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ELECTRIC POWER MARKET AND SHARING ECONOMY: A POSSIBLE FUTURE FOR THE INDUSTRY

RELATORE: Eleonora Di Maria

LAUREANDO: Riccardo D'Amore

MATRICOLA N. 1202393

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INDEX

CHAPTER 1
SHARING ECONOMY: Definition, Determinants and, Characteristics 6
1.1 Conceptual Characteristics and Related Concepts 7
1.2 Collaborative, Access, and Peer-to-Peer Economy 11
1.3 Access vs Ownership 13
1.4 Driving forces 15
1.5 Sharing Economy Activities and Aims 18
1.6 Collaborative Consumption and Circulation Systems 19
1.7 Profit Generation 20
CHAPTER 2
UTILITIES AND ENERGY INDUSTRY: General Description and Focus on the Electric Power Market 23
2.1 Energy: Definition and Characteristics 24
2.2 Resources Classification 25
2.3 General Structure of the Industry 29
2.4 Electric Power Market 31
2.5 New Market Trends 35
2.6 The Italian Context 36
CHAPTER 3
ELECTRIFIYNG THE SAHRING ECONOMY: The Future of the Electric Power Market 39
3.1 Introduction 40
3.2 Distributed Generation 41
3.3 Challenges and Opportunities 43
3.4 Energy Community and Energy Sharing 46
3.5 Policy implications of decentralization 50
3.6 The situation in Italy 53
CHAPTER 4
HOW NEW ACTORS ARE SHAPING THE VALUE CHAIN: Three Italian Cases 57
4.1 Introduction 58
4.2 The role of new actors in shaping the value chain 59
4.2.1 Vandebron 61
4.2.2 Une srl 62
4.3 Energy communities 65
4.3.1 Energia Agricola a Km 0 65
4.3.2 Energy Community GECo 68
4.4 Interviews' results 71

CONCLUSION 74
The Triple Transition 75
Bibliography 79

CHAPTER 1

SHARING ECONOMY:

Definition, Determinants and, Characteristics

CHAPTER 1

SHARING ECONOMY:

Definition, Determinants and, Characteristics.

1.1 Conceptual Characteristics and Related Concepts

The phenomena that the media and the specialized literature define with the name of "Sharing Economy" have experienced a strong growth of popularity especially since the 2008 crisis. The use of the expression has spread exponentially in recent years which is indicative of the growing interest in it. For this reason, the society is trying to define it. However, it is not easy to define a phenomenon with boundaries that are still somehow vague: how can we define something so wide that affects several aspects of our society and that includes millions of people? This chapter does not claim to give an omni comprehensive definition of the concept but starting from its basic characteristics it tries to understand the possible implications in the real world.

Back in 2011, the American journal "The Times" defined the Sharing Economy as one of the ten ideas that will shape the world. Furthermore, according to some studies the phenomenon is destined to develop even more in the next years. Sharing has become a modern practice, both because of the expansion of platforms worldwide and because the positive ideals behind it have caught on around the globe. Following the US example, platforms are proliferating throughout Europe where cities are becoming centers of "sharing" practices. Paris, for example, has become the annual home of the "OuiShare" fest, an event in which entrepreneurs, free thinkers and activists can discuss about new sharing practices, innovation tools and explain their own vision of the future.[1] At the same time, the rest of the world is moving toward this phenomenon: the Arab world has a raft of new sharing innovations, Colombia has become a sharing hub in Latin America, and Seoul is a center of sharing initiatives. A proof of the expansion of the Sharing Economy is the forecast about its growth. According to several experts the market value generated will reach 335 billion of Dollars in 2025 and it will continue to expand geographically.[2]

[1] *Events powered by Ouishare*. (2020). Source: https://www.ouishare.net/fest

[2] Osztovits, Á. (2015). *Sharing or paring? Growth of the sharing economy* (PWC, Ed.). https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf

