Energy Transition through Business Model Innovation - Governance, Actors, and Partnerships

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Abstract

The global energy sector is transforming towards a zero-carbon future, known as the energy transition. This thesis explores the role of business model innovation in facilitating this transition and goes deep through different business models, governance structures, key actors, and partnership dynamics involved. The European Union's commitment to reducing greenhouse gas emissions and achieving climate neutrality by 2050 presents a pressing challenge and an opportunity to build a sustainable future. While moving toward a climate-neutral society involves a number of industries and sectors, including power, industry, mobility, agriculture, and forestry, this thesis concentrates on the residential sectors, which use a significant amount of energy. However, the current energy renovation rate for European buildings must meet the required levels to achieve the energy transition goals. To address this, the thesis investigates various pre-existing energy contracting models and their potential to engage communities and individuals in renewable energy adoption and enhance energy efficiency.

Through interviews, questionnaires, literature review, surveys, and rigorous analysis, the study assesses the suitability of different energy contracting models from political, economic, and social perspectives. By examining the stakeholders' attitudes, insights are gained into the most effective approaches for promoting energy transition and sustainable practices. The research underscores the significance of stakeholder involvement within energy business models in driving energy efficiency initiatives and promoting renewable clean energy projects. By identifying the most suitable models and highlighting their benefits, this thesis aims to contribute to the broader understanding of sustainable energy practices and provide insights for policymakers, businesses, and communities to accelerate decarbonization.

Keywords: Energy transition, business model innovation, stakeholder involvement, energy efficiency.

Riassunto

Il settore energetico globale sta attraversando una trasformazione verso un futuro a zero emissioni di carbonio, conosciuto come transizione energetica. Questa tesi esplora il ruolo dell'innovazione dei modelli di business nel facilitare questa transizione e approfondisce diversi modelli di business, strutture di governance, attori chiave e dinamiche delle partnership coinvolte. L'impegno dell'Unione Europea nel ridurre le emissioni di gas serra e raggiungere la neutralità climatica entro il 2050 rappresenta una sfida urgente e un'opportunità per costruire un futuro sostenibile. Sebbene la transizione verso una società climaticamente neutrale coinvolga vari settori come energia, industria, mobilità, agricoltura e silvicoltura, questa tesi si concentra sul settore residenziale, che rappresenta una parte consistente del consumo energetico. Tuttavia, il tasso attuale di ristrutturazione energetica degli edifici in Europa è molto al di sotto dei livelli richiesti per raggiungere gli obiettivi della transizione energetica. Per affrontare questo problema, la tesi investiga diversi modelli preesistenti di contratti energetici e il loro potenziale nel coinvolgere comunità e individui nell'adozione di energie rinnovabili e nell'aumento dell'efficienza energetica. Attraverso interviste, questionari, revisione della letteratura e analisi rigorose, lo studio valuta la fattibilità dei diversi modelli di contratti energetici dal punto di vista politico, economico e sociale. Esaminando le opinioni degli stakeholder coinvolti, si acquisiscono informazioni sulle approcci più efficaci per promuovere la transizione energetica e le pratiche sostenibili. La ricerca sottolinea l'importanza del coinvolgimento degli stakeholder nei modelli di business energetici per guidare le iniziative di efficienza energetica e promuovere progetti di energia rinnovabile pulita. Identificando i modelli più adatti e mettendo in evidenza i loro vantaggi, questa tesi mira a contribuire alla comprensione più ampia delle pratiche energetiche sostenibili e a fornire spunti per i responsabili delle decisioni politiche, le imprese e le comunità al fine di accelerare la decarbonizzazione.

Parole chiave: Transizione energetica, innovazione dei modelli di business, coinvolgimento degli stakeholder, efficienza energetica.

Abbreviations

EC: Energy Community

REC: Renewable Energy Community

ESCO: Energy Saving Contracting

EPCO: Energy Performance Contracting

ESPC: Energy Saving Performance Contracting

B2B: Buisiness to Buisisness

B2C: Business to Consumers

QCA: Qualitative Comparative Analysis

EP: Energy Performance

EE: Energy Efficiency

BMs: Business Models

PPP: Public–Private Partnership

VPP: Virtual Power Plant

PPA: power purchase agreement

P2P: public-public partnerships

NZE: Net Zero Emissions

GHG: Greenhouse gas

IPCC: Intergovernmental Panel on Climate Change

PPA: Power Purchase Agreement

PACE: Property-Assessed Clean Energy

SWOT: Strengths, Weaknesses, Opportunities, and Threats.

PESTEL: Political, Economic, Sociocultural, Technological, Legal, and Environmental

ECC: EPCOs, Community Energy, Crowdfunding

M&V Process: Measures and Verification Process

Ron: Relevance of Necessity

CovS, coverage for sufficiency

CsQCA: crisp-set QCA

FsQCA: Fuzzy-set analysis

MvQCA: The multi-value

BHM: Business Hyper Model

EecC: Fusion of ESCOs, Energy communities, and Crowdfunding

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1. Introduction

1.1 Problem Statement

According to the Intergovernmental Panel on Climate Change (IPCC), slowing global warming is urgent because of its devasting impact on both nature and human beings. The impacts on nature are already visible, including rising sea levels and extreme weather events like floods, droughts, and brushfires (IPCC, 2022). For human beings, the health consequences of higher temperatures in the future could be severe, and issues of food security and migration could have dramatic political consequences and even lead to civil unrest (European Commision, n.d). The Intergovernmental Panel on Climate Change (IPCC), and the United Nations body for assessing the science related to climate change, warn that global warming from pre-industrial levels must not exceed 1.5°C in order to avoid irreparable damage to the planet. That is why 196 countries joined together in 2015 with a pledge to slow global warming by cutting emissions and other steps by signing the Paris Agreement, the world's first comprehensive climate change agreement. The goal is to hold the increase in the global average temperature to well below two °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C (UNFCCC, 2016). In just a few decades, countries worldwide are working to replace fossil fuels with zero-carbon energy from clean sources like wind, solar, and hydro to halt an unprecedented increase in temperature that major international scientific bodies have linked to carbon emissions from fossil fuels. The EU is doing its part, committed to reducing greenhouse gas emissions by at least 55% by 2030 compared to 1990 under its more comprehensive 2030 climate and energy framework. This target paves the way for achieving climate neutrality in the EU by 2050 (EEA, 2023).

The Intergovernmental Panel on Climate Change stated: "The Net Zero Emissions by 2050 Scenario (NZE) is a normative IEA scenario that shows a pathway for the global energy sector to achieve net zero CO_2 emissions by 2050, with advanced economies reaching net zero emissions in advance of others". The European Union also has set a goal to achieve climate neutrality by 2050, creating an economy that emits no greenhouse gases. This objective is a central aspect of the European Green Deal. It aligns with the EU's promise to support international efforts to tackle climate change as outlined in the Paris Agreement (European Commision, n.d). These goals can only be met with achieving the energy transition. The transition to a climate-neutral society is both an urgent challenge and an opportunity to build a better future for all. All parts of society and economic sectors will play a role – from the power sector to industry, mobility, buildings, agriculture, and forestry. The EU can lead the way by investing in realistic technological solutions, empowering citizens, and aligning action in key areas such as industrial policy, finance, and research while ensuring social fairness for a just transition.

The first European Climate Law, which would have codified the 2050 climate-neutrality target, was proposed by the Commission on March 4, 2020, as a component of the European Green Deal. Therefore, Europe has pledged to lead on climate action and set ambitious goals and directives to achieve that commitment (European Commision, n.d). The Horizon 2020 and Horizon Europe research and innovation programs, the European Green Deal, and other European Union policies and directives propel European Member States towards a 55% cut in emissions by 2030 and climate neutrality by 2050 (European Council, 2023). The EU provided the United Nations Framework Convention on Climate Change (UNFCCC) with its long-term strategy. Given that the Paris Agreement provides a set of requirements to those who have already signed this important worldwide agreement, it requires EU Member States to produce long-term national strategies on how they intend to accomplish the greenhouse gas emission reductions required to satisfy EU objectives. The Programme Horizon is one of the primary key projects consisting of several sub-project which aim to achieve this goal for instance, As part of the Horizon Europe program, the EU has launched a Mission "100 Climate-Neutral and Smart Cities by 2030" (Horizon Europe, 2023). The mission's objectives are to achieve 100 climate-neutral and smart European cities by 2030 and to ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050 (Horizon Europe, 2023).

1.2 FinSESCO Project

ERA-NET Cofond under Horizon 2020 is a type of program co-fund action designed to support public-public partnerships (P2Ps), including joint programming initiatives between Member States, in their preparation, the establishment of networking structures, design, implementation, and coordination of joint activities.

The project FinSESCo is an ERANET 2020 project uniting single projects in 5 countries (Germany, Austria, Romania, Spain, and India). Local funding is provided by the national funding entities and their managing bodies. The project started to differentiate between the countries. In Austria and German, the project started on May 1, 2022. The aim is to revive contracting for the renovation of buildings and investments in renewable energy converters in/on buildings and mobilizing money from private investors via crowd investing by re-using data created during the building assessment in the Energy Performance Certification. Such data, often stored as XML, allows calculating savings by applying deep renovation and exchange of energy converters. Such decarbonization rate shall be advanced. Information from previous projects is offered to investors and project owners. This allows the rating of project types and project owners and the selection of the best energy contracting model for property owners. The big challenge of the project is deploying artificial intelligence for compiling renovation projects from asset-based Energy Performance Certification (EPC) derived data. Co-financing comprises the HORIZON EU fund.

1.3 Research Objectives

Regarding the FinSecso project, several stakeholders are involved with this project, including homeowners and Tenants, as well as Energy Companies - Municipalities - Banks, which in some cases, they posed in the context of the energy community or the energy community.

This thesis examines and identifies practical approaches for achieving the energy transition, focusing on innovative business models. The aim is to explore various energy business models and contracting strategies to determine the most suitable model for engaging different stakeholders, fostering partnerships, and ensuring flexibility within the European context. It is assumed that the success of energy transition initiatives relies on the active participation and collaboration of all relevant stakeholders.

To address this objective, the research will comprehensively analyse different energy business models, investigating their key characteristics, mechanisms, and real-world outcomes. Factors such as financial feasibility, regulatory frameworks, governance structures, and community engagement will be considered in the analysis.

Furthermore, this thesis aims to provide recommendations for stakeholders interested in implementing energy efficiency measures or establishing renewable energy facilities. It will explore the various existing and practised projects and contracting models, assessing their potential and limitations regarding stakeholder participation. This information will be valuable for policymakers shaping legislation and regulations related to this topic, helping them understand the potentials and challenges associated with different models and how they can effectively address these issues.

2. Literature Review

2.1 Energy Transition

NASA reports that the world's average temperature was 1.02°C higher in 2020 than it was on an everyday basis between 1950 and 1980 (2020, NASA). Global warming also results in desertification and an increase in extreme weather events like storms, floods, and fires. This change in the environment poses a risk of irreparable harm. The scientific community is in consensus that this is because of human-caused greenhouse gas emissions into the atmosphere, particularly since the Industrial Revolution. One such gas, carbon dioxide, is mainly produced by the energy industry (including but not limited to electricity generation) (IPCC, Climate Change 2022). At COP 21 in Paris in December 2015, a global agreement was signed that established the target of limiting global warming by the end of this century to below two °C compared with pre-industrial levels and preferably limiting it to 1.5°C. COP26, which took place in November 2021 in Glasgow, confirmed the commitment to achieve carbon neutrality by 2050. In recent years, the energy sector has been responsible for around three-quarters of global greenhouse gas (GHG) emissions (UN Climate Change Conference (COP21)). Achieving net zero energy (NZE) scenario-related and industrial process CO2 emissions by 2050 in the NZE does not rely on action in areas other than the energy sector, but limiting climate change does require such action—scenario (IEA (2021), World Energy Outlook).

The Net Zero Emissions by 2050 Scenario (NZE) meets key energy-related United Nations Sustainable Development Goals (SDGs), particularly by achieving universal energy access by 2030 and significant improvements in air quality. It is consistent with limiting the global temperature rise to 1.5 °C with no or limited temperature overshoot (with a 50% probability), in line with reductions assessed in the IPCC in its Sixth Assessment Report (IEA, 2021). As shown in the figure below, several actions must be taken to achieve the zero carbon goal by 2030 and 2050, respectively.

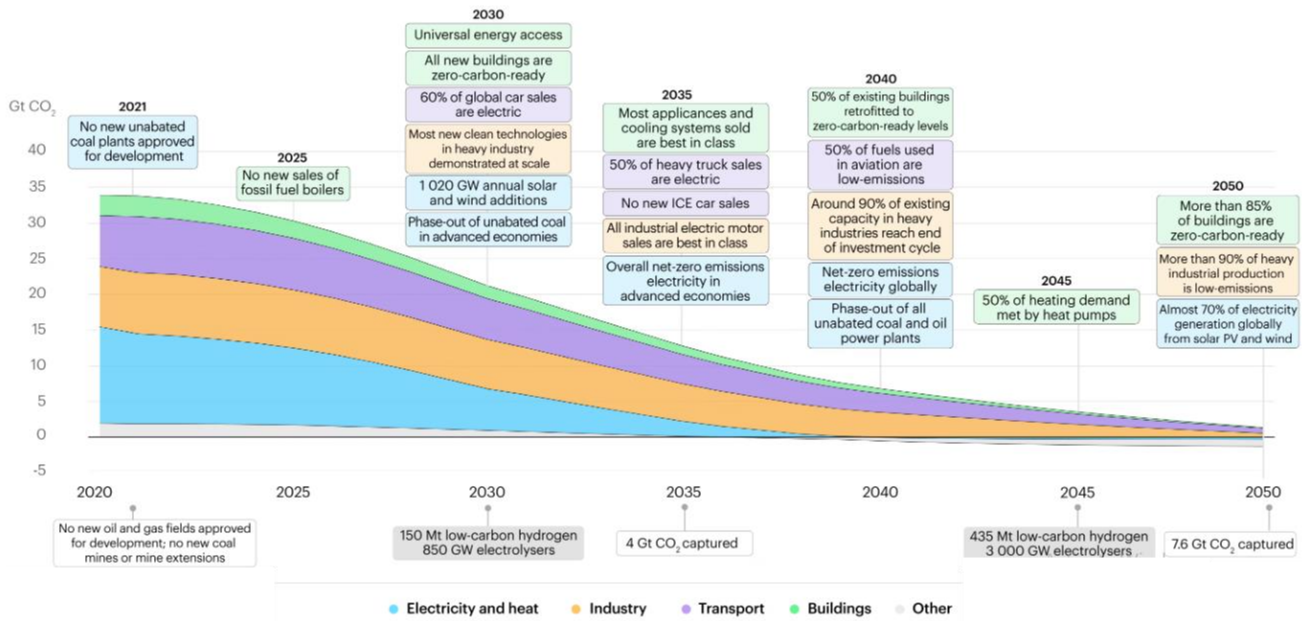


Figure 1: Necessary Actions on the Road to the NZE Scenario for Energy Transition (Source: IEA)

There are many possible paths to achieve net zero CO2 emissions globally by 2050 and many uncertainties that could affect any of them. Komendantova specified that the NZE Scenario is a path, not the path to net zero emissions. Much depends, for example, on the pace of innovation in new and emerging technologies, the extent to which citizens are able or willing to change behavior, the availability of sustainable energy, and the extent and effectiveness of international collaboration (Komendantova, 2021).

The energy transition is considered as the primary tool for achieving this goal. As the Merriam-Webster Dictionary states, "transition" refers to transforming one state to another. International Renewable Energy Agency, IRENA, defines it as "a pathway toward the transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century." Throughout history, societies have gradually transitioned away from one energy source – say, from wood to coal. The goal of the energy transition is to create a secure, economical, and environmentally friendly energy system that is better equipped to manage and balance dynamic patterns of supply and demand from a national level all the way down to a local level (Yixin Lyu et al., 2022). Cities must carefully consider how they create their future energy system if they hope to have a bright future that overcomes the difficulties they currently face. World Economy Forum in 2023 stated that the energy transition must ensure energy equality, with affordable energy available to all populations and enhancing energy security. This undertaking consists of integrating innovative smart technology and control systems to help optimize the effective use of energy and minimize primary energy demand through, for example, better control of energy use in buildings and the integration of city infrastructure and energy planning.

Energy shifts are nothing new historically. The switch from using wood to using coal in the 19th century or the switch from coal to oil in the 20th century are two examples of significant epoch-marking changes that have occurred in the past (Höök, M, 2021). The urgency of defending the world from the gravest threat it has ever faced and of doing it as soon as feasible sets this shift apart from its forerunners. The energy sector has undergone a rapid transformation as a result of this incentive, with costs of renewable technologies falling by 80% for solar photovoltaics and 60% for onshore wind power in just one decade (2010–2019) (IEA, 2021). The energy transition, however, is not only limited to the gradual closure of coal-fired power stations and the development of clean energies. It is a paradigm shift that concerns the entire system (Defeuilley, 2019). This solution can provide benefits not only for the climate but also for the economy and for society. Concerning social sustainability, the new jobs created can absorb those people previously working in the thermoelectric sector (Enel, 2020). It is important that the energy transition be inclusive and ensure that no one is left behind, and it should be as much as inclusive. According to Frans Timmermans, Executive Vice-President of the European Commission, "We must show solidarity with the most affected regions in Europe, such as coal mining regions and others, to make sure the Green Deal gets everyone's full support and has a chance to become a reality" (European Commission).

Decarbonization is one of the primary vital drivers of the energy transition, itself crucial to fighting climate change. It is a process that involves reducing or eliminating greenhouse gas emissions by replacing the use of fossil fuels with renewable sources of energy such as wind, sunlight, and geothermal heat. It's a human activity that takes place in both residential and industrial settings (Enel, 2021). With the majority of required technologies being readily available and technological costs falling, a full-fledged energy transition is becoming economically and technically possible. (Way. et al., 2022) If the appropriate policies and regulations are put in place, the cost of the transition would be comparable to the cost of sustaining the current system. The EU might gain from deep decarbonization regardless of what other economies do. If the appropriate policies are put in place to manage and lessen the distributional implications of deeper decarbonization, the transition may also be socially acceptable (Sovacool et al., 2022). The paradigm shift brought about by the energy transition also presents a significant opportunity to enhance economic prosperity, employment growth, and the social development of the communities involved (Gielen et al., 2019). The battle against energy poverty in many areas of the planet and investments that will help guarantee access to clean energy for all is another critical development opportunity for local communities.

Furthermore, a comprehensive set of policies covering all technological avenues is needed to achieve the necessary levels of deployment by 2030. Only a holistic global policy framework can bring countries together to orchestrate a just transition that strengthens international finance flows, capacities, and technologies and leaves no one behind. In turn, progressive policy and regulatory measures will generate more significant benefits from the energy transition for all peoples, nations, and regions of the world (IRENA, 2022).

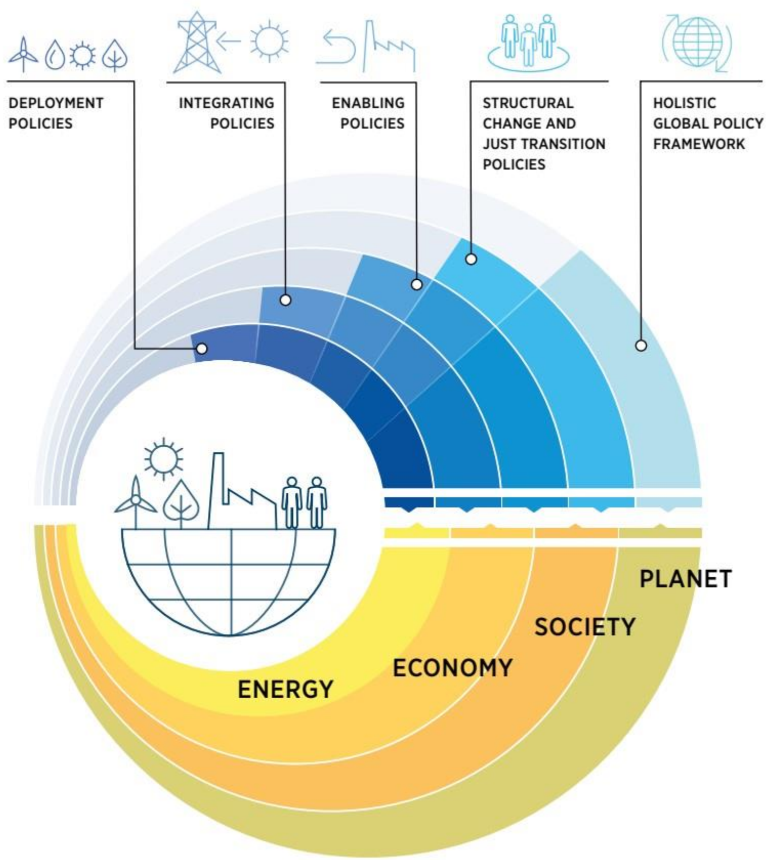


Figure 2: The Diagram Show the Just Transition Attempts (Source: IRENA)

To discuss the energy transition, it is crucial to highlight the key pillars that are essential for its success. These pillars are necessary for achieving the energy transition to be incredibly challenging and even impossible. The pillars of the energy transition are the most important: Energy Efficiency, Promoting renewable technologies, Electrification, Behavioral changes, and International cooperation. Each of these critical factors is detailed in the following.

2.1.1 Key Pillars for a Sustainable Future in the Context of the Energy Transition

1-Energy Efficiency

One of the critical factors in achieving the Paris Agreement is energy efficiency. Energy efficiency, sometimes referred to as the "first fuel" in clean energy transitions, is crucial to the transition to a clean and sustainable energy system, and its effects can extend well beyond energy savings (IEA, 2021).

To meet the increasing energy demands while reducing CO2 emissions, we can strive to optimize the world's energy consumption and enhance our capacity to achieve more with less. Boosting energy efficiency is vital to reducing our reliance on fossil fuels and curbing greenhouse gas (GHG) emissions. By implementing energy-saving measures, we can cut down on fossil fuel consumption and ultimately reduce GHG emissions (Sorrell, 2015). Measures to increase energy efficiency would contribute 35% of the necessary carbon reduction by 2050. All sectors would benefit from these savings, with transportation, construction, and industry accounting for over 60% of the direct carbon reductions attributed to energy efficiency. The potential share of energy efficiency in the industrial sector is 60%, and 30% for the residential sector as well. Energy security also is affected by energy efficiency on a long-term as well as a short-term basis (IEA, 2021).

ODEX report stated that between 2000 and 2019, the energy efficiency of final consumers in the EU improved by an average of 1.2% per year. However, as it is shown in Figure 20, the rate of improvement has slowed down in recent years, with an average improvement of 0.9% per year since 2014. While household energy efficiency progress has been the strongest, averaging 2.1% per year, it has also slowed since 2014, now at 1.6% per year. This slowdown can be attributed to implementation of various regulations affecting buildings and appliances (Odysse Mure, 2020). In contrast, the pace of energy efficiency improvements in the industry sector has been more than halved since the financial crisis, with an average of 0.8% per year since 2007 compared to 1.8% per year between 2000 and 2007. In transportation, energy efficiency has steadily improved by 1% per year, primarily due to cars, while other modes have experienced slower efficiency gains. However, in the services sector, only partial energy efficiency improvements can be measured due to a lack of end-use data (Odysse Mure, 2020)

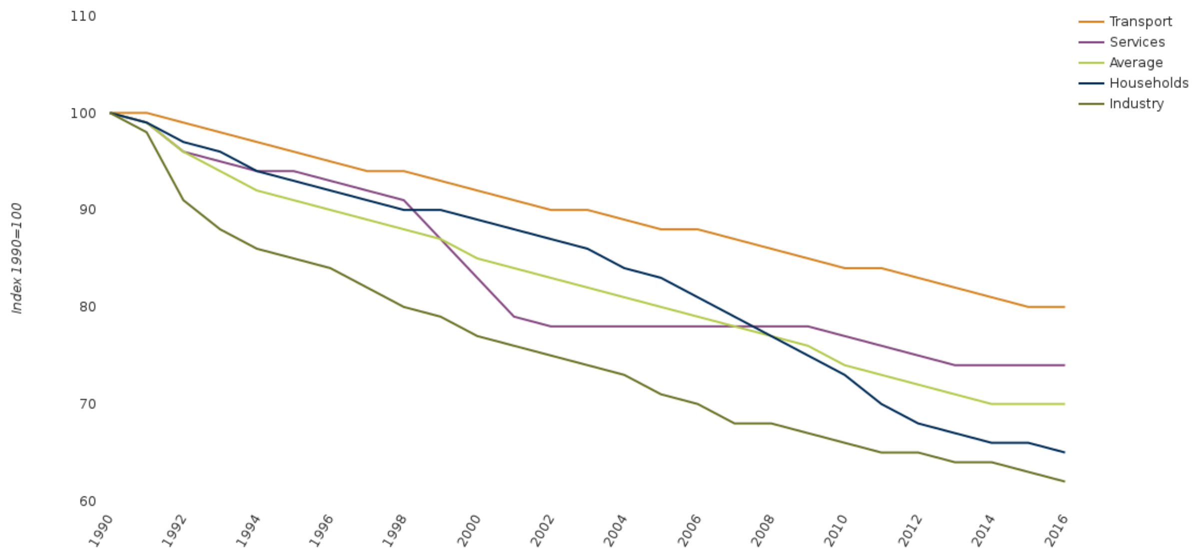


Figure 3— Energy efficiency index (ODEX) for final consumers in the EU (Odysse Mure, 2020)

Energy efficiency enhancement can play a significant role in social and economic development. It also offers some of the cheapest and fastest methods for reducing CO2 emissions while bringing down energy costs and enhancing energy security. Energy efficiency, which results in less reliance on fossil fuels, along with electrification and renewable energy, reduces GHG emissions, lowers fuel import costs for importing nations, improves construction quality, and positively impacts health (Sorrell, 2015).

In terms of the importance of energy efficiency, two main factors can be mentioned.

1- Money: Global spending in the energy sector is nearly USD 5 trillion annually, and the share is around 3.6% of global GDP. Therefore the fundamental motivation for increasing energy efficiency will continue to be countries, companies, and individuals' desire to cut their own spending.

2- Environment: Resource waste is destructive to the environment. Around 60% of the total global environmental impact of human activity is attributable to energy consumption, much of it wasted.

In terms of technologies: According to the Net Zero Scenario, by 2030, common appliances will use 25% less energy than they did in 2020 (IEA 2023). This does not necessarily entail creating new technologies; it can also be accomplished by increasing the number of new appliances purchased that are the most energy-efficient models on the market. In the Net Zero Scenario, for example, LED bulbs will account for 100% of all new lighting sales by 2030, whereas they currently make up around half of all installed lighting in Europe (IEA 2023). Significant gains can be achieved by accelerating the replacement of outdated technology with new, effective technology that is already available in the commercial, industrial, and residential sectors are currently subject to energy performance standards and labeling.

Energy efficiency policies frequently target the related benefits of economic, human, and planetary health and, as a result, frequently receive considerable popular support. By minimizing the nation's dependency on other nations and international corporations, more countries can achieve energy independence by pursuing energy efficiency goals alongside indigenous renewable energy sources. For instance: in response to the current energy crisis, governments are revisiting energy efficiency targets and policies to reflect increased urgency in a focused effort to lower reliance on high-priced fossil fuels, protect consumers from high energy bills and reduce dependency on Russian gas in Europe. For instance, The REPowerEU strategy aims to make Europe independent of Russian fossil fuels before 2030. This has included increasing to 13% the binding EU energy savings target for 2030, up from 9% in the Energy Efficiency Directive, doubling the deployment rate of individual heat pumps to reach 10 million cumulative units over 2023-2027, and accelerating electrification, especially in industry (European Commission 2022).

2-Renewables

It is vital to note that switching from fossil fuels to renewable energy sources is one of the pillars in the battle against climate change and in the transition to a sustainable future. The growing use of renewable energy sources is the cornerstone of the energy transition. The deployment of renewables in power, heat, and transport sectors is one of the main enablers of keeping the rise in average global temperatures below 1.5°C (IRENA, 2018). Thanks to continuous innovation, these are becoming increasingly efficient and competitive while new technologies are advancing. Not only do they generate electricity without emitting greenhouse gases, but they are also virtually inexhaustible; to be precise, the energy used is never renewed but transformed into electricity (IEA, 2021). The chart below provided by International Energy Agency shows that the share of developing technologies at the beginning of their journey would be almost equal to the existing technologies. It tells us to what extent promoting new technologies is vital for reaching NZE Scenario.

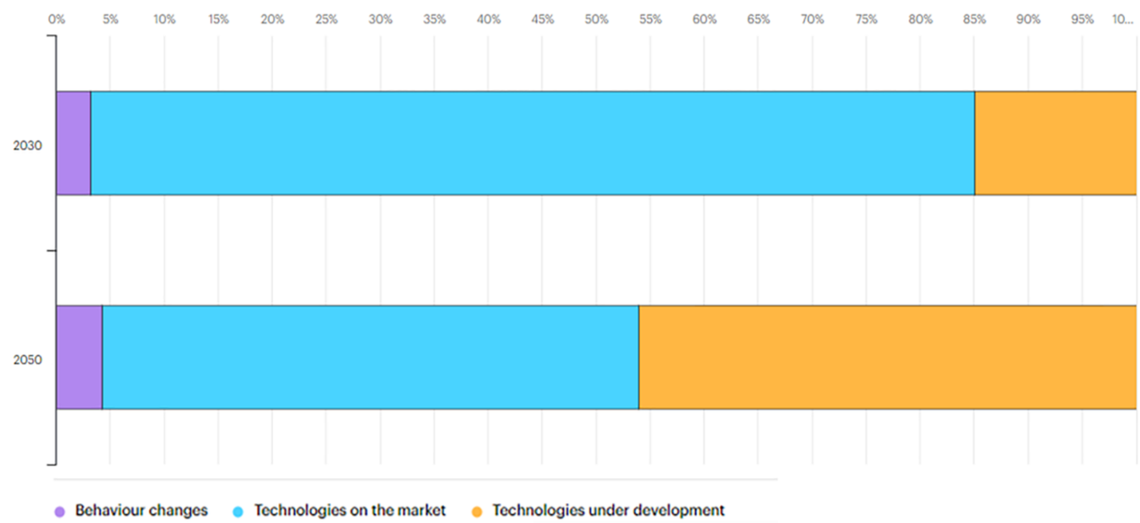


Figure 4: Share of related aspects of renewables toward2030 and 2050 net zero vision (Source: IEA)

The advancement of renewable technologies is closely linked to the development of new job opportunities in the green sector. Additionally, when coal-fired power plants are decommissioned, it presents an opportunity to provide training for the technicians and staff involved, who can then transition into new roles within other industries (Enel, n.d). Renewables are responsible for over one-third of the CO_2 emission reductions between 2020 and 2030 under the Net Zero Emissions by 2050 Scenario. Modern bioenergy is the largest renewable energy source globally, with a 55% share of global production in 2021 (IEA, 2021). Eurostat data indicates that in the European Union in 2020, wind and hydropower were responsible for over two-thirds of the electricity generated from renewable sources, with wind power accounting for 36% and hydropower accounting for

33%. The remaining third was generated from solar power (14%), solid biofuels (8%), and other renewable sources (8%), as illustrated in the Figure below.

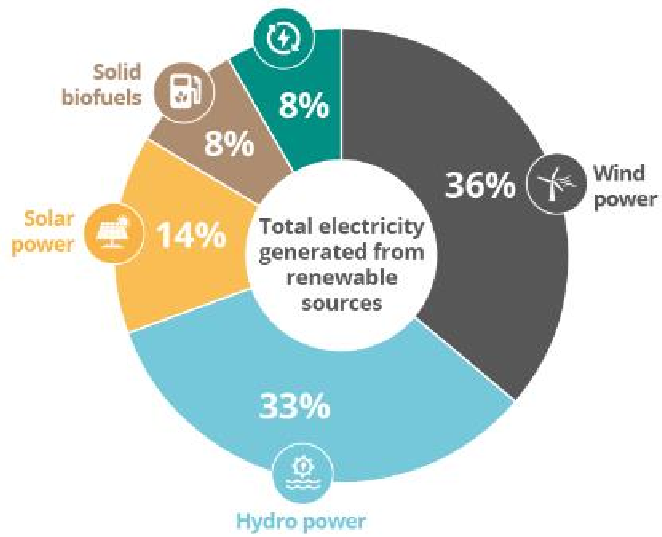


Figure 5: Share of Electricity from Renewable Sources (Source: European commission)

According to recent research by IEA, 2022 set a new record for renewable capacity expansion, with an annual capacity of roughly 340 GW. In order to achieve the Net Zero Scenario, the supply of renewable energy must continue to grow by almost 13% annually throughout the years 2022–2030. Despite record-breaking increases in renewable energy generation, supply growth in 2021 was still well below the benchmark. To get the world on track with the Net Zero Scenario, all renewable technologies must be deployed much more quickly globally (IEA, 2022).

According to the European Environmental Energy report for 2023, renewable sources like solar, wind, tidal and geothermal have the potential to generate more energy than what is currently required globally. However, the challenge lies in establishing adequate capacity to capture and convert the energy into a usable format like electricity. Another challenge is the transportation of the energy to areas where it is needed or storing it for future use. An energy system for the future must be adaptable and resilient to climate change impacts such as droughts, heat waves, and storms. As the proportion of wind and solar power in the system increases, it also needs to be flexible enough to function effectively when the sun does not shine, or the wind does not blow (EEA, 2023).

To keep up with the Net Zero Scenario, solar, wind, hydro, geothermal, and ocean energy use needs to increase substantially more quickly. By 2030, these sources must increase their proportion of the total energy supply from just over 5% to roughly 17%. To do this, yearly renewable energy consumption (excluding bioenergy) must climb by around 13% on average between 2022 and 2030, which is twice as fast as it did between 2019 and 2021.

Most nations encourage renewable energy through policy and have national goals in place. Numerous forms of assistance, including technologically specialized measures, have been implemented. The European Union was and still is at the center of creative approaches to achieving more renewables. Necessary regulations, especially the REPowerEU europian directive, will further support accelerating renewable electricity deployment in the coming years. In July 2021, the European Commission proposed increasing the bloc's renewable energy target for 2030 from 32% to 40%. The REPowerEU Plan further increased the proposed target to 45% in May 2022 (which would require 1 236 GW of total installed renewable capacity). Many European countries have already expanded their renewables support mechanisms in order to accelerate renewable power and heat use with a view to the 2030 targets and in response to the energy crisis resulting from Russia's invasion of Ukraine.

3-Behavioral Issues

Komendantova declared, "Energy transition and the transformation of energy systems require technological capacities, economic incentives, and the political will to drive them. However, they also require behavioral changes by technology users and adapters" (Komendantova, 2021). In the following; she clarified that: To encourage people to adopt more sustainable behaviors, energy policy measures should take into account "human factors" that affect the energy transition. These factors include social acceptance of different renewable energy technologies, people's willingness to use renewable energy sources, and their engagement in related decision-making processes (Komendantova, 2021). While numerous quantitative studies simulate a decarbonized energy system, only a few offer scenarios with absolute decreases in ultimate energy demand due to behavioral changes (Stermieri et al., 2023). The urgent need to stop human climate change and the fundamental shifts required to achieve a sustainable energy transition necessitate significant changes in household energy behaviors. To reduce overall energy demand and align energy demand with the supply of available (renewable) energy carriers, these include the adoption of sustainable energy sources and technologies, the adoption of energy efficiency measures in buildings, the adoption of energy-efficient appliances, and changing user behavior (Economidou et al., 2020). Behavior shifts occur: from quitting smoking to reducing the use of single-use plastics, experience shows that new habits can also be formed (IEA, 2022). Behavior changes are planned, ongoing adjustments customers make to how much energy they use, often daily, to tackle excessive or wasteful energy consumption. It can address some primary obstacles to decarbonization—current carbon-intensive assets and the quick expansion of the clean energy supply—while enhancing well-being and public health (Papadis & Tsatsaronis, 2020). Some behavioral changes that address emissions from carbon-intensive assets, such as gas boilers, can happen today. Despite their simplicity, these actions pack a punch – limiting heating to 19-20°C in buildings would reduce cumulative emissions from fossil fuel boilers by 10% until 2030 (IEA, 2022).

The Net Zero Scenario's behavioral changes also address equality concerns by reducing the disparity between developed and developing economies' disproportionately high per-capita energy use. Behavioral changes are crucial in lowering annual CO2 emissions in the Net Zero Scenario. They play a crucial role in part because carbon-intensive assets are still used. Despite the commercial expansion of clean technologies, some of these assets will continue to be used. In the Net Zero Scenario, for instance, in 2030, almost 80% of the cars on the road still have internal combustion engines. Therefore, behavioral changes that reduce CO2 emissions from driving are needed to address ongoing transportation-related emissions.

