006 to more than $3tn in 2015. To understand the order of magnitude, it is sufficient to mention that in 2015 this area was home to more than 52% of global infrastructure spending, equal to about 6.6% of its GDP. Clearly, the figures include some countries that are not the object of this thesis: China, focused on the Belt & Road Initiative, represents about half of the entire volume, and Japan and India are respectively 14.4% and 11.5% of this total. Therefore, while we cannot say that Southeast Asia is the core of the infrastructure sector, several economies in the region such as Indonesia, Thailand, Philippines and Vietnam have all announced ambitious plans to increase investment in the sector and are expected to emerge as an additional driver of growth in infrastructure demand (Marsh & McLennan, 2017). On a cross-sectorial basis, if the largest investments have historically been directed towards the road infrastructure sector, according to both the Asian Development Bank and Marsh & Mc Lennan, the electricity and power sector will see the greatest levels of investment and overtake the road transportation in the future.

According to the Asian Development Bank (2017), excluding the developed regions of Asia Pacific such as, among others, Japan and Australia, which contributed to the total volume of infra investment in Asia Pacific reported above, developing Asia requires during the period 2016-2030 $26trillion of infra investments in order to maintain a growth trajectory that sufficiently eradicates poverty. This is $1.7 trillion per year to be allocated to the infrastructure sector. The estimated amount, of which a 12% share is attributable to Southeast Asia, is more than double the amount forecast by the ADB itself in 2009 and is mainly motivated by the inclusion of climate-related investments. When comparing this estimate - in any case conservative - with current volumes in the region, one can see an important financing gap. The infrastructure financing gap is defined as the difference between the recommended or estimated infrastructure investment needs for a country and its actual infrastructure investment over recent years (Asian Development Bank, 2018). If one only considers the 25 Developing Member Countries, of which most of the Southeast Asian countries are part, the estimate of $1.34 trillion of infrastructure needs in the period 2016-2020 has been partly met with investments of just $881bn, resulting in an annual gap of about $460bn. Excluding China, which is not part of this study and has the smallest financing gap (1.2% of GDP), the infrastructure financing gap amounts to $308bn, or as much as 5% of the region's GDP. Around 85% of this gap is generated by only 6 of the 24 DMCs countries and, with the exception of India, all of them are countries of Southeast Asia region: Indonesia, Malaysia, the Philippines, Thailand and Vietnam. From this data, it can be clearly seen that the region has a very high and growing infrastructure demand and a shortage of capital allocated to the sector. Who should fill this gap?

Based on an analysis of the Asia-Pacific Risk Center (APRC), of the total amount invested in infrastructure worldwide, public sector spending accounts for to 40% of the total, with 5% and 55% deriving from multilateral development banks and the private sector respectively (Marsh & McLennan, 2017). However, these numbers are markedly different when comparing developed and developing countries, such as Southeast Asia. In this region, 92% of projects are done through public financing, i.e. governments and MDBs, leaving a highly marginal role to private investment (Asian Development Bank, 2017).

Nonetheless, despite the importance of the public sector in emerging markets, the scope for additional public sector investment is likely to be limited. Several factors are responsible for this, including the potential to increase tax revenues through tax reform, redirecting expenditures such as decreasing subsidies to fossil fuels and directing them to sustainable investments, or through additional debt through the public market. However, as the ADB (2017) notes, some countries still have additional fiscal space to increase infrastructure investment, even though this is not likely to be sufficient, except for in the case of China whose financial gap is more limited.

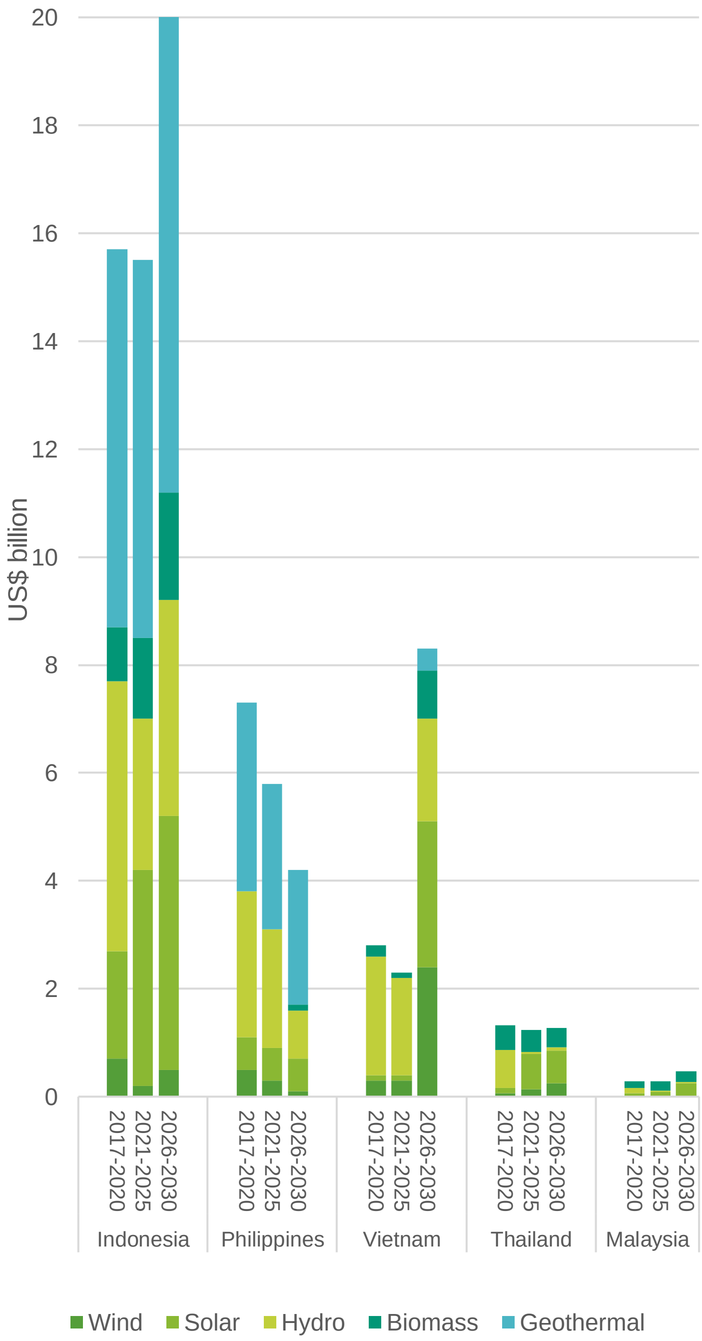
It seems clear that Southeast Asia needs to attract the private sector in order to close the financing gap and reach the sustainable energy targets announced by governments, even though these targets are in themselves insufficient.

It is unlikely that the solution will come from the local banking sector: considering the 5 biggest economies of Southeast Asia plus India, the combined net assets of all their banks is just $300bn, not even a fifth of the total infrastructure investment required by the area. This, added to what has been discussed in paragraph 1.4.2., makes clear that the region cannot rely on the exclusive use of public capital and traditional loans from banks to meet its needs. Other sources of capital are needed, and these can only come from a greater inclusion of the private sector, including, in particular the institutional investors.

After all, considering the total assets of these investors of $85tn (Preqin, 2019), a shift of just 1% of their AuM from other asset classes into infrastructure spread over 5 years, would mean an annual flow of $170bn, a critical addition to infrastructure financing.

While the infrastructure sector shows a chronic underinvestment in Southeast Asia, the renewable energy sector may suffer the problem even more given its demand growth and the ambitious target of neutralizing CO2 emissions. To estimate the amount of resources to be mobilized in this sector, it is necessary start from the renewable energy targets declared by the ASEAN countries, adding to them the average energy cost for each technology, and spread the investments until 2030, when most of the government targets must be reached. A similar

Figure 9: average annual investment need in renewable energy 2017-2030



Source: Treco et al. (2018)

study was made by Treco et al. (2018) for Indonesia, Philippines, Vietnam and Malaysia. The necessary investments were calculated by multiplying the net installed capacity by the technology cost. The installed capacity was estimated taking into account the target publicly claimed by the governments of the above-mentioned countries and spreading these investments over the expected time horizon. This amount, however, is not sufficient, since, as mentioned in the first Chapter, the targets will necessarily have to be revised upwards in order to reduce CO2 emissions. However, according to the calculations made, divided into three macro-periods, the five largest economies in Southeast Asia will require a total flow of $408bn of investments in renewable energy, divided over a period of 13 years. This figure takes into account the published plans of these emerging countries published between 2015 and 2016, and will therefore have to be seen upwards in the coming years, particularly with regard to solar energy, the cost of which has fallen dramatically over the last 4 years and whose technology has gradually stabilised.

In conclusion, the first paragraph examined the growth of energy consumption in Southeast Asia. The demand has now been quantified in about $400bn of investments to be made by 2030, which in any case will be insufficient because the governments' targets, although quite optimistic at the time, are not in line with the Paris Agreement. This demand for renewable energy has been weighed against the infrastructure offer, measured as the level of investment that the sector receives annually. The result is what has been defined by the Asian Development Bank itself as the chronic "financing gap" of the South Asia region. In order to bridge this financing gap, which is not only essential to reduce global emissions, but also to alleviate poverty and support economic growth, it is essential to catalyse institutional investors' capitals. What will be done in the second part of this Chapter, therefore, is to analyse the challenges of investing in renewable energy and what are, finally, the institutional investors' specific ones, identified as the driving force for the energy transition.

2.2. Renewable Energy barriers

Before dealing with the issues that can explain the financing gap, one should briefly deal with the reasons for its existence - could it be purely cultural and dealt at a macro-regional level? One of the chronic problems in Asia is what has been recognized as the Cross-Border Investment Paradox. In recent years, Asian economies have accumulated huge foreign savings and reserves, thanks to their inclination towards savings and their demographic and economic growth. For example, China's foreign savings and reserves are greater than those held by the major European economies and the US itself. However, as noted by the ADB (2018), Asia's efforts to draw on its foreign exchange savings and reserves to fund regional investment have been weak. More specifically, the paradox was pointed out by Lawrence Summers in a lecture at the Reserve Bank of India in 2006. What he stated was that the most surprising development in the international financial system becoming was the large flow of capital from the world's most successful emerging markets to the traditional industrial countries, and the associated enormous build-up of reserves in the developing world (Lawrence Summers, 2006). In essence, there have been three key constituents to this paradox:

- A significant capital flow from developing countries to developed countries and the consequent accumulation of reserves in developing regions
- The reserves of emerging countries that far exceed what is required for prudential and regulatory reasons
- Very low real returns on these reserves

Although this issue was raised more than a decade ago, it is still in place as noted by the Asian Development Bank (2018). In fact, as of end 2016, Asia invested $6.2tn in the rest of the world, while the rest of the world invested $4.4tn in Asia, creating a gap of about $2tn, in line with what was outlined by Summers nearly 15 years ago. If only a quarter of this amount were invested in infrastructure locally, the financing gap would be bridged, and Asia could support its economic growth process. The more industrialized economies in Asia, and in particular by Japan and Korea play a significant role in this - for example, in the context of Japan, $3.75tn out of a total of $3.88tn were invested outside Asia as of 2016, corresponding to 97% of all its reserves. However, this is a common feature throughout Asia and it is likely to be driven by a variety of factors, some cultural, such as the propensity to save, others economic, such as the wish to diversify risk and memories of the 1997 Asian crisis. The net effect though is that capital is exported to developed countries despite the obvious need for regional investment.

Besides this cultural propensity, it is possible to highlight some barriers that are related to the general infrastructural world and some others that are specific of the renewable energy sector. The next paragraphs aim to address these constraints in order to offer possible solutions in Chapter 3.

Academic and industry research has been published trying to address the financing gap in the renewable energy sector. IRENA (2016), for example, identified as critical issues the front-loaded cost structure of most clean energy projects, as well as the weak local financial system and the lack of specific expertise of institutional investors. The Green Climate Fund (2017) focused on the barriers on the supply and on the demand side, while the Climate Policy Initiative (2013) through interviews with investors noted the importance of companies' size and of liquidity risk management. In the following paragraphs, an attempt was made to provide a complete and integrated version of these and further works, whose results are summarized in Figure 10.

Figure 10: Barriers to Institutional Investment in Green Infrastructure

Renewable Energy Specific Barriers	Institutional Investor Constraints
Policy Certainty	Liquidity Constraint
Access to Capital	Investor's Scale
Project Pipeline	Diversification
	Investor's Internal Capabilities

At the outset, the paragraph will assess the main barriers typical of the renewable energy sector, followed by the specific constraints that institutional investors face and that have to be overcome in order catalyse their resources on renewable energy projects.

2.2.1. Policy Barriers

Governments and their regulations are probably the main issue when dealing with infrastructure investment. This is even more important for innovative and sustainable sectors such as renewable energy, which has to compete with well-positioned players in the fossil fuel industry with influential lobbies. As a consequence, all private investors in the sector underline policy risk as the main obstacle that constrains their investments (Climate Policy Initiative, 2013). Policy barriers arise from the lack of a clear strategic and regulatory framework, or inconsistent policies such as shift of direction and interruption of regulatory incentives.

Long-term planning by governments is also crucial for the success of renewable energy investments, as they tend to have long term profit horizons that make them incompatible with constant policy shift and change of direction (Green Climate Fund, 2017). For example, investment in renewable energy in 2016 fell 30% in developing countries due to many factors, including a strong dollar and falls in technology costs, but largely because there was a lack of policy support in countries where projects were delayed (Frankfurt School-UNEP Centre/BNEF, 2017). In practice, certainty, transparency and longevity are key parameters to address policy barriers and associated risks.

Moreover, in Asia, different countries have different legal and regulatory environments that hinder project standardization as each requires different contractual terms and structures to fit the local context (Asian Development Bank, 2018). As a result, investors must evaluate each project separately based on their specific legislation, leading to an increase in total project costs from 1% to 5% (McKinsey Global Institute, 2016).

While the issue is well known, governments often find it difficult to adopt solutions due to the complexity of the energy sector. Moreover, it intertwines with the protection of pension and insurance fund depositors, resulting in a series of complex regulations which, although taken individually are essential, end up complicating the sector even having an opposite effect. There can be three main regulatory problems that have a direct impact on institutional investor allocations:

1. *Energy policies that discourage investments.* These are rules that stimulate the energy transaction but actually have the opposite result. One example is tax policy: The majority of governments stimulate investment in wind or solar energy through tax credit, but at the same time this discourages allocations by tax-exempt institutions, notably pension funds. Another example is economic and fiscal support that aims to support the sector's expansion but is too short-lived or ends up during the asset's life cycle, increasing market volatility and re-investment risk when the investors get back the investment. Consistently with that, a CPI analysis (2011) suggests that reducing the length of policy support by 10 years could raise the cost of the projects by 11-15%.
2. *Unrelated policies that discourages institutional investment.* Pension and insurance funds are generally highly regulated, as they represent the net savings of depositors. At the same time, the energy sector is also highly strategic. While overall these regulations are crucial, they may create a barrier to investing in renewable energy. For example, Solvency II, similarly to Basel III for banks, aims to ensure that insurers have enough reserves to cover the risks of their investment portfolios in order to ensure financial security. The regulation sets reserves for each type of asset class, making investments in renewable energy much more expensive as they require companies to hold more reserves against these projects. Solvency in particular promotes traditional and more liquid asset classes, reducing at the same time the appetite for long term non-listed investments, even when there is a very clear risk-return profile and a well-developed market (Bloomberg 2013). At the same time, although pension funds are not specifically affected by this regulation, the uncertainty about a future extension of similar regulations makes them cautious about illiquid and long-term investments (Climate Policy Initiative, 2013).