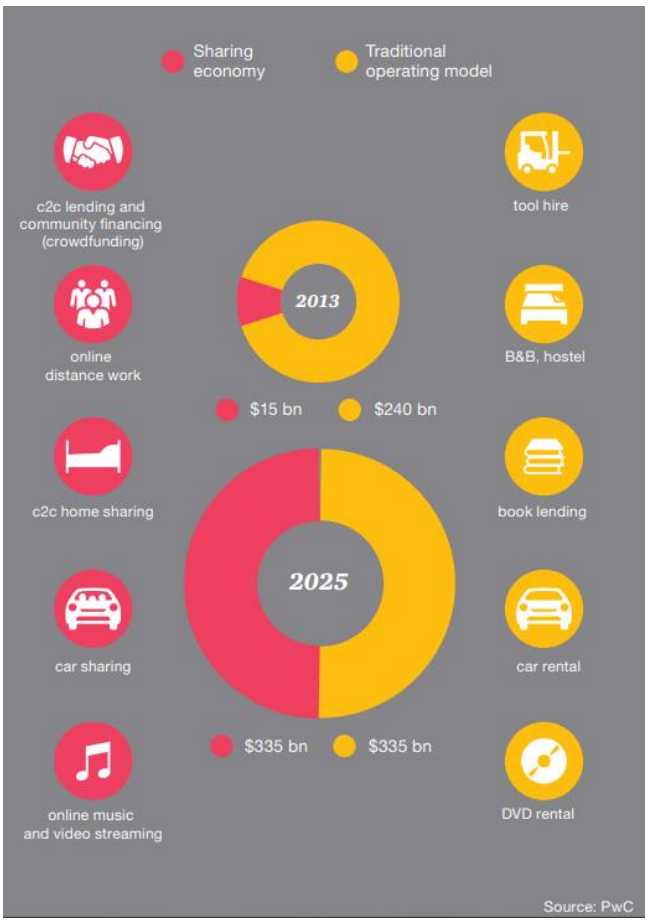

Figure 1: Sharing Economy growth forecast 2013-1025. Source: https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf

In addition, the difficulty in defining this phenomenon arises because during the last years many different organizations pushed to position themselves under the "big tent" of the Sharing Economy to exploit the positive symbolic meaning of the model, the magnetism of innovative digital technologies and the rapidly growing volume of new activities.

So, coming up with a solid definition of sharing economy that reflect common usage is nearly impossible. Generally, this term is attributed to any platform with the aim to combine the demand and the supply of goods and services. But the use of the concept in this way creates confusion in respect to the real meaning of the phenomenon. To clarify the matter and the terminology used in this thesis, I will define the sharing economy as an IT-facilitated Peer-to-Peer or Business-to-Peer model for commercial or non-commercial sharing of underutilized

goods and service capacity through an intermediary without transfer of ownership[3]. One of the main characteristics of this system is that digital platforms are often used. Moreover, it is important to underline the behavior of the consumer, which implies the proactivity as a basic concept. One of the most famous examples, is the platform BlaBlacar.com: it allows users to offer unused seats, thus sharing the trip with other people and reducing costs for everybody.

However, the sharing economy is not only linked to the economic aspect, but it includes relational, social, and organizational aspects that can generate new values, opportunities, and changes. Both for- and no-profit organizations can operate in the system[4]. The operations and long-term impacts of these platforms are shaped by both the market orientation (for-profit or no-profit) and the market structure (Peer-to-Peer or Business-to-Peer). These dimensions shape the platforms' business models, logics of exchange, and potential for disrupting conventional businesses. Examples of each type are shown in *figure 1*.