In the end, behavioral changes are implemented by people and businesses, but they are enabled, encouraged, or required by transparent and consistent government investment and regulations (Economidou et al., 2020). Governments worldwide are urging people to change how they use energy to help solve the global energy crisis. For example, Germany implemented a EUR 9 monthly transportation pass to promote public transportation usage. The governments of Belgium and Ireland advise lowering speeds when driving to conserve fuel. For the others, for instance, restricting space and water heating is encouraged in public education initiatives in the Netherlands, Belgium, Ireland, and Denmark to lessen reliance on Russia and prevent climate change (IEA, 2022). Meanwhile, air conditioning in schools and public spaces has been restricted in Spain and Italy (IEA, 2022).

Policymakers often hesitate to mandate behavioral changes for fear of public opposition or vested interests. However, public support follows good policies, as seen in Stockholm, where support for congestion charging grew from 40% to 70% in the five years following its introduction as the availability of public transport increased (IEA, 2022).

Customers may alter their energy behaviors depending on sociocultural norms, infrastructure accessibility (such as high-speed rail or cycle lanes), and availability. Additionally, Economidou et al. stated that if governments use effective legislation to implement systemic changes connected to mobility and consumer awareness, timely, precise, and persistent policy interventions and investments will be needed to achieve the gradual shifts in attitudes and behaviors required for these transformations. The figure below shows some of the most beneficial actions and measures that the prosumers can do in different sectors to align with 2030 and 2050 visions.

Figure 6: Behavioral Measures by Consumers (Source: IEA)

4- International Collaboration

Energy transition pathways vary across different countries due to differences in factors such as available resources, energy systems, economic modes, technological advancements, and energy strategies (Blazquez et al., 2020; Cherp et al., 2018). Because of those dissimilarities, both speeds and effects vary considerably from one country to another (Hafner et al., 2020). The EU's energy transition focuses primarily on promoting renewable energy technologies and actively developing a low-carbon economy. (Polzin and Sanders, 2020). In particular, the energy transition in Germany is relatively typical, with a large share of renewable energy and a significant improvement in energy efficiency (Böhringer et al., 2020). The main sectors participating in the energy transition in France are concentrated in the power industry, transportation, and energy-efficient building (Mauger, 2018; Beylot et al., 2019). Far from the EU, Japan, one of the most energy-efficient economies in the world, chose to develop hydrogen energy vigorously for its own sake (Kucharski & Unesaki, 2018). In general, all countries have unique strengths and opportunities in the energy transition process, but none of them have achieved a significant quantitative change in their energy transition (Chen et al., 2019). Some countries aim to drastically enhance their efforts to combat climate change by decreasing the amount of carbon dioxide emissions per unit of GDP, increasing the use of non-fossil energy in primary energy consumption, and developing detailed plans to address the climate crisis. (Liao et al., 2021). These urgent actions and these concrete plans have proven the possibility of establishing international cooperation (Noorollahi et al., 2021).

When it comes to international collaboration, there are several global mandates attempting to contribute to the energy and climate dialogue, such as the G7, G20, World Economic Forum, Renewable Energy and Energy Efficiency Partnership, International Renewable Energy Agency (IRENA), and various United Nations (UN) bodies (Wilson, 2015). Regarding the net zero by 2050 Scenario, In order to get the world on track, international cooperation will be essential. Since they frequently engage in high-volume trading, serve international markets, and require the widespread adoption of currently-in-development technologies for their net-zero transition, it will be especially crucial for decarbonizing heavy industries and long-distance transportation. The energy transition in these areas may take decades without focused international cooperation. International collaboration can take several forms, including the engagement of public and private actors via sectoral net zero initiatives. According to the International Energy Agency: The number of these initiatives saw an unprecedented increase in number in 2021, including public-sector, private-sector, and hybrid initiatives. In 2019 and 2020, two such initiatives were launched, one in each heavy industry and long-distance transport sector. Nine new sectoral initiatives were started in 2021 alone: three in shipping, two in aviation, two in steel, and one in cement and chemicals. (IEA, 2022). They cover various topics, such as building industry-backed global roadmaps for net zero in steel and aviation, increasing zero-emission fuels in shipping, and mobilizing international public- and private-sector procurement (IEA, 2022).

Based on the OECD report: The private sector is mainly responsible for these sectoral net zero initiatives, emphasizing business collaboration to promote knowledge sharing and speed up early technology development. Although there are initiatives in these sectors that are both public and hybrid (public-private), some of them still need to be in line with net zero (OECD, 2018). According to the International Energy Report: Various initiatives have been launched to achieve net zero carbon emissions in different sectors. The aviation industry covers 80% of sectoral activity, and the steel sector covers around one-third of global activity and has seen the highest coverage of such initiatives. Other sectors have less than one-quarter of global activity covered by net zero initiatives. Along with sector-specific initiatives, international collaboration has grown across the heavy industry and long-distance transport sectors (IEA, 2022).

Figure 7: International Collaboration Graph (Source: IEA)

5- Renewables Spearheading Electrification

The transition to more sustainable energy generation will only happen if fossil fuels are abandoned over time. The elimination process must be managed progressively and carefully to guarantee grid stability, resilience, and effectiveness. The key to this transition is electrification, which involves gradually replacing devices that rely on fossil fuels with ones that use only energy produced solely from renewable sources in every industry, from home heating to transportation. According to the Enel report in 2021, "Electrification means gradually transitioning to using electricity generated by renewables for public and private services and activities which have until now been powered mostly by fossil fuels."(Enel, 2021).

Moreover, as it is mentioned in the section on promoting renewables as one of the main drivers for accelerating energy transition, clean energy production would be the result. While electrification is the end goal, it must be reached through sustainable energy sources: electrifying the economy by burning more coal or natural gas will not solve the GHG problem; it will only shift it away from end-users to producers (enel, 2021). Therefore, electrification must be based on renewable sources like solar, wind, hydro, and geothermal. Electrification and decarbonization are key energy transition strategies that are fundamental to efforts to slow climate change. Electrification - the replacement of fossil fuels with zero-emissions electricity - speeds up the decarbonization process, thereby curbing the impacts of climate change. This is especially true when the electricity is generated by renewable sources, like the sun and wind. Electrifying energy is a way to remove greenhouse gas emissions from energy consumption in many sectors (Enel, 2021)

Electrification is an important option to achieve net zero goals since it has a significant potential to reduce emissions and decarbonize energy supply chains. In the Net Zero Emissions by 2050 Scenario, the share of electricity in total final energy consumption rises from 20% in 2021 to 27% in 2030 as more energy end uses electricity (IEA, 2021). Electrifying final consumption using energy from renewables is the most effective way to bring about the energy transition. Only by decarbonizing electricity generation will we be able to halt climate change, which is currently threatening the planet (Aalto et al., 2021). The direct electrification of final consumption using renewable energy can also be combined with the indirect electrification of so-called 'hard-to-abate' industrial sectors – shipping, aviation, mining, and heavy industry– using green hydrogen (ETC, 2021). Electrification holds great potential to reduce final energy demand because the efficiency of electric technologies is generally much higher than fossil fuel-based alternatives with similar energy services.

Furthermore, the emission reduction benefits from electrification go hand in hand with an increase in renewable energy. As the number of end-users increasingly shifts towards electricity, more (flexible) capacity is added to the electricity system, mitigating the effects of integrating variable renewables. Similarly, the carbon intensity across all sectors will drop when the electricity supply becomes increasingly saturated with renewables. Most CO2 emission reductions related to electrification between 2021 and 2030 are found in the road transport sector, specifically within the light-duty vehicle segment (Marabete et al., 2021). This segment dramatically benefits from increasing technology deployment and legislation targeting urban air pollution. The second most significant contributor is the electrification of space heating. Currently, natural gas boilers have a significant share in residential heating. However, new energy efficiency standards for buildings will increase the share of heat pumps (Aalto et al., 2021). In the Net Zero Scenario, up to 2030, most electrification-related emission reductions occur in transport (IEA, 2022).

Relative to today, electrification can avoid 1 Gt of CO2 emissions in 2030 under the Net Zero Scenario. Electrification accounts for about 7% of all mitigated emissions between 2020 and 2030. Most of these reductions are in the transport sector, from the electrification of light-duty vehicles (Yuan et al., 2021). The second most significant contributor is the electrification of space heating (Aalto et al., 2021). In the transport sector, electric car sales took off across significant car markets in 2021, the charging infrastructure to support these EVs is also increasing, but deployment must accelerate (Yuan et al., 2021). Likewise, the electrified bus and heavy-duty segments are slowly gaining momentum, but market share and model availability still need to grow. The most promising electrification technologies in the buildings and industrial sectors are air, water, and steam heating and cooling. In the buildings sector, the technological options are well-developed, and today, heat pumps have become the most common heating technology in newly built houses. However, progress is still needed to boost the uptake of heat pumps in existing buildings – the need to retrofit buildings for heat pumps and consumer preferences are reducing the uptake of this technology.

In the industrial sector, electrification technologies are deployed in lower-temperature heat segments such as food and beverages and light manufacturing (Aalto et al., 2021). Most electrification measures offer few productivity benefits compared to similar technology options, so deployment is slower than in other sectors. In terms of policy-making and governmental attempts, many countries are tackling electrification from different angles, targeting either an increase in electricity demand or the share of (renewable) electricity in the total energy supply. Some countries are also addressing the distribution network, mainly developing countries, setting targets on the share of the population connected to the electricity network or increasing the system's capacity. For instance, Sweden recently published a strategy solely focused on electrification and how to enable it further. It focuses on expanding the grid's capacity and further developing the EV charging network and the wind energy sector. (IEA, 2022)

2.2 Business Models within the Energy Transition

The notion of the business model has garnered significant scholarly and practical interest since the rise of e-business in the mid-1990s. However, despite its widespread utilization over the years, scholars still lack consensus regarding its precise definition (Zott et al., 2011). Recently it has been used interchangeably by academics and practitioners as an analytical and classification tool (Baden-Fuller et al., 2010).

The business model concept serves multiple purposes, including articulating the value proposition, identifying target market segments, defining the value chain and value network, estimating cost and profit structures, and formulating competitive strategies (Chesbrough & Rosenbloom, 2002). Business models play a vital role in facilitating the entry of new technologies into the market and generating value from them. They act as intermediaries in value creation, translating technical inputs into economic outputs (Chesbrough & Rosenbloom, 2002).

The business model concept comprises two key components. Firstly, the "Unit of business" refers to the offering provided by firms and the corresponding payment made by customers. The unit of business plays a critical role in shaping strategic decisions (McGrath, 2010). Secondly, "Key metrics" encompass firms' processes and activities to sell their products or services (Osterwalde, 2014). The external environment, including partners, suppliers, and customers, holds great significance within the business model framework. Business models elucidate how value is created and captured (Zott et al., 2011).

Energy business models, and energy efficiency contracting, are among the most essential issues in the energy transition within the building sector (Bianco et al., 2022). Creative uses of technological innovations, innovative business models, and proactive corporate sustainability strategies can sustain the energy transition (Bürer et al., 2022). These tools apply to the supply and demand sides, addressing consumption as much as possible. Research conducted in the past has shown that the energy transition's success relies more on other factors (social or business-related) and not just on technological innovation (Boo et al., 2016). The successful implementation of the energy turnaround thus requires business model innovation as one of the key drivers (Boo et al., 2017). A business model is a procurement and financing strategy to invest in clean energy technologies, leading to increased clean energy deployment in cities (IEA, 2022). Successful business models can help finance and implementation of clean energy projects as well as help eliminate barriers to clean energy deployment. The most appropriate business model for a project will depend on local conditions, the financial and regulatory environment, and the financial support mechanisms in place (IEA, 2022). Therefore, each business model needs to be adapted to the selected project's local conditions and risk profiles.

In the energy sector, business model innovation has increasingly become a priority for the long-term profitability of utilities (Castaneda et al., 2017). Various recent scientific works have looked at the role of business model innovation in supporting fundamental value propositions and value creation changes to promote the energy transition. Loock used choice experiments with investment managers for renewable energy to identify which business models could succeed in the market (Loock, 2012). This work has provided evidence that business models that focus on customers and propose high-quality services are more attractive than business models oriented to low prices and state-of-the-art technologies. Richter explored existing business model approaches adopted by utilities concerning renewable energy and found that utilities have developed viable business models for large-scale renewable energy generation but should invest further to take advantage of them for future businesses.

In large-scale infrastructure transformations, such as the shift from fossil fuels to renewable energy, emphasis should shift from individual technology development to creating entirely new systems, as demonstrated by Johnson and Suskewicz (Johnson MW and Suskewicz, 2009). Business models have been acknowledged as focal points of innovation (Chesbrough, 2007), and understanding how to capture value within these models is integral to their functioning (Teece, 2010). Developing a suitable business model is often a prerequisite for technological innovation, as it facilitates the successful market entry of inventions and addresses unmet customer needs. Consequently, more than technological innovation is needed to guarantee business success. Developing a new business model necessitates a profound understanding of fundamental customer needs, the failures of competitors in meeting those needs, and the trajectories of technology and organization.

Still, business model innovation alone will have limited power to change things without corresponding policies that increase the potential for change among incumbents and the impetus for change from start-ups and new entrants. There is a chicken-and-egg problem where policies are needed to support decision-making on business model reconfiguration (mostly among incumbents); meanwhile, new business models are needed first to stimulate such policy developments (Bürer et al., 2022). Often these new business models come from start-ups and new entrants. However, they struggle with the lack of clear policy frameworks because they often rely heavily on strategic partnerships with incumbent energy players to succeed.

The current energy renovation rate for buildings is only 0.4-1.2% per year in Europe, which is often too low to achieve the climate targets. There must be a wave of energy efficiency projects within the building sector to accelerate the energy transition. There is a strong need for actions to enable a cost-efficient implementation of renewable and energy-saving projects. Energy contracting models also have the potential to accelerate the energy renovation rate for buildings if they can provide a clear benefit and a user-friendly experience to all stakeholders. In order to have a significant impact on the energy transition, energy contracting needs to generate an attractive environment for investors, as access to finance is a significant barrier to energy efficiency projects.

Energy efficiency renovations require advanced technical knowledge and, most of the time, a significant capital investment. Referring to Klinke, Many potential clients of energy contracting, building, or facility owners need the required technical know-how or access to the necessary capital to support significant energy efficiency upgrades. Energy contracting models overcome these obstacles by providing potential clients with a framework for proceeding (Klinke, 2018). The specifics of the energy contracting framework will vary based on the model, but all work towards the exact outcome of easing the process of energy contracting. There are various barriers to clean energy deployment, which can be overcome with regulatory changes, community involvement, innovative business models, and financial instruments. Some examples, according to the McKinsey report in 2017, are:

1_ Financial barriers (e.g., lack of capital) and technical barriers (e.g., lack of resources and site issues) to clean energy deployment can be overcome with the help of business models and financial instruments; for instance: Community energy business models allow citizens who are unable or unwilling to deploy clean energy on their properties (due to reasons such as low income, lack of capital, lack of space, insufficient renewable energy source, not owning the property, etc.) to buy a portion of or buy power from a shared clean energy project. Crowdfunding is one of the financing instruments that can be used to remove the lack of capital barrier, where community members can each pay a small amount to raise funds for a community clean energy project (McKinsey, 2017).

2_ Business models can help increase public acceptance and involvement of residents in the local and national clean energy agenda; for instance: The City of Copenhagen launched a cooperative through its utility to invest in a 40 MW wind farm two kilometers off its coast. The cooperative attracted more than eight thousand investors in the local community, which helped overcome resistance to a large wind farm (McKinsey, 2017).

3_ Innovative business models can stimulate the deployment of new clean energy projects: For instance: The City of Melbourne developed a group energy procurement project and joined forces with other city governments, cultural and educational institutions, and businesses in the area to help the development of a new large renewable energy plant through committing to purchase 110 GWh of electricity over ten years (McKinsey, 2017).

3. Methodology

This thesis employs a methodology which comprises three key measures, as follows:

Phase 1, a desk research approach was employed to understand the business model landscape comprehensively. This involved assessing journal articles, engaging in dialectic discussions with Finsesco Partners, who possessed knowledge and practical experience with various models, analyzing documents and reports published by foremost European authorities, and studying successful project samples in the European Union.

Phase 2, on the business-to-business (B2B) side, a qualitative analysis was conducted using two distinct methods. Firstly, interviews were conducted with stakeholders, including energy companies and academic professionals from various sectors across European countries. Secondly, a complementary questionnaire was distributed among stakeholders to gather insights on different types of contracting models—the simultaneous distribution of the questionnaire aimed to cover any potential gaps in information obtained from the interviews. A Qualitative Comparative Analysis (QCA) matrix was employed to analyze the outcomes of this phase, incorporating insights from the qualitative B2B interviews and questionnaires.

Phase 3, focusing on the business-to-consumer (B2C) side, a quantitative research methodology was employed to gather data from consumers and individuals actively engaged in Renewable Energy. The target participants included individuals in specific model programs or students specializing in Energy Engineering, specifically from the Faculty of Energy at Politecnico di Torino and the University of Potsdam in Germany. The data was collected using Google Forms and subsequently transformed into behavioral descriptions. This approach aimed to capture participants' attitudes towards renewable energy and business models and their energy consumption behaviors and perceptions of the current energy crisis. Inferential hypotheses were tested based on the collected data.

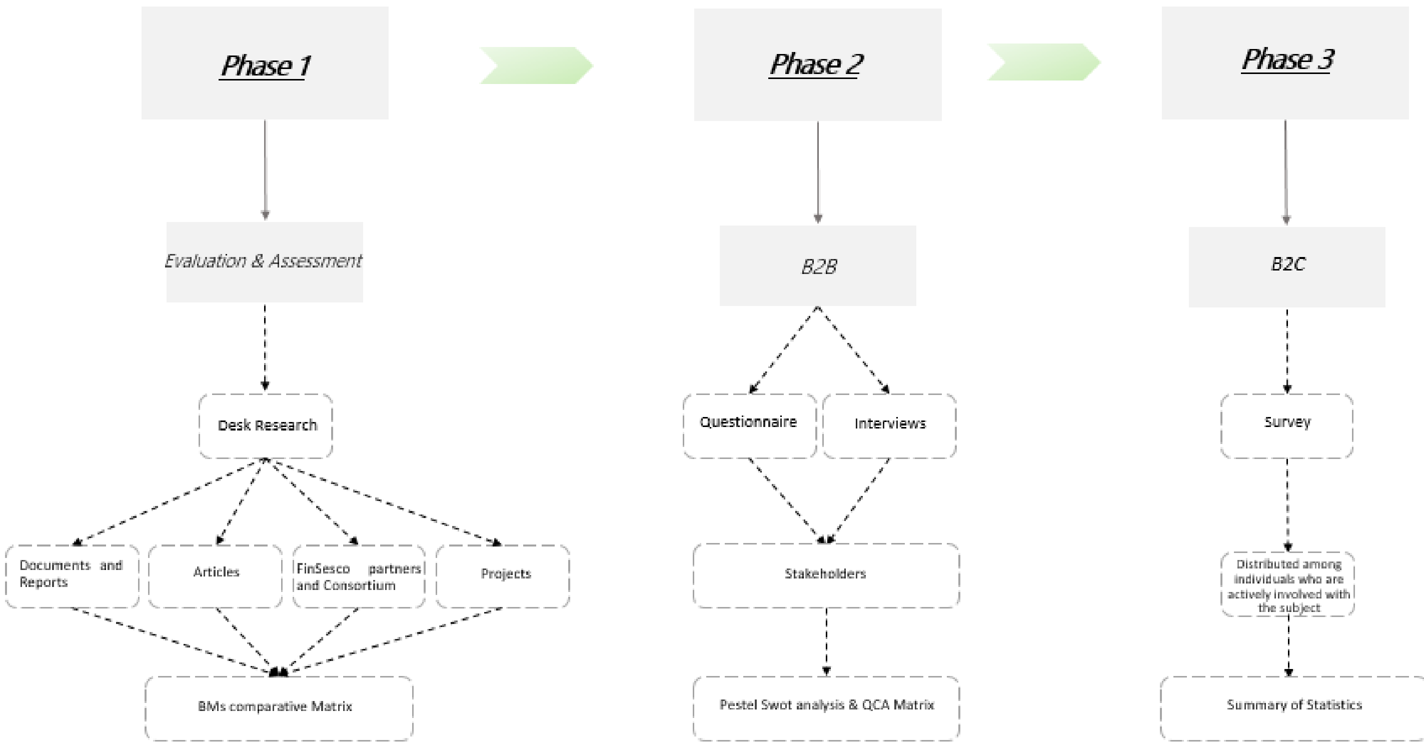


Figure 8: Methodology clarifying chart

3.1 Phase 1

In this research phase, a systematic approach outlines various business models (BMs) potentially applicable to the energy transition. The objective is to establish a robust structural framework that presents the current state of research on BMs for energy transition while also addressing a gap in knowledge by identifying a forthcoming business model capable of effectively reducing and optimizing energy usage and leveraging renewable infrastructures to procure clean energies.

Therefore, the identified business models are categorized into two distinct overviews: a larger multi-dimensional BM and a fund-providing BM. These main categories are further divided into subcategories based on specific criteria. This phase of the methodology involves examining whether it is possible to combine any of these business models or extract the most functional ones for this thesis, which focuses on energy transition within the European Union.

For this purpose, an extensive review of relevant scholarly documents and articles is conducted. Furthermore, several discussions are held with project partners from Finsesco, contributing valuable insights to the research. The combination of literature review and stakeholder engagement enhances the comprehensiveness and reliability of the research findings.

This research aims to make a scholarly contribution to the understanding and advancement of energy transition strategies within the European Union context. By identifying and analyzing potential business models, the study seeks to inform decision-makers and stakeholders involved in energy transition efforts, ultimately facilitating the successful implementation of sustainable practices in the region.

3.2 Phase 2

After an extensive description of the Energy Efficiency Contracting models, it is essential to look for common elements, motivators, and barriers - elements that, when compared, shed light on which way they work best, which have the most prominent potential, and which combinations are correlated to success. However, looking for correlational factors in a limited and small sample universe is challenging when applying traditional quantitative methods (Oana et al., 2021). At the same time, extensive qualitative research is best applied to a smaller universe to fully describe case studies (Rihoux & Grimm, 2006).

A bridge between these two project approaches could be achieved using a Qualitative Comparative Analysis methodology. The methodology itself is a middle point between Qualitative and Quantitative analysis. It provides a mechanism to research a few cases quantifying qualitative information and searching for relationships between variables. Based on the initial research round and comprehension of the models, we could select the first insights and valuable indicators to analyze using a QCA matrix.

Together with a literature review, desk research, interviews with the main stakeholders in the field, and questionaries, we built a sample of case studies concerning business types, methodologies approach, and country or region-wise institutional frameworks to trace comparative analysis between these different cases and assess the sources of success for renewable energy contracting. Quantifying the qualitative perspectives of business models and institutional frameworks in different countries, we can find a correlation between these characteristics and their successes and pitfalls in different contexts. We then correlate the characteristics of the models with enabling conditions.

3.2.1 Interviews

To provide the necessary insights for our partners in the FinSESCo consortium, the investigation with stakeholders from a B2B perspective must include several questions raised from different points of view, combining different qualitative methodologies to provide a complete overview of the scenario. Their perspectives, fears, demands, objectives, and enablers should be included in our research to guarantee security and enhance their activities while operating in a digital platform. Therefore, after desk research and a vast description of the models, in a further step of the project, 10 cases of interviews plus a survey (a short questionnaire were designed to have more databases conducted with a cross-European point of view of the interviewee selected, building a better understanding of motivators, barriers, facilitators, challenges and potentials, and pitfalls of the different selected business models while applying in the different countries, building a clearer picture of the current scenario. The result of this step would summarize first in a frame of Pestel SWOT analysis. The University of Seatle defined it as: "*Like SWOT, PESTLE is an acronym—it stands for Political, Economic, Sociocultural, Technical, Legal, and Environmental. Unlike SWOT, which is tied to analyzing a specific company's internal capabilities, PESTLE is designed to examine a company's external environment. Sometimes referred to as scanning the business environment, a PESTLE is meant to be a macro or* "big picture" look at the market in which your business operates." Then by wrapping up all the information collected from interviews and questionnaires, a Comparative Qualitative Analysis matrix model was designed to benefit a final regression by the R software to have a QCA understanding.

The interview questions were meticulously crafted to ensure a comprehensive understanding of each business model or specific business model discussed with the respective interviewees. These questions aimed to delve into the nuances of "Creating Demand for Innovation - Threads and Opportunities in Renewable Energy Contracting." The questionnaire was structured into distinct main categories, namely:

1- Information Organization and related projects

2- What are the main motivation-demand drivers for innovation in the energy contracting process?

3- What are the most significant resources - economic, social, technical, legal, and political - for completing the energy contracting projects?

4- What elements significantly impact guaranteeing trust and security while innovating in the energy contracting process?

5- What are the most relevant elements of the project's quality?

6- What phenomena have the most significant impact on the diffusion of the projects?

Based on these research questions, we can build a comparative matrix between countries by Demand, Resources, Trust, Quality, and Diffusion, assessing the representatives' opinions, expectations, and insecurities during the innovation processes - both technologically and in terms of governance. Based on that, we can construct the interview questions that were operationalized and asked for those selected.

- What do you envision when starting a different renewable energy contracting project? What are the main goals from a broader perspective? (Decarbonization, energy availability, price, etc)
- What would facilitate the accomplishment of your company's vision?
- What internal changes in your company processes, if any, would you do during the process?
- What regulatory, legal, and technical changes in the energy sector would you make?
- What key components guarantee trust between the different parts involved in the energy contracting process?
- What would you do to diminish the risk and increase security?
- How do you measure the success of a project in your company? How would you change it?
- What aspects do you think are not considered when measuring the quality of projects in the energy sector? What would you include to increase transparency?
- What do you think guarantees the diffusion of the project - elements that increase the portfolio size and the number of users and attract new members?
- What changes would you make in the internal processes to attract new partners and guarantee that projects have some level of replicability?

You can see the exact questions that were asked during the interview in the chapter appendix at the end of this thesis. In the figure below is a complete roster of the interviewees, encompassing all essential details collected during the research phase of this thesis. The outcomes of these interviews will be presented in the results chapter, employing the PESTEL (Political, Economic, Sociocultural, Technological, Environmental, and Legal) SWOT analysis framework.

ID	Role	Business Model	Field
1	Vice Mayor	REC	Government and Academia
2	Project Development/Contractor	Crowdfunding	ESCO and Financing Sector
3	Investment Manager	Crowdfunding	Financing Sector
4	Consultant	EPCo	Consultancy/Legal
5	Head of Business Innovation	REC	Academia
6	Office Coordinator	REC, Intracting and EPCo	Consultancy
7	Researcher	REC	Academia
8	Public Officer	Intracting, Energy Efficiency	Government
9	Director	EPCo	ESCO

Figure 26: Interviewees Information

3.2.2 Questionnaire

Together with a literature review, desk research, interviews with the main stakeholders in the field, and questionaries, it investigated to build a sample of case studies concerning business types, methodologies approach, and country or region-wise institutional frameworks to trace comparative analysis between these different cases and assess the sources of success for renewable energy contracting. Quantifying the qualitative perspectives of business models and institutional frameworks in different countries, we can find a correlation between these characteristics and their successes and pitfalls in different contexts. Then, correlate the characteristics of the models with enabling conditions.

By defining the indicators, it is possible to give them weight which are the possible successful outcomes of these projects. To that end, researching the literature, experiences extracted from interviews and the primary questionnaire sent to the consortium of the FinSesco project arrived at the following key measurement points:

Reference List - Outcomes		
Outcome	Indicators	Reference
Environmental success, affordability and broader development	- GHG reduction - Local pollution Reduction - Improvement to the access to electricity - RE Price in €/kWh - Energy insecurity/poverty reduction	1 = Environmental success was achieved, with broader consequences: reduction in the energy price and increase improvement to the access of electricity 0.5 = Environmental success partially achieved, with limited positive spillover in the energy price reduction in the access of electricity 0 = Environmental success was poor or non-existent, without broader consequences
RE capacity, savings performance, and innovation success	- Cumulative Installed Capacity/MW - Installed capacity - Target to Capacity from RE - Increased primary energy savings - RE Price in €/kWh	1 = RE capacity was increased, with a strong fossil-based capacity displacement. The savings performance was strongly improved 0.5 = RE capacity was partially increased, with a limited fossil-based capacity displacement. The savings performance was somehow improved 0 = RE capacity was not significantly increased. The savings performance was also not meaningful
Diffusion, replicability and range success	- Number of partners - Project portfolio size - The number of partners keeps rising - Stronger ties with the community - Local and political interest in the project	1 = The diffusion and access of the project were strong, reaching a large number of partners and interlocutors 0.5 = The diffusion and access of the project were relevant, although it could be improved 0 = The diffusion and access of the project were poor, failing to meet the expected results

Market incentives	- Subsidies - Loans - Tax reductions - Feed-in Tariffs - Low entrance costs.	1 = The market incentives were strong and actively contributed to the project activities 0.5 = The market incentives were present, although could be improved 0 = The market incentives were poor or not available, third-party capacity was necessary
Community, political engagement and Diffusion Capacity	- Lack of local community backlash - Ex-ante and post-ante ties with the community - Presence of reports in media - New members keep taking part in the project. - Relevant ties with local government	1 = The local community strongly contributed to the project activities. 0.5 = The local community and political actors contributed somehow the project activities, although not actively. 0 = The project faced community or political backlash. The project lack diffusion.
Investment Risk Mitigation	- Presence of investment risk mitigation mechanisms - Savings Insurance - Project liability. Adequate return rate for investors - Pay-as-you-save possibility - Government may assume liability in case the project fails - Availability of resource assessments	1 = There were strong risk mitigators to the investment during the project 0.5 = There were risk mitigators to the investment during the project, although they could be improved 0 = The risk mitigators to the investment during the project were poor or no present at all
Mobilizing Financing Capacity	- Credit enhancement availability - Seed financing - Diversity of financing possibilities - Availability of RE investments funds - Public, Research and Technology, Training or other grants - Public funds availability	1 = Strong capacity to mobilize financing, with various financing possibilities 0.5 = Relevant capacity to mobilize financing although they could be improved 0 = The capacity was poor and the financing possibilities were scarce

Figure 9: Inputs of QCA

Reference List - Outcomes		
Outcome	Indicators	Reference
Environmental success, affordability and broader development	- GHG reduction - Local pollution Reduction - Improvement to the access to electricity - RE Price in €/kWh - Energy insecurity/poverty reduction	1 = Environmental success was achieved, with broader consequences: reduction in the energy price and increase improvement to the access of electricity 0.5 = Environmental success partially achieved, with limited positive spillover in the energy price reduction in the access of electricity 0 = Environmental success was poor or non-existent, without broader consequences
RE capacity, savings performance, and innovation success	- Cumulative Installed Capacity/MW - Installed capacity - Target to Capacity from RE - Increased primary energy savings - RE Price in €/kWh	1 = RE capacity was increased, with a strong fossil-based capacity displacement. The savings performance was strongly improved 0.5 = RE capacity was partially increased, with a limited fossil-based capacity displacement. The savings performance was somehow improved 0 = RE capacity was not significantly increased. The savings performance was also not meaningful
Diffusion, replicability and range success	- Number of partners - Project portfolio size - The number of partners keeps rising - Stronger ties with the community - Local and political interest in the project	1 = The diffusion and access of the project were strong, reaching a large number of partners and interlocutors 0.5 = The diffusion and access of the project were relevant, although it could be improved 0 = The diffusion and access of the project were poor, failing to meet the expected results

Figure 10: Table of Outcomes of QCA

In this work, these quantitative variables are transformed into crispy variables, with an intermediate value: 0, 0.5, or 1, based on the level of presence of the conditions, representing, on the one hand, the complete exclusion of the condition and, on the other hand, its complete presence, with the 0.5 indicating partial achievement of the conditions.

The data composing the analysis matrix came from desk research, document analysis, literature review, and two questionnaires sent to our FinSESCo partners and other essential members and stakeholders actively participating in the investigated renewable energy contracting models. It also conducted ten interviews with project managers, researchers, academic professors, portfolio managers, and company executives from different countries, describing their experience with energy contracting projects in different countries. A representative group of the different models researched formed a sample size of 30 different case studies.

For the questionnaire, it is used ordinal questions to assess how strongly the stakeholder agreed with specific affirmations. Here is a sample question:

"For the implementation of the type of renewable energy contract that you operate (ESCo, Crowdfunding, Interacting), you found state-backed securities (subsidized support infrastructure, regulatory provision, public investment, and training from the government) that allowed the success of the project. On a scale from 1 to 5, where one is the weakest and five is the strongest, how much do you agree with this affirmation?"

After the completion, the data is analyzed using the software R and the packages Tidyverse and QCA, searching for correlation patterns and enablers and comparing the business models. The result of this phase will be presented in the chapter of the Result.

3.3 Phase 3

This thesis focuses on renewable energy, emphasizing integrating business models directly with various renewable energy sources. As each business model possesses specific strengths and weaknesses concerning distinct renewable energy types, the initial step involves identifying and categorizing all forms of clean energy. Subsequently, efforts have been made to ascertain people's inclinations and preferences toward each renewable energy type. Through this process, it is possible to determine the demand for different renewable energy sources, identify viable investment opportunities, and assess the level of public understanding associated with each energy type. Concurrently, the investigation also explores individuals' willingness to implement energy-saving measures and renewable energies in their residential or commercial settings to enhance overall efficiency levels.

Phase 3 primarily focuses on comprehending consumers' demand, willingness, and mindset. To achieve this objective, three pilot case studies have been selected: UK, Germany, and Italy, with this speciality. From those three countries, there are three main predominant cities with the most answers from them: Berlin, Turin, and London. One hundred four responses have been collected, with 44% of the participants from Italy and 32% from Germany, and 24 from the UK. In phase 3, the focus specifically is more on the two models of community energy and crowdfunding, which are models in which people's participation plays a more critical role than the ESCO model, to know which of the features of these two models is more important for people and if people are more interested in each of these, what was the reason?

The survey questionnaire comprises two primary divisions:

1- Questions about Business Models, Consumer Preferences, and Familiarity (Substantive Questions):

- These questions explore the respondents' awareness and familiarity with various business models in the renewable energy sector.

- Additionally, they gauge consumer inclinations toward specific business models and assess the level of understanding regarding energy efficiency measures.

- Their general mindset and concerns about the renewable energy issues

2- Demographic Questions:

- This section of the questionnaire gathers essential demographic information about the respondents.

- It aims to capture data such as age, gender, educational background, professional occupation, and geographical location.

Structuring the survey this way allows for a comprehensive examination of consumer perceptions and demographic characteristics. The results from these divisions will enable a deeper analysis of the relationship between business models, consumer preferences, and demographic factors within the context of renewable energy adoption.

5. Results

In the chapter on results in this thesis, data collection was conducted using various methods to gather relevant information and insights. The following explanation highlights the data collection process employed:

Primary Data Collection: Primary data refers to the original data collected specifically for the research study. This involved conducting interviews, surveys, or experiments directly with participants. For example, a set of interviews was conducted with key stakeholders, industry experts, or consumers that were somehow engaged with the topic of BMs and renewable energy issues to gather firsthand information. Surveys were also distributed among target participants to collect quantitative data on their attitudes, preferences, or behaviors. In some cases, experiments may have been conducted to observe and measure specific variables under controlled conditions.

Secondary Data Collection: Secondary data refers to data that has already been collected by others for different purposes but is relevant to the topic. This includes data from sources such as academic journals, books, reports, or public databases. These secondary sources provide valuable information and insights that complement the primary data and support the research findings. It was investigated to review and analyze relevant secondary data to provide a comprehensive understanding of the research topic.

Document Analysis: Document analysis involves the systematic review and interpretation of written documents, reports, or other textual sources related to the research topic. This attempt includes: analyzing policy documents, company reports, financial statements, academic literature, or any other relevant documents. The purpose is to extract relevant information, identify patterns or trends, and draw meaningful conclusions from the documents.

Data Analysis Techniques: In this thesis, it is included statistical analysis, thematic analysis, content analysis, and tables and coding processing analyze. The researcher carefully analyzed the data to identify patterns, trends, relationships, or themes that emerged from the collected information.

5.1 Phase 1

This thesis systematically reviews several existing academic publications related to the different types of business models and a set of meetings with the Finsesco project consortium and partners. The systematic review is a way to address a specific problem by summarizing the existing research and presenting it in one single document (Harden A, Thomas J, 2005). Then after assessing all BMs, those who aimed to provide funding together with the BMs that, apart from funding, can implement technical knowledge for applying renewables extracted a matrix table according to the outcomes of desk research. Wrapped up all the articles and documents together with the projects that have already been analyzed, two tables were designed focusing on Financial BMs and financial-Technical BMs. Some main criteria, which come as follows, were outlined for weighting each type of BMs.

5.1.1 Global Evaluation of Existing Business Models

With regards to the business models, there exist several potential types of business models, primarily for the renewable energy sector. Through an analysis of various scholarly articles, documents, and reports, a total of twelve distinct business models were identified and subsequently categorized into three main subdivisions, based on the method for acquiring clean energy.