Accounting rules can be another obstacle, as the mark-to-market rule deeply affects illiquid assets. If on one hand the regulation aims to increase the transparency of investments, on the other hand it pushes investors to increase allocations to tradable securities rather than investments in energy infrastructure, where there may be great differences in the short-term market value and the expected value of the asset over its full life (Crowell Moring 2008).

3. *Ambiguous Policies.* Even the best policies can have a very small or even negative impact if investors perceive them as temporary or unreliable. The risk that allocated funds may disappear or that some policies may be revised can freeze the market. Accordingly, a CPI survey (2013), highlights uncertainty as the main risk factor for investors, aiming for policy certainty to increase the allocations towards renewable investments.

2.2.2. Access to Capital

In many Southeast Asian countries, the capital market is still undeveloped, credit and equity markets are shallow and there is little liquidity. The difficulty is even greater when projects involve renewable energy. Several banking institutions are hesitant to develop renewable energy specific business lines, due to high learning costs and new procedures to be adopted when some of the technologies have no track record of revenue generation (Green Climate Fund, 2017). In addition, not only specific technical skills are required, but also knowledge of local markets and industry players, as often the project developers themselves are new or unknown, and with an incomplete or yet-to-be-built track record. This leads banks to assess credit risk conservatively, resulting in an increase in the cost of financing. The issue of access to credit has both a purely banking motivation, linked to the cost of financing which may be too high for the reasons just mentioned, and an external factor given the underdeveloped financial markets, that can have important consequences in the implementation of renewable energy projects, including the difficulty of borrowing money in local currency. In fact, in this type of projects, the revenues generated by the energy power plant are in local currency and this can create an important mismatch with the liabilities of the developer if he has borrowed in foreign currency. What happens in this case is an exposure in terms of currency risk, which is particularly high for projects in developing countries where the currency is not yet stabilized. The risk is generally mitigated by the purchase of hedging products which, although expensive, can be an effective tool in limiting this risk. However, one consequence of an undeveloped financial market is the absence of the swap market or appropriate financial mechanisms and rules allowing the use of local currency risk hedging instruments (Green Climate Fund, 2017). Alternatively, these financial instruments may be available but too expensive, making the project financially unviable.

In the absence of a swap market, an alternative strategy could be to receive funds from local banks, without having the problem to convert the currency. However, access to credit through local banks is also problematic if not impossible (Asian Development Bank and World Bank, 2015).
Many local institutions do not have the necessary experience or information to finance renewable projects. In fact, structuring term sheets and screening criteria to assess the bankability of - for example - Power Purchase Agreements and credit risks requires an understanding of the financial as well as technical criteria of a renewable energy project. In addition, many of them perceive high risk when there is no clear track record and performance history, or when they are not familiar with the market players and the industry structure, increasing the cost of funding (Climate Investment Funds, 2012).
Finally, the deal size is usually too big for local banks, which have limited lines of credit especially on a long-term basis. As a consequence, they would have too high exposure on the sector which could lead to the default of the bank itself if the company fails to repay. The problem could be solved with the syndication market, which often does not exist or is illiquid.

2.2.3. Project Pipeline

Often a problem for investors seems to be the difficulty in finding investment-ready projects (IRENA, 2016). In many cases, this is due to a lack of transparency regarding new opportunities in an alternative market such as renewable power plants. Alternatively, this could also be explained by a lack of capabilities of project developers trying to move from a project idea to a well-documented one. In fact, as IRENA points out, there seems to be a lack of investment-ready or bankable projects with an attractive value proposition able to mobilize private investors, especially those looking for long and stable cash flows for which an adequate risk mitigation strategy is essential. About 70% of the investment pipeline available to equity investors is greenfield projects, but institutional investors consider them much riskier than brownfield projects with demonstrated returns (McKinsey Global Institute, 2016). To catalyse this type of investors, a pipeline of investment-ready projects designed to produce consistent, low-risk returns over time is required. Because this pipeline is vague or absent, investors are reluctant to build a specific internal team capable of assessing its attractiveness.

2.3. Institutional Investor constraints

2.3.1. Liquidity Constraints

Institutional investors must have access to a minimum level of liquidity. In addition, they have to show possible cash in hand in a day, month or year. Generally, as liquidity is one of the greatest risks they face, they prefer to hold a certain amount of cash coupled with other highly liquid asset classes, such as stocks and bonds. These assets are easily manageable for them, because even though they manage a large portfolio, they can invest small amounts in many companies or sectors, allowing them to sell their exposure whilst minimising the risk of large losses. In this way, they increase the liquidity of the portfolio and reduce risks. Beyond these traditional asset classes, the less liquid includes private equity, followed by real estate and, at the end, the infrastructure to which the renewable sector belongs (Beeferman, 2008).

As a matter of fact, direct investments in renewable power plants have high transaction costs, the lock-in period is the longest and there is no constant deal flow that allows to sell the asset at any time.

This is a very real issue since, as the Word Economic Forum (2011) estimates, pension fund can only usually hold roughly 9% of illiquid investments, while insurers just 4% and SWFs a range between 10-20%.

These caps exist for several reasons. For example, clients may have the option to move their investments within various funds of the same institution, and they must be able to do this without the risk that the capital shift will lead to losses for other depositors. Or, there may be particularly high cash requirements due to unexpected reasons such as an increase in the mortality rate or a decrease in the retirement age. Finally, for reasons of financial regulation, such as the Solvency II directive, or to ensure more general flexibility to seize new opportunities and trends.

At the same time, as described in section 1.3.1, these institutions operate with very long-time horizons, and investing in renewable energy could give high risk-adjusted returns if liquidity risk is accepted. Therefore, an effective cashflow management at team level would Guarantee liquidity but at the same time to exploit the long-time horizon, delivering higher returns compared to peers.

The liquidity risk for investments in renewable energy, however, is particularly difficult to price. In fact, the need could come unexpectedly due to anomalous and unforeseeable events that are difficult to statistically quantify. In addition, the illiquidity cost varies from asset to asset, as the cost of selling the renewable power plant may depend on different circumstances, such as the number of possible buyers, potential brokers, the remaining life of the asset and the quality of the financial data available (Climate Policy Initiative, 2013).

However, CPI (2013) through interviews with operators suggests that this cost could be around 100-300 basis points for project finance debt, and potentially higher for riskier equity investments. In addition to correctly pricing liquidity risk, more sophisticated institutional investors could comply with liquidity constraints through a portfolio re-balancing. For example, to directly invest in renewable energy, they could divest some of the bonds they hold and keep more cash in hands to cope with the greater illiquidity of investing in infrastructure. To do this, however, it is necessary that the investment in renewable energy gives higher returns than the more liquid asset classes. However, at the same time regulators are increasing the liquidity requirements for institutional funds, so it is likely that illiquidity considerations will persist over time in addition to the other challenges outlined in the Chapter.

2.3.2. Institutional Investor Scale

When an investor approaches a direct investment in renewable power plants, the success of the investment depends on the sector-specific expertise of the team and on its ability to mitigate the risks. However, only few investors have a team with direct expertise in the sector, and the main discriminating factor in having the team seems to be the size of the investor (Climate Policy Initiative, 2013).

Part of the reason is because direct investments are expensive, as they are generally made outside of the stock market, where a set of consultants have to be approached and involved. In fact, in the M&A phase of these infrastructures it is generally necessary to make an investment appraisal, financial analysis and various due diligence, starting with the legal and ending with the environmental and accounting one. The costs of these processes are high, as well as the risk of making a mistake, with the consequence of holding a non-performing asset for several years. Hence, the costs to consider are not only the remuneration of a qualified team, but also legal fees, consultants, deal sourcing and other transaction costs. Clearly, to make sense, the investment must be large enough to reduce the impact of these fixed costs, with an overall portfolio consisting of at least a dozen similar transactions.

In fact, through interviews conducted by CPI (2013), it seems that in order for this investment to make sense, it is necessary to have a minimum deal size of $100mln and a portfolio of about 5-10 assets to ensure diversification and a discrete deal flow. Therefore, a project portfolio of about $500mln or $1bn seems the minimum necessary, to be then weighted for its illiquidity risk. To balance the overall exposure, allocations in direct infrastructure investments are usually no more than 1% of the investor's total AuM, and therefore the target investor seems to have an overall minimum portfolio of around $50bn if not $100bn.

Taking these considerations into account, the result is that there are probably 45 pension funds and 70-100 insurance companies that are large enough to afford this type of investment. Nevertheless, these still represent a huge amount of capital that can be directed towards renewable energy, about $25tn of AuM (Climate Policy Initiative, 2013).

An exception could be represented by smaller investors in partnership with the main project sponsor, represented by a sophisticated institutional investor with a specialized in-house team. This would allow such institutions to invest directly in renewables without having to perform due diligence internally, but rather delegating it to the more sophisticated partner. However, this does not seem to be the perfect solution as it requires trust in the capabilities of the partner's team, which is often not easy to assess from outside, as well as flexibility to adapt to the partner’s investment and divestment strategies and timing.

2.3.3. Industry Diversification

At the portfolio management level, institutional investors mitigate systematic risk by setting an allocation cap to each individual sector or theme. For example, they may have a certain maximum amount to invest in the technology sector and one for the power sector. Although these limits may be implicit or explicit, for prudential and compensation reasons the weights are generally assigned according to standard benchmarks, unless the board is highly convinced that a particular industry may overperform. Managing these limits becomes much more difficult outside of the equity and bond market, as there are no benchmarks. For these reasons, the investment team may prefer to stay with traditional asset classes rather than risk over-exposure in an illiquid alternative sector, unless the risks are almost entirely mitigated, and the returns are significantly higher. In addition, renewable energy projects usually fall under the "utilities" theme, which includes not only renewable assets, but also traditional ones, making the allocation of resources to the sustainable sector only marginal.

2.3.4. Investor’s Capabilities and Practices

Another challenge is the approach through which individual teams process information and address some of the barriers aforementioned. If these challenges could be at least partially mitigated by growing a competent team, in the same way an unprofessional approach could deepen them or make them even more evident. Some wrong practices are addressed here.

- *Response to illiquidity.* the problem of illiquidity of renewable power plant investments is undoubtedly important, but it could be solved through an accurate portfolio balancing. However, investors often consider the risk to be too high and refuse to carry out any analysis on an alternative asset class. Sometimes, in fact, to balance the liquidity of a portfolio, sophisticated calculations are required, and in any case, even if they are made, the market could question these calculations, pointing out that the team has exposed the company to excessively high risks. Therefore, given the reputational risk to which they are exposed, such investments are made excessively cautiously and only when there is a clearly higher risk adjusted return.
- *Institution of dedicated teams.* If the need for specific technical expertise has already been discussed, many institutions are not inclined to establish internal investment teams. In particular, pension funds have traditionally used external managers to invest their money, therefore becoming skilled evaluators of these external rather than internal managers, which would take them out of their comfort zone and into a position of having to change much of their internal organization. To deal with these changes it is necessary that they are approved by the board and usually only happens for clear value-added operations.
- *Policy risk assessment.* It exists and is difficult to address as outlined in Section 2.2.1, but the impact of uncertainty could be mitigated to some extent through an accurate analysis of the country in which you invest. However, as a team often has to invest in several developing countries, it may lack the time or expertise to assess individual risks in each country, resulting in mispricing or in the exclusion of entire areas due to lack of expertise. On the contrary, larger institutions with larger teams are better able to deal with this type of difficulty.
- *Asset / Liability management.* ALM is intended to minimize the risk that the cash available is insufficient to deal with the liabilities of pension or insurance funds. The analysis can be complex from an analytical point of view and include sophisticated statistical-mathematical models. Even performing this type of calculation, the risk is never completely eliminated.

The way this calculation is made is important for our investment target as the allocations to each asset class are decided. Each model within a company is different and can lead to different results even when dealing with the same liabilities, depending on the level of acceptable risk, the time horizon or simply who takes the risk of fund shortfall. Many of these models have as output only the traditional asset classes, or at least only those that are taken into account by global benchmarks

of which the infrastructure sector is rarely part and from which the energy sector is clearly excluded.
For smaller investors, however, this model is not built internally but external consultants are hired, who usually have no idea what direct investment is (Climate Policy Initiative, 2013).

As a result of what has been discussed, the difficulties in making the renewables a sector able catalyse institutional investors' capital are different. However, some of these risks could be mitigated through some strategies discussed in Chapter 3.
Risk assessment and mitigation seems to be one of the key barriers to overcome. In fact, although returns may be higher than traditional asset classes, they have to be weighted for risk. A good risk mitigation strategy can lead to higher risk adjusted returns and could persuade institutional investors to implement specific investment teams and at the same time bridge the financing gap in the renewable energy sector.

CHAPTER 3: CATALYTIC FINANCE TO UNLOCK THE PRIVATE FINANCING POTENTIAL

Now that the financing gap has been identified and as well as the main barriers that act as a constraint to the involvement of private investments, in this Chapter will be provided some possible solutions to spur private investments in the renewable energy sector in South-East Asia.

The proposals can be grouped into two different categories: the first at the level of the individual project, directed at Developers/Asset managers so that they can make projects economically viable enabling them to attract private capital, the second at fund or fund-of-fund level that should be implemented by governments and MDBs, and operating on a multi-project basis. In the first case, risk mitigation instruments will be identified operating at project level as a way for developers / asset managers to increase the investment's risk-adjusted returns. In the second case, are identified fund schemes that invest in renewable energy with investment by both public and private funds, but with a structure that allocates an appropriate level of risk to each investor. Both solutions should be intended as risk mitigation structures that can overcome the barriers highlighted in Chapter 2.

3.1. Catalytic Finance – Introduction

Some non-traditional financial structures can be implemented with the aim of attracting private investment in a market that is not yet completely developed. These structures are generally made available by inter-governmental institutions such as Development Finance Institutions or Multilateral Development Banks and are set up with the specific aim of leveraging private capital into projects that would not otherwise be financed by the private sector. In this sense, we can refer to this practice as catalytic financing. More specifically, catalytic finance refers to financial structures with a mix of private and public funds that seek to mitigate risk and attract private investment, often referred to as Blended Finance. These tools have existed since the 1990s for emerging countries but have mostly failed to fulfil their purpose. A study of the Global Environment Facility, a fund designed to attract private investment to climate-related projects, showed that the mobilization of private capital was insufficient in comparison to the public capital deployed (GEF, 1998). The obstacles highlighted were the lack of awareness of the fund by private investors, the lengthy approval times and the limited tangible benefits for private investors (GEF, 1998).