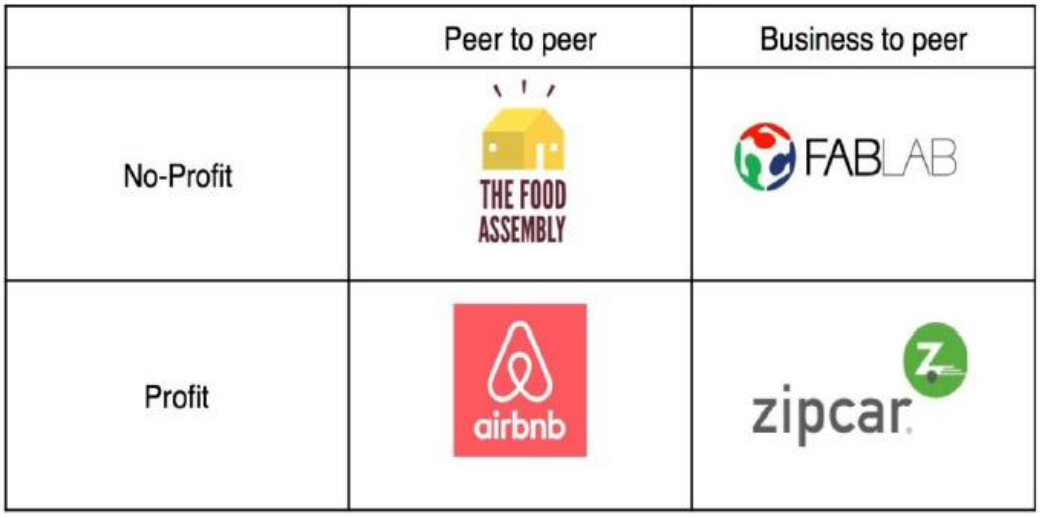

Figure 2: Platform examples in the Sharing Economy. Source: personal elaboration from https://www.icscarsharing.it/wp-content/uploads/2019/02/2014-Schor-Debating-the-Sharing-Economy.pdf

[3] Schlagwein, D., Schoder, D., & Spindeldreher, K. (2019). Consolidated, systemic conceptualization, and definition of the "sharing economy." *Journal of the Association for Information Science and Technology*, *71*(7), 817–838. https://doi.org/10.1002/asi.24300

[4] Gansky, L. (2012). *The Mesh: Why the Future of Business Is Sharing*. Source: *Book*.

For-profit platforms push for revenue and asset maximization. In the following lines I will describe them briefly.

One of the most successful platforms is "Airbnb". The platform matches people that need to rent a house with people that offer it. However, the aim of the company is to offer this Peer-to-Peer lodging service making profits, so charging a percentage fee on every transaction.

The platform "Zipcar" operates in the Business-to-Consumer market with the same aim. It is considered the alternative to the traditional renting car agencies: users need to pay a membership fee in addition to the renting service.

By contrast, many of the initiatives in the Sharing Economy are non-profit. They do not seek growth or revenue maximization, rather they aim to serve needs, usually at a community scale.

The first example is the platform "The Food Assembly". It operates in the Peer-to-Peer market and it matches the supply of small and independent farmers with the demand of consumers who prefer to buy goods from them and not from large retailers. This process is managed by the platform for free, neither a membership fee is required, nor a percentage fee is charged.

The platform "FabLab" operates in the Business-to-Consumer market and offers shared spaces with machinery, tools, and instruments. A FabLab is a co-working space like a laboratory that enables the production rather than the consumption: people can work and build relationship with potential partners.

While Peer-to-Peer sharing is consolidated, Business-to-Business sharing models are still rare. However, some models based on this channel are developing and its importance will increase in the future. One example is the Floow2 platform through which companies can exchanging all aspects of the supply chain. Asset overcapacity can be shared with other companies, from trucks to equipment, materials, services, facilities, and personnel.[5]

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[5] Eschberger, T. (2020, March 3). *B2B Sharing: The next step for the Sharing Economy?* LEAD Innovation Management. https://www.lead-innovation.com/english-blog/b2b-sharing

Finally, the sharing economy is referred to as the access economy, gig economy or collaborative consumption. Most of the time it is related to the circular economy, which aims to minimize waste, and includes co-creation, recycling, re-distribution, and trading used goods.

Activities such as renting, leasing, pooling, and sharing, have been identified as contributing to product lifetime extension.[6]

It is important to note that all the economic activities within the sharing economy are not new: sharing, renting, and exchanging resources were the first economic principles. The novelties of the sharing economy are the scale at which it operates, and the technology used. Traditionally, people were used to share resources with few individuals (most of the time friends or acquaintances) who lived in the same town. Now people can share resources worldwide with strangers, using new digital technologies.