Generating clean energy – Owner

Business models in this particular category encompass the ownership and operation of a clean energy plant by the city itself. This category can be further divided into two subcategories based on the plant's location and connection: on-site and off-site. On-site generation involves the construction and operation of a clean energy plant within a facility owned by the city. The energy generated from this on-site plant is primarily intended to supply power for the city-owned facility's own use. An example of this is the installation of rooftop solar PV systems on buildings owned by the city. On the other hand, off-site generation involves the construction and operation of a standalone clean energy plant owned by the city, where the energy generated is directly fed into the grid. Standalone city-owned clean energy plants are typically situated on designated lands specifically for energy generation, such as solar PV and wind farms. Depending on the city's chosen strategy, there are various business models available for generating and owning clean energy, as depicted in the flowchart below.

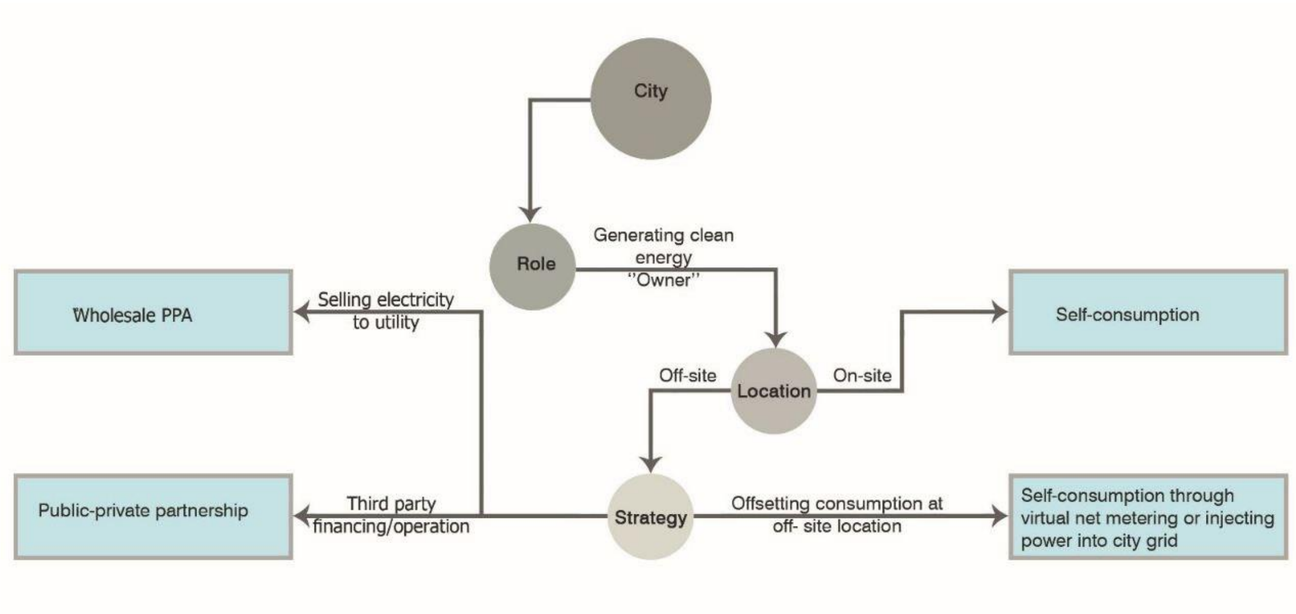


Figure 11: Generating clean energy – Owner Diagram

1 _ self consumption model

The self-consumption business model revolves around generating and consuming renewable energy on-site, reducing reliance on external energy sources, and promoting sustainability. It typically involves installing renewable energy systems, such as solar panels or wind turbines, to generate electricity for personal or business use. The excess energy produced can be stored in batteries or fed back into the grid for compensation (Rohrbach et al., 2019).

The self-consumption business model is based on these keynotes:

1. Energy Generation: The first step is to install renewable energy systems on the premises, such as solar panels or wind turbines. These systems harness the power of natural resources to generate electricity. Solar panels are the most common choice for self-consumption due to their accessibility and reliability.

2. Energy Storage: To ensure a consistent electricity supply, energy storage systems, like batteries, are often employed. These batteries store excess energy produced during high generation and supply it when there is low or no generation. This allows for a more stable and reliable energy supply, even when renewable sources are not actively producing.

3. Consumption Optimization: Self-consumption aims to maximize the use of generated energy on-site. To achieve this, energy management systems can be utilized. These systems monitor energy production, storage levels, and consumption patterns, enabling better control and optimization of energy usage. They can also automate processes to prioritize self-consumption over grid consumption during peak generation times.

4. Grid Interaction: In some cases, when self-generated energy is insufficient to meet demand, users can draw additional power from the grid. Conversely, when excess energy is produced and stored, it can be exported back to the grid. Depending on the regulations and policies, users may receive compensation for the surplus energy they provide to the grid, typically through net metering or feed-in tariffs.

5. Cost Savings and Return on Investment: The self-consumption model offers potential cost savings by reducing dependence on grid electricity, especially in regions with high energy prices or unreliable grid infrastructure. Over time, the initial investment in renewable energy systems can be recouped through lower energy bills and potential revenue from surplus energy sales.

6. Environmental Benefits: By generating renewable energy on-site, the self-consumption model reduces carbon emissions and reliance on fossil fuels. It promotes sustainability and aligns with global efforts to combat climate change.

7. Scalability and Integration: The self-consumption model can be applied to various scales, ranging from residential homes to extensive commercial or industrial facilities. It is also compatible with other energy-efficient technologies, such as energy-efficient appliances, LED lighting, and intelligent home systems, further enhancing energy optimization and reducing overall consumption.

It is important to note that the specifics of self-consumption business models can vary depending on local regulations, energy policies, and available resources. It is advisable to consult with energy experts, installers, and relevant authorities to understand the requirements and incentives in your specific location.

Strength	weaknesses
Sustainability: The self-consumption model promotes the use of renewable energy sources, reducing carbon emissions and environmental impact. **Energy Independence:** It allows individuals and businesses to become less reliant on external energy sources, providing a degree of energy security and stability. **Cost Savings:** By generating and consuming their own renewable energy, users can reduce their reliance on grid electricity and potentially lower their energy bills over time. **Potential Revenue Generation:** Surplus energy produced can be exported back to the grid, potentially generating revenue through feed-in tariffs or net metering programs. **Scalability:** The self-consumption model can be implemented at various scales, from residential homes to large commercial and industrial facilities.	**Initial Investment:** The upfront costs associated with installing renewable energy systems and energy storage can be a barrier for some individuals or businesses. **Intermittent Energy Generation:** Renewable energy sources, such as solar and wind, are subject to weather conditions, resulting in variable energy generation. This intermittency may require additional backup systems or grid interaction to meet energy demands. **Limited Resource Availability:** The feasibility of the self-consumption model depends on the availability of suitable renewable energy resources, such as sunlight for solar panels or consistent wind patterns for wind turbines. **Regulatory Challenges:** The self-consumption model may face regulatory hurdles, including permits, interconnection requirements, and grid integration policies that can vary by jurisdiction.
opportunity	threats
Advancements in Technology: Continuous advancements in renewable energy technology, energy storage systems, and energy management systems offer	**Grid Dependency**: In certain regions or scenarios where grid infrastructure is unreliable or inaccessible, relying solely on self-consumption may pose challenges.

opportunities for increased efficiency and cost-effectiveness. **Incentives and Support:** Government incentives, subsidies, and favorable policies can encourage the adoption of the self-consumption model, making it more financially attractive for individuals and businesses. **Energy Market Integration:** As the energy landscape evolves, self-consumption models can potentially play a role in decentralized energy systems, virtual power plants, and peer-to-peer energy trading.	**Evolving Regulatory Landscape:** Changing regulations, tariffs, and policies related to renewable energy and grid interaction can impact the economic viability and profitability of self-consumption models. **Market Competitiveness:** The self-consumption market may face competition from traditional energy providers, which could affect the adoption and growth of the model.

Figure 12: Self Consumption Swot Analysis Table

The projects examples:

Durban EOS project: By 2030, Durban will have objected to supplying 40% of total electricity consumption from renewable energy. So based on this strategy, the city of Durban has started to benefit from the PV panels to generate electricity in the city-owned building. The system's total capacity is 426.3 MWh annually, bringing an estimated annual reduction in carbon generation of about 439.5 CO_2e (C40 Cities, 2017).

The solar public roofs program in Santiago: The goal of the metropolitan Santiago city is to increase distributed clean energy generation and energy efficiency as part of a regional plan to decontaminate and prevent air pollution. The renewable energy strategies and energy efficiency plan for the public buildings at Santiago is a regional initiative that includes two programs of the Chilean Ministry of Energy to reduce GHG emissions, energy consumption, and energy costs in public buildings. One of the strategies is the solar public roofs plan which includes 18 PV projects in public schools, hospitals, and some emblematic buildings in Santiago. The generated solar energy is used for self-consumption in these buildings. The extra energy will be redistributed into the grid. The total installed capacity under this program is 1075 Kwp .the solar public roofs program had an investment of about 1 000 000 USD provided by the Chilean Ministry of Energy (energypedia, n.d).

2-Wholesale Power Purchase Agreement (PPA)

The wholesale (or utility) PPA is used for selling power on the wholesale market, where the generator establishes a PPA contract with a grid operator such as a licensed supplier or balancing party. The grid operator then sells the electricity on the wholesale market and to its customers. This business model is commonly used in the renewable energy industry to support developing and financing large-scale renewable energy projects. They benefit both the project developer, who gains revenue stability, and the buyer, who can meet their renewable energy targets or secure a long-term supply of clean electricity. It is also suitable for cities in a regulated retail market where utilities have a monopoly over supply but not generation and for cities that do not have any control over their power purchase but are allowed to own a clean energy installation (Solar Power Europe, 2016). A city can finance and build its clean energy project in an off-site location feeding electricity into the grid. The city enters a Wholesale PPA with the utility to sell the electricity. Johannesburg municipal landfill gas would be one the example.

Strengths	weaknesses
Resource Sharing: PPPs allow for the pooling of resources and expertise from both the public and private sectors, leveraging their respective strengths. This collaboration can lead to improved project outcomes and efficient utilization of resources. **Risk Sharing**: PPPs enable the sharing of project risks between the public and private sectors. This sharing of risks can help mitigate financial and operational uncertainties and promote project sustainability.	**Complex Contractual Arrangements:** PPPs typically involve complex contractual agreements between the public and private sectors, which can lead to challenges in negotiating, implementing, and managing the partnership. These complexities can result in delays, increased costs, and potential disputes. **Potential for Cost Overruns:** Due to the long-term nature of PPP contracts, there is a risk of cost overruns. Changes in project scope, unforeseen circumstances, and evolving

Innovation and Efficiency: PPPs often encourage innovation and efficiency through private sector involvement. Private companies bring market-driven practices, technological advancements, and expertise that can enhance the delivery and management of public infrastructure and services. **Access to Funding:** PPPs can provide access to additional funding sources, such as private capital, which can help address financial constraints and fund large-scale projects that may be challenging for the public sector alone.	requirements can lead to additional costs that may impact the financial viability of the partnership. **Limited Public Control:** PPPs involve the transfer of certain responsibilities to the private sector, which can reduce direct public control over the project or service. This lack of control may raise concerns about accountability, transparency, and public interest protection.
opportunity	threats
Infrastructure Development: PPPs present opportunities to address infrastructure gaps and promote the development of public facilities, such as transportation systems, hospitals, schools, and utilities, by leveraging private sector expertise and funding. **Innovation and Technology Adoption:** Private sector involvement in PPPs can drive innovation and the adoption of new technologies, leading to improved project design, operational efficiency, and service delivery. **Economic Development and Job Creation:** PPP projects can stimulate economic growth and generate employment opportunities	**Political and Regulatory Risks:** PPPs can be influenced by changes in political priorities, policy frameworks, and regulations. Political instability, shifts in government support, or alterations to contractual terms may pose risks to the continuity and success of the partnership. **Financial Viability:** Ensuring the long-term financial viability of PPP projects can be challenging. Fluctuations in interest rates, changes in market conditions, and unexpected events (e.g., economic crises, natural disasters) can impact project financing and profitability. **Public Perception and Opposition:** PPPs may face public resistance or opposition due to concerns about privatization, loss of public

through infrastructure development, attracting private investment, and fostering local industry growth.	control, potential conflicts of interest, or perceptions of favoritism towards private entities.

Figure 13: PPA Swot Analysis Table

3 - Public – Private partnership (PPP)

A PPP involves a contract between a public-sector authority and a private party for a clean energy project. In PPPs, a public partner's role can include contributing to the financing, providing sites, monitoring the performance of the private partner, and enforcing its obligations, among others. The private partner's role includes providing financing, undertaking installation, technical operation, and maintenance services, and upon completion of the project providing public services such as electricity.

PPPs have several main features:

1- They are long-term contracts

2- Parties share risk and responsibility

3- Private partners bring their expertise and knowledge

4- They supplement limited public sector funding by bringing in private sector capital

Private partners may operate the plant without any time limitations or for a pre-defined period under a long-term concession contract and transfer the ownership and operation of the plant back to the public partner after this period. The PPP business model generally involves the creation of a Special Purpose Vehicle (SPV), which will develop, build, maintain, and operate the clean energy plant for a designated period. The SPV contracts with the public partner and subcontractors to build the plant and then provides operation and maintenance services (ADB, 2015), (APEC, 2009).

1- A city can apply this model through tendering for a private partner to finance, design, build, own, and operate a clean energy plant. See the case study below for Johannesburg's municipal landfill gas to electricity project with a private partner.

The projects examples:

JOHANNESBURG: MUNICIPAL LANDFILL GAS TO ELECTRICITY. In order to solve the excess methane emissions issue at some of their landfill sites, the City of Johannesburg initiated the landfill gas to electricity project The City's Environment, Infrastructure and Service Department and Ener G Systems have formed a Build Own Operate Transfer (PPP where Ener G, the private partner, has been awarded a 20-year contract for five sites (Robinson Deep, Marie Louise, Linbro Park, Ennerdale, Goud Koppies) with 18 6 MW capacity The operation is run under a profit sharing agreement with the city After 20 years, plants will be transferred to the city were unable to purchase electricity through City Power (the municipal utility) from these sites due to the requirement to procure services at the best value for money as the price proposed by Ener G was higher than the average electricity price provided by Eskom (South African public utility) Ener G submitted bids to the Renewable Energy Independent Power Producers Procurement (instead The project was selected and in August 2015 a Wholesale PPA was signed with Eskom Three of the five plants will be connected to the Eskom grid and two to the City Power grid As per the Renewable Energy Independent Power Producers Procurement (REIPPPP) processes, no wheeling arrangements were needed for these two sites Eskom and City Power have amended their delivery supply agreement to accommodate this additional point of supply on the network so that the metering points become an Eskom point of supply delivering electricity directly to City Power (Franks, L. et al ,n.d).

Strengths	weaknesses
Long-Term Revenue Stability: Wholesale PPAs provide a stable revenue stream for renewable energy project developers, as they typically involve long-term contracts with	**Market and Policy Dependency:** Wholesale PPAs are subject to market conditions and regulatory policies, which can impact the profitability and attractiveness of these agreements. Changes in market dynamics or

fixed pricing terms, ensuring a predictable income over the contract duration. **Market Access:** Wholesale PPAs enable renewable energy projects to access electricity markets and sell their power directly to wholesale buyers, such as utilities, retailers, or corporate entities, facilitating market entry and revenue generation. **Risk Mitigation:** PPAs often include provisions for risk sharing, which can help mitigate financial risks associated with energy price fluctuations, regulatory changes, or operational uncertainties, providing more stability and certainty to project developers. **Scale and Project Viability:** Wholesale PPAs allow for large-scale renewable energy projects that might not be financially viable solely based on retail electricity sales. This enables the development of utility-scale projects, increasing renewable energy generation capacity.	policy shifts may affect the project's financial viability. **Market Price Volatility:** Wholesale electricity prices can be volatile, and the financial performance of a renewable energy project under a PPA can be affected if market prices decline significantly during the contract term. **Contract Duration:** Long-term PPAs may pose challenges in adapting to changing market dynamics or technological advancements over the contract period. Fixed pricing terms may not reflect market value accurately in the future.
<u>opportunity</u>	<u>threats</u>
Renewable Energy Demand: Growing demand for clean energy from utilities, corporations, and consumers presents opportunities for renewable energy projects to secure long-term PPAs, supporting their financial viability and facilitating project development.	**Policy and Regulatory Uncertainty:** Changes in energy policies, incentives, or regulations may impact the attractiveness of wholesale PPAs, potentially leading to project delays, renegotiations, or cancellation of agreements.

Decentralized Markets: The rise of decentralized energy markets, community choice aggregation, and virtual power purchase agreements (VPPAs) offers new avenues for renewable energy developers to enter into wholesale PPAs and sell power to diverse off-takers. **Corporate Renewable Energy Goals:** Many corporations have set renewable energy targets and are actively seeking PPAs to fulfill their sustainability commitments. This presents opportunities for renewable energy projects to secure long-term agreements with corporate buyers.	**Market Competition:** Increasing competition in the renewable energy sector, particularly in regions with high renewable energy penetration, can put downward pressure on wholesale PPA prices, potentially affecting project economics. **Financial and Credit Risks:** The financial stability and creditworthiness of off-takers, particularly utilities or corporate buyers, pose risks to the successful implementation of wholesale PPAs. Inadequate creditworthiness or financial distress of off-takers may lead to payment defaults or renegotiation challenges.

Figure 14: PPP Swot Analysis Table

Procuring Clean Energy - Buyer

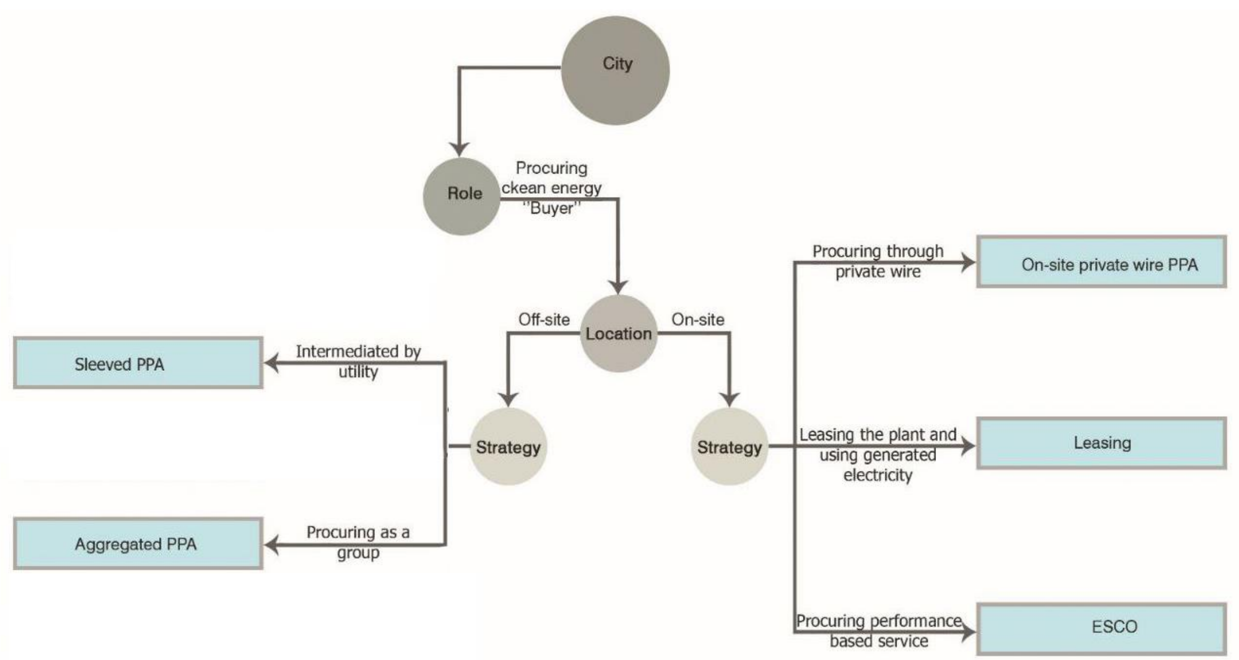


Figure 15: Procuring Clean Energy-Buyer Diagram

This particular category positions cities as electricity purchasers instead of builders and operators of clean energy plants. In this role, cities procure clean energy from external developers or generators. This category can be divided into two subcategories based on the location and connection of the plant: on-site and off-site. The on-site subcategory involves cities purchasing power from an embedded clean energy plant situated within a city-owned facility. However, the clean energy plant itself is owned by a third party rather than the city. In the off-site subcategory, cities purchase power from a clean energy plant located at a different point in the network. This off-site clean energy plant is owned and operated by a third party, such as a non-utility independent generator. Depending on the city's chosen strategy, there are various business models available for procuring clean energy, as depicted in the flowchart below.

1-Energy Perfomance Contracting (EPCO) and Energy services Company (ESCO)

Energy Performance Contracting (EPC) is one mechanism for increasing the uptake of energy efficiency projects. EPC is an existing financing model that funds energy efficiency projects from the cost savings generated from reducing energy use. EPC functions by having an external organization, an Energy Service Company (ESCO), implement and manage the energy efficiency project, distributing the risks to the client. The ESCO has the required expertise and industry knowledge to undertake the energy efficiency project's technical implementation and comprehensive management. The ESCO is then paid back based on the obtained energy savings throughout the project.

Figure 16: ESCO Position among Stakeholders

There are two primary contracting models for EPC, guaranteed savings and shared savings, which allow clients to find a structure that is well suited for their situation. The primary difference between these two models is the payment structure for the ESCO and which party takes on the credit risk. The client will finance the project under the EPC-guaranteed savings structure, assuming the credit risk. The ESCO guarantees a predetermined level of energy savings which acts as a stream of income from cost savings to repay the project's costs. Whereas under the EPC Shared savings structure, the project financing is assumed entirely by the ESCO, and the cost savings are split between the client and ESCO for a predetermined length of time. EPC is a beneficial financial model for energy contracting as it connects interested clients with ESCOs with the necessary technical knowledge to implement energy efficiency projects. An EPC also provides a clear cost structure to the client since they repay project costs based on energy savings instead of a significant initial investment, which is typically a major barrier for interested clients.

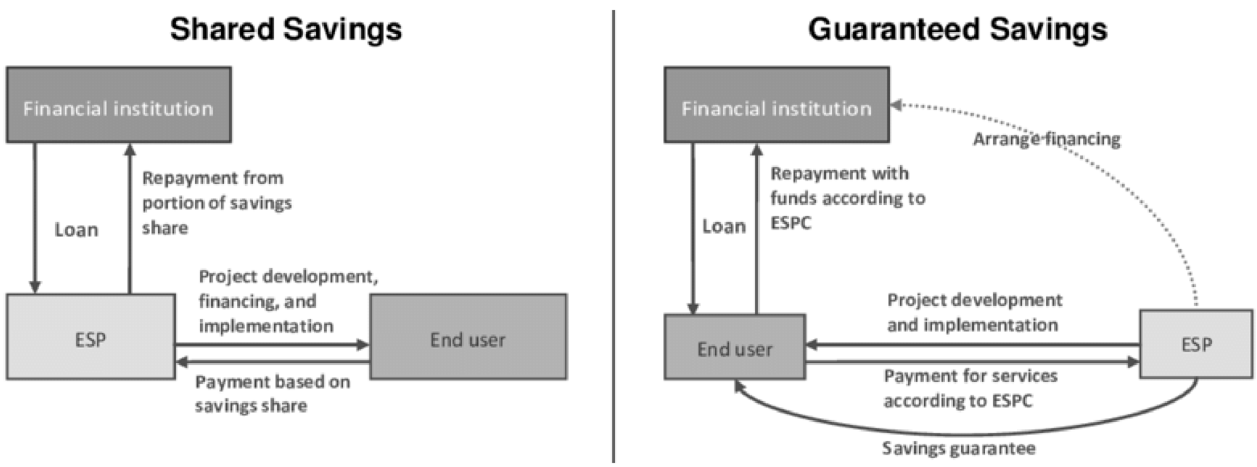


Figure 17: EPC Devisions

There are significant barriers concerning energy contracting that must be addressed in order to accelerate the energy transition in the building sector. Access to capital is a primary barrier for many interested building or facility owners. An energy-efficient project can require a significant upfront investment to cover equipment, renovations, technology, expertise, labor, etc. Many stakeholders interested in energy efficiency need more capital to support a large-scale project. This can deter many individuals from committing to an impactful EE project as they may not want to take on debt for this type of project, or they may cherry-pick a few renovations that will improve their EE in the short term as opposed to a larger project that would a significant impact on their energy consumption. An Energy Service Company (ESCO) can help overcome this barrier as they can provide financing for the project, but they also have limitations. Only large ESCOs can financially support multiple projects simultaneously. In contrast, smaller ESCOs must be more selective with the projects they undertake as they do not have the capital backing of a giant corporation. All of this cumulates in EE projects being left behind due to financing issues, whether it is the building owner who does not have access to the required initial capital, or the ESCO who cannot support an additional project at the time or is not large enough to support the specific project.

Another common energy contracting barrier is the need for more awareness or information. As the energy contracting and ESCO industries are still developing, many people, such as building owners, bank officers, or lawyers, need to familiarize themselves with energy performance contracting and its financing method. Therefore, it is not easy to convince customers to undertake a project since it is a foreign concept, and they may hesitate to proceed. Also, the intuitions that support the project or procurement process may need more information or awareness. This will make it increasingly more work to develop performance contracts and arrange the finance if there is an overall need for more information and available guidance for energy contracting. If parties are informed about energy performance contracting, it can create a more transparent process for all stakeholders, resulting in individuals turning away from or rejecting the project.

Complex legal and contractual issues are another barrier that must be addressed in order to increase energy efficiency projects. Energy performance contracts are unique documents based on reasonably complex transactions, including the methods of contract performance and the methodology for measuring savings and calculating payments. The ESCO and potential customer often need help to decide the contract terms and understand the duties, obligations, and risk allocation. The lack of standardization of energy performance contracts and the procurement process makes it difficult for parties to confidently navigate the process as they have no previous experience or guidance to assist them. The current procurement processes and financial controls will hinder the adoption of energy contracting.

Interacting, or internal performance contracting is another financing technique that can assist in enabling energy efficiency investments. It is very similar in approach to EPC, but the client replaces the ESCO role, so there is no need for an external organization. Interacting is best suited for municipalities as they typically have the structure to apply this model. In most cases, the environmental or energy department of the municipality will act as the internal ESCO and offer energy services to other municipal administration units as they have the required technical resources to manage the EE project. The municipality energy department finances the energy efficiency measures for another internal department. The cost savings from the implemented energy efficiency measures will be used to repay the initial investment from the energy department. The energy department offers zero-interest loans to other municipal administration units for energy efficiency upgrades. The remuneration to the energy department takes place through cross-payment of budgets, so Interacting is entirely financed from municipal/internal budget funds (Schilken, 2013). This internal financing structure makes interacting a very attractive energy contracting model for municipalities and comparable institutions.

Interacting has limitations as it is viable for institutions with the structure and budget to implement it. Municipalities have an existing internal department that can quickly act as the internal ESCO. Other organizations or facility owners typically need more internal resources to implement and manage energy efficiency upgrades efficiently. They may need to gain the required experience or tools to perform upgrades and subsequential management. Much effort must be put towards measuring and verifying to accurately monitor the project, which most potential clients for energy contracting need to possess. It is an excellent option for municipalities and has proven successful when correctly implemented. The common barriers to interacting are similar to those to energy performance contracting, such as a lack of upfront capital and the overall awareness of interacting. Upfront capital to establish the "interacting fund" is a common challenge for municipalities. There are different approaches to overcome this barrier, but this requires an existing awareness of interacting schemes and the associated financing methods. Many municipalities are unaware of interacting as a financing option for EE projects. The best way to address this barrier is to provide outreach regarding interacting and assisting any interested municipalities or organizations through testimonials and guides on how to structure their budgets to support an "interacting fund internally."

A barrier unique to interacting is the lack of an internal structure or policy programs to support interaction. Interacting is only viable for organizations with the necessary structure and budgeting to support it. This supporting structure is typically found in municipalities, non-profit organizations, and potentially large corporations. These organizations have internal departments and cross-budgeting capabilities necessary for interacting. Regarding municipalities, only some existing supporting codes or policies encourage decisions in favor of interacting. Implementing such programs would see an uptake in the number of municipalities securing the initial funding to implement an interacting scheme.

Strengths	weaknesses
Energy Efficiency Focus: ESCOs specialize in energy efficiency solutions, providing expertise in identifying, implementing, and managing energy-saving measures. This focus allows ESCOs to deliver significant energy and cost savings to their clients. **Performance-Based Contracts:** ESCOs often offer performance-based contracts, where their compensation is tied to the actual energy savings achieved. This incentivizes ESCOs to maximize energy efficiency and ensures alignment with client goals.	**Initial Cost Barriers:** Some energy efficiency projects may require significant upfront costs, which can pose a challenge for ESCOs to secure clients willing to invest in long-term energy savings. Overcoming these financial barriers may be necessary for successful project implementation.
Access to Technology and Innovation: ESCOs stay up to date with the latest energy-efficient technologies and innovations. This allows them to implement state-of-the-art solutions that can optimize energy consumption and enhance sustainability.	**Limited Control over Energy Prices:** ESCOs may face challenges when energy prices fluctuate. Lower energy prices can diminish the financial attractiveness of energy efficiency projects, potentially impacting the demand for ESCO services.

Reduced Capital Expenditure: ESCOs often offer financing options, allowing clients to implement energy efficiency projects without upfront capital investment. This can be particularly attractive to organizations with limited financial resources.	**Competitive Market:** The ESCO industry can be highly competitive, with numerous providers vying for clients. Standing out among competitors and securing new contracts may require strong marketing strategies and a proven track record.
opportunity	threats
Rising Energy Costs: Escalating energy costs create opportunities for ESCOs to offer energy-saving solutions that can deliver substantial financial benefits to clients. As organizations seek ways to reduce energy expenses, ESCOs can provide valuable services. **Increasing Energy Regulations:** Stringent energy regulations and sustainability targets set by governments and industry bodies create a growing market for ESCOs. Compliance with these regulations often necessitates energy efficiency improvements, presenting opportunities for ESCOs to provide solutions. **Growing Sustainability Focus:** Increasing environmental awareness and the desire to reduce carbon footprints drive the demand for energy-efficient solutions. ESCOs can capitalize on this trend by offering comprehensive sustainability strategies and services.	**Policy and Regulatory Changes:** Shifts in energy policies and regulations can impact the ESCO industry. Changes in incentives, subsidies, or energy efficiency standards may affect the financial viability and attractiveness of ESCO projects. **Economic Conditions**: Economic downturns or recessions can lead to reduced budgets and financial constraints for organizations, potentially affecting their willingness to invest in energy efficiency projects and limiting the demand for ESCO services. **Technology Advancements:** Rapid advancements in energy-efficient technologies can disrupt the ESCO industry. ESCOs need to stay updated with emerging technologies to remain competitive and provide cutting-edge solutions..

Figure 18: Swot Analysis Table for the ESCO model

2 _ Leasing model

The leasing model is where the investor/owner of the clean energy installation leases the system to the occupant or owner of the site. In the leasing model, the customer operates the system and either self-consumes the energy or exports it back to the grid via an export price or net metering mechanism. The investor receives a monthly rent payment from the customer. This model may be beneficial in markets where PPAs are not allowed (due to restrictions on third-party power sales) since, in this model, the whole system is leased rather than the power being sold to the consumer.

There are several ways of setting up a leasing business model:

1- A utility, developer, or investor finances and arranges the installation and leases the clean energy system to the site/building owner, e.g., the city.

2- A utility or similar third-party lease the system to the occupant (e.g., a tenant)

3- But signs a contract with the landlord for permission to use the space, such as the roof for solar PV.

4- The landlord leases the system to the tenant (Solar Power Europe 2016).

In this model, a third-party developer invests in and installs clean energy systems on city-owned buildings and leases the system to the city. Cities can also use this model to enable the installation of clean energy technologies on third-party buildings or sites. An example would be a city investing and owning the clean energy technology on a site that is owned by a third-party and leasing the system to the occupant (Rocky Mountain Institute 2017).

Project example:

Stadtwerke Stuttgart, a municipal utility, offers households the option to buy or lease solar PV panels. Consulting, installation, and servicing are provided as one package. The option is also to integrate power storage or charging box for electric vehicles. With the lease model, households have no investment costs, and the municipal utility takes over any repairs for.The entire contract period. In addition, the household is rewarded with a bonus every five years by reducing the monthly lease payment. The households consume the solar power the panels produce, and surplus electricity is fed into the grid. The households also receive a feed-in tariff for this, which the grid operator will pay for 20 years from the date of commissioning. After the lease period, the households can take over the photovoltaic system, or the utility can dismantle the system. (Stadtwerke Stuttgart, n.d)

Strengths	weaknesses
Access to Goods and Services: The leasing model provides customers with access to goods and services that they may not be able to afford or prefer not to purchase outright. This allows them to enjoy the benefits of using the product without the high upfront costs. **Flexibility and Convenience:** Leasing offers flexibility in terms of contract duration, allowing customers to adapt to changing needs and upgrade to newer models or technologies more easily. It also provides convenience in terms of maintenance and repair services, which are often included in the leasing agreement. **Lower Financial Risk:** Leasing eliminates the financial risk associated with owning and depreciating assets. Customers do not bear the burden of resale value or technological obsolescence, as these concerns are typically transferred to the leasing company. **Potential Tax Benefits:** In certain regions, leasing expenses may be tax-deductible for businesses, providing potential cost savings.	**Long-Term Cost:** Leasing can be more expensive in the long run compared to purchasing the product outright. Customers may end up paying more in cumulative lease payments than the cost of buying the item. **Lack of Ownership:** Customers do not own the leased item, which means they do not have any equity or asset value. They are dependent on the leasing company for access to the product, and termination of the lease could result in loss of use. **Limited Customization:** Leased items often come with limitations on customization or modification, as the leasing company retains ownership and wants to protect the asset's value for future leases.
opportunity	threats

Market Expansion: The leasing model allows businesses to tap into new market segments by providing affordable access to their products or services. This can attract customers who would not have considered purchasing the product outright.	**Economic Downturns:** During economic downturns or periods of financial instability, leasing may experience a decline in demand as customers prioritize cost-cutting and avoid long-term financial commitments.
Upselling and Cross-Selling: Leasing provides an opportunity for businesses to upsell or cross-sell additional products or services. Customers may be more inclined to add complementary items or upgrade to higher-tier leases, increasing revenue potential.	**Competitive Market:** The leasing industry can be highly competitive, with multiple companies offering similar products or services. Maintaining a competitive edge may require differentiation in terms of pricing, service quality, or product range.
Sustainable Solutions: Leasing can support the adoption of sustainable or environmentally friendly products. By providing access to green technologies through leases, businesses can promote sustainability initiatives and address customer demands.	**Technological Advancements:** Rapid technological advancements can lead to product obsolescence, posing a risk to leasing companies if the leased items become outdated quickly. Companies need to regularly update their inventory to keep up with evolving customer needs.

Figure 19: Swot Analysis Table for the Leasing Model

3-On-site private wire PPA

On-site private wire PPA can be established when a third-party developer installs and operates a clean energy plant in the same building or nearby to the consumer. The consumer and the generator are connected through a direct wire without using the public grid. The consumer buys some or all of the power from the generator under a PPA, and the utility provides the rest of the demand. The generator can also sell the excess power not used by the consumer to the utility through another PPA or feed-in-scheme. The diagram is presented below. The agreed PPA price is generally lower than the retail price to incentivize the customer to enter a PPA with the generator. An example is a third-party developer financing and installing solar PV plants on city-owned buildings and entering into a PPA with the city where they are generated. Energy is sold to the city at a reduced rate and used on-site (5 Solar Trade Association, 2016).

Project example:

WASHINGTON D.C.: PPA for Municipal On-site Solar PV

District of Columbia aims to increase the use of renewable energy to make up 50 of the District's energy supply by 2032. In early 2015 the District of Columbia Department of General Services sought to develop a municipal portfolio of onsite solar energy projects on sites including schools, hospitals, recreation centers, police training facilities, and one carport. To achieve this, DGS entered into a 20-year onsite PPA with Sol Systems and its investor WGL Energy to purchase power generated from the onsite solar PV systems that are installed, owned, and operated by Sol Systems and WGL Energy Project was completed in July 2017 and consists of 10 9 MW of solar PV generation capacity installed across 35 projects Solar PV systems collectively produce about 13 800 MWh annually.