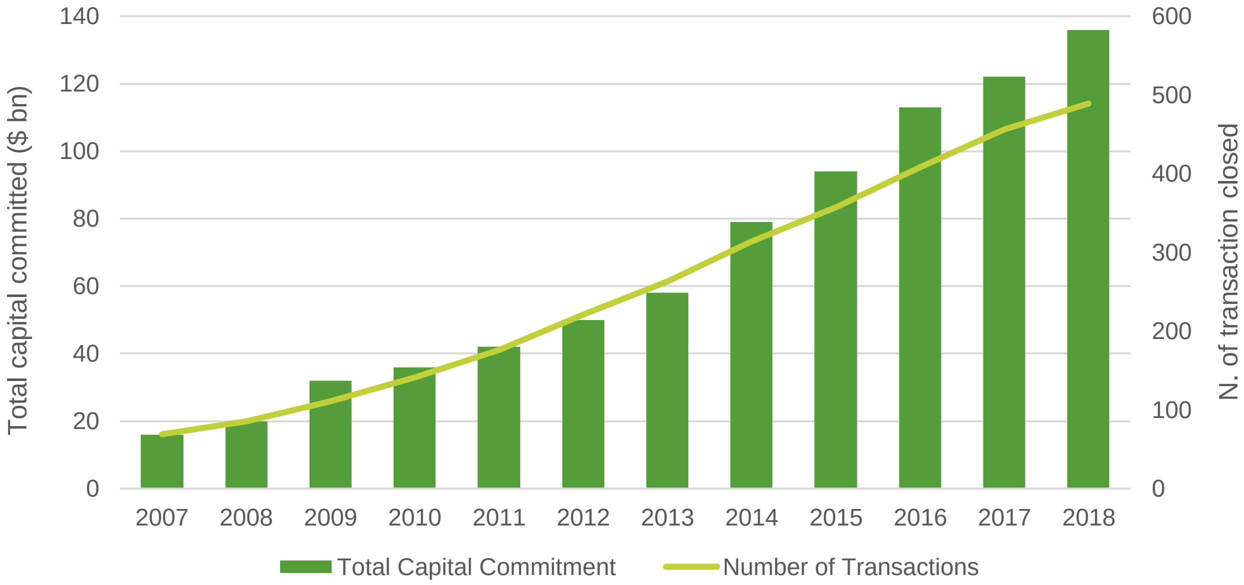
However, in 2015 the introduction of the Social Development Goals and the Paris Agreement gave a new impulse to the implementation of these tools. At the same time, catalytic finance was relaunched with a more proactive and strategic approach. This time, contrary to what happened at the beginning of the millennium, a common set of principles, a clear framework and a roadmap were established by the main international institutions such as OECD and Development Finance Institutions (Sustainable Finance Initiative, 2020). According to these frameworks, Blended Finance is defined as "*the strategic use of development finance for the mobilization of additional finance towards concessional finance from donors or third parties alongside DFIs normal own account finance and/or commercial finance from other investors, to develop private sector markets, address the SDGs, and mobilize private resources*" (OECD, 2018).

The resources allocated by donor countries are part of public resources and therefore paid by taxpayers of those countries. For this reason, in accordance with the roadmap defined by intergovernmental institutions, the use of catalytic finance tools is a temporary step to bridge the financing gap, develop the market and act as an anchor for private investment. The logic is in line with the objectives: to define structures and financial instruments that can bridge the financing gap in the renewable energy sector by attracting private investors who are often reluctant to invest in technologies with a high perceived risk.

In light of this, DFIs can increase expected returns through a range of risk mitigation tools, ranging from financial Guarantees, concessional loans and equity, to intermediary instruments such as funds, syndication, securitization or public-private finance (OECD, 2018).

Following the adoption of SDGs and the increase of infrastructure needs to reduce emissions, blended finance transactions have increased constantly over time (Figure 11), mobilizing more than $140 billion from private investors (Convergence, 2019).

Figure 11: Annual Blended Finance Activities (2007-2018)



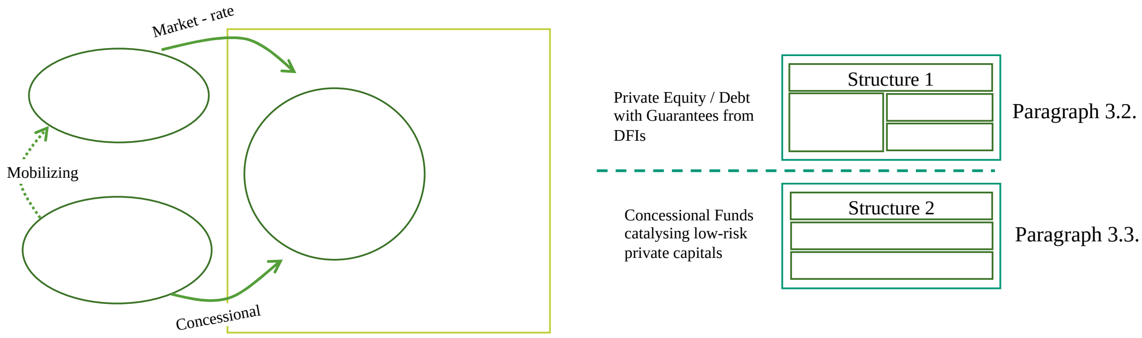
Source: Convergence (2020)

According to Convergence (2019), in the coming years the available resources will be constantly increasing. A survey of the institutions dedicated to driving capital to where is needed most, forecast a "significantly increase of blended finance activities over the next year" with the remaining 60% reporting an intention to "somewhat increase blended finance activities" (Convergence, 2019).

Despite the growing trend, the potential is still not fully tapped and there is great scope for improvement, both in terms of transparency and implementation. As these intergovernmental solutions have only been increasing in recent years, it is not easy to find a qualitative and precise definition of all the tools made available, with the result that only highly experienced and specialized teams in the renewable energy sector are able to integrate them into their projects.

Two main solutions will be provided in the following paragraph and are illustrated in Figure 12. The first is a risk mitigation strategy to be implemented at project level in order to reduce risks, both real and perceived; the second is a structured financing mechanism that aim to leverage private capital through different layers and the cash waterfall.

Figure 12: Blended Finance Mechanics and Structures



Source: Author's Representation

In the following paragraphs, therefore, we will identify in qualitative terms some of these tools made available by Multilateral Development Banks and particularly suitable to solve the specific barriers of the renewable energy sector. In addition, Chapter 4 will present a number of examples where renewable power plants have been completed through the use of catalytic finance where they would not have been otherwise viable.

3.2. Risk Mitigation Tools

The analysis in Chapter 2 shows that the main barrier for private investors that want to directly invest in renewable energy is the high-risk perception. In particular, political and regulatory risks were identified as the main hurdles. Furthermore, only higher risk adjusted returns (compared to traditional asset classes) could persuade institutional investors to set up dedicated internal teams and address the liquidity risk. Therefore, it seems that risk mitigation may be one of the ideal tools able to attract institutional investors.

Risk mitigation, the cornerstone of any infrastructure investment, is based on allocating the risk to those who are most capable of managing it. For example, a political risk may be better managed by an intergovernmental entity rather than a private entity, while operational risk may be better managed by an energy operator. This is exactly the basis of the risk mitigation strategy outlined below.

Risk mitigation tools will be presented by dividing them into macro-categories.

3.2.1. Government Guarantee

A Sovereign Guarantee is a government's Guarantee that an obligation will be satisfied if the primary obligor defaults; usually they relate to payment defaults, but can cover other kinds of obligations and commitment (IRENA, 2020). This type of Guarantees is issued by the country's Ministry of Finance and the mechanism usually includes penalty payments by the local government, which ultimately is covered by public funds. For this reason, governments are not always willing to issue a such a Guarantee for the development of an infrastructure project, as they may have budget constraints or be prevented from doing so by the International Monetary Fund.

In the renewable energy sector, they can be used to cover:

- Non-payment by the off-taker, especially if this is a state-controlled utility company;
- Any other failure to honour the Power Purchase Agreement;
- Unilateral tax changes;
- Currency inconvertibility and currency transfer restrictions;

Such risk allocation reflects the principle of transferring risk to those who are best placed to predict or manage events. For example, a national government could be better suited to mitigate the risk of non-payment by the offtaker, especially if the latter is a state-controlled utility company, as often is the case. In these instances, the government could Guarantee the payment of the controlled company by stepping in as necessary, thus mitigating the credit of the offtaker. Another example could be a payment default motivated by marked changes in energy prices. Since in many countries' energy prices are determined by governments at national level, they may be partially responsible for the missed payment, hence well positioned to mitigate the risk.

In practice, the issuance of Guarantees results in an increase the certainty of cash flows, hence mitigating off-taker and regulatory risk. By mitigating revenue risk, government Guarantee may be important to build a bond-like cash-flow profile with long maturities and reliable payments that would attract institutional investors to invest directly into operating renewable power plants.

3.2.2. Political risk insurance

This has been introduced for instances where national governments are not reliable. Indeed, some countries may not have the means to honour sovereign obligation or have a record honouring Ministry of Finance commitments (IRENA, 2020). There may also be instances where, if they have the capacity to honour contractual obligations, they may chose to ignore them for political reasons: PPAs are often as long as 20 years and, in this timeframe, there will be several elections and different governments may question the contractual obligations imposed by previous politicians.

To overcome these situations in countries with real or perceived political instability, Multilateral Development Banks can provide Political Risk Insurance. In particular, alternative Guarantees may be offered by the Asian Development Bank or the Multilateral Investment Guarantee Agency (MIGA, owned by the World Bank). Their political influence, which makes such Guarantees effective, is based on their "preferred creditor status", which is itself the result of the fact that the relevant national government is a shareholder in the particular institution. In practice, this means that the national government is committed to step-in and implement measures to resolve the issue at hand if there is a risk that the beneficiary could suffer a loss that is directly or indirectly caused by government action. If not possible, the government would compensate the beneficiary for the loss (IRENA, 2020).

The largest policy insurance provider agency is MIGA, a member of the World Bank, and offers coverage on 5 main types of risks:

- War, terrorism and civil disturbance, which includes losses from revolution, insurrection, coups d'état, sabotage and terrorism.
- Currency inconvertibility, i.e. the possibility that the local currency cannot be converted into hard currency due to government action
- Breach of contract, relating to the breach of the terms of the Power Purchase Agreements
- Expropriation, or any other action related to government actions that may undermine the private ownership of the renewable power plant

In addition, some agencies, such as the US Government's DFI, also offer protection against regulatory changes that can adversely affect the profitability of a plant.

Political Risk Insurance, whether at the sovereign level or provided by DFIs, plays a major role in mitigating policy barriers identified in Section 2.1.1 as one of the main obstacles for private investors.

3.2.3. Partial risk Guarantee

This is meant to cover a wider range of longer-term political risks, in particular a range of policy and regulatory risks, helping to increase the certainty of revenues. It can be used when there are government reforms or when government fails to implement the key provision of the regulatory framework (African Development Bank, 2013). One of its most important areas of application is commercial risk protection to which a developer is exposed when accessing the transmission line or national grid. Usually, the grid's development is managed by the government and represent one of the most important obstacles when deciding to invest in peripheral areas in South-East Asia, since they are often not covered by the national grid that links the Renewable Power Plant to the final consumers. The risk is that the power plant is already built and ready to generate energy and the offtaker can't take the energy generated and pay the supply as stated by the PP because of delays in the construction of the transmission line. In these instances, the developer could be exposed to the risk that the offtaker does not pay the energy generated and does not respect the Power Purchase Agreement. In this case, using a Partial Risk Guarantee, the developer could be covered by the offtaker and liquidity risk.

3.2.4. Partial Credit Guarantee

This covers part of the debt service default by the borrower regardless of the reason for the inability to repay the loan. It is more flexible than the tools mentioned above and can be applied to a wide range of risks. The instrument is usually offered by Multilateral Banks such as the Asian Development Bank, or by some Bilateral Banks, whose purpose is to facilitate access to credit for the developer through risk sharing between the lender and the guarantor. It can be used both to access credit from international banks and to facilitate the issuance of bonds on the financial markets. In such cases, the PCG can cover both the delay of a bullet principal payment and/or the interest payment or coupons of a bond (World Bank, 2007).

PCGs are flexible and structured to cover a predetermined percentage of the credit risk: for example, the Asian Development Bank could provide a 50% Guarantee with the lender, ensuring that losses are shared accordingly. The natural consequence for the commercial bank is the lower risk to which it is exposed, thus being able to offer better terms and maturity. In addition, it is used to cover one of the main risks to which the developer is exposed: currency risk. This arises when the currency of a company's activities does not match with the currency of its liabilities, as is often the case with projects in Southeast Asia. In fact, access to debt market is usually in hard currency, while the activities, i.e. the revenues generated by the facility, are in local currency. Therefore, the ideal for the sponsor would be to obtain funds in local currency, in order not to be exposed to the devaluation of the latter which would complicate the repayment of debts in hard currency.

The partial Credit Guarantee in this case can make a fundamental contribution, allowing for example the investor to issue bonds in local currency, but guaranteed by a high credit standing counterparty, with the consequence of decreasing the cost of capital. For example, a local investor could issue a local currency bond in order not to be exposed to currency risk; however, its low credit rating and currency instability could raise its cost of funding exponentially, making the investment uneconomic. In this case, although the bond would be rated Ba1 by Moody, it could be guaranteed through a 70% PCG by the Asian Development Bank, whose rating is a triple A. The credit risk of this bond would therefore no longer be Ba1, but would be mitigated by ADB's triple A rating, which would take over in the event of non-payment by the issuer.

The bond in the example, although in local currency, could then be rated by the agencies as "investment grade" as it is guaranteed by the ADB, and thus attract institutional investors looking for low-risk investments.

It is emblematic of how PCGs can be important not only in attracting capital from private banks, but also in boosting local financial markets and attracting institutional investors through bonds guaranteed by institutions with high credit risk. In addition, they allow the developer to design a project that is not exposed to currency risk, thus eliminating an additional uncertainty in the cash flow generated by the plant.

3.2.5. Conclusions

With the exponential decline in the cost of renewable energy, it is necessary to move from a logic of economic viability to one of risk mitigation. DFIs are no longer required to grant plain concessional debt or equity, but to offer tools that can help create an attractive environment for private investors. If concessional debt, grants and equity are suitable for a non-competitive market, this is no longer the case for renewable energy. Rather, the focus is on increasing the flow of private capital: in this sense, mitigation tools have higher catalytic capacity than concessional debt/equity: an analysis of multilateral institutions indicated that guarantees represent approximately only 5% of their commitment but generate approximately 45% of private-sector mobilization. (Betru A. and C. Lee, 2017). If these tools seem in line with the objective to close the financing gap, developers are called upon to develop the necessary skills to adequately address risks and prepare projects that can be bought by institutional investors once they reach the operational phase. Table 5 summarizes the available tools that an investment team could adopt to mitigate any respective risks.

However, although the guarantees have shown not only the ability to change the risk perception, but also to improve lending terms and returns, (IRENA, 2016), their use is still largely insufficient.

Table 5: Wrap-up on Risk Mitigation Strategy

	Political Risk	Policy & Regulatory Risk	Off-taker Risk	Grid & Transmission Line risk	Currency Risk	Liquidity & Refinancing Risk
Government Guarantee	✓	✓	✓			
Political Risk Insurance	✓	✓	✓			
Partial Risk Guarantee				✓		✓
Partial Credit Guarantee					✓	✓

Source: Author's Representation

A survey by IRENA (2016), shows that only 4% of their total infrastructure risk mitigation issuance is dedicated to renewable investments. In addition, there seems to be an underutilization of guarantees mainly due to a lack of knowledge of the product, but also due to high transaction costs and long processing times.