1.2 Collaborative, Access, and Peer-to-Peer Economy

The term Sharing Economy has been widely criticized as being misleading.

In an article in Harvard Business Review, authors Giana M. Eckhardt and Fleura Bardhi argue that "Sharing Economy" is a misnomer, and that the correct term for this activity is “Access Economy”. The authors say, "When sharing is market-mediated—when a company is an intermediary between consumers who don't know each other—it is no longer sharing at all. Rather, consumers are paying to access someone else's goods or services”.[7]

Michael Bauwens notes that companies such as Uber are not operated by a Peer-to-Peer structure, saying: “A Sharing Economy, by definition, is lateral in structure. It is a Peer-to-Peer economy. But Uber, as its name suggests, is hierarchical in structure. It monitors and controls its drivers, demanding that they purchase services from it while guiding their

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[6] Ertz, M. (2019, August). *Advancing quantitative rigor in the circular economy literature: New methodology for product lifetime extension business models*. https://www.researchgate.net/publication/335327436_Advancing_quantitative_rigor_in_the_circular_economy_literature_New_methodology_for_product_lifetime_extension_business_models

[7] Eckhardt, G. M. (2015, January 28). *The Sharing Economy Isn’t About Sharing at All*. Harvard Business Review. https://hbr.org/2015/01/the-sharing-economy-isnt-about-sharing-at-all

movements and determining their level of earnings. This is a top-down economy, not a shared one"[8].

To have a clear vision of the concepts I will define them briefly.[9]

The term "Collaborative Economy" groups systems that unlock value from underused assets by matching 'needs' and 'haves' in ways that bypass traditional intermediaries and distribution channels. The use of online platforms is essential to do that. Consequently, there is a radical change in the traditional dynamics of demand and supply. The aforementioned platform "The Food Assembly" is a typical example because it allows people to buy directly from the supplier.

'Access Economy' includes systems that enable people to pay for access to the benefits of goods rather than needing to own them outright. It has important implications for how companies in this space compete. It implies that consumers are more interested in lower costs and convenience than they are in fostering social relationships with the company or other consumers. The access economy is changing the structure of a variety of industries: a successful business model in the access economy will not be based on community but it is important to highlight the benefits that access provides in contrast to the disadvantages of ownership. For example, people can easily access media content from Netflix or Spotify.

With the term 'Peer-to-Peer Economy' we define all the systems that connect buyers and sellers facilitating the exchange of assets directly between individuals. For example, the platform Etsy connects makers of crafts with buyers looking for unique or handmade products.

To deeply understand the concept of sharing economy we cannot consider the definitions by their own. All of them describe different shapes of the same phenomenon that is changing the world. It is not only strictly related to Internet and Web 2.0, rather it involves a new type of consumer, relationships, and market vision.

[8] Eskow, R. (2015, February 2). *The sharing economy is a lie: Uber, Ayn Rand and the truth about tech and libertarians*. Salon. https://www.salon.com/2015/02/01/the_sharing_economy_is_a_lie_uber_ayn_rand_and_the_truth_about_tech_and_libertarians/

[9] Botsman, R. (2018, May 10). *The Sharing Economy: Dictionary of Commonly Used Terms*. Medium. https://medium.com/@rachelbotsman/the-sharing-economy-dictionary-of-commonly-used-terms-d1a696691d12

1.3 Access vs Ownership

Within the Sharing Economy there is a change in the Value Capture for the consumer: from the concept of ownership to the concept of access. The traditional consumerist model is considered not applicable to the modern society because it is based on the ruthless exploitation of resources that are, by definition, limited. Ideally, the well-being of a community is measured by the possibility to have access to goods and services, on what and how people can share with each other, and on the reputation and reliability of individuals[10].

People can set their mind on renting, exchanging, lending and, sharing thanks to digital technologies. Scale and efficiency are grown exponentially and with the Internet it is easy and convenient having access to goods and services instead of having the property. This environment allows consumers to avoid the "burdens of ownership", i.e., risks and responsibilities that come with owning a good[11].