Strengths	weaknesses
Direct Supply of Clean Energy: The on-site private wire PPA model enables the direct supply of clean energy from a renewable energy project to a specific location or facility. This ensures a reliable and sustainable energy source, reducing reliance on traditional grid electricity. **Cost Savings:** By procuring clean energy through a private wire PPA, organizations can potentially achieve cost savings compared to purchasing electricity from the grid. The long-term fixed pricing structure and potential for lower energy costs can contribute to improved financial performance.	**Capital Investment:** Implementing an on-site private wire PPA requires significant upfront capital investment in renewable energy infrastructure. The costs associated with building and operating the on-site generation facility can pose financial challenges for organizations.

Environmental Benefits: The on-site private wire PPA model supports sustainability and environmental goals by enabling organizations to reduce their carbon footprint. It demonstrates a commitment to renewable energy and contributes to the transition to a greener energy system.	**Site Suitability and Space Constraints:** Organizations need to assess whether their site has the necessary space and suitability for the installation of the on-site renewable energy generation facility. Limited space or site-specific limitations can hinder the feasibility of this model.
opportunity	threats
Energy Independence: The on-site private wire PPA model offers organizations the opportunity to achieve energy independence by generating their own clean energy. This reduces vulnerability to grid outages, price fluctuations, and supply chain disruptions. **Long-Term Cost Stability:** By locking in long-term fixed pricing through the private wire PPA, organizations can achieve cost stability and mitigate risks associated with volatile energy markets. This provides greater financial predictability and budgeting control.	**Regulatory and Policy Changes:** Changes in energy regulations, incentives, or government policies can impact the financial viability and attractiveness of on-site private wire PPAs. Organizations need to stay informed and adapt to evolving energy policy landscapes. **Technological Advancements:** Rapid advancements in renewable energy technologies can make existing on-site generation facilities less competitive or obsolete over time. Organizations must monitor technological developments and ensure their infrastructure remains up to date. **Upfront Financial Commitment:** The on-site private wire PPA model requires a significant upfront financial commitment. Organizations need to assess their financial capacity and consider the potential risks and returns associated with investing in on-site renewable energy generation.

Figure 20: Swot Analysis Table for PPA Model

4- Aggregated PPA

In this business model, customers with lower energy demand and less experience entering into PPAs can set up multiple buyer structures with other customers to purchase power from a clean energy generator directly.

1-There are various ways to set up this company strategy. One clean energy project with many PPAs: With the generator, each client has a unique direct off-site PPA. Unless a virtual approach is employed through a Synthetic (Virtual) PPA, this structure can only be used in deregulated markets where direct retail sales between generator and consumer are permitted (Mitchell, E & Mills, G).

2-Development of a customer group into a single PPA: A single PPA can be established between the generator and the customer group. The PPA can be set up directly between parties, e.g., Synthetic PPA, or through an intermediated deal with a retailer who enters into a single PPA with the generator on behalf of the customer group. In some cases, this becomes a tri-partite deal where the generator, the retailer, and the customers are all counterparties (WBCSD, n.d). A city can initiate and get involved in forming a consortium of buyers with a significant aggregated energy demand which can help finance an enormous clean energy project.

Project example:

Melbourn Renewable Energy Project : The City of Melbourne has a long-standing commitment to creating a carbon-neutral municipality This commitment includes a target of sourcing 25 of the municipality's electricity from renewable sources by 2018 As part of this strategy, the City of Melbourne has initiated the Melbourne Renewable Energy Project (which includes the formation of a city-led group of local governments, cultural institutions, universities, and corporations to stimulate demand for renewable energy .The group's aggregated demand will enable financing and construction of a new 80 MW wind farm at an offsite location It will be owned and operated by Melbourne based clean energy company Pacific Hydro, and the power will be supplied by its retail arm, Tango Energy The MREP deal is underpinned by an agreement for each customer to purchase large scale Generation Certificates (certificates created by renewable energy generators) from Pacific Hydro, alongside retail electricity from Tango This arrangement allows customers to purchase " electricity at a lower cost whilst directly supporting a new renewable energy project

The contract term is for 10 years The pricing structure includes a fixed price for LGCs, a fixed price for a proportion of energy, and a variable price reset every 2 years for the remaining portion (*The City of Melbourne, Renewable Energy Procurement of, n.d*).

Strengths	weaknesses
Economies of Scale: The aggregated PPA model allows multiple organizations or consumers to pool their energy demand and negotiate a collective PPA. This aggregation can lead to economies of scale, potentially resulting in lower costs and improved bargaining power with renewable energy developers. **Risk Mitigation:** By aggregating energy demand, organizations can share the risks associated with renewable energy procurement. This model provides risk diversification and can help mitigate exposure to fluctuating energy prices and market uncertainties. **Simplified Procurement Process:** The aggregated PPA model streamlines the procurement process for renewable energy. It allows organizations to leverage the expertise of third-party aggregators or intermediaries who manage the negotiations, contract structuring, and project implementation on behalf of the participants.	**Coordination and Collaboration:** Aggregating multiple organizations or consumers requires effective coordination and collaboration among participants. Differences in energy requirements, procurement goals, or risk tolerance may pose challenges in reaching a consensus and aligning interests. **Limited Control:** Participants in an aggregated PPA have limited control over the specific project or energy source. They rely on the aggregator or intermediary to select renewable energy projects and negotiate the terms on their behalf. This lack of direct control may impact the ability to customize or tailor the agreement to specific preferences or sustainability goals.
opportunity	threats

Market Access and Market Development: The aggregated PPA model provides an opportunity for organizations, particularly small and medium-sized enterprises (SMEs), to access renewable energy procurement that may have been challenging individually. It fosters market development by expanding the potential customer base for renewable energy developers. **Enhanced Renewable Energy Adoption:** Aggregated PPAs can drive greater adoption of renewable energy sources by aggregating demand and creating a more attractive business case for developers. This model contributes to the growth of renewable energy capacity and accelerates the transition to a low-carbon energy system.	**Regulatory and Policy Uncertainty**: Changes in energy policies, regulations, or incentives can impact the viability and attractiveness of aggregated PPAs. Uncertainty surrounding government support for renewable energy or grid connection policies may create challenges for project implementation. **Market Volatility:** Fluctuations in energy markets, including changes in energy prices or supply dynamics, can affect the financial viability of aggregated PPAs. Market volatility and uncertainty may impact the ability to secure favorable pricing and long-term cost savings.

Figure 21: Swot Analysis for Agreggate PPA Model

5- Sleeved PPA

Sleeving means a utility physically delivering power on behalf of the customer. In the sleeved PPA model, the generator sells the power to the customer under a PPA, and the customer appoints a third party-supplier/utility to sleeve the power from the generator to the customer. This business model has two variations depending on whether the customer and generator enter into a PPA directly or through the utility. In variant 1, the customer and generator enter into a PPA directly, and the third-party supplier matches the supply and demand and balances services (See figure below for Variant 1). Variant 1 is a type of direct off-site PPA, as explained in the previous section.

A city can use this business model to procure clean energy directly from a clean energy generator not located in its immediate locality.

The second variant is where the generator and customer cannot enter a direct PPA. In this intermediated model, the generator and customer rely on the utility to enter into a PPA with the generator and provide a separate retail agreement to the customer to pass the power through the network and renewable energy certificates. This business model is suitable for markets where direct energy sales are not permitted and requires the use of an intermediary, usually a utility. (ACORE, 2016) The diagrams for the two variants of the Sleeved PPA business model are presented below.

Strengths	weaknesses
Price Stability: The sleeved PPA model provides price stability by establishing a fixed price for the energy supplied over the contract term. This stability can help organizations better manage their energy costs and budget effectively. **Customization:** The sleeved PPA allows organizations to tailor the agreement to their specific energy needs and sustainability goals. It provides flexibility in terms of contract duration, energy volume, and renewable energy sources, enabling a customized solution for each organization. **Risk Mitigation:** The sleeved PPA model helps mitigate risks associated with energy price volatility and market uncertainties. By locking in a fixed price and securing long-term supply, organizations reduce their exposure to fluctuating energy prices and potential supply disruptions.	**Complexity:** Implementing a sleeved PPA involves complex financial and contractual arrangements. It requires coordination among multiple parties, including the energy generator, a financial intermediary, and potentially the local utility or grid operator. The complexity of the arrangement may pose challenges in terms of contract negotiation and administration. **Counterparty Risk:** The sleeved PPA model involves reliance on various parties, including the energy generator and the financial intermediary. The financial stability and performance of these counterparties can pose risks if they fail to meet their obligations or if there are issues with project development or financing.

opportunity	threats
Renewable Energy Adoption: The sleeved PPA model encourages the adoption of renewable energy sources by providing organizations with a direct supply of clean energy. It supports sustainability goals and helps organizations reduce their carbon footprint. **Market Access:** The sleeved PPA model allows organizations to access renewable energy projects that may be located in different regions or have specific expertise. It provides opportunities for organizations to procure renewable energy from diverse sources and support the development of clean energy projects.	**Regulatory and Policy Changes:** Changes in energy policies, regulations, or incentives can impact the financial viability and attractiveness of sleeved PPAs. Shifts in government support for renewable energy or modifications in utility regulations may affect the feasibility and economics of the model. **Financial Market Conditions:** Sleeved PPAs often require financial intermediaries to facilitate the transaction. Changes in financial market conditions, such as fluctuations in interest rates or limited access to capital, can affect the availability and terms of financing for sleeved PPAs.

Figure 22: Swot Analysis for Sleeved PPA Model

Project example:

HOUSTON _ SolaireHolman Solar Farm PPA :The City of Houston has been holding the top spot on the U S Environmental Protection Agency's (Top 30 Local Government list of the most significant green power users from the Green Power Partnership. The city uses over 89 percent of its energy from green power. The City of Houston had an existing PPA with Hecate (now SolaireHolman) for buying 30 MW of solar power. In February 2017, the city increased the purchase volume to 50 MW. As part of this expansion, the city has entered into a PPA with ENGIE under which SolaireHolman solar farm located in Alpine, Texas, will supply the city's electricity provider, Reliant Energy Retail Services LLC, with up to 50 MW of solar power at a set guaranteed price for 20 years which then will be transferred to City of Houston through the electricity provider (The City of Houston, 2017)

Facilitator / Trader / Aggregator

In addition to producing and procuring clean energy, cities can also play a pivotal role as intermediaries in the energy sector. This involves three distinct approaches: aggregation, trading, and facilitation of clean energy. This business model allows cities to establish platforms that foster engagement with residents and encourage the adoption of clean energy. Depending on a city's specific strategy, various business models can be chosen to fulfill this role effectively. Further details regarding these models are elaborated upon in the following section.

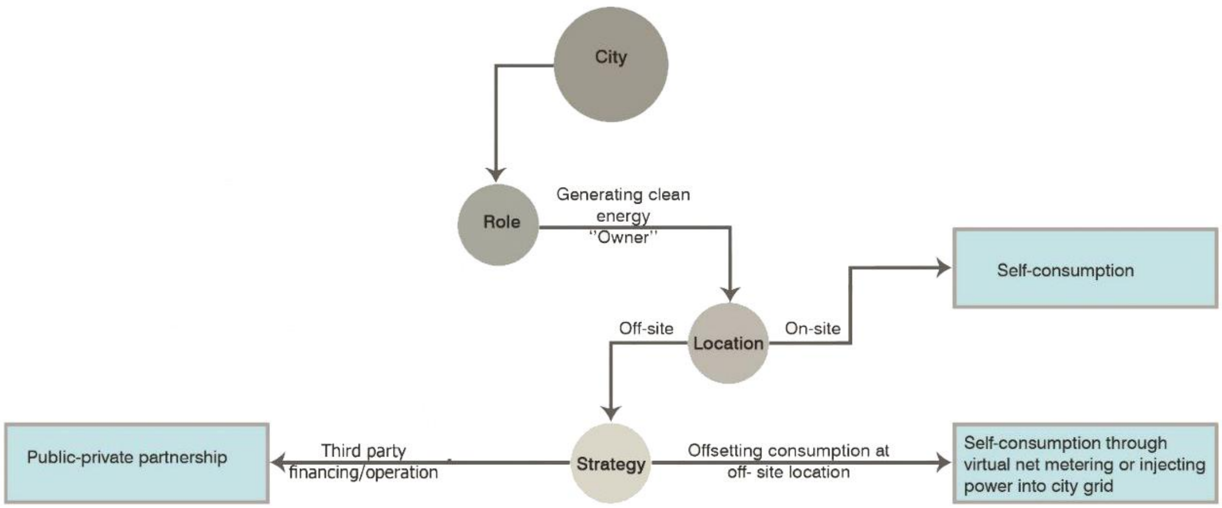


Figure 23: Facilitator, Trader, Aggregator Diagram

1-Energy Community

In recent years, community energy has become more and more popular. There are many reasons to consider joining, including financial gain, environmental concerns, and independence. When individuals come together and create their answers to the issues with our energy system, this is what is known as community energy (Hamwi & Lizarralde, 2017). Communities install their renewable energy systems, supplying clean power and bringing the benefits back to their areas, driven by climate change, a desire to combat pollution or fuel poverty, or both.

Community clean energy projects focus on community ownership, community leadership, and community benefits. A community energy business model is generally established through shared ownership or joint ventures, where benefits are shared by the community, crowd-funded projects, and community ownership models such as co-operatives, social enterprises, community charities, development trusts, and community interest companies (OFGEM, 2015).

Individuals are at the center of the energy system thanks to community energy. It brings them together to engage in democratic climate action by understanding, generating, owning, using, and saving energy. Community energy offers the energy system clear responsibility and participatory governance, which is empowering, open, and equal. It boosts community resilience while hastening the transition to a zero-carbon energy system. Communities that could otherwise be cut off from the energy infrastructure are also included.

Nevertheless, it goes beyond this. A just transition is necessary for the social challenge of developing a carbon-free energy system. Community energy organizations have already made significant contributions to decentralizing the energy system, behavior modification, reducing carbon emissions, and upskilling communities across the UK. They are at the forefront of energy system innovation. Community energy builds the consent, trust, and active participation needed to ensure a rapid and just energy transition.

The proportion of electricity generation from variable renewables like wind and solar will multiply as the energy transition in the Energy Community Contracting Parties moves forward. According to research released today by the Energy Community, the power system can accommodate up to 30 GW of variable renewable energy sources without making further investments in flexibility sources, with the expenditures currently anticipated to be made until 2030.

Some benefits to the energy community:

1- The most dominant one is the generation of income considering direct financial gain from energy sales and job creation, such as establishment maintenance for the facilities' reduced electricity.

2- Developed the local regions by attracting investors and creating jobs.

3- Can also raise awareness of energy-saving behavior low carbon energy sources, and the other energy issues

4- This participatory could be through different dimensions such as economic or political processes dealing with energy policies which they become more independent and more identical

5- Foster community cohesion empowers citizens and improves social well-being concerning education and participation of people dealing with energy. Communities are more receptive to ethical and environmental commitment

6- Connect to both participation and education, people involved in Community Energy activities are generally also more receptive to ethical and environmental commitment to the community and can influence people's lifestyles to more sustainable behavior

7- Particularly in countries where renewable energy sources do not reach a high percentage in the energy mix, community energy can help reach renewable energy generation targets.

8- Community Energy may contribute to maintaining a reliable, secure, and efficient network

9- Community Energy schemes are widely recognized as an essential part of just, effective, and secure energy transition

10- They also contribute to carbon reduction and power security

A town must be able to access the energy grid to sell its energy successfully. However, this access is frequently denied. To even enter the energy market, all renewable energy installations must be able to "inject" their energy into the grid. It often proves very difficult for RECs to access this grid because it is operated for profit by grid operators who are not required and do not see it in their interest to connect local community-owned projects. Europe's grid has to be updated in many places. The energy grid that we currently have is not fit for the decentralized renewable system that we need now. The regulated business model of the grid operators needs to incentivize them to upgrade their assets. Lack of funding is the most fundamental obstacle frequently confronting an organization wanting to establish a Renewable Energy Community. Vulnerable populations in low-income locations are undoubtedly the most severely impacted because they lack the resources to invest quickly.

From the pre-planning stage to the development, investment, and operation phases, a new project requires various amounts and formats of finance. Banks and other lending institutions frequently need a better understanding of what a community energy project is and what kind of business model is acceptable is a vital component of the financial challenge. Only a few countries have enough successfully run projects to provide banks the confidence to lend.

A combination of novel strategies and promoting already-existing tools, such as development seed funds or loan guarantee systems, are needed to overcome the financial constraints. The loan will only need to be repaid with a modest interest rate if the project succeeds; otherwise, the loan will become a grant, and the community will not be held responsible.

Compared to other players in the energy sector, Renewable Energy Communities are highly unique. They should be recognized as such because they are essential and helpful to the energy transition. Therefore, RECs require a particular legal structure. They need help to thrive in countries where they are not recognized or catered explicitly for in legislation. The rules and processes that apply to potential RECs are frequently dispersed and incompatible without an Enabling framework. Even worse, there may be regulations to restrict or impede community ownership of the energy infrastructure, as was the case in Spain with the infamous "sun tax." This law effectively prevented towns and individuals from producing and using their energy until it was repealed. The abolition of restrictive laws is only the first step in any case. To succeed, RECs require a favorable legal environment. It takes much work to navigate bureaucracy, especially for new ventures. The members frequently must apply for permits from various state authorities and deal with the difficulties of establishing a new organization and delayed or ambiguous government bureaucracy.

Two primary forms are applied to the energy communities regarding the business models.

1-Utility-sponsored model: The utility owns or operates a project open to voluntary community participation. This model has the advantage of using utilities' existing legal, financial, and program management infrastructure.

2-City-owned or sponsored model: This model involves ownership of the clean energy installation by a city. The power produced is sold to a third party (a utility) or consumed on-site to offset energy usage at public facilities such as schools, community buildings, etc. Its advantages are exemption from lease or property tax payments if located on a city-owned site and access to low-cost financing with municipal bonds. 17 When the project generates sufficient additional revenue, there could be indirect benefits in the form of community benefits, such as programs targeting vulnerable and fuel-poor households, providing energy advice to community members, etc.

Strengths	weaknesses
Price Stability: The sleeved PPA model provides price stability by establishing a fixed price for the energy supplied over the contract term. This stability can help organizations better manage their energy costs and budget effectively. **Customization:** The sleeved PPA allows organizations to tailor the agreement to their specific energy needs and sustainability goals. It provides flexibility in terms of contract duration, energy volume, and renewable energy sources, enabling a customized solution for each organization. **Risk Mitigation:** The sleeved PPA model helps mitigate risks associated with energy price volatility and market uncertainties. By locking in a fixed price and securing long-term supply, organizations reduce their exposure to fluctuating energy prices and potential supply disruptions.	**Complexity:** Implementing a sleeved PPA involves complex financial and contractual arrangements. It requires coordination among multiple parties, including the energy generator, a financial intermediary, and potentially the local utility or grid operator. The complexity of the arrangement may pose challenges in terms of contract negotiation and administration. **Counterparty Risk:** The sleeved PPA model involves reliance on various parties, including the energy generator and the financial intermediary. The financial stability and performance of these counterparties can pose risks if they fail to meet their obligations or if there are issues with project development or financing.
opportunity	**threats**
Renewable Energy Adoption: The sleeved PPA model encourages the adoption of renewable energy sources by providing organizations with a direct supply of clean energy. It supports sustainability goals and	**Regulatory and Policy Changes:** Changes in energy policies, regulations, or incentives can impact the financial viability and attractiveness of sleeved PPAs. Shifts in government support for renewable energy or

helps organizations reduce their carbon footprint. **Market Access:** The sleeved PPA model allows organizations to access renewable energy projects that may be located in different regions or have specific expertise. It provides opportunities for organizations to procure renewable energy from diverse sources and support the development of clean energy projects.	modifications in utility regulations may affect the feasibility and economics of the model. **Financial Market Conditions:** Sleeved PPAs often require financial intermediaries to facilitate the transaction. Changes in financial market conditions, such as fluctuations in interest rates or limited access to capital, can affect the availability and terms of financing for sleeved PPAs.

Figure 24: Swot Table for Energy Community Model

2 - Municipal aggregation:

According to this approach, a municipality, city, or group of municipalities might establish an organization to buy power in large quantities to satisfy the energy needs of interested citizens and companies. The community's several classes of power users have often registered in the program automatically, but they can decline. Cities can bargain for competitive rates with suppliers and developers by pooling their energy consumption. Long-term PPAs with independent renewable energy sources can be used to source most of the electricity. Although the local private utility often does not participate in the energy generation process, it is still in charge of electricity transmission and distribution, invoicing, collections, and other customer services (IRENA, 2016).

A city can utilize this business model with a municipal utility. The city can obtain clean energy directly from generators and at a more competitive rate by aggregating the energy demands of its citizens and nearby businesses, allowing its citizens to access clean energy and satisfy citywide clean energy targets.

Project Example:

SAN FRANCISCO CLEAN POWERSF :The City of San Francisco has the goal to meet 100 of city’s electricity demand from renewable energy sources As part of this goal, the city launched San Francisco’s Community Choice Aggregation program, CleanPowerSF, in May 2016 It is a program permitted by law in several states that allows cities and counties like San Francisco to buy electricity on behalf of their residents and businesses Through aggregating the demand, CleanPowerSF aims to create demand and source cleaner energy as well as support local economy While San Francisco is responsible for owning and purchasing energy to meet demand in CleanPowerSF program, their investor-owned utility partner, PG&E, continues to deliver the power, maintain the network, respond to outages, and provide billing services Residents and businesses are automatically enrolled in the programme, but there is the option to opt-out There are two tariffs in CleanPowerSF that enrolled customers can select from Green and SuperGreen Green tariff provides at least 40 renewable energy from sources in California and SuperGreen provides 100 renewable energy from sources in California with a slight premium over Green tariff rates. (Clean PowerSf, n.d)

Strengths	Weaknesses
Increased Bargaining Power: Municipal aggregation allows local governments to aggregate the energy demand of residents and businesses within their jurisdiction. This provides increased bargaining power when negotiating energy supply contracts, potentially leading to lower prices and more favorable terms for participants. **Local Economic Development:** Municipal aggregation can support local economic development by prioritizing the procurement of clean and renewable energy from local sources. This stimulates the growth of local renewable energy projects, creates jobs, and fosters a sustainable energy ecosystem. **Community Engagement and Empowerment:** Municipal aggregation	**Limited Control over Energy Sources:** Municipal aggregation often relies on energy suppliers to provide the actual energy supply. As a result, local governments may have limited control over the specific sources of energy used. This can be a challenge for communities aiming to prioritize renewable energy or specific types of clean energy sources. **Regulatory and Legal Complexity:** Municipal aggregation involves navigating complex regulatory frameworks and legal requirements. Compliance with state and local regulations, contract negotiations, and coordination with utility companies can be time-consuming and resource-intensive.

promotes community engagement and empowers residents and businesses to participate in shaping their energy supply. It allows for greater involvement in decision-making processes, promotes energy efficiency initiatives, and raises awareness about renewable energy and sustainability.	
opportunity	threats
Renewable Energy Adoption: The sleeved PPA model encourages the adoption of renewable energy sources by providing organizations with a direct supply of clean energy. It supports sustainability goals and helps organizations reduce their carbon footprint. **Market Access:** The sleeved PPA model allows organizations to access renewable energy projects that may be located in different regions or have specific expertise. It provides opportunities for organizations to procure renewable energy from diverse sources and support the development of clean energy projects.	**Market Volatility:** Energy markets are subject to volatility, with fluctuating energy prices and supply dynamics. This volatility can impact the financial viability of municipal aggregation programs, potentially affecting the ability to secure cost-effective energy supply contracts. **Changing Regulatory Environment:** Changes in energy regulations and policies at the state or national level can influence the viability and effectiveness of municipal aggregation programs. Evolving regulatory frameworks may require adjustments to program structures or impact the availability of certain incentives or funding mechanisms.

Figure 25: Swot Table for Municipal Aggregation Model

3- Virtual Power Plant (VPP)

A software platform known as a virtual power plant (VPP) allows for the remote control of a network of medium- and small-scale generator units, including solar, micro combined heat and power (CHP), wind, biogas, small hydro, storage systems, and systems connected to flexible consumers with variable demand. 5 All units are independently owned and managed while remotely controlled and deployed through the VPP's central control center.

A city can put this economic model into practice by participating in developing and administrating a VPP. Prosumers, decentralized energy generators, and storage systems can participate in VPP by offering variable power resources. Individual homes and companies can join VPP as flexible consumers and offer intelligent responses to VPP (Solar Power Europe, 2016).

The goal is to manage the generation and consumption of the connected units efficiently, trade the generated and consumed power profitably, and benefit from high prices so that participating consumers pay lower energy bills through remuneration and decreased electricity costs. Participating generators make more profit by accessing higher prices. For instance, to reduce the strain on the grid and profit from high prices, VPP can discharge linked electric vehicles' batteries and reduce flexible customers' usage at peak load times. By managing the levels of generation and consumption within its network, VPP either sells the electricity or ancillary services on the energy and balancing markets or dispatches the combined power regionally to balance supply and demand in the (regio South African-German Energy Partnership, 2017).

Project Example:

YOKOHAMA Virtual Power Plant : The city of Yokohama, TEPCO Energy Partner, Inc, and Toshiba Corporation have partnered to create the Virtual Power Plant building project The project includes installing storage batteries in elementary and junior high schools that are designated local disaster shelters and running remote operation tests to control electricity usage at times of peak demand Coordinating usage in ordinary times and acting as an emergency power source during emergencies will help to deal with peak electricity demand and increase resilience to disaster TEPCO EP will use storage battery group control systems developed by Toshiba to adjust power supply (demand response) during regular hours, while the City of Yokohama will use them to provide power in the event of a disaster or other emergency This project will help with reducing the use of old and inefficient thermal power plants currently used during peak loads through charging batteries during periods of low demand and supplying power during peaks using remote energy management systems.

<u>Strengths</u>	<u>Weaknesses</u>
Flexibility and Scalability: Virtual Power Plants offer flexibility in integrating diverse energy resources, including renewable energy generation, energy storage systems, and demand response capabilities. This flexibility enables the efficient management and optimization of distributed energy resources, allowing for scalability and adaptability to changing energy needs. **Grid Stability and Reliability:** VPPs can enhance grid stability and reliability by effectively managing and balancing electricity supply and demand. By aggregating and orchestrating distributed energy resources, VPPs can provide grid services such as frequency regulation, voltage control, and peak load management. **Decentralized Energy System:** VPPs promote the transition to a decentralized energy system by integrating distributed energy resources and empowering prosumers (consumers who also produce energy) to actively participate in the energy market. This enables greater energy independence, reduces transmission losses, and enhances overall energy system efficiency.	**Technological Complexity:** Implementing and managing a VPP involves complex technological integration and coordination. Ensuring seamless communication, interoperability, and data management across diverse energy resources and systems can be challenging and require significant investments in technology and expertise. **Market Barriers and Regulations:** VPPs face regulatory and market barriers that can limit their full potential. Inconsistent policies, regulatory hurdles, and market structures that do not adequately value the benefits of VPPs may impede their widespread adoption.
<u>opportunity</u>	<u>threats</u>

Renewable Energy Integration: VPPs provide an opportunity to effectively integrate and optimize renewable energy generation, such as solar and wind, into the grid. They enable the integration of intermittent renewable energy sources by managing their variability and ensuring a reliable and stable power supply. **Energy Market Participation:** VPPs can enable prosumers to actively participate in energy markets by leveraging their distributed energy resources. This opens up opportunities for prosumers to monetize their excess generation, participate in demand response programs, and contribute to grid services, fostering a more inclusive and dynamic energy market.	**Cybersecurity Risks:** VPPs rely on digital communication and control systems, which can expose them to cybersecurity risks. Protecting against cyber threats and ensuring the security of data and control systems is crucial to maintaining the integrity and reliability of VPP operations. **Economic Viability:** The economic viability of VPPs is influenced by various factors, including the cost of technology, energy market dynamics, and regulatory frameworks. VPP operators need to ensure that the potential revenue streams from energy market participation and grid services outweigh the costs of implementing and operating the VPP.

Figure 26: Swot Table for VPP Model

Financial Instruments

Financial instruments are used to finance clean energy projects in both the private and public sectors. They are essential because a clean energy investment primarily comprises the upfront cost, one of the most critical barriers to clean energy deployment. In addition to overcoming this, financial instruments can help circumvent other obstacles, such as a lack of long-term or project financing from the private sector or underdeveloped financial markets where it is difficult to obtain financing at reasonable costs. Therefore, publicly funded financial instruments should target eliminating barriers or risks hindering private investment and deliver a tremendous amount of private funding using minor public funds. Therefore, selecting the correct type and level of financial instrument is vital to tackle these barriers effectively.

The common financing mechanisms that have been used widely in various sectors are:

Self-funding: This is one of the simplest financing mechanisms, where the system owner, usually also the power consumer, uses cash to pay for the installation outright. This financing mechanism is heavily dependent on support schemes and also available only to investors with large amounts of cash.

Debt: Debt financing is where the owner/investor borrows part of the money needed for the clean energy installation. Debt financing comes in several forms: loan, senior debt, and subordinated debt (mezzanine finance).

Equity: In equity financing, the investor has a share which gives the investor the ownership of some or all of the assets and earnings of the project but only after all other debt obligations are met.

In this chapter, we have explained several innovative financial instruments that cities can use to accelerate clean energy deployment:

1- Crowdfunding

2- Feed-in scheme

3- Renewable energy certificates (RECs)

4- Net metering

5- On-tax bill financing

6- On-energy bill financing

7- Tax incentives

8- Investment grants

9- Green bond

10- Pay as you go (PAYG)

The table below represents how much control or influence a city can exert on these financial instruments. These may differ for each city depending on the regulatory context and powers of the city.

1- Crowdfunding

Crowdfunding is an innovative way of sourcing funding for new projects/businesses. It enables fundraisers to collect money from many people via online platforms. Crowdfunding is most often used by startup companies or growing businesses as a way of accessing alternative funds. It can also be a way of cultivating a community around your offering. By using the power of the online community, you can also gain helpful market insights and access to new customers. There are different types of experienced crowdfunding models which come as follows:

<u>Dept. and Peer-to-peer lending</u>

The crowd lends money to a company with the understanding that the money will be repaid with interest. It is very similar to traditional borrowing from a bank, except that you borrow from many investors. The advantage of this model is that it may be easier to win support for a campaign, as the backers are attracted to getting a return. This crowdfunding type may work best for businesses with a track record of revenues.

<u>Equity crowdfunding</u>

Sale of a portion of a company to several investors in exchange for capital. The concept is comparable to purchasing or selling common stock on a stock exchange or to a venture capitalist. In other words, equity crowdfunding will contribute money in exchange for shares or a small stake in your business, project, or venture. Given that participants earn shares according to the amount of money they contribute.

<u>Rewards-based crowdfunding</u>

In this model, a non-financial reward, such as goods or services, is typically expected in compensation for a person's contribution when they donate to a project or business. (eg, credits on a record cover, tickets to an event, gifts, etc.) the more an investor donates to your fund, the greater the reward they will receive. Since the reward does not usually cost much to deliver, it could be one of the advantages of this model.

Donation-based crowdfunding

Individuals create tiny donations to help a particular humanitarian initiative reach its bigger financing goal. At the same time, I am receiving no financial or material return.

Crowdfunding platforms typically assist smaller, entrepreneurial developers with funding their renewable energy initiatives. These initiatives often involve small-scale investments of less than €10 million locally. The industry for crowdfunding worldwide, estimated to be worth €10 billion in 2021, is anticipated to expand dramatically over the next few years. Energy experts anticipate that the ground-breaking idea might now be used to boost the growth of renewable energy. Specifically, in the European context, in 2020, there were USD 2,089.41 million in transactions on the crowd-investing market, and by 2026, it is predicted to reach USD 3,524.14 million. The effect of the pandemic-induced lockdown, which drove enterprises to close, caused a considerable decline in revenue for vendors operating in the market under study during the Covid period. This resulted from the low levels of investment in business expansion and other activities. There are over 880 crowdfunding platforms in Europe. Some well-known platforms in the area include Funded by Me, CrowdCube, and Seedrs.

Moreover, there is the share of European platforms belonged to different countries until 2016, German (30.4%), Dutch (21.7%), French (17.4%), and Austrian (8.7%). The UK, Sweden, Belgium, and Finland platforms (4.3%). Germany and the Netherlands have the eldest active platforms, and Germany has the most significant volume of crowdfunded RES projects, followed by the UK and the Netherlands. France, Austria, Finland, Sweden, and Belgium come at a distance.

According to a survey done by Leaderkit in 2020 (a well-known crowdfunding platform), 43% of platforms are self-financed, angel investors sponsor 25%, and 4% are funded by venture capital, according to their analysis resulting from questionnaires answered by different crowdfunding platforms, 35% claimed to have spent over €200,000, 26% spent €101,000 – 200,000 and 7% – €10,000 or less. So it could be estimated that companies spend at least 89,000 EUR to build a crowdfunding platform. The price of crowdfunding software varies depending on the type of business, the needs, the location of operations, and other elements. One thing is sure: launching a business is only the first step, and still, it may be estimated that we confront extra expenses while running the platform, and again, it varies based on model and country regulatory requirements, software, and third-party integrations. For launching a regulated platform, there are estimated direct costs. In order to protect investors, the FCA mandated that loan-based crowdfunding platforms maintain a minimum of £20,000 in reserve capital between 2013 and 2017. Moreover, the sum has increased to £50,000 after 2017.

The new regulations suggest the following structure: Platforms must have higher levels of:

Variable volume-based measure – for platforms that are fully authorized:

- 0.3% of the volume of loaned funds up to £50m

- 0.2% of the volume of loaned funds above £50m up to £500m and

- 0.1% of the volume of loaned funds above £500m

It is essential to add also other expenses for launching a new crowdfunding platform, such as the cost of adding new duties or hiring new staff and the cost of new software. For instance, in this case, the costs for the subscription may vary from £50 to £3,000+ per month, and also the cost of the third party.

Crowdsourcing allows the company to call on external people and thus benefit from their different and new points of view concerning its activities. It will also allow the company to exploit the intelligence, know-how, and creativity of a large number of individuals in order to pool their imaginations to solve the innovative task, project, or challenge that requires crowdsourcing.

For those involved in crowdsourcing, the aim is to get involved in such a challenge because they will receive a financial reward or a prize awarded by the company in exchange for their commitment. For a company, crowdsourcing can also be a way to do its market research at a low cost by distributing its products to customers. They can provide advice and feedback to improve the product. It is also advantageous for customers because they become brand ambassadors and get the products for free.

They are several successful experiences related to different models of crowdfunding in Europe. For instance, Kinetik Automotive, a business producing electric cars in Bulgaria, started a crowdfunding campaign in June 2021, intending to raise BGN 185,000 to resuming operations after a fire destroyed its manufacturing facilities in April. Since the campaign's launch, Kinetik has received over BGN 85,000 from 178 contributors. Furthermore, in February 2021, HeavyFinance, a regulated crowdfunding site that makes it simple for small farmers to get loans for agricultural equipment, will be launched. Since launching in Lithuania in 2020, Heavy Finance has arranged more than 60 loans with a combined value of around 3 million euros.

However, there are still some barriers to crowdfunding platforms based on the geographical location and the regulation and administration applied to them. Depending on the type of crowdfunding selected by the platform owner, a wide range of national laws apply to crowdfunding throughout the Member States. Therefore, the following should be mentioned as the primary obstacles to citizens investing in renewable energy through crowdfunding:

1. The lack of a national framework applicable to crowdfunding leads to excessive regulatory and administrative burdens that vary from country to country and are a disincentive to setting up a crowdfunding platform and for cross-border investment.

2. The need for more transparency and the legal uncertainty for external investment due to the variety of national regulatory systems.

3. The need for an EU crowdfunding framework.

4. Uneven playing field regarding the publicity of RES projects and tax incentives.

Depending on the model used (if it is equity, lending, or reward), The amount of legislation that will have to be complied with by the crowdfunding-financed project differs and alternates from financial regulations in the case of an equity crowdfunding platform to banking regulations for lending models and consumer's law, intellectual property, and electronic commerce legislation, for instance, according to a 2020 European Commission survey, one in every four European SMEs faces a problem when applying for a loan through banking institutions. The Netherlands was the most challenging country for SMEs to access a loan, with 43% of SMEs reporting difficulties, while the United Kingdom and France were the least problematic. This barrier makes the road uneven Lending base platforms.

Also, depending on the transposition undertaken by Member States of EU legislation since crowdfunding may fall under the scope of many Directives. This is also an element of difficulty for crowdfunding platforms, especially when aiming to operate EU-wide and for cross-border investors. For instance, to operate in the EU, a crowdfunding platform (even if depending on the model) would have to be licensed in all 28 Member States, which is very difficult, not to say impossible, due to the enormous financial and administrative burden it would represent. A common EU framework that enables a quality label that boosts confidence in crowdfunding platforms, enables cross-border investment, cuts the red tape on licensing platforms, and increases investors' and citizens' confidence would be vital to promoting crowdfunding in the European Union.