At the same time, other researchers have highlighted some administrative barriers that prevent the spread of the instrument. As in fact Humpry & Prizzon (2014) point out, many DFIs are generally used to book guarantees in the same way as loans for the purposes of risk capital allocation, as if a Guarantee were a loan exposure for 100% of the amount, thus discouraging the use of Guarantees. In addition, the OECD does not consider guarantees as Official Development Assistance (ODA), further discouraging the use of guarantees over loans (Betru A. and C. Lee, 2017). In short, although the tool has high potential to attract private resources, an additional effort is required by all participants: from DFIs to increase the transparency of their tools, from developers to make use of the tools available, from governments and institutions to better recognize the value of such guarantees.

3.3. Structured Financing Mechanisms – Securitization of Funds

While guarantees are one of the most powerful instruments of catalytic finance, the most traditional tools are concessional debt and equity.

Concessional debt is generally issued by multilateral development banks on terms that are more advantageous to the borrower than those offered by commercial banks: it could be cheaper, longer or can have longer grace periods. It is designed to operate in conditions where markets are not able to deliver, developers cannot access local debt or where banks cannot bear the risk.

Concessional equity means direct investments by a development finance institution in renewable energy projects. Usually a public institution decides to join the investment as a sponsor just for projects that are necessary for the country but are unbankable; in this case, they could participate in the riskier stages of development and construction and then selling to private investors once the plant has reached the operational phase.
These instruments have been in place since the 1990s and are particularly important for key infrastructure in emerging countries that provide access to essential resources such as water, energy or roads. However, the aim here is not only to deliver non-bankable investments in infrastructure, but to create an attractive and liquid market for private investors: in this context, direct equity and debt mechanisms as well as grants have shown capacity to deliver investments that would not have taken place without the presence of public capital, but have shown limits in leveraging private investments. In fact, while for few strategic infrastructures a 50% partnership between public and private funds can be sustainable, this can only be a temporary solution that does not solve the structural problems of the market addressed in Chapter 2. What are necessary therefore, are instruments capable of leveraging private capitals by using small amounts of public funds, as it is the case with the risk mitigation tools previously illustrated. However, there is a future also for traditional blended finance instruments such as direct equity or debt, but they must be structured differently in order to (i) have a higher catalytic performance (ii) be an instrument that allows the development of the private market, which can survive autonomously afterwards.
In recent years, more and more innovative structures have emerged to meet these challenges, at the same time using traditional blended finance tools. Actually, what had been a direct grant-based approach to deliver public benefit became more layered and complete (Sustainable Finance Initiative, 2020).

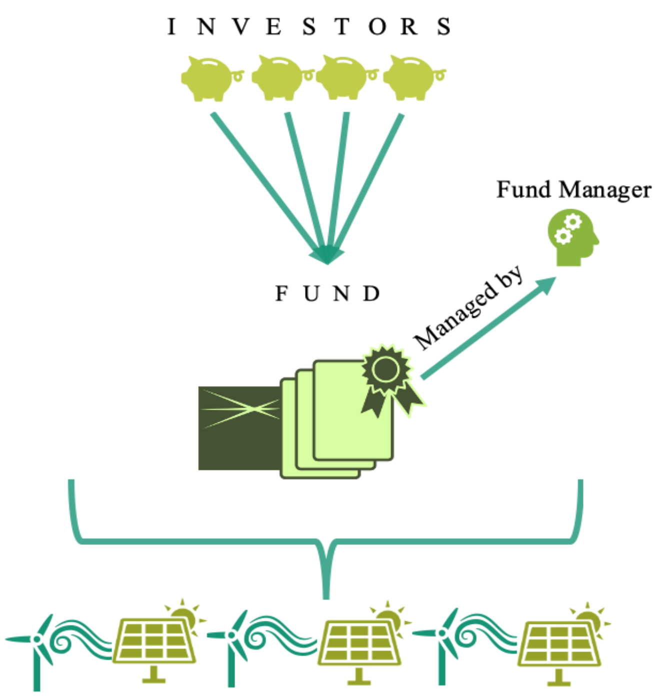
A concrete example of one of these innovative and more effective approaches will be presented in the next paragraph so that empirical evidence can be provided alongside the concepts that will be illustrated below.
Differently from the previous paragraph, the analysis will move to a higher layer, i.e. not financial instruments to be used at the single project level such as the guarantees that have been discussed, but on the innovative structuring of unlisted funds that can invest in multiple projects through traditional instruments such as concessional debt and equity, but in a much more proactive way.

A project sponsor, whether private or semi-public such as an MDB, can decide to invest in infrastructure in two ways: (i) directly finance the individual project (ii) allocate the capital to a fund managed by an asset manager, i.e. a team with expertise and track record in direct investment in infrastructure.

The direct investment was implicitly discussed in the previous paragraph: A Development Finance Institution decides on its own initiative which project to finance with equity, debt or as risk Guarantee provider.

On the other hand, indirect investment is based on the allocation of capital to an investment fund managed by an asset manager, who in turn uses this capital and the funds of other quota-holders, to invest in a number of renewable energy projects. This second approach has been illustrated in the Figure 13.

Figure 13: Indirect Investment Structure



Source: Author's Representation

The indirect investment, compared to the direct one, has some advantages:

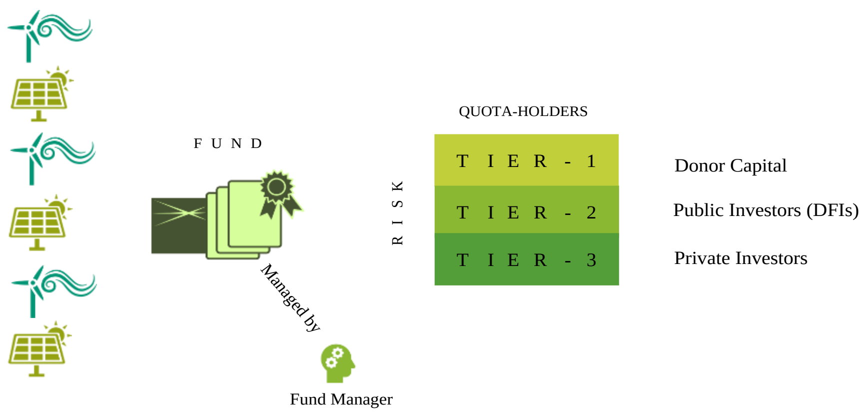
- Ability to deploy capital quickly on various infrastructure funds as there are already historical performance track records and data available
- Diversification, as the fund can raise capital from different institutions and thus manage a portfolio that couldn't have with only its own capital
- Access to the expertise of the fund manager who may be more experienced in investing in renewable energy than in-house teams
- Opportunity to participate in infrastructure projects even for less sophisticated investors

However, this investment method, which can be defined as "indirect" as the investor does not choose the individual investment, which is instead delegated to the fund manager, has been in force for decades without having been the solution to bridge the financing gap.

Nevertheless, if we combine the structure of indirect investment with traditional instruments such as concessional debt / equity, and also with innovative structures defined later, it is possible to design new and more effective catalytic instruments. The model presented below, combined with a risk mitigation strategy to be implemented at project level, could have the capacity to attract those missing private investments and fill the financing gap of renewable energy.

Starting from the indirect investment strategy, it is possible to implement a structured finance approach that evokes home mortgages, i.e. securitization, but that can be generalized. The economic flow of a securitized product such as an MBS can be reshaped and adapted to indirect investments in renewable energy. Differently from the famous MBS (a.k.a. collateralized debt obligation), there will be no mortgages creating cash flows, but renewable energy plants of different sizes, held by an unlisted fund (rather than pooled in a tradable security) that is underwritten by private and public investors. The concept of risk diversification and segmentation into tranches with different level of risk also applies here. In fact, while the CDO is divided into tranches and sold at different levels of risks, in our case we have a portfolio of renewable assets, whose cash flows are collected in a single facility - the fund - that is divided in tranches each one having a different level of risk. The structure is summarized in Figure 14.

Figure 14: Layering the Investment Chain of an Indirect Infrastructure Investment



Source: Author's Representation

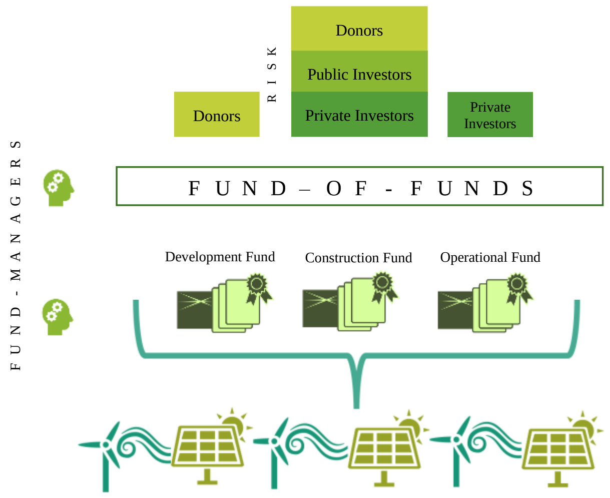
In this way, it is possible to aggregate investors with higher risk appetite (public investors, speculators, developers) to institutional investors with lower risk appetite (institutional investors) in one single facility. The consequence is to create a stratification in different tiers, where the tier 1 investor - theoretically participated by catalytic capital - takes more risk (e.g. receives revenues only after the subsequent tiers have been satisfied in a certain percentage of their investment, or contribute to losses in a subordinate way), while tier 2 and 3 can be participated by the private sector which have a lower risk appetite and lack of knowledge of the market, and that have been attracted to this sector thanks to the knowledge and track record of public and specialized investors. To recap: renewable power plants generating cash flows are collected in a single fund, the quota-holders are layered in different tiers each one having different risk appetite. Remuneration is based on a cash-waterfall concept where tier 1 investors only receive dividends when the other tiers are satisfied. This system is set to catalyse private capital by guaranteeing to the upper tiers a minimum guaranteed return.

The structure can be further complicated, but with additional benefits in terms of catalytic potential. The fund that has been "layered" will be now "thickened" in order that each phase of the project (development, construction, operation) can be addressed by the most appropriate investor, but through a single facility.

As already stated, one of the peculiarities of renewable energy is the front-loaded capital structure, i.e. the large capital expenditure and high risks in the development and construction phases compared to the operational one. In fact, in the development phase the feasibility analysis involves expenses such as project due diligence (for which legal, accounting, financial advisors, etc. ...) with the risk that the project will never materialize. In the second phase, the construction phase, in addition to the large amount of capital to be employed, the sponsor is exposed to variables such as construction permits, site accessibility, regulatory reforms, etc. ... At the same time, the last phase when the plat is operative does not match the preferences of speculative investors or developers who want to free up capital to allocate in new projects. In short, each of the 3 phases is different each one having a specific target investor with adequate financial structure.

Returning to the structure discussed so far of the indirect investment and stretched through various layers each exposed to a different risk, it is possible to establish 3 sub-funds, each of them dealing with one of the 3 specific phases (development, construction, operation), and in each of these funds a different type of investor. E.g. donors, developers and speculative investors in the first two phases of a renewable power plant (development and construction), institutional investors in the last (operations). The advantage is to allocate at each stage the most suitable investor to deal with it. Figure 15 exemplifies this structure.

Figure 15: Layering and Thickening the Investment Chain in an Indirect Infrastructure Investment



Source: Author's Representation

In order to fully understand the complex structure just outlined, a practical case will be discussed shortly to describe its functioning.

What is worth considering now, is how this structure creates value and why it has a high catalytic potential. Looking back at the barriers identified in Chapter 2, a structure designed in this way could be complementary to the risk mitigation strategy (in any case to be adopted at the individual project level) and overcome the remaining barriers:

- *Investor's scale.* One barrier that was highlighted was the difficulty for smaller institutional investors to participate in the investment. In fact, only the most sophisticated of them could afford an infrastructure portfolio, due to its illiquidity and need to set up internal teams with specific expertise. In this case, the team is represented by external fund managers, chosen for their expertise and track record. Moreover, if in Chapter 2 a portfolio between $500mln and $1bn sounded the minimum necessary to justify the existence of an internal team and at the same time allow a diversification of risk, the ticket size to participate to an unlisted fund is much smaller, thus allowing smaller institutional funds to participate.
- *Risk perception.* It has been said that risk is often considered excessively high, often due to political instability in the country and lack of expertise in the sector. In this sense, participating in an unlisted fund promoted by DFIs is a kind of Guarantee for the private investor, who may feel comforted by their political influence.
- *Risk preferences.* The subdivision into specific funds allows each investor to participate to the investment stage more suitable for its financial structure. In this sense, life

insurance and pension funds can be allocated to the fund dedicated to the operational phase of the project, because it offers a bond-like financial structure.

- *Risk return profile.* A lack of track record and public information where the main hurdles to identify the superiority of the infrastructure investment over traditional asset classes. The consequence was to push investors not to take risks and not to deal with its illiquidity cost. On the other side, developers could participate to the development phase by leveraging their track record and easily free up capital as the project reaches the operational phase.

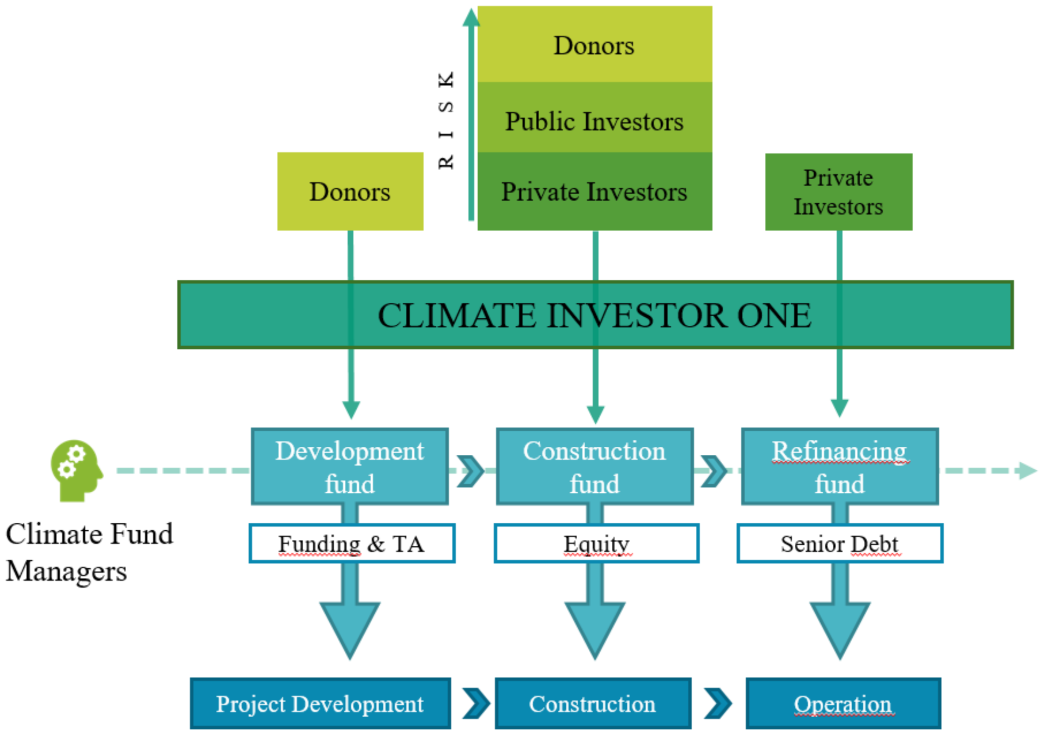
However, the layered structure could provide a much better risk-return profile, at least until public funds do not leave the market to private investors only.