It is important to say that information is crucial when we talk about access and usage. When information about resources is shared, usually via online marketplaces, the value of those goods may increase: the theory of open access to information enables greater innovation, and makes for more efficient use of them, thus supporting resilient communities. Moreover, with information it is also possible to overcome the fear of the unknown. In fact, when people are involved in an exchange they need to know or at least trust the counterparty and organizations should ease this process by sharing information among users. Beyond trusting others, the users of a platform need to trust the platform itself[12].

Three important steps led the transition from the 'ownership economy' to the 'access economy'[13]:

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[10] Gansky, L. (2012). *The Mesh: Why the Future of Business Is Sharing*. Source: *Book*.

[11] Schaefers, T. (2015, April 11). *How the burdens of ownership promote consumer usage of access-based services*. Marketing Letters. https://link.springer.com/article/10.1007/s11002-015-9366-x?error=cookies_not_supported&code=c0dae627-b5b8-4fec-bb6b-f82fa38e9ae0

[12] Ross, E. (2017, February 21). *How open data can help save lives*. The Guardian. https://www.theguardian.com/media-network/2015/aug/18/open-data-save-lives-emergency-services-disaster-relief

[13] Denning, S. (2014, July 15). *An economy of access is opening for business: five strategies for success | Emerald Insight*. Emerald Insight. https://www.emerald.com/insight/content/doi/10.1108/SL-05-2014-0037/full/html

1. The first step was in the 1990s with the advent of the Internet. This radical leap of connectivity eliminated the need of intermediaries and mined the traditional vertical value chain. Suddenly users could buy goods online faster and cheaper than in a physical store. The Value Chain was turned horizontally.
2. These horizontal Value Chains, called Peer-to-Peer marketplaces, were destined to further innovate, or disrupt businesses of all kinds. Access became the new central value of this economic model, and consequently the expectations and fulfillment of needs changed. Potentially, everyone can become a supplier, for example E-Bay provided a national venue for resellers and Amazon allowed almost anyone to become a retailer.
3. The third step is the one that sees the Internet and the access economy as the engine of a new social revolution. Customers have the option of choosing access rather than ownership. Instead of planning their lives on the premise of acquiring and owning more private property, a new generation of web adventurers, mostly young people, is finding meaning and satisfaction in having shared access to things and interacting with other people in the process. They are discovering that shared interactions promote significant positive externalities – experiences, learning and relationships, plus freedom from the burdens of ownership.

To deeply understand the shift between the traditional and the sharing economy, we must not consider those three steps in a sequence or separated from each other, rather they coexist and are included together in the concept of Sharing Economy. The central point is not the ownership but the possibility to use and share goods and services, so in a sense having the 'temporary ownership' of resources. The contrast is obvious, especially if we consider the principles of the capitalism.

Markets are changing as well. The physical market, intended as the physical space where exchanges take place, are evolving into communities. The service and the experience are becoming increasingly more important.

Everything mentioned until now is applicable both at consumer level and organization level. Companies are facing a fast-moving economy, with technologies that improve every day and the life cycle of goods is always shorter. For this reason, they are trying to avoid ownership and moving toward the access: organizations can rent machinery or equipment instead of buying them, the stock is reduced, and Just-in-Time practices and customization are favored. Thanks to the Internet, companies are now connected, they seek for collaboration and communication instead of competing. In the following *Table* are mentioned the main differences between the two concepts.

OWNERSHIP	ACCESS
Global	Local
Suspicion	Confidence
Linear	Circle
Private	Common
Competition	Collaboration
New	Used
Person	Users
Product	Service

Figure 3 Characteristics of Ownership and Access. Source: personal elaboration from Google

1.4 Driving forces

From social lending, peer-to-peer hotels, peer-to-peer task, bike sharing and car sharing, the rise of the share economy is reinventing not just what we consume but how we consume. The new game-changing movement started to gain momentum as a response to the global financial crisis and an attempt to fight over consumption. Money shortage drove people to the idea that things could be owned collectively, allowing lenders to gain and borrowers to save more money.