Strengths	Weaknesses
Access to Capital: Crowdfunding provides an alternative funding source for individuals, entrepreneurs, and organizations who may have difficulty accessing traditional financing channels. It allows them to raise capital directly from a large number of people who are willing to contribute small amounts. **Market Validation:** Crowdfunding allows entrepreneurs to gauge market interest and validate their ideas or products before full-scale production or launch. Positive responses and contributions from backers can provide valuable feedback and market validation for future success. **Community Engagement:** Crowdfunding platforms foster community engagement by connecting creators or entrepreneurs with backers who share similar interests or values. It creates a sense of involvement and participation, building a supportive community around the project or business.	**Technological Complexity:** Implementing and managing a VPP involves complex technological integration and coordination. Ensuring seamless communication, interoperability, and data management across diverse energy resources and systems can be challenging and require significant investments in technology and expertise. **Market Barriers and Regulations:** VPPs face regulatory and market barriers that can limit their full potential. Inconsistent policies, regulatory hurdles, and market structures that do not adequately value the benefits of VPPs may impede their widespread adoption.
opportunity	threats

Renewable Energy Integration: VPPs provide an opportunity to effectively integrate and optimize renewable energy generation, such as solar and wind, into the grid. They enable the integration of intermittent renewable energy sources by managing their variability and ensuring a reliable and stable power supply. **Energy Market Participation:** VPPs can enable prosumers to actively participate in energy markets by leveraging their distributed energy resources. This opens up opportunities for prosumers to monetize their excess generation, participate in demand response programs, and contribute to grid services, fostering a more inclusive and dynamic energy market.	**Cybersecurity Risks:** VPPs rely on digital communication and control systems, which can expose them to cybersecurity risks. Protecting against cyber threats and ensuring the security of data and control systems is crucial to maintaining the integrity and reliability of VPP operations. **Economic Viability:** The economic viability of VPPs is influenced by various factors, including the cost of technology, energy market dynamics, and regulatory frameworks. VPP operators need to ensure that the potential revenue streams from energy market participation and grid services outweigh the costs of implementing and operating the VPP.

Figure 27: Swot Table for Crowdfunding

2- Feed-in schemes

A feed-in scheme is a financing instrument where the clean energy generator receives a direct payment per unit of energy produced, i.e., a feed-in tariff.

The scheme can also offer feed-in premiums added to the wholesale market price when the generator sells its production. Caps and floors can also be introduced to prevent excessive profits or limit generator risks in cases where the electricity market price is too high or too low.

Feed-in schemes guarantee a predictable and long-term revenue stream, which can serve as a stable financing basis for a business model. Feed-in schemes generally vary depending on the installation size, technology, and fuel used, and the payment is generally based on production or export levels. A city can introduce feed-in tariffs to incentivize residents and businesses to generate clean energy on their buildings and promote clean energy deployment in the private sector. The city can also use the feed-in scheme to purchase the energy generated from an individual's or business's clean energy systems to help it reach its clean energy goals.

An example is the value of the Solar rate Austin Energy provides to its customers for on-site solar energy production in Austin.

3-Renewable energy certificate (REC)

A renewable energy obligation or quota system is a scheme introduced at a national level requiring producers to generate a specified proportion of energy from renewable sources, suppliers to supply a given proportion from renewable sources, or consumers to consume a given proportion from renewable sources.

These requirements are fulfilled through certificates, e.g., renewable energy certificates (RECs). Each certificate represents the certified generation of one renewable energy unit (typically one megawatt-hour). REC represents a quantification of the non-energy attributes of power generated using renewable resources, unbundled from the value of the electricity. REC can be used for both regulatory compliance purposes and voluntary consumption. Certificates provide a tool for trading and meeting renewable energy or quota obligations among suppliers and generators and for voluntary clean energy purchases. Additional cash flow and funding for installing new clean energy projects can be achieved through the sale of RECs.17 RECs can facilitate cities to claim clean energy purchases and achieve their city-wide clean energy targets. Bundled renewable energy purchases with the associated RECs enable cities to claim towards GHG emission reduction and decarbonize their energy supply targets.

4-Net metering

Net metering can be used under a self-consumption business model. Through net metering, prosumers can net off the generation from their consumption over a considerable timeframe. Therefore, generation and consumption do not have to coincide or match amounts. This mechanism allows the prosumer to net off the generation from their meter even though they do not consume power when it is generated. As the power is netted off from the meter, this excess energy is valued at retail price as the consumer does not have to pay for their consumption for the netted amount. This allows the prosumer to benefit more from their investment than just exporting the excess power to the grid with an export tariff rate generally lower than the retail price, e.g., wholesale price. This second approach is called net billing. With net billing, consumers can reduce their energy bills by receiving credits for the monetary value of exported energy.

There are several variations of net metering, such as aggregate net metering and virtual net metering. These variations can be used with other business models such as PPA, community energy, etc. They allow customers to receive bill credits for some or all of the generation from an off-site clean energy project. Virtual net metering allows clean energy generators to have many energy consumers, and similarly, consumers may have many generators to choose from. Aggregate net metering enables cities to net off the energy produced on an off-site clean energy project from the meters of their multiple sites, such as city-owned buildings. These net metering variations can also be used for the residents to receive net metering credits from a shared community energy project.

5-On-tax bill financing

On-tax bill financing is a mechanism local governments use to provide low-interest loans for homeowners to invest in clean energy, which they gradually pay back through slightly higher property taxes. An example of this model is the property-assessed clean energy (PACE) financing model used in the United States. There are many PACE programs, such as the City of Dallas PACE.

As the loan is secured by the property instead of the owner, the repayment obligation can be transferred to the new owner. This financing instrument comes at a reduced rate, as local governments can obtain debt at a lower cost than individuals. The on-tax bill financing programs are generally financed through municipal green bonds.

6-On-energy bill financing

This financing method suits individuals or businesses interested in installing clean energy technology on their premises. On-energy bill financing aims to remove the upfront cost of clean energy installations for customers by incorporating the financing into their regular energy bill. The loan payments are spread out over a long period with a low-interest rate. Typically, the responsibility for repayment remains with the property rather than the homeowner or company. Therefore, if the property is sold, the new owner must agree to assume the repayment obligation to take ownership.

Cities can facilitate on-bill financing programs in several ways, including mandating or incentivizing utilities to participate, addressing legal issues related to liabilities arising from these programs, collaborating with utilities to provide access to capital, and combining the program with subsidies to support the installation of a broader range of clean energy technologies and energy efficiency measures. (IEA-RETD, 2012). An example of this mechanism is Clean Energy Works Portland.

7-Tax incentives

Governments commonly utilize tax incentives and benefits to encourage the adoption of new clean energy technologies. These incentives can be applied to various types of taxes and are typically implemented for a specified period until the market for energy production is considered established. Alternatively, governments may impose energy taxes on fossil fuels instead of offering tax incentives for clean energy. These taxes can include levies related to emissions, such as taxes on CO2 emissions, as seen in the case of British Columbia's carbon tax. These taxes address market failures by incorporating the external costs associated with fossil energy sources in the heat and electricity sectors. Implementing such taxes aims to create a more level playing field and facilitate the competitiveness of clean energy in the marketplace.

Tax incentives can also be provided in the form of tax credits, which reduce the tax obligations of the recipient. For instance, an investment tax credit allows for deductions from tax obligations or income for investments made in clean energy. This encourages individuals and businesses to invest in clean energy by offering them financial benefits. Additionally, governments often employ another common tax incentive, subsidizing clean energy technology's cost. This is achieved by reducing the sales tax or import duty associated with purchasing equipment for clean energy generation, thus making the acquisition more affordable (APEC,2009).

In summary, tax incentives and benefits, including tax credits, subsidies, and reductions in sales tax or import duty, are employed by governments to promote the adoption of clean energy technologies and create a more favorable market environment for their development and deployment.

8 Investment grants

The investment grants/rebates are generally in the form of cash and used to encourage the deployment of clean energy technologies and eliminate the investment cost barrier by reducing the upfront cost to the customer. They are used by states, municipalities, cities, utilities, and other non-governmental organizations to encourage the use of specific renewable energy technologies. Rebates and grants are generally available for a limited time and from a limited budget. (Feldman, D., Bolinger, M. 2016) While grants may require the city to evaluate each proposed project/installation, rebate programs generally have eligibility requirements, and all eligible projects qualify for the rebate. Therefore, rebate programs can be easier to administer than grant programs.60

9-Green bond

Green bonds resemble traditional bonds but with a critical distinction: the funds generated from green bonds are specifically directed towards financing environmentally friendly projects that are closely monitored to ensure adherence to sustainability criteria. Given that many cities face constraints in accessing capital markets, green bonds offer a means for municipal governments to secure funding for clean energy initiatives (IRENA, 2016). Similar to conventional bonds, investors who purchase green bonds earn financial returns on their investments

10-Pay as you go (PAYG)

In the pay-as-you-go (PAYG) financing mechanism, the clean energy equipment or system supplier removes the up-front capital barrier by providing the clean energy system to the customer for an initial small (or no fee) and the customer pays to use the energy through a top-up system. This system generally requires a mobile phone. Customers can buy pre-paid top-up cards from their local distributor or through their mobile phone and use SMS communications to unlock the clean energy system for a specific period remotely. Depending on the conditions of the agreement, the ownership of the system is transferred to the customer, and the system is unlocked indefinitely after certain payments. There is no loan requirement; however, if the customer stops buying top-ups and using the system, the system may be eventually removed and redeployed by the provider (Horváth & Szabó, 2018)

5.1.2 The Evaluation Matrix

In conclusion, to synthesize the collected data, a process of key-concept coding has been performed, enabling to homogenize the concepts found in different papers. It has contributed to categorizing 25 different business models in the proposed categories. The proposed categories are located in the two main subdivisions, which are absolute financial BMs that concentrate only on providing necessary funds to execute a project and the Financial-prosumers BMs that not only try to find a way to obtain the money but are the collaborative - innovative way of supplying and generating clean energy. These clusters of BMs are mainly based on the literature review. In the end, the analysis in this master thesis has explicitly or implicitly referred to three of the presented categories. The three business models (BMs) were chosen based on their level of innovation, specifically collaboration and participation. Following a comprehensive evaluation of the strengths, weaknesses, opportunities, and threats (SWOT analysis) associated with each BMs, it has been determined that the energy community, energy service companies (ESCOs), and crowdfunding align more effectively with the fundamental concept of this thesis. Moreover, through multiple meetings with the partners and consortium of the FINsesco project, this decision has been made to propose an innovative solution rooted in these three business models.

In the assessment of various BMs, a set of six fundamental criteria is employed. These criteria are devised to encompass a comprehensive range of features that apply to the broader concept of BMs. The author selected these criteria after an extensive review and analysis of multiple sources, aiming to capture the commonalities and distinctions among various business models that were assessed. This careful examination identified the six main criteria that effectively encompass the most significant aspects applicable to the concept of business models (BMs). By incorporating these criteria, a comprehensive framework is established, ensuring the coverage of essential elements relevant to the evaluation of BMs. Through this approach, the author seeks to provide a robust assessment that captures the key considerations for understanding and comparing different BMs in a meaningful and insightful manner. The criteria are outlined as follows.

Support Local Generation: refers to guidelines or principles that prioritize and promote the development and utilization of locally generated renewable energy sources. These criteria aim to maximize the benefits of renewable energy within a specific geographic area or community. It emphasizes utilizing renewable energy resources produced locally, such as solar, wind, hydro, or biomass energy.

Independent from Local Resources: refers to the ability of a renewable energy system to operate and generate power without relying heavily on locally available resources. Instead, it focuses on diversifying energy sources and ensuring energy independence through a mix of renewable energy technologies.

Easy implementation (contractual structure): refers to the simplicity and efficiency of the contractual framework and agreements involved in establishing and operating the energy business. Accelerating project development and fostering a conducive environment for renewable energy deployment is necessary. It reduces complexities, improves transactional efficiency, and supports the successful implementation of the business model's energy generation and supply activities.

Low, upfront Investment: refers to requiring minimal initial capital expenditure to establish and launch the model. It focuses on minimizing the upfront financial burden for investors or entrepreneurs and making the business model more accessible and attractive to potential stakeholders. It is necessary to attract investors, reduce financial risks, and promote wider adoption of renewable energy solutions. It enables greater market participation and creates opportunities for entrepreneurs or organizations with limited financial resources to enter the renewable energy sector.

Suitable for the market (Regulated and deregulated):

Refers to the model's adaptability and compatibility with regulated and deregulated energy markets. It focuses on a business model that can effectively operate and thrive within different market structures, whether governed by regulatory authorities or in a more liberalized and competitive environment.it is necessary to vary market conditions, capitalize on opportunities, and navigate regulatory requirements. It enables the business to operate effectively, expand its market reach, and maximize its potential for success across different market structures.

Public/Community involvement:

Refers to the active engagement and participation of the public or local communities in the planning, development, and operation of energy projects. It emphasizes the importance of including stakeholders and fostering a sense of ownership, transparency, and collaboration within the energy business community.it is necessary to build strong relationships with the community, create shared value, and ensure that the energy project contributes positively to the well-being and aspirations of the local population.

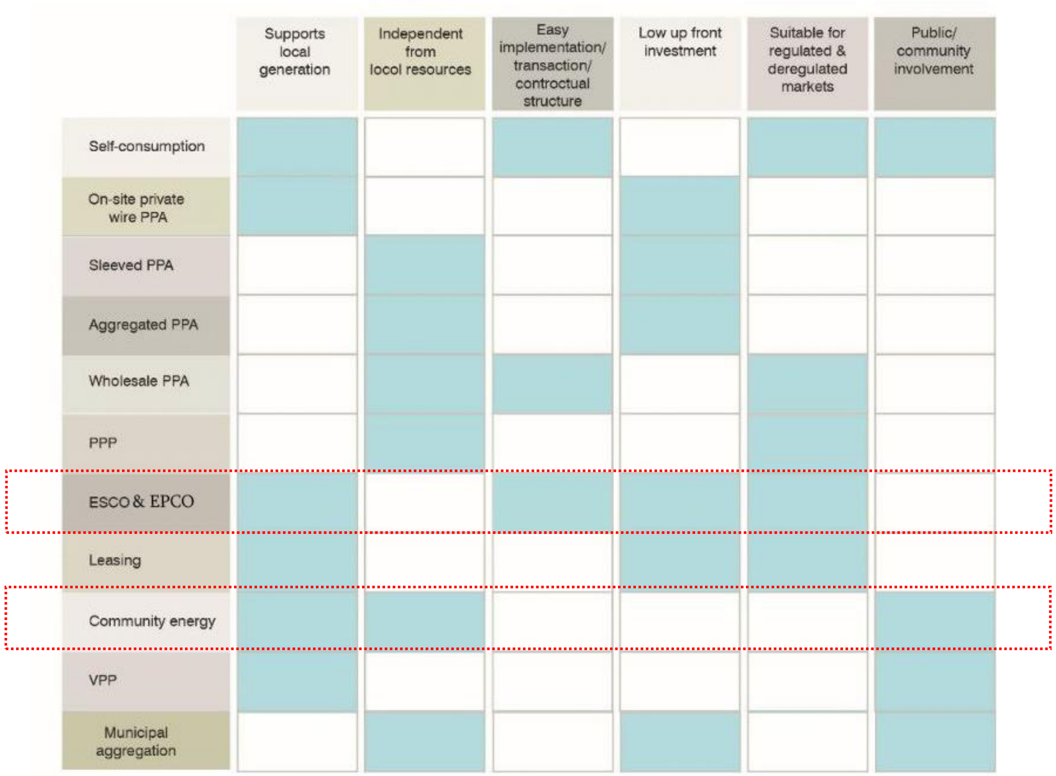


Figure 28: BMs evaluation matrix

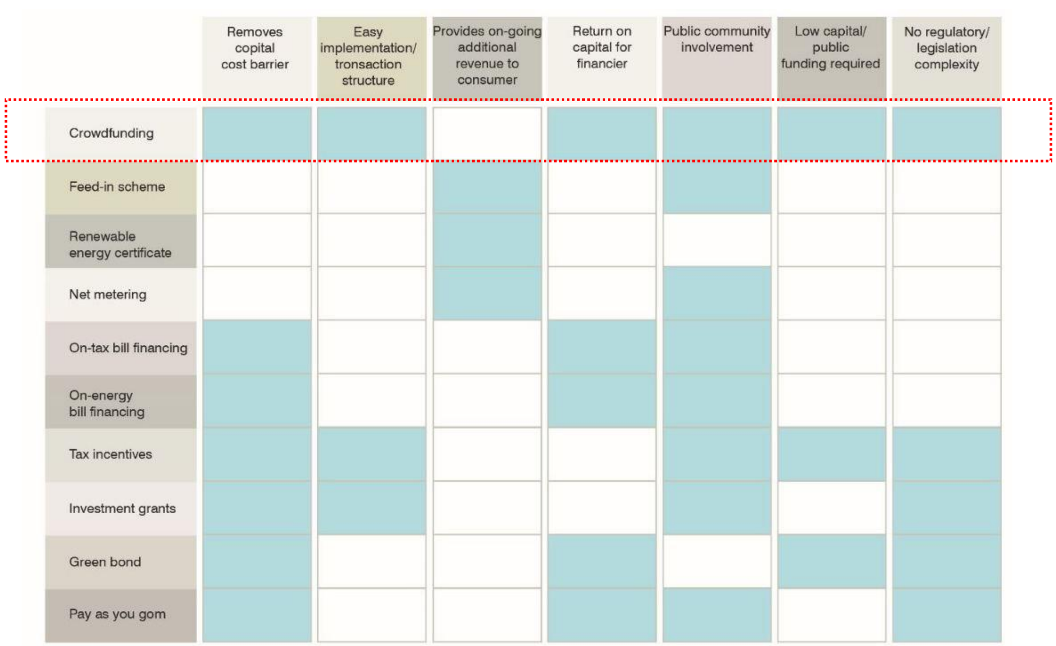


Figure 29: BMs evaluation matrix (Specificaly for Finacial Instruments)

5.2 Phase 2

5.2.1 Interviews

The primary data collection was based on semi-structured interviews through ten online meetings and phone calls. The work is based on semi-structured interviews to increase the space of capturing the subjective perspectives of the interviewees, collecting information not foreseen by the original questions, and expanding the object of analysis to perspectives not limited by the original design (Magnusson & Marecek, 2015). The interviews were conducted with industry experts operating in the energy market. The group of interviewed members will come from previous desk research and FinSESCo's network, selecting relevant stakeholders from energy firms - suppliers, associations and energy consultants, representatives from financing institutions, and researchers.

ID	Role	Business Model	Field
1	Vice Mayor	REC	Government and Academia
2	Project Development/Contractor	Crowdfunding	ESCO and Financing Sector
3	Investment Manager	Crowdfunding	Financing Sector
4	Consultant	EPCo	Consultancy/Legal
5	Head of Business Innovation	REC	Academia
6	Office Coordinator	REC, Intracting and EPCo	Consultancy
7	Researcher	REC	Academia
8	Public Officer	Intracting, Energy Efficiency	Government
9	Director	EPCo	ESCO

Figure 30: Interviewees Information

<u>PESTEL SWOT Analysis for the BMs Based on Interviews</u>

Crowdfunding

Strengths

Political: When combined crowd investing with Energy Communities and municipalities, these different stakeholders can participate from the beginning of a project.

Economic: Crowdfunding is an opportunity to fund smaller projects that usually do not raise the attention of large financial institutions while contractors still have the same amount of work.

Social: Crowdfunding is easily adapted to blockchain technology because of its "dispersed nature"; Partial ownership of the project is fundamental for its success - "local participation is a big thing."

Technological: There are no technological risks compared to Solar or Wind. Technology is safe and proven, with plenty of expertise. In the technical aspect, as a contractor, a 2 Mw project does not differ from one of 20 Mw - meaning they have approximately the same amount of work.

Environmental: "Crowdfunding makes investing in renewable projects possible for a type of investor that would normally not participate in those projects."

Law: Crowdfunding platforms are largely regulated by the financial market authorities - "it has a clear solid legal framework." These platforms have a solid legal base as they host different projects and transactions.

Weaknesses

Political: Trust is a fundamental aspect of crowdfunding - it only works if the investors trust not only the project but also the platform(s) hosting it and the legal arrangements provided by the country. Therefore, the platform must be reliable and show potential investors its reliability - that takes time. This combination of factors plays a role in which projects the investors will invest in.

Economic: Big financial institutions have certain thresholds; they are looking for a specific size. They are looking for projects of at least 5MW. It is an economic challenge to find the perfect project size and how to match the investors. Crowdfunding must be seen, however, as an additional source of funding, not the main one.

Social: The projects are usually initiated by constructors and financial institutions, starting from something other than consumer demand. Investors have an increasing interest in renewables these days, but it can be challenging for an individual to invest small amounts.

Technological: New technologies need to get more attention for their risks, not being suitable for crowdfunding projects. The same thing happens with the platforms. Investors are hesitant to invest in new crowdfunding platforms.

Law: Investors invest in multiple projects to diversify. In that sense, the popularization of crowdfunding created several different platforms that could be more reliable in terms of investment, that being, it does not have the necessary user traffic, hosts campaigns that are not frequent, and without more significant projects. "Probably because the element of trust is not there."

Opportunities

Political: Bringing together municipalities and local communities to partially co-own the projects increases the chances of success. For a platform to work, increasing the number of reliable projects while increasing trust continually is necessary.

Economical: If a particular project can handle these higher transaction costs, then it is a viable alternative for smaller renewable energy projects. Presenting more suitable projects increases the level of trust. Crowdfunding is better suited for smaller projects. However, larger projects can be combined with funding from traditional funding institutions while raising local participation to participate as project investors through crowdfunding. Doing that can fill a niche role within renewable energy projects. "There is already there; it is already working."

Social: Easily adapted to blockchain technology since it is dispersed. "The way you as a project developer allow the possibility of the community to take part in the project'. That being, while constructors give some compensation for the project -as the installation will be close to their homes, and they stimulate them to take part in the financing of the project, allowing them to make some return - the chances of success increase, and the several parts are benefited.

Technological: There are several crowdfunding platforms primarily consolidated. Consumers now appropriate the technology.

Environmental: Crowdfunding makes investing in renewable projects possible for a type of investor that would usually not participate in those projects".

Law: Crowdfunding platforms are also accepted by commercial banks. There is an excellent legal base and vast experience for this agreement between senior lenders, local community investors, and crowdfunding platforms.

Threats

Political: The municipality permit is essential to a project. Solar and wind crowdfunding projects usually depend largely on the municipality's approval, making them more independent and volatile according to the municipality's agreement and their political interests.

Economic: It depends on how provable the technology is and which size the project size. Investors are cautious about putting their money on projects that have not been proven. They will only invest in a limited percentage of the total project. Through crowdfunding, however, the project's total cost will rise since the funding will be dispersed. That so, the costs of landing a project will increase because crowdfunding's costs are higher than traditional commercial bank funding; transaction costs are higher since the projects are smaller - "it is not so efficient" compared to commercial banks. At the same time, there is a risk of going to the market "too early" in the early stages of the project and not landing attraction to the crowd investors because the risk is too high.

Social: The community plays an active role in strengthening the project and increases the chance that the project will be successful. If the developer ignores their participation and gives some sort or partial ownership of the project, the chances are the project will not find sufficient engagement. At the same time, guaranteed initial investment from a bank brings trust for subsequent local community investment through crowdfunding. Therefore, projects that do not raise community support, such as energy efficiency refurbishment, may not be ideally suited for crowdfunding. It is then essential to bring the project to the community after the developer has established an agreement with a commercial bank. At the same time, getting investments from commercial banks without them foresing a possible commitment from the local community is getting more complex.

Technological: Technology readiness determines whether projects will get funded or not. Sometimes interesting locations with suitable energy potential do not start because the connection to the grid is too far away, and the project size needs to be larger - or profitable enough - to bear the costs of connecting it to the grid.

Environmental: The projects are permeated by the expectation that the Kw/h sold can profit, so when Solar Energy or Wind prices are unfavorable, the number of projects initiated may be reduced.

Law: Senior debt is provided by a commercial bank, but the local participation provides only a small amount compared to the total amount of the project. Therefore, there must be some subordinate agreement between the senior lender - the commercial bank institutions - and the crowdfunding arrangement. It is, although, an already solid and known commercial arrangement.

EPCo and ESCo

Strengths

Political: EPCo can be used for many different types of projects, from different types of clients - public, private, and consumers -, from different sizes. Public grants can act as boosters for EPC projects.

Economic: Different from crowdfunding, for example, EPCo projects can be started from several parts: government, clients, ESCOs, or investment banks. A private company can acquisition of projects by itself, present, motivate, and identify possible projects and facilities, and prepare feasibility studies. Financial institutions can also work in the front matching ESCOs and clients as a form to diversify the investment portfolios, acting also performing Energy Audits - assessing the proper risks, "putting money on the market with lower risks." Different advantages are achieved according to the initiator or the project - ESCOs have the expertise and knowledge - to implement it cheaper and reduce installation costs.

Social: As several parts can act to foster the initiation of a project, the clients gain autonomy to search for ESCOs or investors in the projects.

Technological: Today, ESCOs can perform technical performance assessments for long periods, minimizing risks. This pushes ESCOs companies to start projects, persuading clients of the possibility of paying less on energy bills.

Environmental: Companies also diversify their portfolios by decentralizing risks and investing in EPCo projects.

Law: In European Union, there is a clear framework for EPCo within the public sector.

Weaknesses

Political: Usually, to start a project in a new country, the first step is usually taken by governments interested in starting EPC in their territory, even when there are some market opportunities. Therefore, new operations start small - with low payback period projects between private companies and the government. Presenting a clear legal framework for the operation. Banks and other financial institutions must be highly prepared to understand the EPCo specificities, assess the risks adequately, and propose correct interest rates and collateral. Grants are important to create new opportunities in the market. However, grants should be used only for non-energy conservation measures - that is, projects with larger payback periods, otherwise, or energy conservation measures with long payback periods. Therefore, grants should be used wisely to support, for example, badly conservated structures. "It is a very political instrument." The ESCOs or investment institutions usually search for cities where a mayor is interested in developing such a project.

Economic: There must be an awareness of what types of projects and with what payback period extension the players are willing to accept for each moment. An assessment of the EPCo market stage for every country is fundamental to understanding which will be the ideal initiator and which complexity the project would require.

Social: It is difficult to guarantee all the several possible parts of projects on the same level of trust. There must be an active effort to guarantee trust and transparency in the relationships and contracts. A strategy would be the open book approach - demonstrating how the model works for every stakeholder, with financial institutions as observers of the project development, while ESCOs keep transparency regarding the costs and savings.

Technological: There is a clear bias to the Measurement and Verification process of the Savings on the part of the ESCOs. There is no incentive for them to implement an unbiased M&V process.

Environmental: There is usually a "cherry picking" of projects - projects too small are often ignored since the transaction costs are higher to support the development. Combined with that, there is a limited capacity of ESCOs to offer adapted financing for different project sizes. Different measures for energy efficiency vary largely according to different external factors during the extension of a project. Therefore, companies choose the projects with measures with a more stable payback period - energy conservation, such as in-door lighting, has a short payback period when compared to heating infrastructure ones - that have a payback period of up to 15 years in some cases. When you start EPC projects in a new country, usually, the companies opt for "the quick wins." "It creates a nice image of Energy Performance Contracting but at the same time breaking the market," as companies do not access the risks for larger projects, putting trust blindly in the method.

Law: There must be an extensive legislative and legal analysis, identifying the gaps for different countries to boost EPCo in them where it does not have the culture of EPCo contracting. There is, then, an initial barrier to introducing EPCo to different markets. The contracts between the several parts can be extensive and complex - often is required a legal institution with the expertise to construct them and hold every possible relationship between the parts and adapt to a vast possibility of arrangements.

Opportunities

Political: If a project has the support of grants, the contract can be made shorter, making it more efficient. Although, without the support of grants, ideally, a project must diversity the measures. "A good contract is one that you can end earlier or can invest more measures, so you have more benefit as a client."

Economic: There is a huge potential in the residential sector for EPCo. As soon as a country has developed a strong environment between the public and private sectors, with companies experienced enough, the residential sector can be largely explored with guaranteed returns. "This sector lays the biggest potential." In that sense, blockchain and smart contracts can be differential to help boost the trust between several stakeholders. The platform(s) could also start with lighter versions of EPCo projects and assess the savings performance from shorter periods to raise trust. For example, if a project has a payback period of 10 years, it can be started is an evaluation after two winter seasons to evaluate the underachievement or overachievement and readjust the following steps.

Social: Potential of interaction with other options such as EPCo combining with crowdfunding and public sector initial investing or also combining with private funding. There is, then, a potential to adapt to complex situations and readjust according to the size of the project combining different sources of funding while creating co-ownership through crowdfunding. At the same time, there is a gap to be filled by projects starting from the consumer side, guaranteeing their requirements through fostering a project.

Technological: EPCo can be used not only for the renovation phase in the energy efficiency procedures but also in the operational and maintenance stages. There are some companies specializing in the latter. This pushes companies the usage of better materials during the implementation phase to optimize the maintenance process.

Environmental: "Energy efficiency doesn't know crisis" - there is a steady marginal profit for this type of investment.

Law: Opportunity to a platform work as a Super ESCo, a specialized organization with the capacity to develop projects - with proposals, documentation, financing structure, and savings forecast in only one environment, making it easier to find projects, adjust to their sizes, and develop the market where it could be feasible. By the side of the government, it could also boost EPC in the public sector by minimizing the launching barriers.

Threats

Political: The entering requirements vary from country to country. For some countries, the contractor must raise a higher value for the initial transaction costs to fund the project. The way financial institutions assess the risks largely varies depending on the country, the experience of the developer the type of project. Streetlighting, for example, requires very low technical capacities compared to school refurbishment (in a middle point) and also from hospitals (large-scale projects). In that sense, the type of risk analysis varies largely from project to project, causing difficulties in diversifying the type of projects a company is invested in, being affected also by the experience of the financial institutions in these types of projects. There must be an active role of government in thinking of strategies to combine the strategies with short and long payback periods.

Economic: What is not very real, but is written in the agreements often, is that the ESCos are sharing the savings - this cannot happen in many countries and markets where the energy prices are not high enough because of the payback period. Usually, the payback period can be up to 10 to 12 years and depends on the savings, depending on the situation - you are not able to share the savings with the clients. But when the energy prices are rising, then you can,

Social: Every stakeholder must be fully informed and aware of the specificities of the EPCo market, their transaction costs, and their risks. By doing that, you can keep motivation from the side of financial institutions, so it is created a culture of investing in EPCo projects.

Technological: The contractor must know exactly what to do and be confident that they can bear the risks - the performance risk, the technical risk, and the financial risk. Apart from that, they must transfer the operational maintenance during the duration of the contract. This contract must include everything from the identification of measures, design, the chosen technology, and the materials - bearing the risks during the implementing time, knowing that the contractor will only be paid with achieving savings, aligning with the agreement between the client and the ESCO. The quality of the Energy Audits varies largely from country to country, and it imposes a thread to the savings of a project. The private market must host experienced ESCO and engineers. There must be a diversity of small, medium, and big ESCOs to fill different project sizes. The costs for the operational and maintenance phase can be higher than the ones from the implementing one. Therefore, there must be a clear design for the profit that bears the costs of the maintenance phase.

Environmental: The distribution companies get bonuses for selling more energy; they do not have an interest in saving energy. Their interest in selling more and more energy must be decoupled. There must be an alignment together with distribution companies.

Law: The EU legislation regarding EPCo is still recent. Up to 2017 in the EU, EPC debt was always threatened as public debt. Most of the contracts were implemented through forecasting - the ESCO invests and sells the future receivables to banks to implement future projects. Since 2017 (EU Regulation 2017/1369; Eurostat Guidance note), this has changed, and there are now certain criteria to treat it as public debt or not.

Energy Community

Strengths

Political: The EU has established policy frameworks and incentives that explicitly support energy communities. Initiatives like the EU Renewable Energy Directive and the Clean Energy Package provide regulatory provisions, financial support, and favorable conditions for the development of community-based renewable energy projects. These policy measures strengthen the political standing of energy communities by recognizing their importance and providing avenues for their growth. Moreover, energy communities benefit from participating in European networks and associations that focus on renewable energy, sustainable development, and community engagement. These platforms provide opportunities for knowledge exchange, capacity building, and policy advocacy at the EU level. By engaging in these networks, energy communities can amplify their political impact and collaborate with like-minded organizations across Europe.

Economic: The energy community operates through an efficient mechanism that involves the production of energy and the sale of any surplus generated.

Social: They are characterized by their high level of participation and engagement, distinguishing them from the other two energy models. The participatory nature of energy communities enables active involvement from community members, fostering a sense of ownership, shared decision-making, and collective action.

Technological: Energy communities have gained significant traction and recognition for their well-established contributions to household-level solar and wind energy production. Solar and wind technologies have emerged as prominent choices within energy communities due to their proven efficiency, scalability, and renewable characteristics.

Environmental: it makes it possible for a group of people to embark on renewable energy initiatives and establish infrastructure for such purposes, even if their primary objective does not solely revolve around environmental concerns.

Law: As energy communities have gained significant popularity as innovative BMs in recent times, governments are gradually taking steps to regulate the market in line with the distinctive characteristics of these communities. Recognizing the growing importance of energy communities, governments are increasingly focusing on developing regulatory frameworks that align with the specific needs and requirements of these community-driven energy initiatives.

Weaknesses

Political: As for the energy communities, due to the involvement of several stakeholders, it's always challenging to coordinate between all the stakeholders and make them aligned with the municipalities and national level.

Economic: It's essential to ensure all the members and stakeholders that the return on their investments is guaranteed.

Social: To instill confidence in individuals or other possible stakeholders that put their fingers before and during the project, it is imperative to ensure a guaranteed return on investment.

Technological: Currently, the energy community model is most effective suited for the integration of wind and solar technologies. In contrast, the utilization of other renewable energy technologies is still a considerable distance away from an ideal state. Furthermore, energy communities face limitations in terms of technology diversification due to their heavy reliance on the specific geographical location in which they operate.

Law: A notable challenge arises from the unique juxtaposition of energy-producing communities and the established energy market, which ideally should remain separate and undisturbed. However, in practice, legal complexities emerge due to an inherent issue: the law stipulates that members of energy communities should have equivalent rights and privileges to those of final consumers. This particular provision creates a paradoxical situation, as it necessitates striking a delicate balance between the autonomy and distinctiveness of energy communities and the principles of fair market competition.

Opportunities

Political: The execution of projects within the energy community model diverges from other models, as it often entails continual demands from external bodies and authorities. Consequently, there is a greater likelihood and frequency of encountering demands, predominantly originating from municipalities and energy companies.

Economical: Since community energy initiatives have demonstrated their viability as a proven business model, there exists a strong potential to attract investments and funding from various private entities operating within the research and energy production sectors. Within the energy community context, an external opportunity often arises in the form of third-party entities that express a vested interest in supporting research and development efforts within the renewable energy sector. These entities typically possess substantial financial resources, enabling them to contribute to the advancement of renewable energy projects. A prominent example of such an entity is San Paolo Bank in Italy, which has assumed the responsibility of supporting its objectives through an energy community initiative in the northern region of the country. The bank has made significant investments in solar power plants, providing substantial financial assistance to propel the project forward. The support of third-party entities with ample financial resources serves as a catalyst for the growth and success of energy communities. It empowers these communities to overcome financial barriers and accelerate the deployment of renewable energy infrastructure. Additionally, the involvement of reputable institutions adds credibility and attracts further investments, creating a positive cycle of funding and innovation. Collaborative partnerships with these entities can unlock significant opportunities for sustainable energy development, fostering the transition toward a greener and more sustainable future.

Social: The energy community model encounters diverse consumer types, leading to a complex landscape and boosting diffusion. A minority of consumers approach the project primarily from an environmental perspective, although they are relatively rare. The majority of consumers, on the other hand, are primarily driven by financial aims and returns while also having some level of environmental concerns. For these consumers, the key factor in their engagement is the potential monetary benefits. Additionally, there are other consumer types who actively seek strong participatory collaboration within their neighborhood or region. These consumers value the opportunity to actively engage and contribute to the energy community, fostering a sense of community ownership and shared benefits.

Technological: In the current landscape of renewable clean energies, photovoltaic (PV) technology has established itself as a well-proven and widely adopted solution. Consequently, there exists a strong inclination among consumers and stakeholders to invest in solar panels, presenting an opportunity for community energy projects. However, it is important to acknowledge that while PVs are prevalent, they do not represent the sole efficient technology available. This highlights a weakness within the energy community sector, as the utilization of other renewable technologies has been relatively overlooked or underutilized. Expanding the focus to encompass a broader range of renewable energy technologies would enhance the diversification and resilience of community energy projects.

Environmental: The potential of the energy community model to attract third-party entities with financial advantages helps these communities align themselves with positive environmental objectives or credentials. Many of these entities are required to demonstrate their environmental concerns, as demanded by national and governmental authorities. These demands place responsibility on large institutions with substantial resources to take environmental action and fulfill their responsibilities. Regarding some stakeholders, they have, for example, district budgets: monetary and non-monetary, which the non-monetary in many cases refers to, and environmental objectives like the CO2 budget.