3.3.1. The Climate Investor One Experience

Climate Investor One is a fund sponsored by the Dutch Development Bank FMO, that closed its fundraising period in June 2019. CP1 provides financing solutions throughout the whole life of its project: it develops, constructs and operates renewable energy projects and invests 70% in low-income countries and 30% in upper-middle income countries. With total capital of $850mln it represents the world's largest blended finance structure. The fund, in addition to intergovernmental institutions, is largely participated by private investors. Its structure was designed by the Global Innovation Lab for Climate Finance in 2014-2015 (Climate Finance Lab, 2020) and in addition to representing a reference point in terms of size is also a benchmark for financial innovation. In fact, the fund is the most important example of how the delivery chain of blended finance can extend vertically and horizontally and gain attractiveness for private investors thanks to its structure.

Accordingly, its innovative structure represented in Figure 16 attracts different sets of investors grouped and aligned with the risk profile of the different project life stages, while also coordinating the deployment of capital (Sustainable Finance Initiative, 2020).

Figure 16: Structure of the Climate Investor One



Source: The Lab (2019)

The quota-holders delegate the investments, their design and implementation to a fund manager, the Climate Fund Managers, who makes recommendations to individual funds on which projects to invest. In this way, CI1 investors make up for the absence of an internal investment team and delegate the management to a fund manager who has expertise in the field; the latter is responsible for implementing and evaluating the projects.

The fund is owned by various types of investors, but donor countries have played a key role in attracting private capital.

In fact, when in 2019 the final round of capital raising was closed, it achieved results exceeding the expected $530mln. The cornerstone investors that played a crucial role in catalysing private investments were: The Green Climate Fund (GCF), The Ministry of Foreign Affairs of the Netherlands, the EU, the Nordic Development Fund, and the United States Agency for International Development. These investors committed in advance to invest their capital, and thanks to their expertise in developing countries have been able to catalyse from the private market 4 times the public capital employed, for a total of $850mln raised (Sustainable Finance Initiative, 2020).

The pool of capitals is managed by the Climate Fund Managers through three different funds underlying CI1: the development fund, the construction fund and the refinancing fund. Each of these funds invests in a specific phase of the renewable power plant. In fact, the pipeline starts from the Development Fund, which then passes the project to the Construction Fund. Once Phase 2 of the construction is complete, the Refinancing Fund join the investment in the operational phase mainly by granting long-term loan, which allows the project to increase its leverage and decrease the cost of capital.

The development fund finances, usually in partnership with other sponsors, the implementation and design phase of the project; In addition to the capital, it provides the technical assistance necessary to carry out the complex project screening, feasibility, financial modelling, legal due diligence etc. Despite the high technicality of this phase, the project can count on the experience and track record of the fund manager, thanks to whom the risks are mitigated and the projects standardized.

When the development phase is carried out, the fund can invest equity for the construction phase. In this second phase, access to debt is complex, and the CI1 structure allows to create a streamlined structure composed almost exclusively of equity to quickly complete the construction phase. The equity investment is composed by 3 different tiers, each one with a different level of risk. In fact, investor returns flow through a cash waterfall system and primarily satisfy investors in tier 2 and 3, who are generally market driven and who have been attracted thanks to the first loss capital of public funds. In addition to a good risk-return profile, investors in these layers can acquire track records, understand the new market and reduce the perceived risk in developing markets (Sustainable Finance Initiative, 2020).

Subsequently, these investors may have acquired the necessary skills to directly invest in the renewable sector without having to use public funds to cover first losses.

In the last phase, the operational one, the refinancing fund ensures long term debt to optimize the financial structure of the project and decrease the cost of capital. This refinancing fund represents the ideal instrument for institutional investors who are interested in long holding periods and stable cash flows. Leveraging the project also means that part of the equity investment is repaid by distributing returns to construction fund investors that now have free capital for new investments.

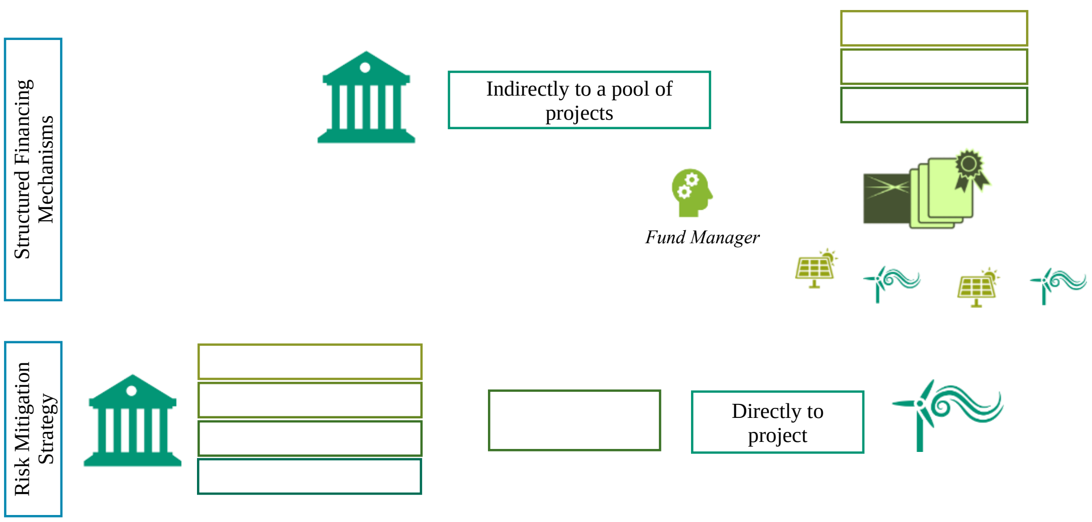
The CI1 structure represents an ideal compromise between public subsidies and private capital. The presence of Donor Countries and funds such as the GCF have played an important role in risk mitigation, thanks mainly to their track record and expertise in developing counties, but also to the political influence they can exert on local governments. As a result, they have catalysed 400% of the public capital employed, and have allowed private institutions to build a track record and expertise in this new renewable energy sector.

In conclusion, the solutions presented in Chapter 3 aim to overcome the barriers defined in the previous Chapter. There are two mechanisms highlighted that can achieve the objective:

1. Use of guarantees to mitigate the risks of a single project;
2. Pooling blended capital through "stretched and enlarged" structures to solve problems of size, expertise and risk profiles.

These two solutions are complementary. In fact, if risk mitigation strategies have to be used at the individual project level, innovative structures to pool private and public capital can work on the financing aspect providing a consistent flow of funds and a solid pipeline of projects.
The aggregate structure has been illustrated in Figure 17.

Figure 17: Aggregated Blended Finance Proposition to Bridge the Financing Gap



Source: Author's Representation

CHAPTER 4: CASE STUDY

The last chapter aims to investigate empirically an investment into renewable power plants in South East Asia, identifying the success factors and its difficulties. The goal of the case study is to highlight the success factor of a deal, in order to provide some guideline for private investors not yet specialized in the sector. Furthermore, it will assess the validity of the Risk Guarantees mechanisms to catalyse private sector investments and to bridge the financing gap.

For this reason, the focus will be on risk mitigation strategies, with a particular emphasis on Guarantees granted by Development Finance Institutions so as to understand their effectiveness to overcome private sector's hurdles. It will be illustrated a transaction executed by Sindicatum Renewable Energy Company ("Sindicatum"), a developer, constructor and operator of renewable power plants in South East Asia. I was provided information to the transaction through a series of interviews with its CFO.

The Asset

Sindicatum was seeking to finance the construction of two solar power plants in the Philippines, for a total of about 130MWp, both of them on the island of Luzon, where Manila is located. The Projects are each built on about 80 hectares of leased land and are connected to the national grid through an interconnection not creating any issue with evacuation of the power.

Background

From an economic point of view, the Philippines is one of the most advanced countries in the region, and in recent years has managed to implement a number of effective schemes to attract private investors in renewable energy such as Sindicatum. This is part of ambitious plans to scale up renewable energy production. The National Renewable Energy Program ("NREP") recently lifted the 2030 target planned renewable energy power generation from 5.4 GW to 15.3 GW and a new NREP plan released in July 2020 set an even higher target of 20 GW by 2040.

As a consequence, the Philippines have been promoting a series of successful policies that stimulated the renewable market. Some of these policies could also be used as a model by least developed counties in the region that are failing to implement an attractive framework. In parallel, the country also offers and attractive macro-economic environment for international investors.

In fact, a factor that was key to Sindicatum's investment was the stable macro-economic and political environment. The Philippines has a stable local currency, strong economic growth, a somewhat reliable political system, is rated investment grade by the main rating agencies. This all reduces the perceived policy risk that, as illustrated in Chapter 2, is one of the main barriers for private sector investors.

As noted during one of the interviews, the Philippines seem to do fairly well also in terms of transparency and effectiveness and it is very positive that they were able to implement a political and regulatory framework that facilitate business execution for both domestic and international investors. In this respect, it is impressive that they have been able to resist the strength of the fossil fuels lobbies which have slowed down the greening-energy process in some countries in the region.

On the financial side, the Philippines seem to have a well-developed and functioning banking system compared to other countries of the region, as many are just now emerging from decades of communist regimes and have underdeveloped financial systems and capital markets. The availability of local currency project finance debt mitigates a previously highlighted barrier such as currency risk.

From an energy sector prospective the Philippines have also been able to offer an interesting development model. Since 2017, there are no longer any financial and economic incentives provided by government and these are no longer important given that the capital cost of solar installations makes solar power deliverable at prices below fossil fuels (see p. 12). Rather, the government has developed an efficient power management system and a renewable energy obligation for utility companies. Such a plan obliges energy distributors to increase renewable energy dispatching by 1% per year, and has the merit to stimulate a pipeline of bankable renewable project, that at the same time boosts the market and increases its liquidity. Therefore, the market offers good business conditions for power plants investors since there is strong demand for renewable energy. Accordingly, power developers can find reliable off-taker willing to enter in a PPA during development improving the cash flows certainty and the project bankability. The importance of stimulating the market was noted on several occasions during the interviews, since the existence of a reliable PPA is a key factor to access local debt and create catalytic market conditions to close the financing gap.

While the government of the Philippines seems to have succeeded in creating an attractive regulatory framework for private sector investors, developers still have to deal with the implications of it being a developing country, even if investment grade. Among the main risks that must be considered and "priced" by the project sponsor, the permitting stage, the connection to the national grid (inclusive of all land permits), construction permits, all require significant time and cost and is particularly risky as it involves capital expenditures without certainty over the project feasibility and timings. Therefore, it must be taken into account by the developer in its financial model and must be correctly priced when assessing the economic viability of the project. Empirical evidence suggests that the bureaucratic procedures seem to be one of the main problems for developing countries with corruption, lobbies and long processing times. In this context, the Philippines was able to build an efficient system where procedures are long but sufficiently transparent.

Key Players

While Sindicatum is the main sponsor of the projects, like the majority of infrastructure investments, it is structured according to the principles of Project Finance:

- Non-recourse finance & balance sheet (asset owned by an SPV)
- Finite life of the SPV
- 15-25 years of life horizon
- 65-80% of leverage

It will be described the development of one of the projects below – the other is essentially the same. Indeed, this ability to replicate (for example, structures, financing, permitting) is a major advantage in construction of such projects.

In the SPV the main sponsor is Sindicatum Renewable Energy in partnership with a local company which, in addition to being mandatory in the Philippines for foreign investors, can also play a risk mitigation role. The two sponsors have independently borne the costs of the development phase: feasibility studies and the cost of several external advisors, market screening to identify an off-taker, permits to build, land use conversion and national grid accessibility permits.

Once the development phase was completed and the risk mitigation strategy was set in place, it was possible to move to raising debt finance. Following discussions with local banks, a careful risk mitigation strategy was set in place via project finance debt with a LTV of 75%, lowering the capital cost for equity investors. It is worth noting that the local bank was able to provide funding already at in the construction phase, with the considerable benefit of lowering the project's cost of capital early in the project's life. During the interviews it was noted that this was possible because they approached the lenders after the project had already covered all its main risks (see further below).

On the energy distribution side, thanks to strong demand in the renewable energy market (driven as mentioned above by the renewable energy obligation for energy distributors), several of the main utility companies in the country expressed an interest and one of the largest ones was selected – itself with an international investment grade rating. Interestingly the utility company was interested in becoming a shareholder in the project after construction. Therefore, as part of the PPA it received an option to becoming a minority investor after construction – this would allow the sponsors to free up capital to be reinvested in new projects while reducing the off-taker risk, since the buyer itself would be a shareholder in the project. Moreover, the off-taker can participate in a business with limited risk (since he is himself the energy purchaser) effectively decreasing the cost of energy and hoping for a future revaluation of the asset.

Risk Mitigation Strategy and the Credit Guarantee

By signing an agreement for the purchase of the power with a major counterparty already at the development phase, the project owner was not only was able to access local debt, but also made possible a detailed cash flow valuation. In addition, since the offtaker was rated investment grade with limited default risk, revenues and liquidity risks were mitigated, since these arise when the project is no longer able to sell its output resulting up with a cash shortfall.

While finding a reliable offtaker is fundamental while investing in any developing country, the same applies for the selection of a constructor, as he can mitigate the construction risk (delays poor quality, etc.). To that end, Sindicatum entered in an EPC agreement in which the contractor was responsible for building the project all the way to commissioning. Sindicatum acted in line with the more classical risk mitigation strategy: allocate the risk to those who are best able to control the consequences.

Country risk is probably was one of the most difficult risks to reduce or eliminate. While in Chapter 3, the solution government Guarantee was suggested to bear unexpected changes in regulations, the interview with the CFO of Sindicatum highlighted the limited usefulness of such tools. First, the processing times are extremely lengthy and often not compatible with the speed of private sector operators. Secondly, accessing the Guarantee even while meeting all the parameters is not for granted, as selection criteria among projects to be guaranteed is not transparent.

In effect Sindicatum has addressed country and political risk through:

- Regional expertise. The consolidated track record in the Southeast Asian region has led the project sponsor to gain a strong knowledge of the local markets and their weaknesses. It is not only a matter of political or monetary instability prediction, but also of knowing if the country is "open and ready" for business.

- Local Partner. Although the local partner has a minority interest in the economics of the project, his knowledge of the market and of the local regulatory system is a risk mitigation factor for policy and regulatory risk and can assist for any other contingencies that may arise during the development and construction period. As a result, having an influential local partner is an is important feature of risk mitigation when it comes to understanding and respond to deal with policies.

Whilst it would appear that all the risks have been covered, one of the most important, currency risk (as noted in Chapter 2 and addressed in Chapter 3 through Credit Guarantees) has not yet been addressed. In terms of this risk, Sindicatum addressed it both at project and corporate level.

At project level, it was possible to access funding from local banks. The financing in Philippine Peso allows to match the revenues, as these are paid in local currency according to the PPA. In this way, any local currency devaluation, would not cause a mismatch between assets and liabilities – when project debt is raised in foreign currency (e.g. USD or EUR) there could be a balance sheet currency mismatch, which becomes a risk to the project and its sponsors in case of a devaluation of the local currency as it makes the foreign currency debt too expensive to service.

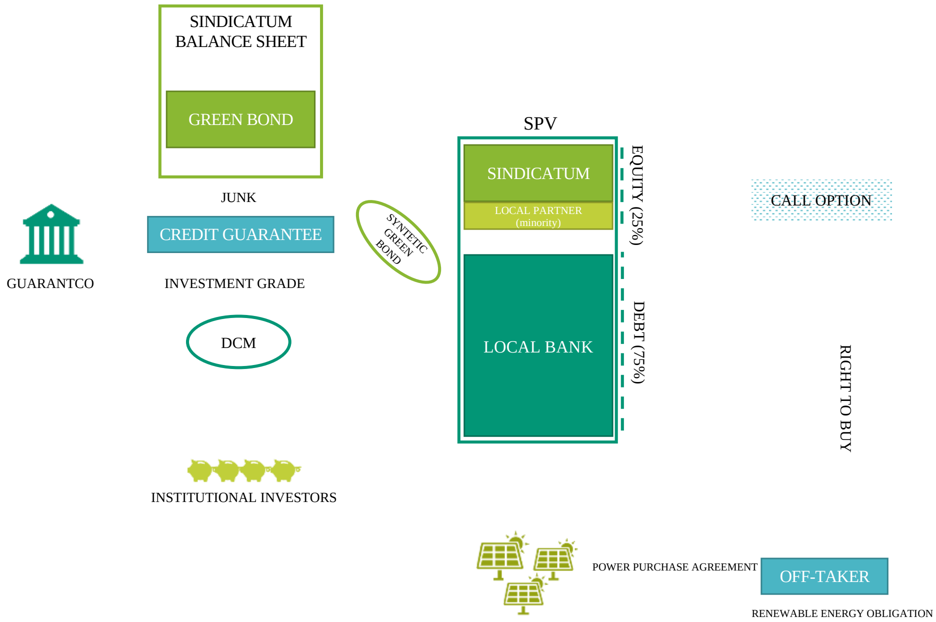
Since the project is held by a special purpose vehicle, Sindicatum also hedges its exposure at corporate level, as its balance sheet could face the same issues of the SPV. At corporate level, hedging can be more difficult to access, since the project are ring fenced in separate vehicles and currency hedges are very expensive and difficult to obtain for long durations. Nonetheless, Sindicatum managed to mitigate the risk even at corporate level by issuing local currency Green Bonds, effectively providing a hedge against the future revenues from the Solar plants. However, since Green Bonds issue are not easy to issue for an unrated renewable developer in Southeast Asia, Sindicatum used an instrument proposed in Chapter 3: A Credit Guarantee issued by GuarantCo, a Development Finance Institution sponsored by the government of the UK, Switzerland, Australia, Sweden and the Netherlands.

Being a Credit Guarantee, GuarantCo ensures investors the payment of coupons and principal repayment contractually due by Sindicatum. In case of insolvency, GuarantCo takes over the repayment of the bond and satisfies the investors on Sindicatum behalf. The consequence is that in the eyes of investors the credit risk is no longer represented Sindicatum, but by GuarantCo, which has a higher rating of A1 according to Moody's. Therefore, the green bond issued has an improved risk profile compared to a standard obligation, achieving the target level of "investment grade" fundamental for many institutional investors.

The Philippine Peso Green Bond, worth c. $20mln[3], was issued in 2018 with a maturity of ten years (hence maturing in 2028). This transaction followed earlier Green Bond tranches in Indian Rupees which had shorter maturities, therefore enabling Sindicatum to raise capital from investors with different holding periods. Although the coupons and notional capital are in US dollars, they are indexed to the USD/PHP exchange rate: the consequence is that although paid in hard currency, the repayment actually follows the Philippine Peso.

The Green Bond transactions were very successfully received by the market, also thanks to its "green" factor: indeed, according public information, some of the investors were interested in the investment mainly because of the "green" status, as it could mitigate the carbon footprint of their company. The complete structure of the deal is represented in Figure 18.

Figure 18: Structure of Solar Energy Investment in the Philippines



Source: Author's Representation

The Credit Guarantee actually validated the proposition made in Chapter 3 that it enables to overcome some investors hurdles since it generated the following positive effects:

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[3] A simplified version of the bond has been presented. Indeed, the total funding was ca. $60m and also included tranches in Indian Rupee to mitigate currency risk of some projects located in India that are not discussed in this thesis.

I. Currency Risk mitigation.

II. Decrease in the cost of funding and enhanced project's returns. Indeed, thanks to its improved credit profile the cost of capital was 7%, in line with local government bonds, whereas without the Guarantee it could have been much higher;

III. Increased maturity (more suitable for infrastructure investments) and improved A/L management. Even assuming that Sindicatum could have issued a bond without guarantee, it would have been impossible with a maturity beyond five years especially since, as indicated in the interviews, the local debt markets have a strong preference for shorter maturity bonds.

IV. Appetite for a bond that is essentially illiquid and from an issuer with limited market recognition in a sector that is now starting to develop in Southeast Asia.

Success factors

To wrap up, the solar project financing was successfully closed due to a number of factors that positively contributed to the deal and that should be streamlined by all the investment teams:

- Effective Risk mitigation strategy based on: (i) use of Credit Guarantees (ii) effective screening of the offtaker to mitigate revenue risk (iii) establishment of an EPC agreement to mitigate construction risk (iv) regional expertise and track record to mitigate political risk and "price" them;
- Access to local debt. Not only Sindicatum managed to mitigate local currency volatility, but the access to local debt also improved the risk-return profile, as it was already available in the construction phase;
- Influential local partner. If necessary, it could play an intermediary role with the local government; its presence is also relevant to decrease the perceived risk of an international investor.

The case study was also a tool to analyse the validity of what was proposed in Chapter 3, i.e. the use of guarantees offered by multilateral banks to bridge, together with other catalytic financial instruments, the financing gap. In particular, it provided a practical application of the Credit Guarantee proposed in Chapter 3 with the aim of evaluating its attractiveness for private investors. Analysing the Philippine solar plants being constructed there has been cheaper funding for the sponsor, but also managed to catalyse institutional investors through the purchase of Green Bonds. Moreover, the interest of institutional investors in this asset class was confirmed by their interest in the bond issued, highlighting that the main problem is not the attractiveness of the sector, as stated in the thesis, but rather the conditions of a market still underdeveloped and in need of public institutions support being in its early years.

Further and more comprehensive conclusions will be drawn below.

CONCLUSIONS

At the outset of the thesis it was analyzed the demand in the Asian energy sector. In particular, it was pointed out the existence of a growing market in the South East Asian region, with energy consumption doubled from 2000 to today. The reasons behind the growing demand was identified in an intercorrelation of various macro trends including population growth, urbanization, geopolitical power shift and industrialization. Thus, it was noted the importance of focusing on a high-growth market whose sustainability is essential to comply with the Paris Agreements in order to reduce global warming. It was also noted that, although several countries in the region have set ambitious targets in terms of renewable energy growth, these are still insufficient or lack of an effective implementation plan: in fact, while emissions have increased in recent years, emissions should decrease by 3.8% annually until 2040 to comply with the Paris Agreement.

This background set the stage of the thesis, that has the aim of identifying innovative financial structures to facilitate the birth of a liquid and profitable renewable energy market.

This purpose was based on the considerations that the main obstacles faced so far by private investors are not the lack of interest in the sector, but rather structural problems peculiar to the infrastructure sector in developing countries. In fact, as illustrated in the first chapter, the renewable energy competitiveness in recent years has increased exponentially, to the point of becoming the cheapest energy resource in circulation. The emblematic example proposed is the solar energy costs, which in the last decade has gone from 359$/MWh to 40$/MWh: cheaper than any other fossil source.

In addition, by assessing the financial structure of a renewable energy investment, it appeared interesting for the private sector, and in particular for institutional investors, indicated by the thesis as the possible drivers of energy change. In fact, it was assessed that not only an investment in renewable Power Plant can provide a risk-adjusted return (at least) in line with traditional asset classes, but also offer strong protection against financial shocks, as demonstrated by analyzing the performance of the various asset classes during the Global Financial Crisis. In addition, the structure of an investment in renewable power plants seems to be similar to that of a bond, the preferred instrument of insurance companies and pension funds. Thanks to their low operating costs, front loaded capital structure, risk profile and predictable cash flows, power plants have great potential to catalyse institutional investors, especially if they invest while the plant is in the operational phase. However, despite the potential of the market (on the one hand high demand, on the other hand interesting investment for the private sector), in Chapter 2 a strong mismatch between supply and demand in the Asian infrastructure sector was highlighted, giving rise to a huge financing gap. In fact, in Southeast Asia it was estimated an infrastructure financing gap of $300bn over the period 2016-2020, or 5% of the GDP of the area.

By analysing the renewable energy demand over the next decade, a financing gap of €408bn is expected, which is necessary to bridge in order to comply with the renewable energy targets declared by local governments. Moreover, as has been illustrated throughout the thesis, these targets do not even seem to be sufficient to reduce emissions required by international treaties: the investments should be greater and the financing gap potentially wider. Hence, it seemed clear the need to investigate the causes of this financing gap and the motivations behind it, with the aim of proposing some possible solutions to catalyse private investments that could bridge this gap.

As it was assessed, one of the main difficulties encountered by international investors is to deal with the political and economic instability of the region. Lack of incentives, inconsistent rules, strong fossil fuels lobbies and local currency instability all contribute to define the policy risk as one of the key factors to address. At the same time, another structural barrier identified is related to access to capital, not only motivated by a weak banking sector, but also by an underdeveloped debt and equity capital markets. As discussed, the consequence is the difficulty in obtaining local currency debt exposing sponsors to currency mismatch between the revenues generated by the facility (in local currency) and debt (in hard currency). The absence of a pipeline of readily investable projects was presented as a further obstacle to the development of the renewable energy market, as it increases the illiquidity - already high - of the sector and does not guarantee the deal flow required by international operators. Finally, when evaluating investments in renewable power plants, it was highlighted that international operators face two more problems: local and sectorial expertise and scale constraints. The former has as one of the consequences the inability to price liquidity risk; the latter implicates that no more than150 pension and insurance funds can afford direct investments in renewable energy while ensuring adequate diversification and limited exposure to illiquid sectors. Although these operators still represent $25tn of AUM, an alternative approach would be required to expand the market to less sophisticated operators.

These 5 main barriers for investments have been discussed in Chapter 3 along with other smaller ones. Three of these barriers seem to be related to the local energy market (policy risk, access to capital, project pipeline) while the remaining two (local and sectorial expertise and investor's scale) are due to an inadequate private sector. Since these problems are on two different levels, two solutions have been proposed, one operating at project level, the other operating at fund's level. The latter proposes indirect investments (not managed by an internal investment team, but by an external fund manager) and an innovative infrastructure fund design, based on a "layered and thickened" system. Layered because the proposed structure does not provide equal rights to the fund's unit-holders, but rather is based on different tiers whose remuneration is based on a cash waterfall concept. Thickened because it is based on the establishment of 3 sub funds each one specialized in a specific investment phase of the power plant and subscribed by the investor that can bear with its risk-return profile (different in its development, construction or operational phase). The structure, participated by a mix of public and private capital (blended finance), aims to catalyse private investors by exposing public funds - for a limited period - to those risks that are not sustainable for the private sector. The aim of the proposal is to mitigate some barriers at the basis of the financing gap such as lack of expertise, diversification risk, project pipeline and investor scale.

The other proposal, operating at project level, aims to present a series of risk mitigation tools made available by Development Financial Institutions with the aim of overcoming market inefficiencies. Among the tools outlined are government guarantees, political risk insurances, partial risk guarantees and Credit Guarantees.

These paired with a careful risk mitigation strategy aims to overcome several remaining barriers: illiquidity of the capital market, exposure to currency risk and political instability, offtaker risk and transmission line risk.

The risk mitigation strategy and the guarantees granted by multilateral banks were the basis of the case study in Chapter 4: in the case study that was selected, a DFI such as GuarantCo granted a Credit Guarantee on a green bond issued by Sindicatum Renewable Energy for a renewable power plant in the Philippines. Thanks to interviews with the sponsor's CFO, it was possible to evaluate the effectiveness of these mechanisms proposed throughout the thesis.

- In terms of private-capital catalytic potential, the Credit Guarantee was in line with expectations. In fact, the project sponsor was able to access the capital of institutional investors in the debt capital market. The positive element to note is that both Sindicatum and institutional investors would not have issued or subscribed the bond without the state guarantee. In fact, as repeatedly pointed out by the CFO of Sindicatum, without the Guarantee which enhanced the bond's rating, it would not have been possible for them to access the DCM. In fact, the green bond would have been rated as "junk" and would have had to offer a premium of 4-500bps compared to the issued one (coupon of 7%). Likewise, institutional investors would not have been able to participate in the renewable sector market, as a junk bond in Philippine Peso would have been too risky for them. Hence, the Guarantee proposed was able to catalyse private capital that wouldn’t have invested in the sector otherwise.

In addition to that, it also provided collateral benefits important to overcome some barriers faced by private investors:

- In terms of currency risk, the instrument allowed Sindicatum to obtain debt in local currency, avoiding a risk that would have been difficult to manage. At the same time, the sponsor was also able to decrease its cost of capital, essential for some projects to be economically viable.
- By reducing the risks of the deal, the Guarantee was able to indirectly increase the risk return profile of the investment. This could catalyse investors who are still sceptical about the returns offered by the industry, prompting institutional funds to set up investment teams with track record, thus helping to break down an additional barrier identified in Chapter 2.
- The Guarantee mechanism contributed to the development of the local debt capital market, increasing its accessibility and transparency. An active DCM is essential as one of the barriers identified was the size of local banks, often inadequate for large deals. In this context, it certainly provides an alternative access to local currency financing.

To wrap up, the case study validated some of the proposals made in Chapter 3, and in particular the value of the Credit Guarantee to catalyse institutional investors.

From another point of view, following the interview with the CFO of Sindicatum, some issues were identified with regard to another proposed instrument: the political risk guarantee. In fact, it seems that this other risk mitigation tool is not easily available due to opacity and lengthiness of the authorization process. However, as suggested by the case study, sectorial expertise and the presence of a local partner can partially substitute certain regulatory risks. Nonetheless, the potential of a Political Guarantee could be similar to the Credit Guarantee previously analysed. For its proved catalytic potential, institutions are called upon to implement transparent and lean processes if they actually want to contribute to bridge the financing gap.

In conclusion, it seems that some of the proposed instruments can effectively catalyse private investors and contribute to close the financing gap. However, even if they are necessary, they can hardly be sufficient, as the gap is massive and some structural barriers can only be temporarily addressed by Multilateral Banks. In this respect, governments must act on their own to increase the stability of the country and improve the business conditions. Stability of the political system, credible reforms, bureaucratic speed, transparency, efficient power management system and market liquidity incentives are the starting points.