Law: The EU has established policy frameworks and incentives that explicitly support energy communities. Initiatives like the EU Renewable Energy Directive and the Clean Energy Package provide regulatory provisions, financial support, and favorable conditions for the development of community-based renewable energy projects. These policy measures strengthen the political standing of energy communities by recognizing their importance and providing avenues for their growth. Moreover, energy communities benefit from participating in European networks and associations that focus on renewable energy, sustainable development, and community engagement. These platforms provide opportunities for knowledge exchange, capacity building, and policy advocacy at the EU level. By engaging in these networks, energy communities can amplify their political impact and collaborate with like-minded organizations across Europe.

Threats

Political: Municipalities often introduce regulations that add complexity to the energy community landscape. One such rule stipulates the separation of public administration from private entities said that public administration shouldn't be mixed with private subjects when something is economical at the state level. Moreover, on a broader scale, the government is required to comply with the rules set by the European Union. Similarly, cities are obligated to adhere to national regulations.

Economic: A notable challenge arises from the unique juxtaposition of energy-producing communities and the established energy market, which ideally should remain separate and undisturbed. However, in practice, legal complexities emerge due to an inherent issue: the law stipulates that members of energy communities should have equivalent rights and privileges to those of final consumers. This particular provision creates a paradoxical situation, as it necessitates striking a delicate balance between the autonomy and distinctiveness of energy communities and the principles of fair market competition.

Social: Initiating a project entails a demand originating from various sources, such as public authorities, self-identified energy communities, consortiums of energy communities, or external third parties. However, challenges arise as stakeholders often lack clarity on the subsequent steps required. In this regard, academic institutions can offer feasible studies that provide a clear path forward, assisting stakeholders in navigating the project's complexities. These studies address technical, economic, and regulatory aspects, serving as roadmaps for stakeholders to make informed decisions and progress confidently in establishing a profitable energy community project.

Technological: The presence of a threat arises when it comes to the management and distribution of energy within the energy community model. In many cases, the existing grid infrastructure is inadequately organized to cater to the specific needs of these communities. The grid network is typically designed to serve large-scale power plants, with little consideration given to the geographical proximity of energy communities. This issue is particularly pertinent in less-developed European countries, where the disparity between the location of energy communities and the centralized grid infrastructure is more pronounced. In addition, today, the majority of RECs primarily come from PV sources, while a few are generated from hydropower and biogas. Although biomass holds potential as a renewable energy source, its utilization is hindered in certain regions due to factors such as restrictive forest laws, which impede its development and deployment.

Environmental: The potential impact of climate change serves as a threat to European Union. Climate change can lead to adverse weather conditions such as extreme heatwaves, storms, or floods, which may damage renewable energy infrastructure and disrupt the reliable generation of clean energy. These environmental hazards can undermine the stability and resilience of energy communities, affecting their ability to maintain consistent energy production and meet the demands of their members. Additionally, climate change-related challenges may require additional investments in protective measures or adaptations to mitigate the potential risks, posing financial and operational challenges for energy communities.

Law: There is a notable variation in the allowances granted to energy communities for their megawatt-scale energy production within the boundaries of the European Union. For instance, in Italy, the allowance remains relatively low, around 1 megawatt, whereas in the Netherlands, it is significantly higher.

5.2.2 Questionanaire

For the questionnaire, it is used ordinal questions to assess how strongly the stakeholder agreed with certain affirmations. Here is a sample question:

"For the implementation of the type of renewable energy contract that you operate (ESCo, Crowdfunding, Intracting) you found state-backed securities (subsidized support infrastructure, regulatory provision, public investment, and training from the government) that allowed the

success of the project. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation?"

The complete list of questionnaires will be presented in the appendix section at the end of this thesis.

5.2.3 QCA Matrix

The choice of using the QCA is based on the potential of the analysis of the causal complexity that involves different combinations of conditions. The collection of quantitative data on a large number of observations can be difficult to achieve. In contrast, in a small number of cases, qualitative methods such as interviews and case studies are better fitted for a deeper interpretation of the scenario. The QCA methodology is better suited at this middle point and is particularly appropriate in the kind of work that questions complex causal relationships and multiple interactions (Oana et al., 2021). The use of QCA in management, innovation, and business research has gained attention (Fainshmidt et al., 2020; Roig-Tierno et al., 2016), with occurrences also in Renewable Energy Research (Pruditsch, 2017).The use of the QCA for this study is due to its characteristic of being outcome-oriented, that is, identifying the conditions necessary to achieve an expected outcome, and being able to identify the combination of factors that result in a possible success of a policy program or business model.

Within the "quantification" of qualitative methods, there are different approaches within QCA: crisp-set QCA (csQCA), multi-value QCA (mvQCA), and fuzzy-set QCA (fsQCA). Crisp-set analysis (csQCA) employs dichotomous conditions, admitting values that can be translated into 0 or 1 (true or false, or condition present or missing). The multi-value (mvQCA) values take on values that can be 0, 1, and 2, for example, to specify intermediate types such as small, medium, and high. The advantage of mv-QCA is to introduce more complexity in the analysis of cases, given the composition of a limited number of theoretical possibilities (Grofman & Schneider, 2009). Fuzzy-set analysis (fsQCA) is the most developed type of QCA (Oana et al., 2021), and the author will be using it during this research. The application of this method is ideal for cases with great complexity, in which conditions tend to be derived from continuous quantitative variables.

In this work, these quantitative variables are transformed into crispy variables, with an intermediate value: 0, 0.5 or 1, based on the level of presence of the conditions, representing, on the one hand, the complete exclusion of the condition and, on the other hand, its complete presence, with the 0.5 indicating partial achievement of the conditions.

The data that compose the analysis matrix came from desk research, document analysis, literature review, and from two different questionnaires sent to both our FinSESCo partners and to other important members and stakeholders who actively participate in the investigated renewable energy contracting models. It is also conducted 10 interviews with project managers, researchers, academic professors, portfolio managers, and company's executives from different countries, describing their experience with energy contracting projects in different countries. A representative group of the different models researched formed a sample size of 30 different case studies.

ID	Location	Business Model	Technology	State-backed securities	Mobilizing funding capacity	Risk mitigation capacity	Technological capacity	Legal framework and regulatory provision	Market incentives	Community engagement	Outcomes		
											Environmental and Savings performance	Infrastructure and affordability	Size and Innovation potential
1	NL	Crowdfunding	Solar	1	1	1	1	1	1	1	1	1	1
2	NL	Crowdfunding	Wind	0	0.5	1	1	1	0.5	0	1	1	1
3	NL	EPCo	Solar	0	1	1	0.5	0.5	0.5	0	1	1	1
4	NL	EPCo	Wind	0	1	1	0.5	0.5	0.5	0	1	1	1
5	N. IT	Energy Community	Solar	0.5	1	0	0.5	0	0	0.5	0.5	0	0.5
6	N. IT	ESCo	Biogas	0	1	0	1	0	0	0.5	0	0	0
7	N. IT	Energy Community	Hydro	0.5	1	0	0.5	0	0	0.5	0.5	0	0
8	S. IT	Energy Community	Wind	0.5	1	0	1	0	0	0.5	0.5	0.5	0.5
9	S. IT	Energy Community	Solar	0.5	1	0	1	0	0	0.5	0.5	0.5	0.5
10	BE	Crowdfunding	Solar	1	1	0	1	0.5	0.5	0	0	1	0
11	AU	EPCo	Solar	0	1	1	1	1	1	0	1	1	0
12	AU	Super EPCo	Solar	0	1	1	1	0	1	0	1	1	0
13	AU	EPCo	Energy Efficiency	0	0	1	1	1	1	0	1	1	0
14	AU	Super EPCo	Energy Efficiency	0	0	1	1	0	1	1	1	1	0
15	PT	ESCo	Solar	0	1	0	0.5	0	0	0.5	0	0	0
16	PT	Energy Community	Solar	0	1	0	0.5	0	0	0.5	0.5	0.5	0.5
17	PT	Intracting	Solar	0	1	0	0.5	0	0	0.5	1	1	1
18	PT	ESCo	Heat Pump	0	1	0	0.5	0	0	0.5	1	1	1
19	DE	EPCo	Solar	1	1	1	1	1	1	1	1	1	1
20	DE	Crowdfunding	Solar	1	1	1	1	1	1	1	1	1	1
21	DE	EPCo	Wind	1	1	0.5	1	1	1	1	1	1	0.5
22	DE	Crowdfunding	Wind	1	1	0.5	1	1	1	1	1	1	0.5
23	DE	Energy Community	Solar	1	1	0.5	1	1	1	1	1	1	1
24	PL	Energy Community	Solar	0	1	0	0	0	1	1	1	1	0
25	IT	EPCo	Energy Efficiency	0	1	0.5	1	0	1	0.5	0.5	0.5	0
26	IT	Energy Community	Biogas	0	0	0	1	0	0	0	0.5	0	0
27	IT	EPCo	Heat Pump	1	1	1	0.5	0.5	0.5	1	0.5	0	0
28	IT	EPCo	Refurbishment	0	1	1	0.5	0	0.5	0	0	1	0
29	CZ	EPCo	Energy Efficiency	0.5	1	0.5	1	1	1	0.5	1	1	0.5
30	SK	EPCo	Energy Efficiency	0.5	1	0.5	1	1	1	0.5	1	1	0.5

Figure 31: QCA Matrix Table

Based on the data it is constructed on the QCA matrix, its invistigated to analyze the results on two different dimensions: analysis of necessity and analysis of sufficiency. The analysis of necessity is to understand whether condition X is necessary for outcome Y that is "whenever we see the outcome Y present, condition X is also present" (*Oana et al., 2021, p. 65*). Here it is calculated the RoN (Relevance of Necessity), in which the lower the more trivial the condition is, while the higher the RoN, the more important a certain condition is for an outcome.

Further, it is calculated the analysis of sufficiency, finding the minimal configurations of conditions that are sufficient for a given outcome (Dușa, 2021). Looking here for the covS, coverage for sufficiency. It works similarly to a regression model, where the value presents how well it can explain the outcome. Following it is presented the tables with the results after coding the data using the software R.

Variable	inclN	RoN	covN
legal	0,568	0,971	0,962
market	0,705	0,897	0,912
risk	0,614	0,909	0,900
community	0,614	0,909	0,900
securities	0,432	0,927	0,8644
tech	0,864	0,545	0,792
funding	0,864	0,318	0,717

Figure 32: conditions ~ outcome (environmental_savings)

Variable	inclN	RoN	covN
legal	0,568	0,971	0,962
market	0,727	0,929	0,941
risk	0,636	0,938	0,933
securities	0,409	0,905	0,818
community	0,545	0,833	0,800
tech	0,841	0,522	0,771
funding	0,886	0,333	0,736

Figure 33: conditions ~ outcome (infra_affordability)

Variable	inclN	RoN	covN
securities	0,577	0,844	0,682
legal	0,615	0,773	0,615
community	0,692	0,714	0,600
risk	0,654	0,698	0,567
funding	0,962	0,200	0,472
tech	0,846	0,316	0,458
market	0,577	0,578	0,441

Figure 34: conditions ~ outcome (size_innovation)

Variable	inclS	PRI	covS
funding	0,717	0,674	0,864
tech	0,792	0,750	0,864
market	0,912	0,906	0,705
risk	0,900	0,893	0,614
community	0,900	0,870	0,614
legal	0,962	0,960	0,568
securities	0,864	0,824	0,432

Figure 35: conditions ~ outcome (environmental_savings)

Variable	inclS	PRI	covS
funding	0,736	0,714	0,886
tech	0,771	0,750	0,841
market	0,941	0,939	0,727
risk	0,933	0,931	0,636
legal	0,962	0,962	0,568
community	0,800	0,769	0,545
securities	0,818	0,800	0,409

Figure 36: conditions ~ outcome (infra_affordability)

Variable	inclS	PRI	covS
funding	0,472	0,378	0,962
tech	0,458	0,350	0,846
community	0,600	0,455	0,692
risk	0,567	0,500	0,654
legal	0,615	0,545	0,615
market	0,441	0,367	0,577
securities	0,682	0,533	0,577

Figure 37: conditions ~ outcome (size_innovation)

5.3 Phase 3

In this section of results, respondents were questioned about their familiarity with the concept of business models and, if familiar, which of the researched models resonated with them the most. This inquiry aimed to discern the level of individuals' acquaintance with business models and their related variations. Consequently, the findings shed light on the usefulness of investing in training initiatives and establishing workshops to enhance awareness and understanding among individuals regarding the business model concept.

Moving forward, the research encompassed the solicitation of demographic information from participants. This approach sought to ascertain the respondents' group affiliation and characteristics. By exploring the influence of personality traits, situational factors, and mental backgrounds on renewable energy topics, insights can be gleaned to devise solutions that render limited energy resources and business models more appealing to individuals. This approach aims to align renewable energy initiatives with individuals' inclinations and enhance their engagement and acceptance of innovative business models.

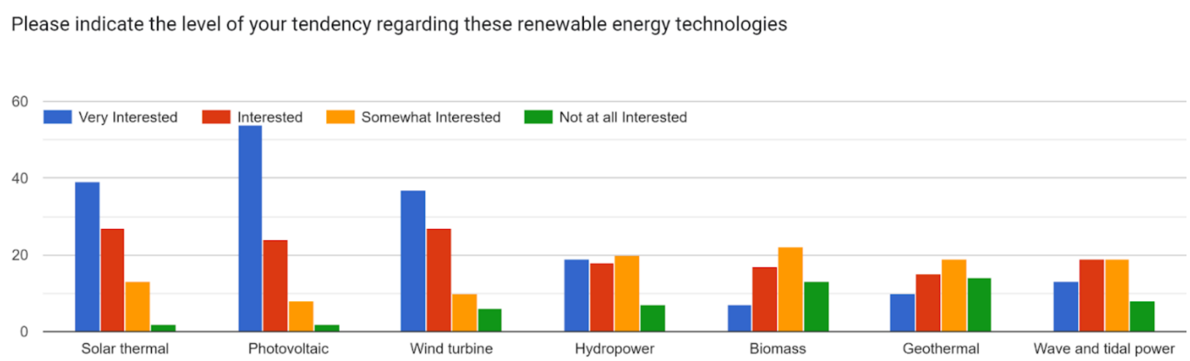
The sample size chosen by the author comprises two distinct groups of individuals:

1- Educated and academic individuals with a bachelor's degree or higher. The survey was distributed among students and faculty members at the University of Potsdam in Germany and Politecnico di Torino in Italy. The target group primarily consisted of young individuals within the age range of 20 to 35 years.

2- Mixed types of consumers: The survey questions were distributed through a platform (Survey Monkey) accessible to individuals from various countries, which specifically in this research is targeted UK. Germany. This diverse group included individuals from different occupations, from the workforce to educated professionals.

By including both educated and academic individuals as well as a mixed group of consumers, the author aimed to gather insights from multiple perspectives and different types of consumers, ensuring a comprehensive understanding of the subject matter.

The survey results have been visually represented through several charts, showcasing the respondents' preferences in each section. Specifically, in response to the question concerning consumer tendencies towards renewable technologies, the data reveals that photovoltaic technology garners the highest interest among the respondents. Following photovoltaic technology, wind turbines and solar thermal technologies are the most favored options. Interestingly, the remaining types of technologies demonstrate similar interest among the respondents. Therefore, based on the survey findings, it is evident that photovoltaic, wind turbine and solar thermal technologies are the most well-established and preferred technologies according to all the responses that were obtained during the field study.



.Figure 38: The chart shows the tendency of consumers towards each specific renewable technologies

The following chart provides insights into the respondents' familiarity with business models, particularly in renewable energies. Surprisingly, over 80% of the respondents exhibit limited knowledge or have limited familiarity with business models. Notably, approximately 54% of the participants indicated a complete lack of understanding of the concept of business models.

This underscores the importance of education regarding BMs innovation and highlights the functionality of BMs within the energy sector. Enhancing awareness and knowledge makes it possible to promote the efficacy of business models and attract more individuals to this concept. Considering the respondents' interest in renewable technologies, integrating the concept of business models that operate in conjunction with these technologies can accelerate the transition toward sustainable energy solutions.

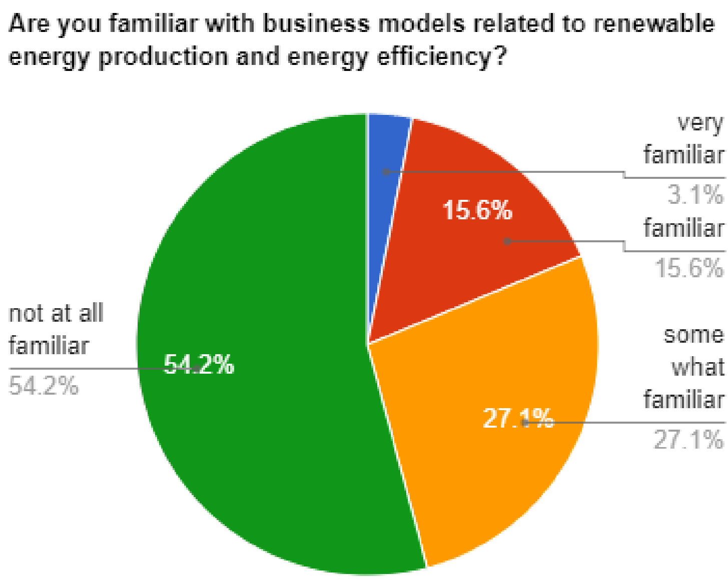


Figure 40: The chart shows the Familiarity about BMs from the Side of Consumers

Among the respondents who demonstrated familiarity with business models, the financial instrument known as crowdfunding emerged as the most recognized and established model. Conversely, the model known as ESCO, together with EPCO, appeared to be largely unfamiliar to the respondents. The data reveals that the crowdfunding model enjoys greater popularity than other models, especially in Germany and the UK. However, there is still a significant knowledge gap and a lack of comprehensive understanding among the general population regarding crowdfunding. These findings highlight the varying levels of knowledge and exposure to different business models within the renewable energy domain among the surveyed individuals.

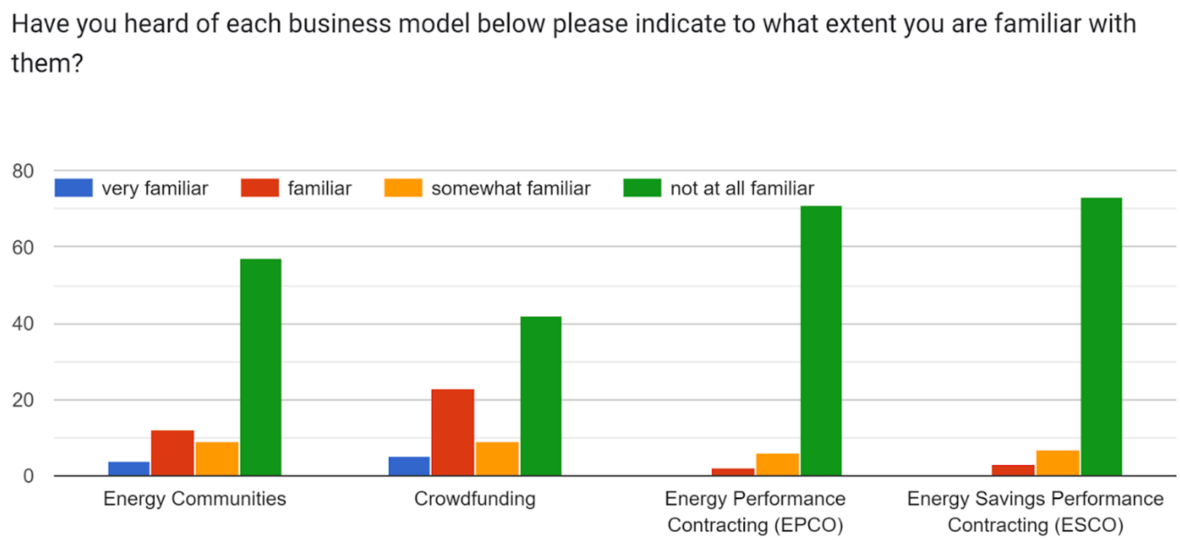


Figure 41: The chart shows the level of Familiarity about BMs from the Side of Consumers

As anticipated, the crowdfunding platform has exhibited a higher effectiveness level than the other two models. The results indicate that approximately half of the respondents claimed to have some level of familiarity with the crowdfunding model. However, an important finding is that most respondents reported needing more direct engagement with crowdfunding. They expressed a lack of experience and stated they had not participated in any crowdfunding activities. Upon delving into various aspects of the crowdfunding platform, it becomes evident that individuals are more inclined to give loans, getting rewards and donations. This signifies that people are particularly attracted to the potential benefits and opportunities associated with receiving rewards or contributing to crowdfunding initiatives.

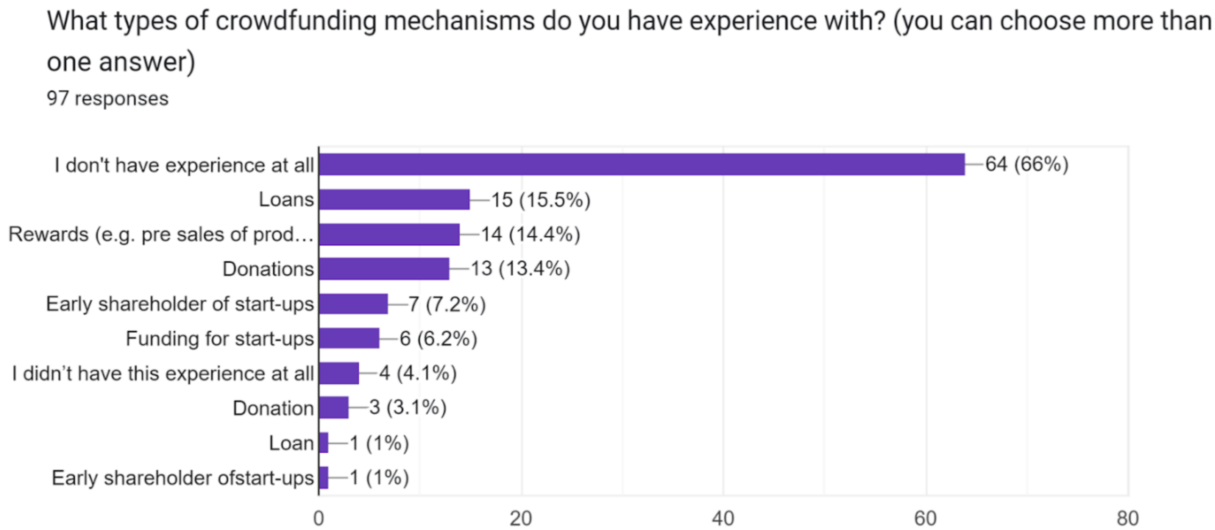


Figure 42: The chart shows the Familiarity of Consumers about crowdfunding

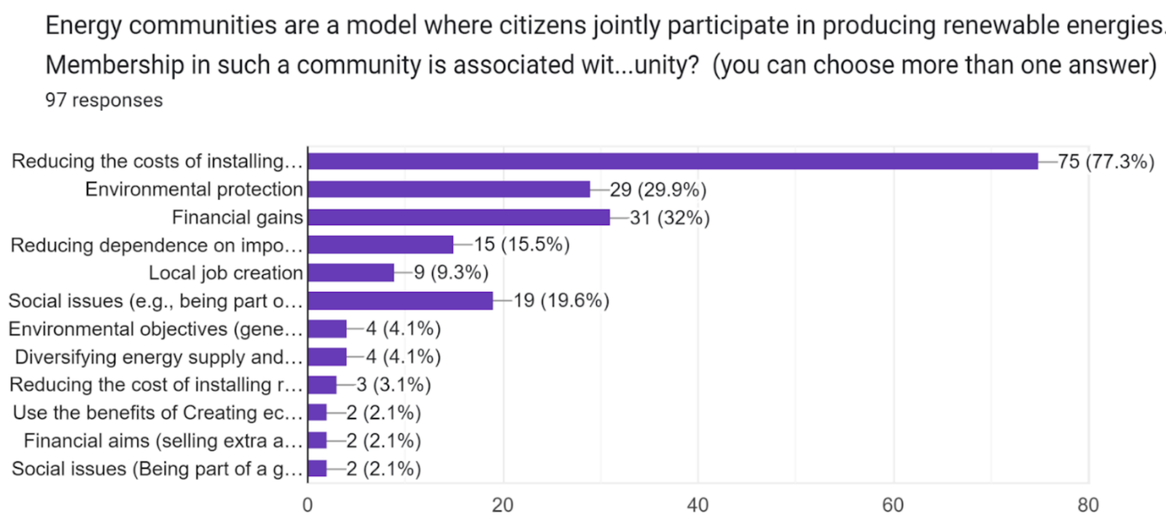


Figure 393: The chart shows the Familiarity of Consumers about Energy Community

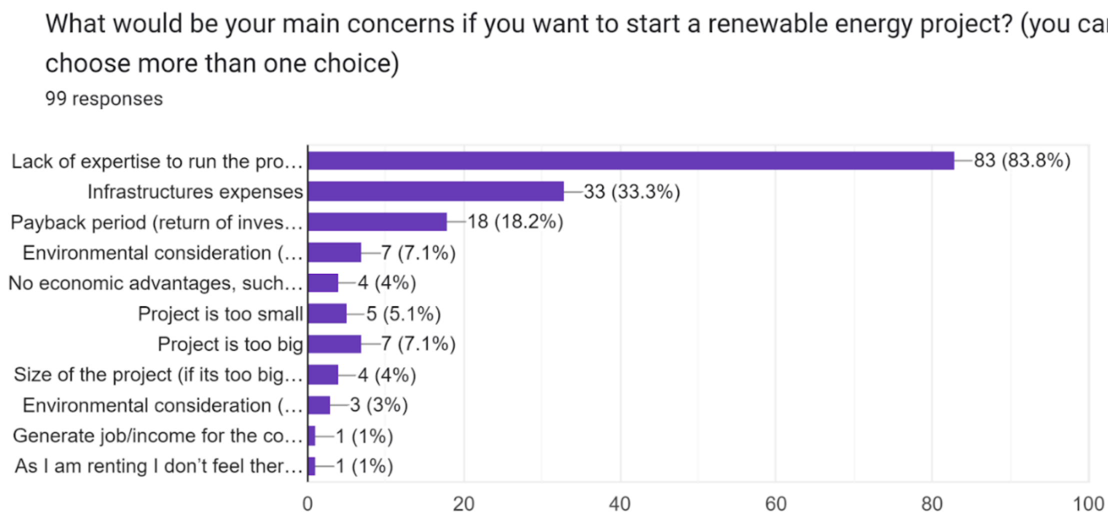


Figure 44: The chart shows the Concerns of Consumers about the Issue of Energy

As depicted in Figure 43, the primary motivator for consumers to participate in renewable energy community projects is the potential cost reduction associated with installing renewable instruments. However, social issues and environmental objectives were reported to have a relatively lower significance than the cost factor. On a broader scale, when considering future renewable energies and consumer concerns, infrastructure expenses, specifically economic factors, were identified as one of the main worries. Interestingly, lack of expertise emerged as the most significant concern for consumers, highlighting the importance of knowledge and specialized skills in the renewable energy sector.

There were two open-ended questions included in the survey.

1- What is your main concern about renewable energies in the future?

2- In your opinion, what are the biggest obstacles to joining a Renewable Energy Community?

As for the first question, most respondents indicated that their main concern regarding renewable energy projects is the issue of cost coupled with low implementation. Regarding the second question, three prevalent themes emerged from the responses. Firstly, many respondents expressed concerns about the investment cost associated with renewable energy projects. Secondly, there were doubts about witnessing tangible changes and positive results from these initiatives. Lastly, respondents needed clarification about how to find the project, relevant information, and how they could start.

The subsequent investigation asks some demographic questions from the side of consumers. Demographic questions in a questionnaire or survey are designed to gather information about the characteristics and background of the participants. According to the Dobosh, M. "Demographic questions in a survey allow researchers to gain background information on their participants. These questions provide context for the collected survey data, allowing researchers to describe their participants and better analyze their data. Common demographic questions explore participant age, sex, race, ethnicity, education, and employment but can include any background characteristics a researcher believes are essential to the research project. Therefore, These questions help researchers understand the composition of the sample population and provide valuable insights into how certain factors may influence responses or behaviors.

In this thesis, the demographic questions cover special aspects which are:

- Geographic location: This provides regional or cultural context that may influence opinions or behaviors.
- Gender: This allows for examining potential variations in responses based on gender-related factors.
- Education: This provides insights into the level of education and how it may influence understanding or perspectives.
- Type of Residence: This variable is highly informative in discerning the housing arrangements of participants, shedding light on the specific environment in which their beliefs and attitudes may be influenced.
- Political Affiliation: This criterion serves as a key indicator of the participants' ideological inclinations, allowing for an understanding of the unique mindset associated with their respective political beliefs.
- Income level: This can shed light on the economic background of participants and how it may impact preferences or decisions.

By including demographic questions, survey data can be analyzed based on different demographic segments, allowing for a deeper understanding of how certain factors may shape responses. This information can help identify patterns, trends, and potential disparities, providing a more comprehensive analysis of the issue of renewable energies. Additionally, demographic data is often used to segment and ensure a diverse and representative sample. The results of the demographic inquiries are presented herein.

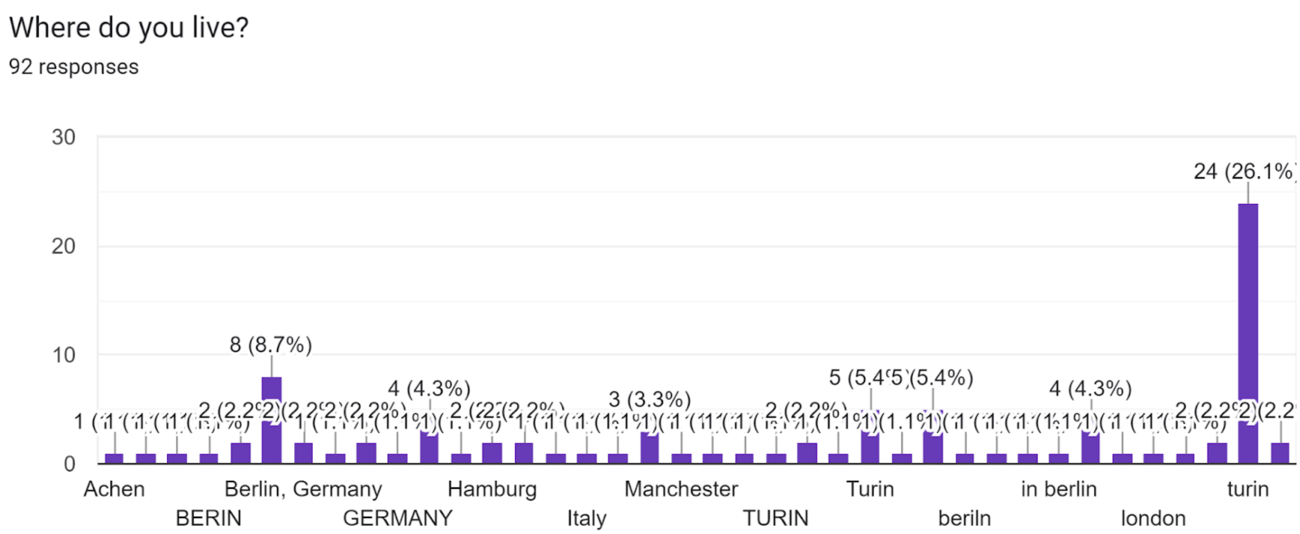


Figure 45: The chart shows the Information about the Residents area of Responends

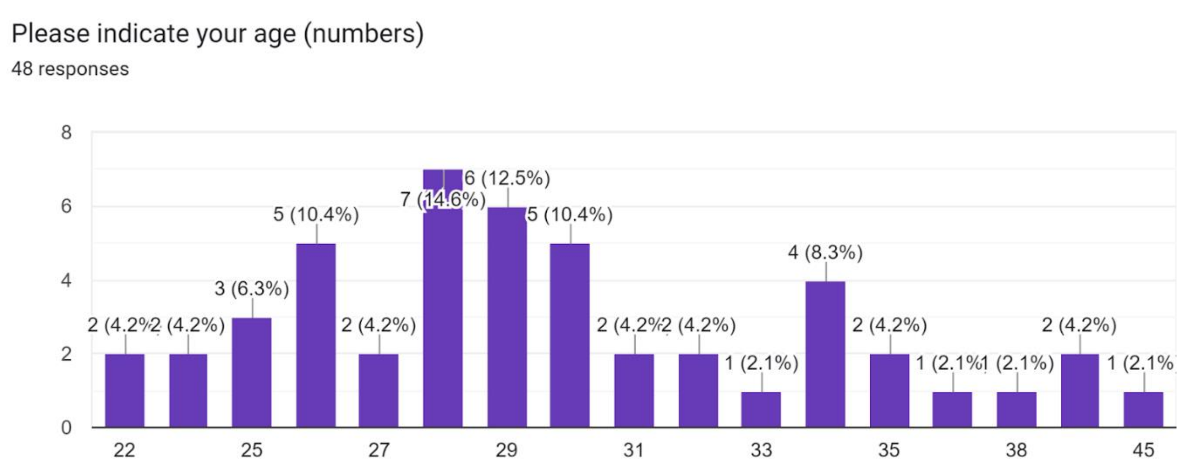


Figure 46: The chart shows the age of Responends

It is important to note that the responses to this question were collected during the midpoint of the survey distribution period, resulting in a lower number of overall responses compared to the average.

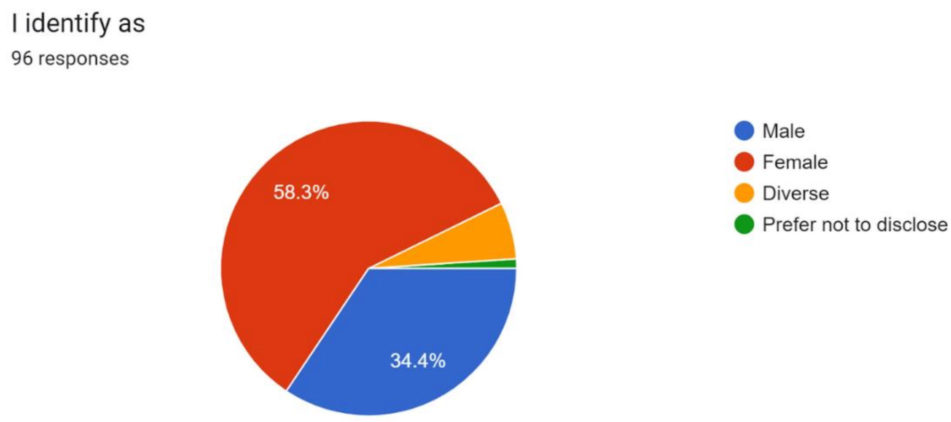


Figure 40: The chart shows the Information about the Gender of Responends

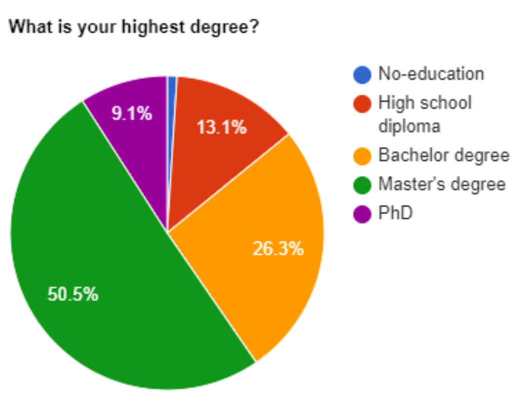


Figure 41: The chart shows the Information about the Education of Responends

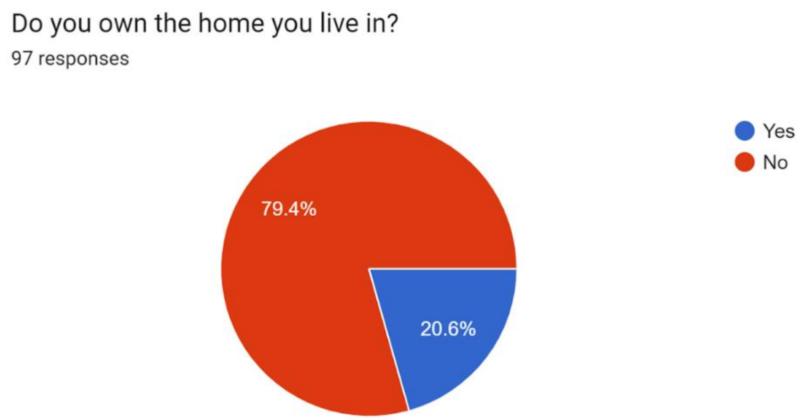


Figure 42: The chart shows the Information about the Situation related to the Property owenership of Responends

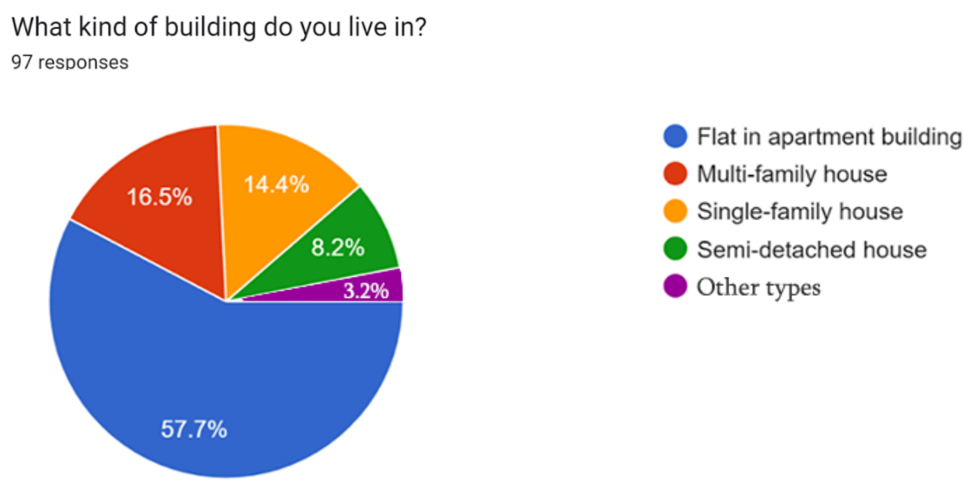


Figure 43: The chart shows the Information about the Situation related to the Property owenership of Responends

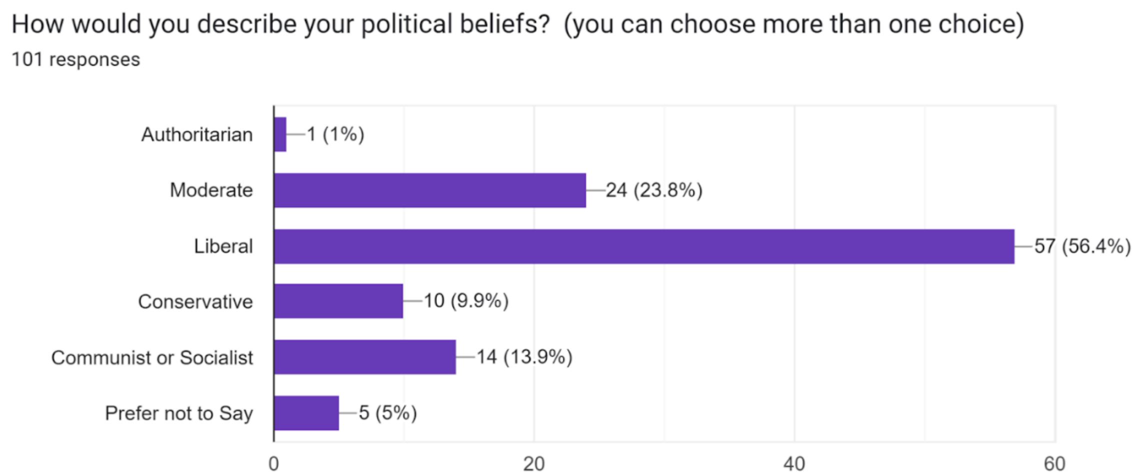


Figure 44: The chart shows the Information about the Political Believe of Responends

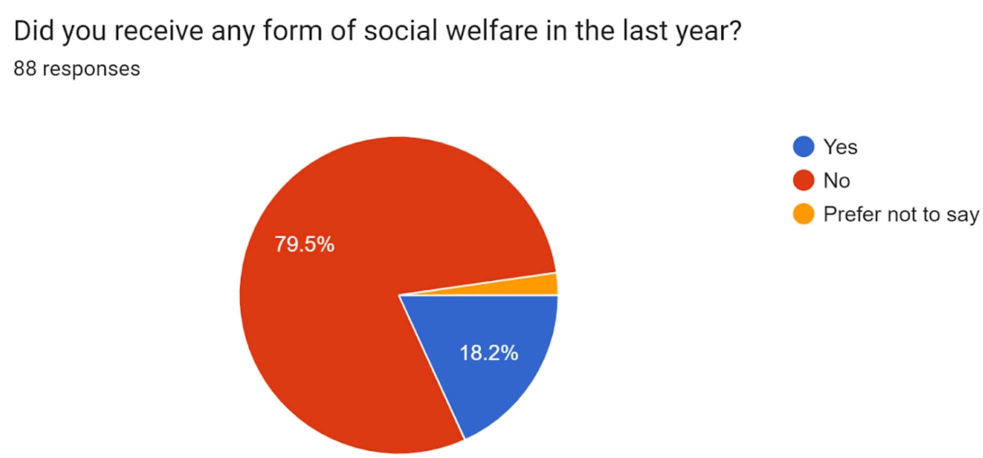


Figure 45: The chart shows the Information about the Economic situation of Responends

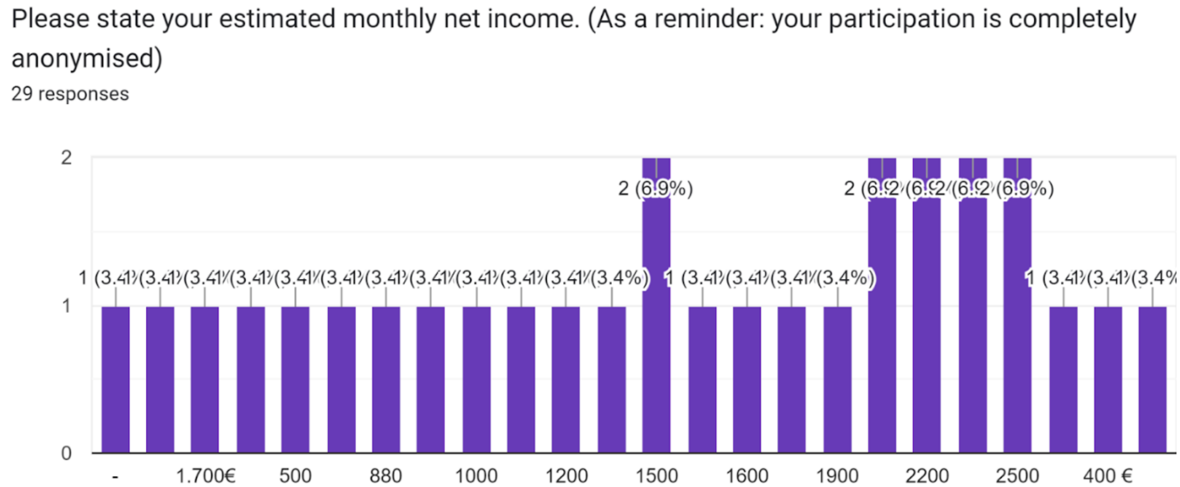


Figure 46: The chart shows the Information about the Economic situation of Responends

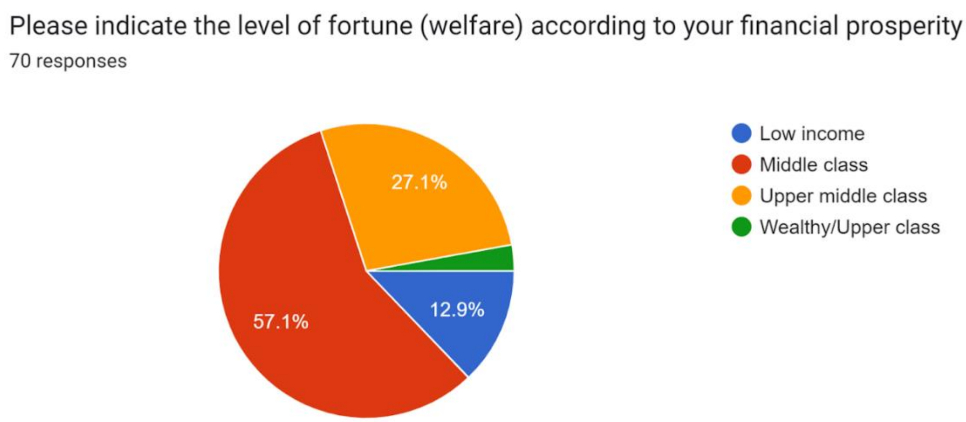


Figure 47: The chart shows the Information about the Economic situation of Responends

The results of the demographic questions yield intriguing findings. Firstly, it is noteworthy that most respondents (57%) identify themselves with a liberal background and mindset. In contrast, a mere fraction of respondents (less than 25 respondees) align themselves with conservative, Socialist, or communist backgrounds. Approximately 24% of respondents identified themselves as having a moderate political inclination. Since respondents were allowed to select multiple choices, some individuals may have indicated a specific ideology and a tendency towards moderation.

An exciting observation arises when considering the conservative consumer group. This segment tends to have higher incomes and often possesses detached houses. The answers were diverse regarding the respondents' educational attainment, and the author could not establish a clear and tangible connection with other factors. However, the distribution of responses was so close to each other. Approximately only 9% of respondents stated that they completed their education and obtained a Ph.D. degree. In comparison, approximately 76% were individuals with academic backgrounds, including master and B.sc degrees, which is expected given that the targeted group included students.

6. Recommendations

This section of the thesis is divided into two parts.

i. In the first part, 18 recommendations are presented, each aligned with specific targets derived from the findings of the three phases of the methodology. These recommendations serve as actionable steps to address the identified challenges and leverage the opportunities identified throughout the research process. Each recommendation is linked to a particular target, providing a clear framework for implementation and evaluation.
ii. The second part focuses on the final model, which serves as a comprehensive synthesis of the research achievements within this thesis. This model encapsulates the key insights and recommendations extracted from analysing three selected business models and combines them as a united model. It acts as a unifying framework, bringing together the best practices of the assessed models and providing a comprehensive road map. By developing this roadmap, the research aims to provide a holistic perspective as an innovative tool based on business models for the energy transition process. It reflects the culmination of the research findings and guides stakeholders and policymakers seeking to navigate the complexities of the energy transition through business model innovation.

The Recommendations come as follows:

1. The QCA results show that the legal framework is a critical criterion concerning the energy BM processes. When the territorial context changes, many conditions considering a BM platform that wants to operate also change. Then the platform must undertake extensive research to understand the complexities and potential barriers to operating in that territory, highlighting trade-offs and adaptation risks. Likewise, the public bodies, either at a local or national level, should pass supportive laws as much as transparent or secure for the platforms to operate. All contracts must be clear and referenced by the legislation in the country, guaranteeing full access to users to the legal framework that underpins and sustains the platforms. It is essential to make current legislation available in a tab on the platforms. (**Targets**: BM platforms and public bodies)
2. The QCA shows that community engagement and state-backed securities can be a risk when not achieving a satisfactory outcome concerning project size and innovation capacity

based on the portfolio of a particular platform which offers energy BM: the absence of these factors can be a complicating element to expand the number of citizens using the platforms. Thus, it is suggested that when the platforms of BMs are ready and operational, their managers apply for grants for projects that will be operationalized and partially funded through the platforms. These projects must be associated with strong local government and community support, stimulating project ownership. (**Targets**: BM platforms, Citizens & Communities, and Local government)

3. The QCA points out that energy contracting through crowdfunding necessarily requires community support. In that sense, a platform of this BM must understand how to motivate and engage their members so that projects are successfully funded. An association with construction companies in the initial stage is a possibility. In this process, such platforms partner with an engineering company to jointly present projects to consumers in certain locations, convincing them about the possibilities of saving energy and about the reliability of the platform to carry out their investments. (**Targets**: Crowdfunding BM, Citizens & Communities, and Engenireenig companies)
4. Risk mitigation mechanisms have a critical effect on price affordability and savings performance. The BM platforms must manage the interest of all stakeholders involved in the hiring process. For this, the platforms must clearly show the risks involved in each project. Therefore, to minimize risks, it recommended enforcing mechanisms to guarantee the forecast of energy savings and adopting audits in a transparent and unbiased process. A third-party organization should perform periodic audits to observe project performance and make adjustments. The possibility for the parties involved in the project to visit the construction and be present during audits must also be guaranteed in the contract. (**Targets**: BM platforms, a Third-party organizations)
5. The QCA shows a technologically strong environment in Europe to guarantee the BMs innovation, in addition to different financing possibilities to achieve success. Likewise, all successful or partially successful case studies found a technological infrastructure available for innovation and a diversity of options for financing the projects. It is believed that the use of smart contracts in blockchain technology can find larger acceptance and greater possibility of replication and adoption, ensuring a system differential to attract investments

in a structure that can be easily assimilated by companies operating on a platform in Europe. (**Target**: BM platforms)

6. There are currently several ESCOs operating in Europe, many of them young, with little experience in energy efficiency measures, which makes it difficult to minimize risks. To ensure trust, the platforms must host past projects by the ESCOs, showing previous works and the amounts raised. The portfolio of successful projects carried out through the BMs platforms is a fundamental factor in guaranteeing the reliability of users and financing institutions concerning the ESCOs model. (**Target**: ESCOs model)
7. It is necessary to adjust the type and size of the project according to the execution model. It is suggested, for example, crowdfunding for projects with local and community support, with some kind of engagement such as renewable solar installations or energy measures in public buildings such as schools or hospitals, which need greater resources and a greater number of investors, to compensate for the high fees. Projects with long payback periods without community appeal, such as energy measures in a family unit, should find a smaller number of investors, and the total value of the work should be adjusted to the value raised by the platforms, in addition to payback periods and interest rates. (**Targets**: Crowdfunding model, Communities, and Investor)
8. The research indicates that the BM platforms should engage the local community to support financing the projects. Most of the investments come from within the locality where the work is being carried out. That is why it is essential to actively mobilize these resources. Through the platforms, interest rates must be adjusted to ensure the attraction of investors who are not directly related to the works that is, seeing them as part of an investment portfolio. It is also suggested that the platforms be disclosed to common investors who are not familiar with energy efficiency measures to advertise it as an opportunity to diversify their investments. (**Targets**: Energy BM platforms, Local Communities, and Investor)
9. Renewable energy installations or large-scale energy measures projects are also attractive for commercial banks and other traditional financing institutions. The platforms must, then, ensure that the terms of the contracts are also valid for this type of legal entity. Likewise, ensuring security and minimizing risk is critical to attracting this type of investment. It is recommended that contracts be stipulated by all parties involved and valid for senior

lenders, local community investors, and crowdfunding investors. (**Targets**: Commercial Banks, Energy BM platforms, Crowdfunding model, Local Communities, and Investor)

10. The research points out that crowdfunding must usually be seen as an additional source of funding, not the main one. For projects with a higher initial financial volume, it is recommended that constructors, through the platforms, guarantee an initial investment through a traditional bank in advance. The remaining amount would be raised through the platform. Likewise, to attract investment from traditional investors in projects with a community appeal, the platform must demonstrate that the project has local support, ensuring that those positively affected by the project are willing to invest in the platforms and fund the rest of the work. (**Targets**: Traditional Banks, Crowdfunding model)
11. The platforms should encourage not only consumers interested in energy measures in their homes to act in the search for projects. ESCOs have the expertise and knowledge - being able to implement it cheaper and reduce installation costs. Therefore, they should be encouraged to seek projects with consumers and use the platforms to secure investments. At the same time, financial institutions can look for projects on their own, partially financed, and use the platform to find the ideal ESCO to carry out the works and the platform to raise the remaining amounts. (**Targets**: ESCOs, Finacial Institutes)
12. The research has shown that there is untapped potential in the residential energy measures sector. Projects are rarely initiated by consumers. Therefore, the platforms should encourage users to make their energy certificate and house blueprints available quickly and uncomplicated, ensuring with little information that ESCOs are aware of the possibilities and risks for the implementation of a project. In that way, the platforms could be served to fill a market gap. (**Targets**: Energy BM platforms, ESCOs, Consumers)
13. It is recommended that an initial short-period assessment is provided for projects with long payback periods. The assessment can be conducted after two winter seasons to evaluate the underachievement or overachievement and possibly make readjustments. The M&V procedures must be conducted by a third-party organization, according to the International Measure and Verification Protocol. (**Targets**: Energy BM platforms, ESCOs, Consumers)
14. Considering that the project for the Energy community model can theoretically involve a variety of stakeholders, this issue adds complexity to the collaboration required for mutual benefits. For instance, if you are an energy company seeking to initiate a clean energy

project within the energy community model, you would need to engage with municipalities, citizens, and other energy companies ESCOs, EPCOs entity, financial authorities and supporters, academic institutions, and more. So it is essential for energy communities to maintain a proactive approach to understanding and fulfilling the demands presented by external political actors while staying true to their community-driven objectives. (**Targets**: Energy BM platforms, Energy Communities, ESCOs & EPCOs, Academic Institutions, Political Actors, Financial Institute)

15. In the interviews, it was mentioned that one of the major drawbacks currently faced by Energy Communities is the heterogeneous dispersion of energy grids in relation to the geographical locations of the communities. This situation hampers the seamless flow of energy and imposes limitations on the optimal utilization of renewable energy resources within these communities. It is imperative for policymakers and energy stakeholders to prioritize investments in grid infrastructure development and promote regulatory frameworks that support the integration of energy communities. Therefore decentralization is always a great solution in this sense. (**Targets**: Energy Communities, Policymakers)
16. It is recommended that public authorities, specifically at the national level, endeavour to foster a market that maximizes freedom. This objective can be achieved by reinforcing and clarifying directives within the relevant laws. It is crucial to ensure transparency and precision in these regulations while avoiding excessive interference in the normal trading activities of the stakeholders involved. By balancing oversight and allowing market dynamics to unfold naturally, municipalities' speciality, in this case, can create an environment that empowers and facilitates the success of energy communities and their associated business models. (**Targets**: National Level, Municipalities)

17. Due to insufficient knowledge about energy BMs, education becomes crucial in attracting more individuals and communities to engage in such projects. As consumers play an integral part in the success of these initiatives, raising awareness and understanding is essential. This can be achieved through educational efforts, such as implementing annual lessons on BMs starting from high school with government support. Additionally, practical workshops can be organized to enhance citizens' hands-on knowledge. To facilitate this education, it is beneficial for local authorities or even the government to designate specific energy-positive districts within different city zones. Incentives can be provided to residents

of these neighbourhoods to attend and participate in workshops focused on BMs. By adopting a participatory approach, residents can actively engage in learning and gain practical insights into implementing renewable energy projects and energy efficiency measures. Overall, a combination of formal education and interactive workshops can effectively raise awareness, build knowledge, and encourage active participation in sustainable energy initiatives at the community level. (**Targets**: Energy BMs, Consumers & Citizens, Energy Communities)

18. It is indicated that in specific business models, particularly in the case of energy communities, an increased advertisement can significantly attract more individuals and subsequently expand the size of the project. This, in turn, can lead to greater availability of monetary resources. (**Target**: Energy Communities)

Final model

After presenting necessary recommendations for each of the three business models, as well as for public bodies and governments, the findings are consolidated by creating a new business model tool. This tool incorporates the insights obtained throughout this thesis. The resulting hyper model is designed to be applicable in any European context, with the capability to act swiftly by integrating all relevant stakeholders. This hyper model serves as a comprehensive framework that addresses the challenges and requirements of the energy transition process. By leveraging the knowledge gained from the research, it offers a practical and adaptable solution for facilitating sustainable energy initiatives. Its effectiveness lies in engaging and aligning diverse stakeholders, promoting collaborative decision-making and implementation. The developed hyper model is a valuable tool for European countries seeking to drive their energy transition agendas forward. Its comprehensive nature, adaptability, and focus on stakeholder engagement make it a practical framework that can expedite the transition to a sustainable energy future across the European continent. The following is a road map and recommendations that provide a comprehensive framework for stakeholders to navigate the energy transition process, addressing fundamental challenges and fostering the successful integration of sustainable energy solutions.

1- "Business Hyper Model" (BHM), which the author called this way, is a model referred to as the Sustainable Energy Collaborative Financing Initiative, which goes beyond mere funding provision by generating clean energy for citizens and overcoming barriers in various domains. The BHM, coined by the author, represents a fusion of Crowdfunding, ESCO with the Energy community, which the author called "CEE" in abbreviation, resulting in an innovative mechanism that has the potential for substantial profitability given the significant size of energy communities compared to EPC organizations, ESCOs, and crowdfunding platforms. For the establishment, this thesis recommends implementing a Tripartite Agreement and contract between these three entities and other parties if involved. Hence the substantial parties can come across the project through the smart contract. This thesis recommended ensuring that the operating companies sign a conduct guide and accept contract terms for operating on the platforms and that the smart contracts automatically trigger the rules and procedures and the distribution of energy savings. This consolidated approach forms a consortium among the three parties, enabling seamless project execution, diversifying the portfolio, heightened environmental and financial benefits, and a streamlined and time-efficient pathway to success. The platform could be used as a type of fund manager together with a savings distributor in situations when homeowners receive resources through grants to operate through the platform and carry out energy measures.

2- As mentioned, the laws and regulations are the main barriers. In implementing the CEE hyper model, conducting a comprehensive and upfront assessment of the legal framework and decision-making processes relevant to the territory in which CEE intends to operate is crucial. This assessment should include a thorough analysis of the existing regulations, laws, and governance structures that may impact the deployment and operation of the CEE hyper model.

3- To attract the ideal number of users to the model, several factors are important: the design and visuals of the platform, the number of projects available, successful execution, and fundraising in past projects. The CEE model must meet all these requirements to attract projects and investors and compete with other similar platforms. However, before that, the CEE model should prioritize its readiness to effectively promote and advertise within the specific territorial context. This is crucial due to the lack of consumer awareness and understanding of energy business models, which hinders their participation. Therefore, it is vital to educate people about the concept of business models, their functions, and the benefits they offer to consumers, with a specific focus on the CEE model. To achieve this, this thesis recommends employing various tools and strategies, such as educational workshops and the distribution of informational flyers. These initiatives will help familiarize the local population with the CEE model, its advantages, and its relevance to their specific energy needs. By enhancing consumer knowledge and awareness, barriers to participation can be overcome.As the platform expands internationally, particularly within the boundaries of the European Union, it is necessary to consistently assess the demands, barriers, and strengths within each specific territory. This assessment can be conducted through market research, surveys, and engagement with local stakeholders. Understanding the demographic situations and cultural issues unique to each country is essential for tailoring promotional efforts and ensuring the platform's success. The platforms must be able to grow gradually. It is ideal at the beginning that smaller EPCo projects be undertaken for portfolio building, bugs in interface fixing, and trust building. However, the platforms must be adapted to host projects with long payback periods in the future, not only the low-hanging fruits. This will allow the platform to differentiate itself from other investment interfaces on the market today, ensuring that projects that are often ignored can raise funds.

4- Financial institutions, while looking for portfolio diversification, search for projects that are not so small that they do not provide an attractive financial return but not so large that the project is involved in risks. The model to stay active, attract investments, and ensure its use and reliability, must offer different types of projects to attract diverse investors, matching them to various projects: financial companies or other investors trying to diversify their investment portfolio will search for projects with more attractive interest rates, while investors directly attached or positively affected by the project would bear lower interest rates with longer payback periods. The CEE model should therefore be a space for investors, builders, local communities, individual consumers, or governments to find a match and be able to jointly launch projects through an interface that connects them. Different advantages are achieved according to the project initiator. In this way, the CEE must allow different stakeholders to initiate projects, adapting the submission to the type of stakeholder.

5- To ensure engagement and the necessary financial support, it is recommended to adjust interest rates according to the risks involved. This entire process must be documented and stored, ensuring transparency.

6- It is essential to make clear to financers, constructors, and consumers the possibility of the project not achieving the desired savings performance, not raising the necessary financial resources, the estimated time for carrying out the work, possible disturbance factors generated by the adopted energy measures, fees, and the estimated payback period. In this way, when operating different products in different sizes in the context of the CEE model, consumers know exactly what to expect and the risks, avoiding future problems.

7. Conclusion

7.1 Summary of Results

First and foremost, it is imperative to emphasize that this thesis exclusively pertains to the term "BMs PLATFORMS" when discussing suggestions and recommendations. The platform, as conceptualized within the scope of this research, represents an innovative tool for anyone seeking to engage in renewable energy projects and boost energy efficiency through an energy business model or energy contracting project. While this research primarily focuses on the residential sector, it has the potential to be replicated and adapted for larger-scale projects. By adjusting the scale, this platform can accommodate diverse contexts and cater to various stakeholders' needs in the renewable energy and energy efficiency domains.

This platform encompasses the individual components of EPCs, ESCOs, Crowdfunding, and Energy communities either as standalone BMs or in an integrated form. Furthermore, it can also incorporate the presence of each of these components as part of larger-scale BMs, on the other hand. Notably, this thesis has suggestions for these platforms and local and National level authorities that want to enrich their energy planning agenda while reaching the energy transition aim within their countries and cities in the European Union (EU) context. Hence the term "Platforms" encompasses not only smart, single platforms like FinSESCO, which served as the foundation for the development of this thesis but also encompassed other relevant actors or authorities seeking to engage with business model concepts and undertake initiatives in the field of renewable energy.

Focusing on the results, the results obtained by the Qualitative Comparative Analysis bring exciting reflections. At first, the analysis of case studies shows us that the main barrier to be overcome is the legal aspect. When calculating the Relevance of Necessity, we see that in two of the three outcomes, the legal aspects are the most important for the outcome - specifically for environmental and savings performance and for price affordability. Interestingly, the legal aspects of the projects taken as a case study are almost always described powerfully - phrases like "the legal framework in our country is not clear," "there are some legal barriers to overcome," and "the legal framework makes the process slower" this is mostly was about the Energy Communities and popped up more than once during interviews. Therefore, in this thesis, it's proven that this is one of the aspects to be explored in greater depth throughout the research for a complete and exhaustive description of the legislation regarding energy contracting in European countries.

However, looking at the QCA matrix, also we see that issues regarding legal barriers are generally associated with Energy Communities. At least in the European Union, the legal barriers for EPCo and Crowdfunding are lower. This is because, in the first case, contracting through EPCo has occurred in European countries for at least 30 years. The processes for establishing a legal framework in countries that still need to gain experience are undoubtedly exhausting; it is a long process that requires great effort and interest from national and local governments for its implementation. Fortunately, in European countries, the processes for contracting through EPCo are already well defined, with guidelines and documents at different levels of governance. In the case of crowdfunding, although more recent, contracting processes through this means are becoming increasingly popular, mainly due to the legal basis regarding the business model.

It is also interesting to note the effect of state-backed securities (RoN 0.844) and community engagement (RoN 0.714) on the outcome of project size and innovation capacity. It shows that for the more excellent dispersion of projects, with a large number of members involved, it is essential to guarantee security through the government (whether local or national) and the involvement of the local community in supporting and joining the project. That is, projects will face a more significant challenge without local and community support. Therefore, it is essential to understand how the countries within the EU and the platforms within that countries can ensure the engagement of the local community in the contracting processes.

Other than that, it is also essential to highlight the role of risk mitigation mechanisms (RoN 0.938) for price affordability and savings performance (RoN 0.909). Understanding how to distribute the different risks among the stakeholders in the contracting process is a fundamental task, and projects in which the chances could be more precise or where there are no robust measurement and verification mechanisms are more likely to fail. The innovative tools should fundamentally present the risks, adjust payback periods and interest rates, and enforcement mechanisms to guarantee the forecast of energy savings.

The Coverage for Sufficiency (covS) analysis also shows interesting results. In all three outcomes, funding options and technological consolidation appear as the essential elements for an outcome's total or partial success. That is, in cases where the projects were totally or partially successful, the most present conditions were technological consolidation and funding options. In an energy contracting project, apart from all other possible conditions, all successful or partially successful ones found a technological infrastructure available for innovation and diverse options for financing the projects through the market or public mechanisms. This is a discussion that was largely present in interviews and conversations with specialists.

Although it sounds obvious, it is interesting to observe that the technological environment of energy BM and financing options, at least in Europe, are consolidated, allowing a safe environment in terms of infrastructure for innovation in most countries of the EU. Despite the results presented by the Qualitative Comparative Analysis, nuances and details are not captured by the methodology, which is why it was essential for this work to analyze stakeholders through qualitative interviews with specialists in the energy contracting sector, using the PESTEL-SWOT methodology to analyze the data. In this thesis, it is investigated to divide the stakeholders according to the business model in which they are effectively operating, whether as a financier, project manager, or as a researcher on the subject: EPCo & ESCo, Crowdfunding, and Renewable Energy Communities.

It is noticed during the QCA analysis and the interviews that the main barrier to energy BM innovation is the legal aspect - the lack of a clear framework, laws, and guidelines for the direction of a project. Observing the data, the case studies that found the most considerable instability concerning the legal aspects were those linked to the Energy Community business model. Countries are in different stages of the energy community's model: in various stages of implementation and consolidation of the legal framework, and presenting mixed results, which presents itself as a great difficulty for the consolidation of an innovation. The usage by REC of a platform for energy contracting using blockchain technology is possible. However, the initial effort must be not only by national and local governments, consolidating the legal framework, matching their interests, and allowing full implementation. At this moment, it is suggested that there are better paths to link the prototypes of the subject.

During the stakeholder analysis with crowdfunding specialists, it is noticed that it is a highly flexible tool with a high power of adaptation and combination with other models - either with

EPCo or even with energy communities. It is a tool that has become popular, especially for financing renewable energy installations financing projects that would be difficult to get the full amount through traditional banks. According to one of the specialists that were interviewed, "Crowdfunding makes investing in renewable projects possible for a type of investor that would normally not participate in those projects."

The crowdfunding method is popular in most different areas of commerce nowadays. That also facilitated the dispersion of several different platforms specialized in renewable energy contracting. In the EU, these platforms are regulated mainly by the financial market authorities, with a solid legal background to guarantee their security and minimize risks. Several outlets have been solidifying their expertise while increasing their portfolio and the number of projects that could be financed. That guarantees that commercial banks and traditional financing institution representatives can also participate in crowdfunding projects. According to our analysis, they feel safe in participating in such ventures since there is an excellent legal basis and vast experience for the contractual agreement between several stakeholders involved in a project: senior lenders, local community investors, and crowdfunding platforms.

However, there are some specificities of the model that must be taken into account when adopting it with platforms. Essentially, the total cost of a project is usually higher as it is dispersed among different investors. At the same time, crowd investors usually have only a minor share of a project's total investment. Necessarily, there is initial financing through a traditional financial institution. In this way, projects through crowdfunding, according to respondents, are not as efficient in terms of costs when compared to traditional ways of investing. Financial institutions, while looking for portfolio diversification, search for projects with particular sizes, a size large enough that it can have an expected financial return. However, at the same time, substantial projects may fail to raise enough funds only through crowdfunding, as it is necessary to count on various consumers to raise money for the most significant part of the project. It is an economic challenge to find the perfect project size and how to match the different investors. Thus, crowdfunding must be seen as an additional source of funding, not the main one.

Another characteristic to be observed regarding the platforms is that constructors and financial institutions usually initiate the projects - it does not usually start from consumer demand. That is one of the main risks related to the business model. Despite starting from the demand of investors, projects that do not have community support, such as single household energy efficiency refurbishment, may not be ideally suited for crowdfunding because it may not raise enough community support to bear the investments. It is important, then, to bring the project to the community after the developer has established an agreement with a commercial bank. At the same time, getting investments from commercial banks without them foresing a possible commitment from the local community is getting harder.

Therefore, "trust is a fundamental aspect of crowdfunding": you need to have trust in the project, in the technology, in the guarantee that there is initial funding and that the community will get involved to finance the rest. In addition, trust in the platforms that will be used to raise funds is essential. The platform must prove itself reliable, and this process can take time. Investors who have crowdfunding projects in their portfolios already have their favorite platforms and are hesitant to put their money on new ones. It must be a continuous job for the new platform to grow and stimulate the confidence of traditional investors.

However, a factor in increasing trust between parts and increasing the popularization of the platforms can be smart contracts. Due to its dispersed nature, the technology can be easily accepted and adaptable, being useful for projects that can afford higher financing costs, have initial funding guaranteed by financial institutions, use crowd investing to mobilize a local community, and guarantee the execution of projects while receiving a financial return at interest rates.

The fundamental challenge for using crowdfunding is to find the ideal size and understand from whom the will for financing would come - since, in this case. Ideally, projects start from a financial institution or construction company and have a specific size. To reach gaps that cannot be filled by crowdfunding, a combination with EPCo seems ideal for certain projects within the platforms. Different from crowdfunding, EPCo projects can be started from several parts: government, clients, ESCOs, or investment banks. A private company can acquire projects by itself, present, motivate, and identify possible projects and facilities, and prepare feasibility studies. Financial institutions can also work in the front matching ESCOs and clients as a way to diversify the investment portfolios, acting also performing Energy Audits - assessing the proper risks, "putting money on the market with lower risks." Different advantages are achieved according to the initiator or the project - ESCOs have the expertise and knowledge - to implement it cheaper and reduce installation costs. Therefore, EPCo is suited for different types of projects, from different kinds of clients - public, private, and consumers -, from different sizes.

Various parts can act to foster the initiation of a project; the clients gain autonomy to search for ESCOs or investors in the projects. Companies can start the project as they can perform technical performance assessments for long periods, minimizing risks, so they persuade consumers with the possibility of paying less on energy bills. Therefore, there is a huge unexplored potential in the residential sector for EPCo. "This sector lays the biggest potential." Blockchain and smart contracts can be differential to help boost the trust between various stakeholders. The platforms could also start with lighter versions of EPCo projects and assess the savings performance from shorter periods to raise confidence. For example, suppose a project has a payback period of 10 years. In that case, it can be started as an evaluation after two winter seasons to evaluate the underachievement or overachievement and readjust the following steps.

There is also a potential for interaction of EPCo, crowdfunding, and public sector initial investing or private funding. There is, then, a potential to adapt to complex situations and readjust according to the size of the project by combining different sources of funding while creating co-ownership through crowdfunding. At the same time, there is a gap to be filled by projects starting from the consumer side, guaranteeing their requirements through fostering a project. Another possibility that the platforms can explore is to use EPCo not only for the initial installation phase but also during the maintenance. There are some companies already specializing in the latter. This pushes companies the usage of better materials during the implementation phase to optimize the maintenance process, guaranteeing larger savings and profit.

The most important part of the platform must be to guarantee trust between the different stakeholders involved in a project, using the tools available to demonstrate transparency in relationships and contracts - an open-book approach through smart contracts would be feasible. This is a fundamental aspect because experts point out that there is a clear bias to the Measurement and Verification process of the Savings on the part of the ESCOs. They need more incentives to implement an unbiased M&V process. The platforms must ensure this so that processes are transparent and verification measures available to all.

It is essential to bring transparency to the platforms to avoid continuity in a current 'cherry picking' in projects; projects too small are often ignored since the transaction costs are higher to support the development. Combined with that, there is a limited capacity of ESCOs to offer adapted financing for different project sizes. Different measures for energy efficiency vary widely according to different external factors during the extension of a project. Therefore, companies choose the projects with measures with a more stable payback period - energy conservation, such as in-door lighting, has a short payback period when compared to heating infrastructure ones - that have a payback period of up to 15 years in some cases. Usually, the companies opt for "quick wins."

Therefore, the analysis of stakeholders in this project points out the usage of both crowdfunding and EPCo projects within the platforms to guarantee a larger number of projects, which would result in a greater popularization of the platform and, consequently, an increase in trust. At the same time, offering different types of financing would increase the possibility of matching project size, funding, and project ownership, allowing different stakeholders to start projects with different sizes, costs, and return rates, guaranteeing, for example, that projects with high payback periods find investors, while companies can boost their own portfolios with higher interest rates. It is about flexibly adapting and adjusting the different dimensions of a project to the constraints while different projects are financed, increasing the number of users.

Based on the survey responses, it has been determined that PV panels, solar thermal systems, and wind turbines are the most appealing technologies for consumers. This finding highlights a significant trend in the energy sector, indicating a mutual inclination between energy companies, crowd funders, energy communities, and consumers. This alignment fosters the development of three business models that prioritize the utilization of solar panels and wind turbines, and also, this observation provides evidence that the utilization of these three business models is highly relevant in the context of renewable energy planning and projects. Thereby facilitating a smoother transition toward sustainable energy sources.

Valuable and interesting insights were extracted by analyzing the survey responses, particularly by overlapping demographic answers with substantial ones. It was observed that wealthier respondents, particularly those with conservative tendencies, displayed less inclination towards energy efficiency measures in their properties and assets. This finding is significant, as it highlights a contrast in support and advocacy compared to other respondents. These individuals predominantly self-identified as conservative. Furthermore, upon specifically assessing the results for each of the three countries that were examined, it becomes apparent that there are no significant differences in the inclination of individuals towards BMs and energy efficiency measures. The survey findings indicate that the respondents from these countries share similar perspectives and attitudes regarding the adoption of BMs and energy efficiency initiatives. This suggests a consistent trend and a lack of distinct variations among the surveyed populations in terms of their support and interest regarding energy BMs in these areas.