In addition, since the proposed instruments are financed with public funds, they are designed to be a temporary and not permanent solution. In fact, as confirmed in an interview with a former employee of the Green Climate Fund, the final solution will be a liquid and profitable market for institutional investors, together with the presence of sophisticated financial-market instruments such as derivatives in order to hedge the project at affordable prices.

SUMMARY

Southeast Asia is experiencing an intercorrelation of various macro trends such us demographic shift, emerging middle class, urbanization and industrialization. These trends pushed energy demand to almost double since 2000, growing by 3.4% per year and well above the world average of 2% per year. The increase in energy demand has been covered 85% by fossil fuels. Nevertheless, the use of renewable energy has also doubled in the last two decades, but now represents a mere 20% of the total energy demand (IEA, 2019). Southeast Asian nations have started to set medium- and long-term national targets for renewable energy and have also formally joined the Paris Agreement by committing to emission reductions. To date, it appears that all countries in the region have set target levels of renewable energy to be achieved by the next decade, although only a few of them have presented these targets together with a well-defined strategy (IRENA, 2018).

Taking into account the national renewable energy targets, the IEA is expected that by 2040 energy demand will be 60% higher than today with 62% growth in fossil fuels and 101% in renewables. Despite the growth in renewable energy, it seems insufficient as CO2 emissions would increase to a level of 2355 Mt CO2 from 1520 Mt CO2 today, very far from what is needed.

Much more will have to be done to be in line with the Paris Agreement, and governments will have to scale up even more capital. To further increase investments in renewable power plants, innovative ways of financing need to be explored, able to catalyse private investments by lowering funding costs, mitigating risks and building a strong pipeline of projects.

This background set the stage of the thesis, that has the aim of identifying innovative financial structures to facilitate the birth of a liquid and profitable renewable energy market.

This purpose was based on the considerations that the main obstacles faced so far by private investors are not the lack of interest in the sector, but rather structural problems peculiar to the infrastructure sector in developing countries. In fact, as illustrated in the first chapter, the renewable energy competitiveness in recent years has increased exponentially, to the point of becoming the cheapest energy resource in circulation. The emblematic example proposed is the solar energy costs, which in the last decade has gone from 359$/MWh to 40$/MWh: cheaper than any other fossil source. In addition, by assessing the financial structure of a renewable energy investment, it seems appealing for the private sector, and in particular for institutional investors, indicated by the thesis as the possible drivers of energy change. In fact, while the risk – return profile of an unlisted investment cannot be defined with certainty due to a lack of track record, according to several studies illustrated throughout the thesis they are at least comparable to other traditional asset classes and generate resilient returns. The financial profile of an infrastructure investment seems

particularly suitable for those looking for a non-volatile investment with a long holding period. For completeness, further variables should be taken into account in the investment process that can deeply affect the risk-return profile, such as the investment phase (i.e. development, construction or operational period) and the geographic location (i.e. developed or developing country).

In addition, renewable energy's equity investment profile is different from traditional infrastructure, to the extent that these assets can paradoxically have a bond-like cashflow structure to which institutional investors could be particularly interested. In fact, the main financial differences with traditional power plants, and the reasons why the cash flow structure could be similar to bond, are: low operating costs, low operating risks, high up-front capital costs and front-loaded risk profile and long-term / fixed-price offtake agreements.

Given the risk return profile and the financial structure of a renewable power plant, institutional investors could potentially drive a green energy transition. In fact, not only the financial profile matches their preferences, but they also represent the largest pool of capital in the world. However, this vast potential remains largely untapped so far. In fact, according to a survey conducted by Preqin (2019) on a sample of 5,800 institutional investors on their investments in the last two decades, 37% of them have invested in infrastructure and only 20% in renewable energy-focused funds, and only 1% have made investments directly in renewable energy projects. In fact, as analysed throughout the thesis, only large players invest in alternative asset classes, and only a percentage of them composed of even larger investors have the opportunity - or ability - to directly invest in renewable energy projects without having to hire fund managers, gaining in terms of investment suitability and transparency. As a consequence, despite the potential of the market (on the one hand high demand, on the other hand interesting investment for the private sector), a strong mismatch between supply and demand in the Asian infrastructure sector was highlighted.

Indeed, according to the Asian Development Bank (2017), excluding the developed regions of Asia Pacific, developing Asia requires during the period 2016-2030 $26trillion of infrastructure investments in order to maintain a growth trajectory that sufficiently eradicates poverty.

When comparing this estimate - in any case conservative - with current volumes in the region, one can see an important financing gap, defined as the difference between the recommended or estimated infrastructure investment needs for a country and its actual infrastructure investment over recent years. For example, over the period 2016-2020, in the Southeast region, the infrastructure financing gap amounted to $300bn, or as much as 5% of the region's GDP.

While the infrastructure sector shows a chronic underinvestment in the region, the renewable energy sector may suffer the problem even more given its demand growth and the ambitious target of neutralizing CO_2 emissions. In fact, the five largest economies in Southeast Asia will require a total flow of $408bn of investments in renewable energy, divided over a period of 13 years in order to comply with the renewable energy targets declared by national governments. Moreover, as has been illustrated throughout the thesis, these targets do not even seem to be sufficient to reduce emissions required by international treaties: the investments should be greater and the financing gap potentially wider.

Hence, it is clear the need to investigate the causes of this financing gap and the motivations behind it, with the aim of proposing some possible solutions to catalyse private investments that could bridge this gap. With the aim of finding financial solutions, several barriers have been highlighted that hinder private investors to enter the market and that need to be addressed to close the financing gap.

1. Governments and their regulations are probably the main issue when dealing with infrastructure investment. This is even more important for innovative and sustainable sectors such as renewable energy, which has to compete with well-positioned players in the fossil fuel industry with influential lobbies. As a consequence, all private investors in the sector underline policy risk as the main obstacle that constrains their investments (Climate Policy Initiative, 2013). Policy barriers arise from the lack of a clear strategic and regulatory framework, or inconsistent policies such as shift of direction and interruption of regulatory incentives. Moreover, long-term planning by governments is also crucial for the success of renewable energy investments, as they tend to have long term profit horizons that make them incompatible with constant policy shift and change of direction. While the issue is well known, governments often find it difficult to adopt solutions due to the complexity of the energy sector. Moreover, it intertwines with the protection of pension and insurance fund depositors, resulting in a series of complex regulations which, although taken individually are essential, end up complicating the sector even having an opposite effect.
2. In many Southeast Asian countries, the capital market is still undeveloped, credit and equity markets are shallow and there is little liquidity. The difficulty is even greater when projects involve renewable energy. Several banking institutions are hesitant to develop renewable energy specific business lines, due to high learning costs and new procedures to be adopted when some of the technologies have no track record of revenue generation (Green Climate Fund, 2017). The issue of access to credit has both a purely banking motivation, linked to the cost of financing which may be too high for the reasons just mentioned, and an external factor given the underdeveloped financial markets, that can have important consequences in the implementation of renewable energy projects, including the difficulty of borrowing money in local currency. In fact, in this type of projects, the

revenues generated by the energy power plant are in local currency and this can create an important mismatch with the liabilities of the developer if he has borrowed in foreign currency. What happens in this case is an exposure in terms of currency risk, which is particularly high for projects in developing countries where the currency is not yet stabilized.

3. There seems to be a lack of investment-ready or bankable projects with an attractive value proposition able to mobilize private investors, especially those looking for long and stable cash flows for which an adequate risk mitigation strategy is essential. About 70% of the investment pipeline available to equity investors is greenfield projects, but institutional investors consider them much riskier than brownfield projects with demonstrated returns.

4. Generally, as liquidity is one of the greatest risk institutional investors face, they prefer to hold a certain amount of cash coupled with other highly liquid asset classes, such as stocks and bonds. These assets are easily manageable for them, because even though they manage a large portfolio, they can invest small amounts in many companies or sectors, allowing them to sell their exposure whilst minimising the risk of large losses. In this way, they increase the liquidity of the portfolio and reduce risks. Beyond these traditional asset classes, the less liquid includes private equity, followed by real estate and, at the end, the infrastructure to which the renewable sector belongs (Beeferman, 2008).

As a matter of fact, direct investments in renewable power plants have high transaction costs, the lock-in period is the longest and there is no constant deal flow that allows to sell the asset at any time.

5. Only very sophisticated institutional investors can afford direct investments. In fact, to build an internal investment team, paying external advisors and provide diversification, it seems necessary to have a minimum deal size of $100mln and a portfolio of at least 5-10 assets to ensure diversification and a discrete deal flow. Therefore, a project portfolio of about $500mln or $1bn seems the minimum necessary, to be then weighted for its illiquidity risk. To balance the overall exposure, allocations in direct infrastructure investments are usually no more than 1% of the investor's total AuM, and therefore the target investor should have an overall minimum portfolio of around $50bn if not $100bn.

Taking these considerations into account, the result is that there are probably 45 pension funds and 70-100 insurance companies that are large enough to afford this type of investment.

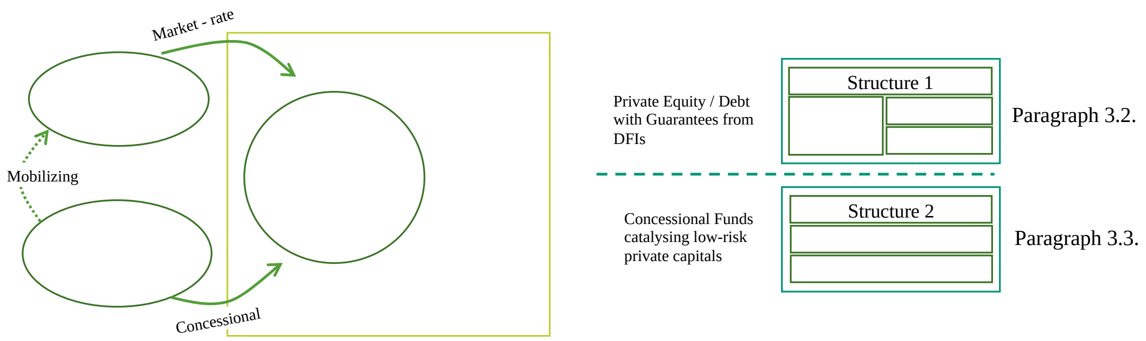
As a result, the difficulties in making the renewables a sector able catalyse institutional investors' capital are different. Risk assessment and mitigation seems to be one of the key barriers to overcome. In fact, although returns may be higher than traditional asset classes, they have to be weighted for risk. A good risk mitigation strategy can lead to higher risk adjusted returns and could persuade institutional investors to implement specific investment teams and at the same time bridge the financing gap in the renewable energy sector.

The barriers highlighted seem to have two different sources: one related to the local energy market (policy risk, access to capital, project pipeline) the other (local and sectorial expertise and investor's scale) related to an inadequate private sector. Since these problems are on two different levels, two solutions have been proposed, one operating at project level, the other operating at fund's level.

The first operates at the level of the individual project, directed at Developers/Asset managers so that they can make projects economically viable through risk mitigation, enabling them to attract private capital, the second at fund or fund-of-fund level that should be implemented by governments and MDBs, operating on a multi-project basis. In the first case, risk mitigation instruments are identified at project level as a way for developers / asset managers to increase the investment's risk-adjusted returns. In the second case fund schemes are proposed that invest in renewable energy with private and public capital, but with a structure that allocates an appropriate level of risk to each investor

The instruments proposed are generally made available by inter-governmental institutions such as Development Finance Institutions or Multilateral Development Banks and are set up with the specific aim of leveraging private capital into projects that would not otherwise be financed by the private sector. More specifically, these solutions could be labelled as catalytic financing, and they refer to financial structures with a mix of private and public funds that seek to attract private investment. This mix of public and private capitals is often referred to as Blended Finance solutions.

Figure 19: Blended Finance Mechanics and Structures



Source: Author's Representation

- The first solution, operating at project level, aims to present a series of risk mitigation tools made available by Development Financial Institutions with the aim of overcoming market inefficiencies. Among the tools outlined:

Sovereign Guarantee and political risk insurance: they are guarantees that an obligation will be satisfied if the primary obligor defaults; usually they relate to payment defaults, but can cover other kinds of obligations and commitment (IRENA, 2020). This type of guarantees is issued by the country's Ministry of Finance or by Multilateral Banks such as ADB, World Bank and EIB and the mechanism usually includes penalty payments by the national government / multilateral bank. In particular, it could be useful to mitigate policy and regulatory risk and offtaker risk. Both crucial for a renewable energy project to be economically viable.

Partial risk guarantee: meant to cover a wider range of longer-term political risks, in particular a range of policy and regulatory risks, helping to increase the certainty of revenues. It can be used when there are government reforms or when government fails to implement the key provision of the regulatory framework (African Development Bank, 2013). One of its most important areas of application is commercial and revenue risk protection to which a developer is exposed when accessing the transmission line or national grid.

Partial Credit Guarantee: covers part of the debt service default by the borrower regardless of the reason for the inability to repay the loan. The instrument is usually offered by Multilateral Banks such as the Asian Development Bank, or by some Bilateral Banks, whose purpose is to facilitate access to credit for the developer through risk sharing between the lender and the guarantor. It can be used both to access credit from international banks and to facilitate the issuance of bonds on the financial markets. In such cases, the PCG can cover both the delay of a bullet principal payment and/or the interest payment or coupons of a bond (World Bank, 2007). PCGs are flexible and structured to cover a predetermined percentage of the credit risk: for example, the Asian Development Bank could provide a 50% Guarantee with the lender, ensuring that losses are shared accordingly. The natural consequence for the commercial bank is the lower risk to which it is exposed, thus being able to offer better terms and maturity. In addition, it is used to cover one of the main risks to which the developer is exposed: currency risk. The partial Credit Guarantee in this case can make a fundamental contribution, allowing for example the investor to issue bonds in local currency, but guaranteed by a high credit standing counterparty, with the consequence of decreasing the cost of capital. It is emblematic of how PCGs can be important not only in attracting capital from private banks, but also in boosting local financial markets and attracting institutional investors through bonds guaranteed by institutions with high credit risk. In addition, they allow the developer to design a project that is not exposed to currency risk, thus eliminating an additional uncertainty in the cash flow generated by the plant.

However, although the guarantees have shown not only the ability to change the risk perception, but also to improve lending terms and returns, (IRENA, 2016), their use is still largely insufficient. A survey by IRENA (2016), shows that only 4% of their total infrastructure risk mitigation issuance is dedicated to renewable investments. In addition, there seems to be an underutilization of guarantees mainly due to a lack of knowledge of the product, but also due to high transaction costs and long processing times. As a consequence, to analyse the validity of these tools proposed above, they are properly addressed through the case study in Chapter 4.

- The second mechanism proposes indirect investments (not managed by an internal investment team, but by an external fund manager) and an innovative infrastructure fund design, based on a "layered and thickened" system.

An investor, whether private or semi-public such as an MDB, can decide to invest in infrastructures in two ways: (i) directly financing the individual project (ii) allocating the capital to a fund managed by an asset manager, i.e. a team with expertise and track record in direct investment in infrastructure.