As previously mentioned, most respondents identified themselves with a liberal mindset. Upon analyzing the responses individually, it becomes evident that those consumers who exhibited more significant support for business models and demonstrated a deeper understanding of various aspects of these models were predominantly affiliated with liberal political beliefs. This finding carries implications for the operation of energy communities, aligning with the liberal principles observed in countries that prioritize market freedom and capitalism. Within such societies, minimal government intervention in the market prevails, and the rule of law serves as a foundational element. This characteristic bestows a significant advantage upon energy communities, as they thrive within a market environment that affords them autonomy and imposes minimal regulations.

In general, the majority of respondents still demonstrate a limited understanding of the concept of energy business models (BMs) and the potential benefits they can offer. The survey results indicate that many individuals need a higher level of comprehension regarding this innovative approach. This suggests a need for further education and awareness-building initiatives to enhance the understanding and appreciation of energy BMs among the general population. By increasing knowledge and fostering a better understanding of these models, individuals can better grasp the advantages and opportunities they provide in the realm of energy planning and sustainable development.

On average, the respondents expressed that the cost of renewable energy facilities and the low implementation of such projects were their primary concerns. However, when the same question was asked concerning the present time, the main concern shifted towards the lack of expertise, with 46% of the respondents identifying it as an issue. This is where Energy Service Company (ESCO) business models can play a significant role in addressing these gaps and providing assistance to consumers. Furthermore, when explicitly considering the energy community model and respondents' interest in joining such projects, the prevailing themes revolved around the following two phrases:

1- The investment cost

2- Doubts about witnessing fundamental changes and positive results,

3-Finding a project and then involvement

Notably, most respondents demonstrated a need for clearer and more accurate comprehension of the concept of energy communities, as revealed in a previous question regarding their familiarity with different business models. This highlights the need for further education and awareness-building initiatives to enhance understanding and promote active engagement in energy community projects.

7.2 Limits of the Methodology

The chapter on the limitations of the methodology in a thesis focuses on acknowledging and discussing the constraints, shortcomings, and potential weaknesses of the research methodology employed in the study. This chapter is important as it demonstrates the researcher's awareness of the limitations and provides a transparent evaluation of the study's methodology.

Sample limitations: Despite the potential benefits of having access to a diverse range of data and participants from various organizations, companies, and individuals, limitations emerged due to constraints in time and resources. To ensure the practicality and applicability of the methodology, the author encountered several challenges.

The most critical challenge was distributing a survey comprising a comprehensive set of questions, as outlined in the methodology chapter. Gathering more answers strengthens the credibility of the research and enhances the reliability of the survey results. However, given the time constraints inherent in this master's thesis, obtaining a large number of responses was not feasible. Therefore, a targeted approach was adopted, focusing on a smaller sample size and targeting a particular group of individuals. In this thesis, the author limited the sample to 100 responses from Germany, England, and Italy. These countries were chosen as representatives of different European economic situations and policies, markets, and varying levels of development. Germany operates under a social market economy system. It emphasizes a balance between economic growth, social welfare, and market competition. England operates under a liberal market economy system, often referred to as a free-market or laissez-faire approach, while Italy follows a mixed-market economy system. It combines elements of a market-oriented economy with significant government intervention. There as an outcome, the views and perspectives of people and experts differ across these countries, and the mindset of consumers about renewable energy and related issues might have some alternation due to the differences in approaches in their targeted countries. While it would have been more comprehensive to distribute the questionnaire in all European countries and obtain responses from a broader range of participants, the selected countries were considered representative enough to draw conclusions applicable to the European Union.

Germany and Italy were selected due to the author's six-month presence in each country during working on this thesis, which also involved the period of an internship abroad, enabling firsthand engagement and data collection. England was included as a contrasting example, despite no longer being part of the Union. Including England enriched the results and allowed for generalization to other Union countries, as they often have similar systems. However, the challenge of acquiring responses in England was addressed by conducting the survey online through the platforms related to such a task, resulting in fewer answers than in the other two countries.

These limitations, particularly the constrained time frame and the varying number of responses across countries, should be taken into consideration when interpreting the findings and generalizing them to the broader European context.

7.3 Future Research Perspectives

This chapter presents an exploration of potential future research directions and perspectives that can build upon the findings and insights gained from this thesis. It aims to identify areas where further investigation is needed to deepen our understanding of energy transition and business model innovation. During this thesis, several significant findings have been elucidated. However, it is essential to acknowledge that no research endeavor can claim to be entirely exhaustive. Consequently, the insights gained and innovations made within this thesis represent a stepping stone toward further exploration of the identified issues. The research has shed light on various aspects, but ample room remains for additional investigation and analysis. Presented below are vital topics that, despite their coverage in this thesis, warrant further attention and exploration:
Key findings

- Cross-region overview of the Energy business model
- Circular Economy and Energy Business Models
- Grid management and business models
- Energy business model and new technologies AI

Cross-region overview of the energy business model

This research thesis primarily focuses on the European Union context, aiming to identify key features, barriers, and opportunities within the market and provide fundamental recommendations for business model platforms seeking to facilitate the energy transition. However, it is essential to acknowledge that there is significant potential for exploring other regions beyond the EU. Many African countries need help with adequate access to clean energy. Business models can play a vital role in facilitating the acquisition of clean energy in these regions, even if the providers or stakeholders are located outside of Africa. Furthermore, energy resources are available in regions like the Middle East, but energy planning and efficiency still require significant efforts for optimal utilization. Business models have shown promise in addressing these challenges effectively. However, it is crucial to recognize that each region possesses unique characteristics and circumstances, necessitating a more in-depth examination of their potentialities.

Future research endeavors could explore similar issues in less developed areas, focusing on how business models can support renewable energy initiatives and overcome specific challenges these regions face. Additionally, within Europe, there is a tendency to concentrate more on highly developed countries, neglecting the potential for collaboration and stakeholder engagement in less connected regions, such as Eastern Europe. Investigating the possibility of renewable energy development and the role of business models in these specific contexts would be valuable.

Conducting comprehensive research on these aspects will contribute to a broader understanding of energy transition dynamics in diverse regions and facilitate the development of tailored business models that align with the unique circumstances of each area. By exploring and addressing the specific challenges and opportunities in less developed regions, the energy transition can be accelerated, ultimately leading to a more sustainable and inclusive energy future.

Grid management and business models

The issue of grid management has been identified in this thesis as a significant barrier to realizing the full benefits of renewable energy production for consumers. The relationship between business models and grid management is crucial to the energy sector's transition towards a sustainable future. As the energy landscape evolves with the integration of renewable energy sources, decentralized generation, and emerging technologies, the traditional centralized grid management approaches must adapt to accommodate these changes.

The synergy between business models and grid management lies in their combined ability to drive the energy transition. Innovative business models can create opportunities for new grid management approaches, while grid management practices can support the implementation of sustainable business models. For example, a business model that enables peer-to-peer energy trading among prosumers (consumers who also generate energy) can benefit from grid management technologies that ensure secure and reliable transactions within the grid.

Future research can explore the interplay between business models and grid management to identify effective energy system optimization strategies. This includes studying the impact of different business models on grid stability, exploring the role of grid management in enabling new business models, and evaluating the regulatory and policy frameworks that support their integration. Additionally, investigating the scalability, interoperability, and cost-effectiveness of business models and grid management technologies will be crucial for their successful implementation on a larger scale.

Circular Economy and Energy Business Models

The concept of a circular economy has gained significant attention in recent years as a means to achieve sustainable development and address the challenges of resource depletion and environmental degradation. In the context of the energy sector, integrating circular economy principles into energy business models holds immense potential for optimizing resource utilization, minimizing waste, and enhancing overall system efficiency.

One area of research within the intersection of circular economy and energy business models is the exploration of new revenue streams and business opportunities that arise from the circularity of energy systems. This involves identifying innovative ways to capture value from waste streams, such as using industrial by-products or converting biomass and organic waste into energy sources. By integrating circularity principles into energy business models, companies can contribute to sustainability goals and develop new revenue streams, reduce costs, and improve their overall competitiveness.

Furthermore, circular economy approaches can also drive the development of more sustainable energy infrastructure and technologies. For example, designing and implementing energy systems that prioritize recycling, reusing, and refurbishing components can minimize the extraction of raw materials and reduce the environmental impact associated with the manufacturing and disposal of energy infrastructure. This includes initiatives such as recycling end-of-life solar panels, repurposing batteries from electric vehicles for energy storage, and promoting the use of remanufactured components in renewable energy systems. Such circular practices can contribute to the reduction of carbon emissions and the conservation of natural resources.

Another critical aspect of circular economy and energy business models is the integration of energy efficiency measures. Energy efficiency is a crucial pillar of the circular economy, as it focuses on optimizing energy use and reducing waste. By incorporating energy efficiency considerations into energy business models, organizations can identify opportunities to improve energy performance, reduce energy consumption, and lower operational costs. This can be achieved through strategies such as energy audits, retrofitting of buildings, and the adoption of advanced energy management systems. Additionally, circular economy approaches can foster the development of energy-efficient products and services, promoting a more sustainable consumption pattern.

The integration of circular economy principles into energy business models also calls for a shift towards more collaborative and interconnected approaches. This includes fostering partnerships among stakeholders across the value chain, from energy producers to consumers, waste management companies, and policymakers. Collaborative initiatives can enable the sharing of resources, the development of symbiotic relationships, and the implementation of circular practices at a systemic level. For instance, energy companies can collaborate with waste management companies to explore waste-to-energy opportunities or with consumers to promote energy-efficient behavior and the adoption of circular energy solutions. The integration of circular economy principles into energy business models offers substantial opportunities for sustainable development in the energy sector. By embracing circularity, energy companies can unlock new revenue streams, reduce waste and resource consumption, and enhance energy efficiency. This requires a comprehensive approach that encompasses the redesign of energy systems, the development of innovative technologies, and the establishment of collaborative partnerships. Future research should focus on identifying best practices, assessing the environmental and economic impacts, and exploring policy frameworks that can support adopting circular economy principles in the energy sector.

Energy business models AI

This thesis has dedicated significant attention to exploring the various existing business models and their integration with current technologies. However, in the realm of technology, rapid advancements are foundational, necessitating continuous attention and awareness of the evolving technological landscape to assess both the potential benefits and risks associated with specific projects. In this context, the rise of artificial intelligence (AI) is transforming our world at an unprecedented pace, introducing new dynamics that can disrupt established contractual structures among different stakeholders and bring forth novel opportunities and challenges.

AI technologies have the potential to revolutionize energy business models by enabling advanced data analytics, automation, predictive modelling, and optimization algorithms. These capabilities can enhance decision-making processes, optimize energy production and consumption, and improve overall system efficiency. By leveraging AI, energy stakeholders can gain valuable insights into customer behavior, market trends, and operational patterns, enabling them to develop innovative services, personalized offerings, and more effective demand response strategies.

Furthermore, integrating AI technologies in energy systems can facilitate the emergence of new market actors and business models. For instance, AI-powered platforms can enable peer-to-peer energy trading, where consumers can directly exchange energy among themselves, bypassing traditional intermediaries. This decentralization of energy transactions and the emergence of energy communities can promote energy democratization, increase energy independence, and foster the adoption of renewable energy sources. However, it is crucial to approach the application of AI in energy business models with caution. The rapid deployment of AI systems raises concerns about data privacy, cybersecurity, and potential biases embedded in algorithms. It is essential to establish robust governance frameworks, ethical guidelines, and regulatory mechanisms to ensure AI's responsible and equitable use in the energy sector.

Future research in this domain should focus on understanding the potential impacts of AI on energy business models, including its implications for market dynamics, stakeholder interactions, and policy frameworks. Additionally, exploring ways to address the ethical, legal, and social impact of AI in the context of energy transition is vital. This includes examining the role of transparency, explainability, and accountability in AI systems, as well as considering the human-centric aspects of technology adoption. By embracing the transformative potential of AI while considering its associated challenges, the energy sector can harness its power to create more sustainable, efficient, and inclusive business models that contribute to the global energy transition goals.

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Appendix

List of questions for the interview (Interview Protocol)

Creating Demand for Innovation - Threads and Opportunities in Renewable Energy Contracting

At the beginning we need to give a short introduction of the Finsesco project depending on how much they already know from the invitation process.

1. Information Organization and related projects

1. Please provide a brief description of your organization, including its size, location(s), nature of service, and country of origin and countrie(s) of operation.

.

i. Name of organisation, founding year, employees; maybe market share?

iii. What is the type of your organization? Non-profit? Governmental? Private?

iv. Which type(s) of Energy Contracting is the organization associated with: ESCo, EPCo, Crowdfunding, or Intracting or other alternative organizational forms, such as REC?

vi. How your company/organization does is distinct from other companies in the field?

2. What type of projects you are usually associated with?
   a. Make sure they provide info regarding one or more of the following:
      i. LED
      ii. Windows exchange/sealing
      iii. Heat pump
      iv. Solar Thermal
      v. Roof Ceiling
      vi. Thermal performance optimization of envelope
      vii. PV (Did they start out with PV to raise trust and them switch to rennovation?)
      viii. Wind
         a. Please rank according to expertise/complexity needed, risk, parties involved, average payback period, average return, number of partners involved, inconvenience of measures for clients, transaction costs, required funding

b. Can you give us an example of the specificity of working with ____ compared to ______?

<Refers to roman i to vi. Make sure to make the conversation fluid, and compare the different types of projects they are **involved with, adapting it to the different stakeholders** we will be interviewing.>

3. Can you give us more information on average project characteristics?
    a. Make sure to provide info regarding the following characteristics.
        i. What is the usual size of your projects?
           # of households, RE production, RE savings, financial volume
        ii. What is the average payback period?
        iii. What is the average return you expect?
        iv. What are the risks involved in such projects?
        v. What kind of expertise do you need?
        vi. How many parties are involved?
        vii. What type of inconvenience this project may cause to the tenant/owner?

4. Information on role, company and innovation.
    a. Since when are you involved with 2(a)?
    b. What is your specific role in your organisation?
    c. What is your specific role with regard to2(a)?

2. Understanding demand drivers and motivators

1. Has your organisation ever started a project itself?
2. In your experience who is usually the initiator of projects?
3. In your experience how to best gain access to projects?>
4. What are the main goals when you start a project?
    a. Numeric <only if applicable>
        i. Return
        ii. Investment sum
        iii. Energy savings
        iv. Installed RE capacity
        v. Involved households
        vi. Length of the project
        vii. CO2 reduction
    b. Non-Numeric
        i. Environmental protection
        ii. Energy security
        iii. Energy availability
        iv. Fight climate change
        v. Fight energy poverty
5. What is the standard procedure when initiating a new project?

7. What are the conditions to accept a project?
    a. What aspects would make you refuse a project?

b. How aligned with the organisations vision must the project be?

8. What is the importance of ESPC/EPCs in your organisation?
    a. Do you have a specific department dedicated to it?
    b. What are the chances of accelerating business if you would draw more resources to ESPC/EPC as compared to other forms of financing?
    c. How do you think would make it easier to increase the importance of ESCo?

9. Who are the main drivers of innovation for ESPC?
10. What are the main drivers for innovation for ESPC?

3. Understanding resources, enablers, and barriers

1. What regulatory, legal, and technical changes in the energy sector would you make if it was possible for you, in order to facilitate projects?
    a. Make sure they answer each of the following points:
        i. When does the government support?
        ii. When does the government act as a barrier?
        iii. What are the legal barriers and constraints?
        iv. What are the technological opportunities for the area?

3. In your opinion, what are the most important enabling factors for your projects?
    a. Make sure they give insights regarding each of the following points:
        i. Tax reduction
        ii. Local government support
        iii. Funding diversification
        iv. Clear Working Framework
        v. Broader motivations

    c. What are the most important aspects of third-party funding? <for instance>
        i. Risk
        ii. Return
        iii. Project size
        iv. else

4. Understanding trust and risks

1. In your opinion, what are the key components that guarantee trust between the different parties involved in an energy contracting process?
    a. What would you do to diminish the risk and increase security?
    b. What would you do to increase transparency between the several parties involved in a Project?
2. In your opinion, does funding diversification facilitate project execution?
    a. Do you think it improves the safety of project execution if the funding is diverse or not?

b. Do you use insurance agencies to secure your funding? <if applicable>

3. How do you monitor the execution of your projects?
    a. What good practices do you suggest?
    b. What is your preferred way of risk assessment?
    c. To what extent do you communicate and cooperate with other project parties to assess risks?

5. Understanding quality and success of outcomes

1. How do you measure the success of a project with an ESPC/EPC project?
2. Would you ideally change the way success is measured?
3. What aspects are not considered when measuring the quality of a ESPC/EPC project?
4. In your opinion, what is the most successful model of revenue-sharing?
    a. Make sure they give a complete overview of the following aspects:
        i. How "easy" and flexible is this model? How well can it deal with uncertainty?
    b. What are your suggestions to minimize risks, distribute them, and guarantee profit and revenue-sharing?
    c. Would you be willing to operate in an environment where a financial investment in energy efficient refurbishment is based solely on an energy Performance Certificate?

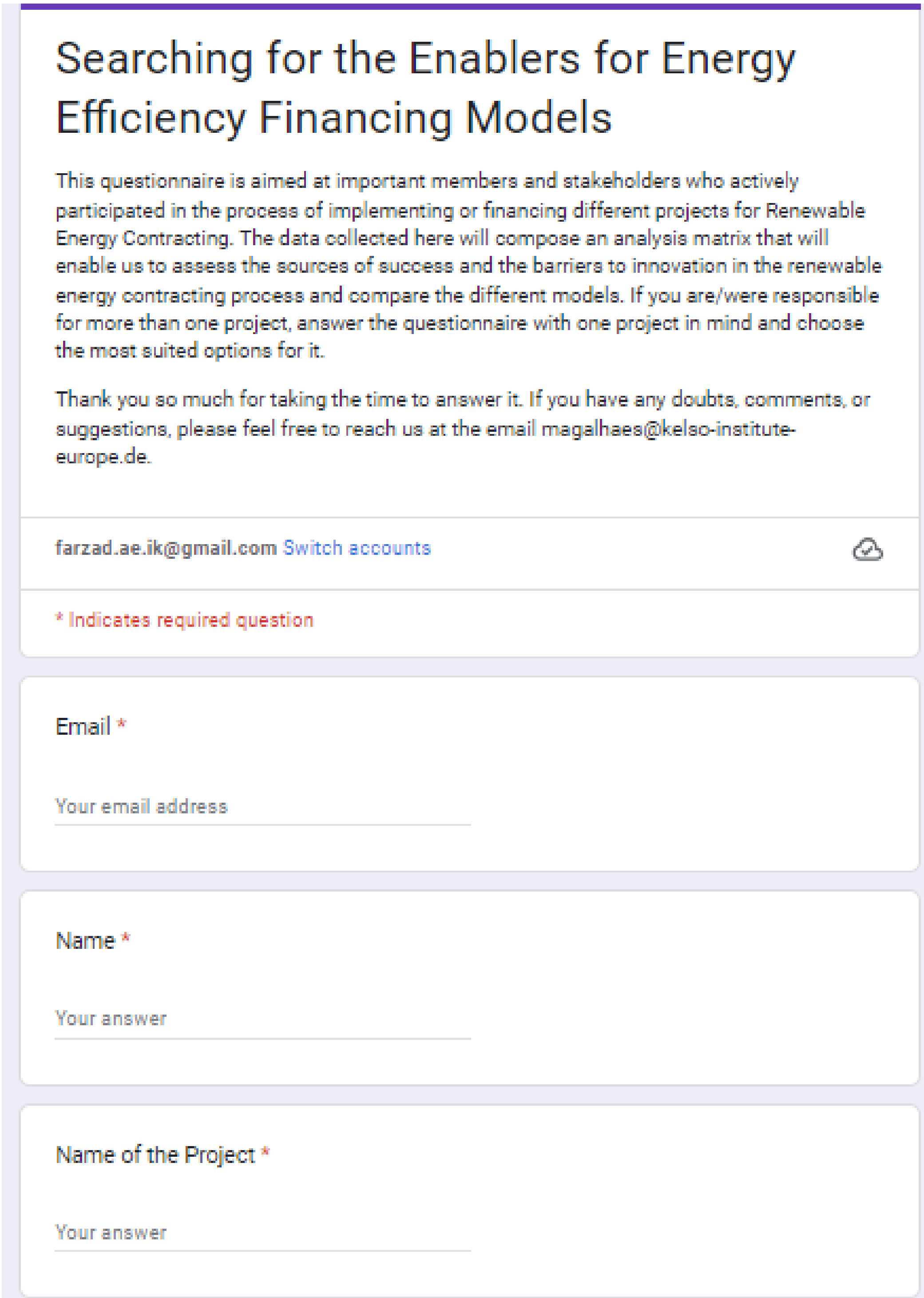
5. Understanding Diffusion

1. What do you think guarantees the involvement of stakeholders / diffusion of the project?
    a. Make sure they say elements that increase the portfolio size, and the number of users, and **attract new members ->** e.g., with **crowdfunding the number of investors**
2. What changes would you make, if any, in the internal processes to attract new partners and ideally make **projects replicable**?
3. In your opinion, which are the most important multiplicators
    b. What is the role of facility owners, refurbishment companies, local politicians, the community, media?
4. How to find potential projects?
    c. Where do you search for interesting projects?
    d. How do you search for new opportunities to invest in (ESCo, EPCo, Crowdfunding, Interacting, Energy Communities)?

7. Potentials of energy communities

1. Do you know what a renewable energy community (REC) is?
2. Was your organisation involved in any projects that collaborated with RECs?
3. Based on what you know about energy communities, what are the main drivers that attracted members of REC to cooperate with your organisation?
4. Based on the project that you've done, to what extent do you believe your organisation contributes to the involvement of vulnerable consumers in general and in the context of RECs in specific?
5. In collaboration with REC, how did you normally provide funds (internal or external) for RE installations and subsequently energy efficiency measures?
6. Do you have any experience with the integration of crowdfunding with REC?

The Questionnaires:



Searching for the Enablers for Energy Efficiency Financing Models

This questionnaire is aimed at important members and stakeholders who actively participated in the process of implementing or financing different projects for Renewable Energy Contracting. The data collected here will compose an analysis matrix that will enable us to assess the sources of success and the barriers to innovation in the renewable energy contracting process and compare the different models. If you are/were responsible for more than one project, answer the questionnaire with one project in mind and choose the most suited options for it.

Thank you so much for taking the time to answer it. If you have any doubts, comments, or suggestions, please feel free to reach us at the email magalhaes@kelso-institute-europe.de.

farzad.ae.ik@gmail.com Switch accounts

* Indicates required question

Email *

Your email address

Name *

Your answer

Name of the Project *

Your answer

Were the following stated-backed securities to operate your project available? *

	Yes	No	I don't know
Subsidized support infrastructure	○	○	○
Regulatory provision with a policy framework fostering demand-side flexibility	○	○	○
Public investment	○	○	○
Training	○	○	○
Research and Development Funding availability	○	○	○
The competence of a Ministry of Environment regarding RE-policies	○	○	○

For the implementation of the project you found state-backed securities and well designed public policies that allowed its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
○	○	○	○	○

Country *

Your answer

Year of the Project *

Your answer

Energy Contracting Type (Business model you are/were involved with) *

- [ ] Crowdfunding
- [ ] Intracting
- [ ] Energy Performance Contracting
- [ ] Energy Saving Contracting
- [ ] Energy Community
- [ ] Other:

Type of Technology Used *

- [ ] Solar
- [ ] Wind
- [ ] Water
- [ ] Biogas
- [ ] Heat: Heat pump
- [ ] Energy-efficient Refurbishment
- [ ] Other:

Did you find the legal flexibility and regulatory framework to operate your project? *

	Yes	No	I don't know
Lack of relevant legal barriers to the development of the business model	◯	◯	◯
Lack of national, regional, or local barriers to support the type of energy contracting	◯	◯	◯
Informed and flexible regulatory schemes	◯	◯	◯
Presence of international commitments and treaties	◯	◯	◯
Experience in approval procedure for constructing and operating RE facilities	◯	◯	◯

For the implementation of the project you found legal flexibility and a well designed legal framework that contributed to its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
◯	◯	◯	◯	◯

Did you have the following technological capacity and digital infrastructure prior to the project? *

	Yes	No	I don't know
Strong national technological infrastructure and digitalization policies	○	○	○
Big data, machine learning model, and AI presence in energy generation and management control	○	○	○
Use of disruptive or recent technologies to increase operational performance and energy efficiency optimization, including blockchain technologies use and knowledge	○	○	○
Interoperability of hardware, trusted and reliable cybersecurity, guaranteeing data access to third parties	○	○	○
Training provision	○	○	○
Availability of high skilled human resources with technological and funding knowledge	○	○	○

For the implementation of the project you found the prior technological capacity and digital infrastructure that contributed to its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
◯	◯	◯	◯	◯

Were the following market incentives available? *

	Yes	No	I don't know
Subsidies	◯	◯	◯
Loans	◯	◯	◯
Tax reductions	◯	◯	◯
Feed-in Tariffs	◯	◯	◯
Measures aimed at creating a competitive market structure considering the European electricity market liberalization. Low market concentration, low entrance costs.	◯	◯	◯

Country *

Your answer

Year of the Project *

Your answer

Energy Contracting Type (Business model you are/were involved with) *

- [ ] Crowdfunding
- [ ] Intracting
- [ ] Energy Performance Contracting
- [ ] Energy Saving Contracting
- [ ] Energy Community
- [ ] Other:

Type of Technology Used *

- [ ] Solar
- [ ] Wind
- [ ] Water
- [ ] Biogas
- [ ] Heat: Heat pump
- [ ] Energy-efficient Refurbishment
- [ ] Other:

For the implementation of the project you found the prior technological capacity and digital infrastructure that contributed to its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
○	○	○	○	○

Were the following market incentives available? *

	Yes	No	I don't know
Subsidies	○	○	○
Loans	○	○	○
Tax reductions	○	○	○
Feed-in Tariffs	○	○	○
Measures aimed at creating a competitive market structure considering the European electricity market liberalization. Low market concentration, low entrance costs.	○	○	○

Were the following market incentives available? *

	Yes	No	I don't know
Subsidies	○	○	○
Loans	○	○	○
Tax reductions	○	○	○
Feed-in Tariffs	○	○	○
Measures aimed at creating a competitive market structure considering the European electricity market liberalization. Low market concentration, low entrance costs.	○	○	○

For the implementation of the project you found strong market incentives that contributed to its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
○	○	○	○	○

Were the following community and political engagement and difussion capacity characteristics present? *

	Yes	No	I don't know
Lack of local community backlash	○	○	○
Ex-ante and post-ante ties with the community.	○	○	○
Involvement of a green party in government	○	○	○
Reports in media about the project	○	○	○
New members keep taking part in the project. Project aimed at changing the end-user behavior (driving RE demand, challenging reactive consumership)	○	○	○
Relevant ties with local government and presence of communication channel	○	○	○

For the implementation of the project you found a community engagement that contributed to its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
○	○	○	○	○

The project could benefit of Investment Risk Mitigation mechanisms? *

	Yes	No	I don't know
Availability of resource assessments	○	○	○
Savings Insurance	○	○	○
Project liability. Long project duration, adequate return rate for investors.	○	○	○
Pay-as-you-save	○	○	○
Government may assume liability in case the project fails	○	○	○

For the implementation of the project you foiund diverse risk mitigation mechanisms that contributed to the sucess of the project. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
○	○	○	○	○

Which mechanisms aimed at mobilizing Financing Capacity were present? *

	Yes	No	I don't know
Public, Research and Technology, Training or other grants	○	○	○
Credit enhancement availability	○	○	○
Seed financing	○	○	○
Diversity of financing possibilities with domestic or international capital market	○	○	○
Availability of RE investments funds	○	○	○
Public funds	○	○	○

For the implementation of the project you found a diversity of financing possibilities that contributed to its success. On a scale from 1 to 5, where 1 is the weakest and 5 is the strongest, how much do you agree with this affirmation? *

1	2	3	4	5
○	○	○	○	○

Considering the following indicators, would you consider that the project could reach Environmental success, affordability and broader development? *

	Yes	No	I don't know
Greenhouse gas emissions reductions	○	○	○
Affordable Energy Price	○	○	○
Local polution Reduction	○	○	○
Improvement to the access to electricity	○	○	○
Energy insecurity/poverty reduction	○	○	○

Based on the following characteristics, would you find the project succesfull when considering its RE capacity, savings performance and innovation sucess?

	Yes	No	I don't know
Increased Installed capacity	○	○	○
Target to Capacity from RE	○	○	○
Adoption of disruptive technologies	○	○	○
Increased primary energy savings	○	○	○
Final price in €/kWh	○	○	○

Could you reach a relevant Energy Savings Performance? *

- ○ Yes
- ○ No
- ○ I don't know

Based on the following characteristics, would you find the project succesfull when considering its difussion, replicability and range success? *

	Yes	No	I don't know
Number of partners	◯	◯	◯
Project portfolio size	◯	◯	◯
The number of partners keep rising	◯	◯	◯
There is now stronger ties with the community	◯	◯	◯
There is local and political interest in the project	◯	◯	◯

Do you find the following indicators of your project ideal? *

	Yes	No	I don't know
Number of Partners	◯	◯	◯
Project Portfolio Size	◯	◯	◯

Number of Members

Your answer

Generation Capacity (in MwH)

Your answer

Would you be available for further contact in the form of a short interview?

- Yes
- No

Please add any further considerations regarding the project or any information you think is relevant.

Your answer

FinSESCo Project – Questions for partners

This form is the initial step in a broader movement to understand the institutional complexities of different renewable energy contracting models. It will be the first B2B contact to build a comparative research framework between energy contracting models, investigating their barriers, what enhances them, and searching for enabling factors.

Our idea at this moment is to have the opportunity to solve some doubts that arose during our first research stage round in the FinSESCo project, with members from companies and relevant stakeholders, asking them to share their knowledge and their practical experiences.

Thank you very much for your attention and willingness to answer the questionnaire. Any questions or suggestions, please make sure to contact us.

Kind Regards,

The Kelso Institute Europe Team

Email *

Valid email address

This form is collecting email addresses. Change settings

General contact information

Description (optional)

Questions for EPCo/ESCo model

Description (optional)

1. What type of models for energy performance contracting are dominant in your country? Does this vary based on the type of client?

Long-answer text

2. How is the fluctuation of energy prices considered within the contracting process for energy contracting? Please share any experience you have in dealing with fluctuating energy prices for energy contracting.

Long-answer text

3. What do you consider to be the major barriers in your country in the contracting process for Energy Performance Contracting?

Long-answer text

4. If the energy savings exceed the guaranteed level, is it typical to pay the ESCO a portion of the additional savings? If so, what is the average percentage the ESCO would receive?

Long-answer text

5. How is measurement and verification considered when entering into an Energy performance contract since the lifetime of the project will typically be 10-15 years and things will change over the years?

Long-answer text

6. Do you know any companies in your country that are providing any kind of energy performance contracting services, crowdfunding platforms/companies for Renewables or energy efficiency? If yes please provide the company name and possibly a direct contact.

Long-answer text

Questions for Crowdfunding Model

Description (optional)

1. There are 4 main types of crowdfunding models which are (debt – reward – donation – equity). Which one of them is more compatible in terms of financial regulations and legal requirements (in the case of an equity crowdfunding platform -> banking regulations for lending models, and consumer's law, intellectual property, electronic commerce legislation or also other legislation) ?

Long-answer text

2. Please describe the property tax system in your country. Please mention variations, advantages and disadvantages.

Long-answer text

3. Do you think Public-Private Partnership (PPP) works well in your country? Explain in details.

Long-answer text

4. Do you have any special tax conditions for vacant houses (In case when a property is empty for some period of time)?

Long-answer text

5. Is the public administration (municipalities) in your country totally in charge of local dwellings? Do you think the national level interferes? If so, in which sense?

Long-answer text

2. If we consider crowdfunding a joint venture between municipalities, local banks, and citizens to provide energy and infrastructure, to what extent do you think there is a transparent regulation of collaboration between local banks with municipalities in your country? Is the transparency sufficient to make way for a functioning barrier free market?

Long-answer text

3.In the EU a crowdfunding platform for its operation would have to be licensed in all 28 Member States. Is there already a transparent national supportive law for cross-border investments supporting crowdfunding in your country?

Long-answer text

EuroPace Questions

Description (optional)

1. In your country, does the building tax rate system vary depending on certain local regions? Does it vary from rural to urban areas?

Long-answer text

The Survey

Energy Business Models

This survey helps me to gain insights into renewable energy production and energy efficiency. The data will be analysed exclusively in the context of my master's thesis. The data-gathering procedure is completely anonymised. Thank you in advance for taking the time to fill in the survey. Please contact me in case of inquiries under my e-mail addresses, as listed below.

amirfarzad.ameriekhtiarabadi@studenti.polito.it
ameri@kelso-institute-europe.de.

Accedi a Google per salvare i risultati raggiunti. Scopri di più

Please indicate the level of your tendency regarding these renewable energy technologies

	Very Interested	Interested	Somewhat Interested	Not at all Interested
Solar thermal	○	○	○	○
Photovoltaic	○	○	○	○
Wind turbine	○	○	○	○
Hydropower	○	○	○	○
Biomass	○	○	○	○
Geothermal	○	○	○	○
Wave and tidal power	○	○	○	○

Are you familiar with business models related to renewable energy production and energy efficiency?

- ◯ very familiar
- ◯ familiar
- ◯ somewhat familiar
- ◯ not at all familiar

Have you heard of each business model below please indicate to what extent you are familiar with them?

	very familiar	familiar	somewhat familiar	not at all familiar
Energy Communities	◯	◯	◯	◯
Crowdfunding	◯	◯	◯	◯
Energy Performance Contracting (EPCO)	◯	◯	◯	◯
Energy Savings Performance Contracting (ESCO)	◯	◯	◯	◯

What types of crowdfunding mechanisms do you have experience with? (you can choose more than one answer)

- [ ] I don't have experience at all
- [ ] Loans
- [ ] Rewards (e.g. pre sales of products or spiritual/cultural rewards)
- [ ] Donations
- [ ] Early shareholder of start-ups
- [ ] Funding for start-ups

In your opinion, what are the biggest obstacles to crowdfunding projects?

La tua risposta

Energy communities are a model where citizens jointly participate in producing renewable energies. Membership in such a community is associated with various benefits. What would be the primary motivators for you to join a renewable energy community? (you can choose more than one answer)

- [ ] Reducing the costs of installing own renewable energy installations
- [ ] Environmental protection
- [ ] Financial gains
- [ ] Reducing dependence on imported fuels
- [ ] Local job creation
- [ ] Social issues (e.g., being part of a community)
- [ ] Altro: ____

In your opinion, what are the biggest obstacles to joining a Renewable Energy Community?

La tua risposta

What would be your main concerns if you want to start a renewable energy project? (you can choose more than one choice)

- ☐ Lack of expertise to run the project
- ☐ Infrastructures expenses
- ☐ Payback period (return of investment)
- ☐ Environmental consideration (Assuming that renewable energy installations negatively impact the environment as well)
- ☐ No economic advantages, such as jobs for the local community
- ☐ Project is too small
- ☐ Project is too big
- ☐ Altro: ____________

What is your main concern about renewable energies in future?

La tua risposta

Where do you live?

La tua risposta

I identify as

- ◯ Male
- ◯ Female
- ◯ Diverse
- ◯ Altro: ____________________

Please indicate your age (numbers)

La tua risposta ____________________

What is your highest degree?

- ◯ No education
- ◯ High school diploma
- ◯ Bachelor degree
- ◯ Master's degree
- ◯ PhD
- ◯ Altro: ____________________

Do you own the home you live in?

- ◯ Yes
- ◯ No

What kind of building do you live in?

- ◯ Flat in apartment building
- ◯ Multi-family house
- ◯ Single-family house
- ◯ Altro: ____________________

How would you describe your political beliefs? (you can choose more than one choice)

- ☐ Authoritarian
- ☐ Moderate
- ☐ Liberal
- ☐ Conservative
- ☐ Communist or Socialist
- ☐ Prefer not to Say

Did you receive any form of social welfare in the last year?

- ◯ Yes
- ◯ No
- ◯ Prefer not to say

Please state your estimated monthly net income. (As a reminder: your participation is completely anonymised)

La tua risposta

Please indicate the level of fortune (welfare) according to your financial prosperity

- ◯ Low income
- ◯ Middle class
- ◯ Upper middle class
- ◯ Wealthy/Upper class

Invia

Cancella modulo

Energy Transition through Business Model Innovation - Governance, Actors, and Partnerships

Master Thesis in Politecnico di Torino

POLITECNICO DI TORINO

DEPARTMENT OF REGIONAL AND URBAN STUDIES AND PLANNING
MASTER'S DEGREE PROGRAMME IN
TERRITORIAL, URBAN, ENVIRONMENTAL AND LANDSCAPE PLANNING
CURRICULUM IN PLANNING FOR THE GLOBAL URBAN AGENDA

Master thesis by

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