An indirect investment is based on the allocation of capital to an investment fund managed by an asset manager, who in turn uses this capital and the funds of other quota-holders, to invest in a number of renewable energy projects. The indirect investment, compared to the direct one, has some advantages:

Ability to deploy capital quickly on various infrastructure funds as there are already historical performance track records and data available;

Diversification, as the fund can raise capital from different institutions and thus manage a portfolio that couldn't have with only its own capital;

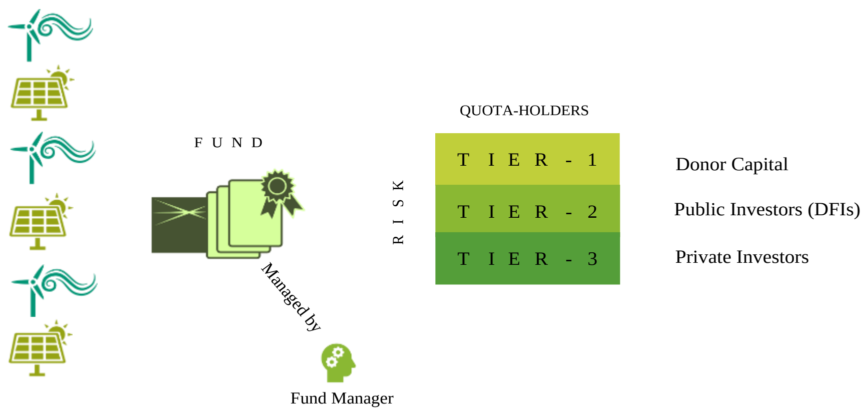
Access to the expertise of the fund manager who may be more experienced in investing in renewable energy than in-house teams;

Opportunity to participate in infrastructure projects even for less sophisticated investors.

By combining the structure of indirect investment with traditional instruments such as debt / equity (to target green power plants), and also with innovative structures defined below, it is possible to design new and more effective catalytic instruments.

Starting from the indirect investment strategy, it is possible to design an instrument that evokes home mortgages but than can be generalized for every asset producing cash flow: securitized products. The economic flow of a securitized product such as an MBS can be reshaped and adapted to indirect investments in renewable energy. Differently from the famous MBS, there will be no mortgages creating cash flows, but renewable energy plants of different sizes, held by an unlisted fund that is owned by private and public investors. The concept of risk diversification and segmentation into tranches with different level of risk also applies here. In fact, while the CDO is divided into tranches and sold at different levels of risks, in our case we have a portfolio of renewable assets, whose cash flows are collected in a single facility - the fund - that is divided in tranches each one having a different level of risk. The structure is summarized in Figure 14.

Figure 20: Layering the Investment Chain of an Indirect Infrastructure Investment



Source: Author's Representation

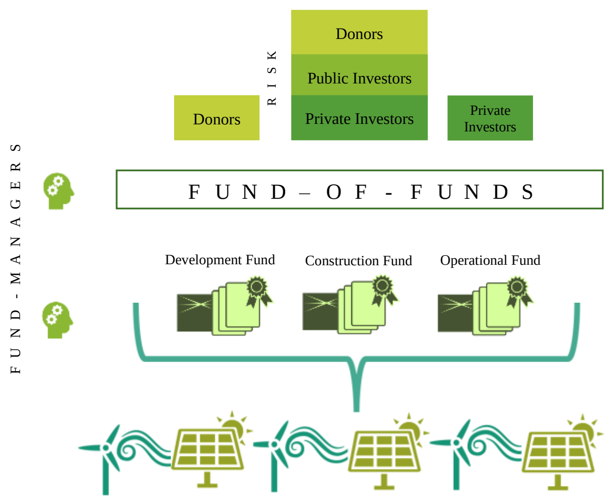
In this way, it is possible to aggregate investors with higher risk appetite (public investors, speculators, developers) to institutional investors with lower risk appetite (institutional investors) in one single facility. The consequence is to create a stratification in different tiers, where the tier 1 investor – ideally owning public catalytic capital - takes more risk (e.g. receives revenues only after the subsequent tiers have been satisfied in a certain percentage of their investment, or contribute to losses in a subordinate way), while tier 2 and 3 can be participated by the private sector which have a lower risk appetite and lack of knowledge of the market, and that have been attracted to this sector thanks to the knowledge and track record of public and specialized operators. To recap: renewable power plants generating cash flows are collected in a single fund, the quota-holders are layered in different tiers each one having different risk appetite. Remuneration is based on a cash-waterfall concept where tier 1 investors only receive dividends when the others are satisfied. This system is set to catalyse private capital by guaranteeing to the upper tiers a minimum guaranteed return.

The structure can be further complicated, but with additional benefits in terms of catalytic potential. The fund that has been "layered" will be now "thickened" in order that each phase of the project (development, construction, operation) can be addressed by the most appropriate investor, but through a single facility.

The model it's based on the peculiar the front-loaded capital structure of a renewable power plant, i.e. the large capital expenditure and high risks in the development and construction phases compared to the operational one. In fact, in the development phase the feasibility analysis involves expenses such as project due diligence (for which legal, accounting, financial advisors, etc. ...) with the risk that the project will never materialize. In the second phase, the construction phase, in addition to the large amount of capital to be employed, the sponsor is exposed to variables such as construction permits, site accessibility, regulatory reforms, etc. ... At the same time, the last phase when the plat is operative is less risky and has lower returns, hence it does not match the preferences of speculative investors or developers who want to free up capital to allocate in new projects. In short, each of the 3 phases is different and each one has a specific target investor with adequate financial structure.

Returning to the structure discussed so far of the indirect investment fund, stretched through various layers each exposed to a different risk, it is possible to establish 3 sub-funds, each of them dealing with one of the 3 specific phases (development, construction, operation), and each of these funds owned by a different type of investor. E.g. donors, developers and speculative investors in the first two phases of a renewable power plant (development and construction), institutional investors in the last (operations). The advantage is to allocate at each stage the most suitable investor to deal with it. Figure 15 exemplifies this structure.

Figure 21: Layering and Thickening the Investment Chain in an Indirect Infrastructure Investment



Source: Author's Representation

A structure designed in this way could be complementary to the risk mitigation strategy (in any case to be adopted at the individual project level) and overcome the remaining barriers:

Investor's scale. One barrier that was highlighted was the difficulty for smaller institutional investors to participate in the investment. In fact, only the most sophisticated of them could afford an infrastructure portfolio, due to its illiquidity and need to set up internal teams with specific expertise. In this case, the team is represented by external fund managers, chosen for their expertise and track record. Moreover, if a portfolio between $500mln and $1bn sounded the minimum necessary to justify the existence of an internal team and at the same time allow a diversification of risk, the ticket size to participate to an unlisted fund is much smaller, thus allowing smaller institutional funds to participate.

Risk perception: It has been said that risk is often considered excessively high, often due to political instability in the country and lack of expertise in the sector. In this sense, participating in an unlisted fund promoted by DFIs (owning the riskiest tier of the fund) is a kind of Guarantee for the private investor, who may feel comforted by their political influence.

Risk preferences: The subdivision into specific funds allows each investor to participate to the investment stage more suitable for its financial structure. In this sense, life insurance and pension funds can be allocated to the fund dedicated to the operational phase of the project, because it offers a bond-like financial structure. On the other side, developers could participate to the development phase by leveraging their track record and easily free up capital as the project reaches the operational phase.

Risk return profile: A lack of track record and public information where the main hurdles to identify the superiority of the infrastructure investment over traditional asset classes. The consequence was to push investors not to take risks and not to deal with its illiquidity cost. However, the layered structure could provide a much better risk-return profile, at least until public funds do not leave the market to private investors only.

In order to fully understand the complex structure just outlined, a practical example is presented throughout Chapter 3.

The last chapter aims to investigate empirically an investment into renewable power plants in South East Asia, identifying the success factors and its difficulties. The goal of the case study is to highlight the success factor of a deal, in order to provide some guideline for private investors not yet specialized in the sector. Furthermore, it investigates the validity of the Risk Guarantee mechanisms to catalyse private sector investments proposed in Chapter 3.

For this reason, the focus is on mitigation strategies, with a particular emphasis on Guarantees granted by Development Finance Institutions so as to understand their effectiveness to overcome private sector's hurdles. It is illustrated a transaction executed by Sindicatum Renewable Energy Company ("Sindicatum"), a developer, constructor and operator of renewable power plants in South East Asia. I was provided information to the transaction through a series of interviews with its CFO.

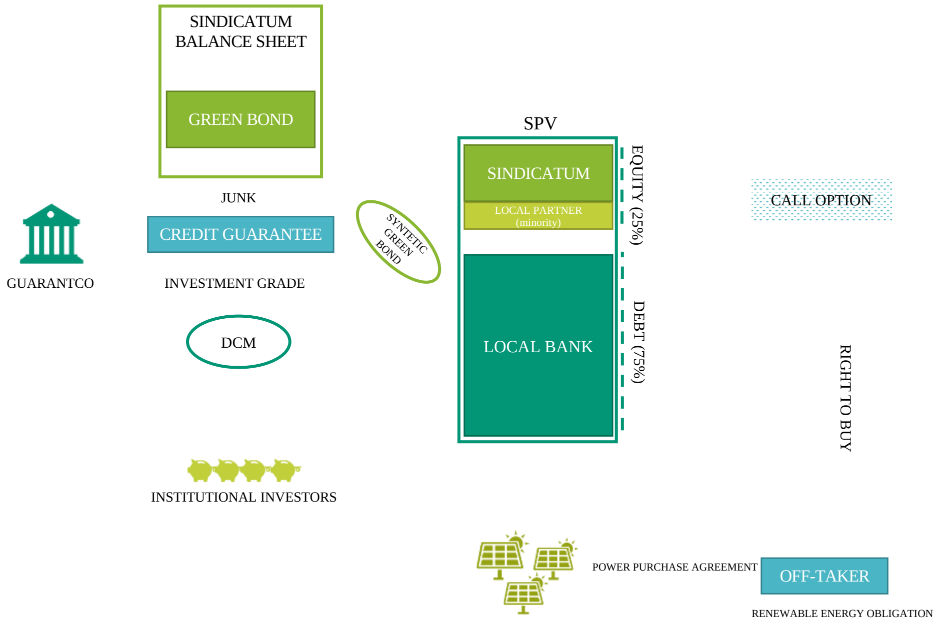
In particular, a DFI such as GuarantCo, a Development Finance Institution sponsored by the government of the UK, Switzerland, Australia, Sweden and the Netherlands, granted a Credit Guarantee on a green bond issued by Sindicatum Renewable Energy for a renewable power plant in the Philippines. This bond was essential for the project sponsor in order to mitigate currency risk and to decrease the cost of funding. Being a Credit Guarantee, GuarantCo ensures investors the payment of coupons and principal repayment contractually due by Sindicatum. In case of insolvency, GuarantCo takes over the repayment of the bond and satisfies the investors on Sindicatum behalf. The consequence is that in the eyes of investors the credit risk is no longer represented Sindicatum, but by GuarantCo, which has a higher rating of A1 according to Moody's. Therefore, the green bond issued has an improved risk profile compared to a standard obligation, achieving the target level of "investment grade" fundamental for many institutional investors.

The Philippine Peso Green Bond, worth c. $20mln[4], was issued in 2018 with a maturity of ten years (hence maturing in 2028). This transaction followed earlier Green Bond tranches in Indian Rupees which had shorter maturities, therefore enabling Sindicatum to raise capital from investors with different holding periods. Although the coupons and notional capital are in US dollars, they are indexed to the USD/PHP exchange rate: the consequence is that although paid in hard currency, the repayment actually follows the Philippine Peso.

Although only partially addressed in the summary, the comprehensive financial structure of the project can be summarised in Figure 18.

[4] A simplified version of the bond has been presented. Indeed, the total funding was ca. $60m and also included tranches in Indian Rupee to mitigate currency risk of some projects located in India that are not discussed in this thesis.

Figure 22: Structure of Solar Energy Investment in the Philippines



Source: Author's Representation

As resulted from the empirical evidence, it was possible to evaluate the effectiveness of the use of guarantees proposed throughout the thesis.

- In terms of private-capital catalytic potential, the Credit Guarantee was in line with expectations. In fact, the project sponsor was able to access the capital of institutional investors in the debt capital market. The positive element to note is that both Sindicatum and institutional investors would not have issued or subscribed the bond without the state guarantee. In fact, as repeatedly pointed out by the CFO of Sindicatum, without the Guarantee which enhanced the bond's rating, it would not have been possible for them to access the DCM. Indeed, thanks to its improved credit profile the cost of capital was 7%, in line with local government bonds, whereas without the Guarantee it could have been much higher. Likewise, institutional investors would not have been able to participate in the renewable sector market, as a junk bond in Filipine Peso would have been too risky for them. Hence, the Guarantee proposed was able to catalyse private capital that wouldn't have invested in the sector otherwise.

In addition to that, it also provided collateral benefits important to overcome some barriers faced by private investors:

- In terms of currency risk, one of the main barriers for international investors in developing countries, the instrument allowed Sindicatum to obtain debt in local currency, avoiding a currency mismatch (between revenues and interest payments) that would have been difficult to manage. At the same time, the sponsor was also able to decrease its cost of capital, essential for some projects to be economically viable.

- By reducing the risks of the deal, the Guarantee was able to indirectly increase the risk return profile of the investment. This could catalyse investors who are still sceptical about the returns offered by the industry, prompting institutional funds to set up investment teams with track record, thus helping to break down an additional barrier identified in Chapter 2.
- The Guarantee mechanism contributed to the development of the local debt capital market, increasing its accessibility and transparency. An active DCM is essential as one of the barriers identified was the size of local banks, often inadequate for large deals. In this context, it certainly provides an alternative access to local currency financing.

To wrap up, the case study validated some of the proposals made in Chapter 3, and in particular the value of the Credit Guarantee to catalyse institutional investors.

From another point of view, following the interview with the CFO of Sindicatum, some issues were identified with regard to another proposed instrument: the political risk guarantee. In fact, it seems that this other risk mitigation tool is not easily available due to opacity and lengthiness of the authorization process. However, as suggested by the case study, sectorial expertise and the presence of a local partner can partially substitute certain regulatory risks. Nonetheless, the potential of a Political Guarantee could be similar to the Credit Guarantee previously analysed. For its proved catalytic potential, institutions are called upon to implement transparent and lean processes if they actually want to contribute to bridge the financing gap.

In conclusion, it seems that some of the proposed instruments can effectively catalyse private investors and contribute to close the financing gap. However, even if they are necessary, they can hardly be sufficient, as the gap is massive and some structural barriers can only be temporarily addressed by Multilateral Banks. In this respect, governments must act on their own to increase the stability of the country and improve the business conditions. Stability of the political system, credible reforms, bureaucratic speed, transparency, efficient power management system and market liquidity incentives are the starting points.

In addition, since the proposed instruments are financed with public funds, they are designed to be a temporary and not permanent solution. In fact, as confirmed in an interview with a former employee of the Green Climate Fund, the final solution will be a liquid and profitable market for institutional investors, together with the presence of sophisticated financial-market instruments such as derivatives in order to hedge the project at affordable prices.

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