This also revived the once forgotten feeling of a big family, reuniting consumers on a personal basis, and letting them feel like a member of a huge, national, or even international community[14].

[14] Torben Rick. (2016, October 15). *The drivers behind the rise of the collaborative economy*. https://www.torbenrick.eu/blog/strategy/the-drivers-behind-the-rise-of-the-collaborative-economy/

The rise of the collaborative economy is driven and enabled by market forces that are converging now. As these trends accelerate, the same will do the collaborative economy. Several are the drivers behind the rise of the Sharing Economy.

1. ***Economic drivers.*** With the Great Recession (2008) people saw a decline of personal stable income, so a decline in disposable income and purchasing power. At first the impact of the crisis was on the financial US sector and then it became a systemic global crisis. Later it developed into a confidence crisis because banks could not rely on the system anymore. Financial constraints make people more receptive for lending or sharing than they would otherwise be. The economic recession made it significantly harder for consumers to acquire bank loans, or make a return on a savings account, legitimizing the existence of Peer-to-Peer money lending platforms. Unemployment rates have risen, and people needed new ways to earn and save money for their daily needs[15]. Moreover, this has been an increased pressure on the traditional model and on manufacturers to seek design, production and distribution alternatives that will reduce costs. In this context, the circular economy approach has been gaining interest among many global corporate actors[16]. As we saw before in *Figure 3*, the Sharing Economy has a completely different system of values. People think about the concept of waste, they try to extract everything from the goods extending their life cycle, they care about the experience and the environment, they share resources with each other building relationships, and they want to be an active part of the whole process.

2. ***Technology***. As mentioned before, the development of the Sharing Economy is favored by the Internet and the Web 2.0. Enabling technologies have acquired a main role in the system: it is easier for people to transact directly, communicate with each other, and build relationships all over the world. New types of networks are arisen in combination with new services. Thanks to them, people become an

[15] Dervojeda, K. (2013, September). *Accessibility Based Business Models for Peer-to-Peer Markets*. European Commission. https://www.researchgate.net/publication/291808233_Understanding_the_Sharing_Economy-Drivers_and_Impediments_for_Participation_in_Peer-to-Peer_Rental

[16] Wikipedia contributors. (2020, September 5). *Sharing economy*. Wikipedia. https://en.wikipedia.org/wiki/Sharing_economy#Driving_forces

active actor in the system and not only a passive receiver of information: we are no longer talking about individuals, rather we are talking about users that share values, languages, and way of living.

3. ***Social.*** Consumers, in part due to the crisis, are rethinking the basic values of their lifestyle. The basic concepts of capitalism like individualism, personal well-being, and consumerism are increasingly questioned in favor of new values. Economic advantages are important in the short-term and what really matters is the relational and social aspect. Collaboration and sharing are based on confidence and with the enabling technologies and networks people can build and strengthen relationships. Consumer satisfaction is not only related with the purchase experience but what is more important is the usage experience, especially when it is shared with others. Attention is shifted toward the environment and the belief in sustainable organizations that carry out their activities respecting it; in fact, important concepts of the sharing economy are reutilization and attention to waste. Finally, a social trend is boosting the development of this model: congested urban areas. It creates a new series of problems that can be addressed by the sharing economy. "Unlike earlier generations of information or technology-based enterprises, sharing enterprises rely on a critical mass of providers and consumers who are sufficiently close to each other to make their platforms work, often finding value in the very fact of the beneficial spillovers from proximity"[17].

[17] Davidson, N. M. (2016). *The Sharing Economy as an Urban Phenomenon*. Yale Law & Policy Review. http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=118436221&site=eds-live

1.5 Sharing Economy Activities and Aims

Even if within the Sharing Economy activities can be very different and organizations can offer completely different goods or services, the aims of this model can be grouped in four categories.

1. Redistribution and Reuse

When we talk about physical goods, the main activity of the Sharing Economy is not the production of them, but the model is focused on the redistribution and exchange of already existing resources. We are witnessing the rise of a sort of secondary market. Everything started in 1990s when the famous platform E-Bay was created: Its aim was to give a second life to goods that are no more useful to their owner. It is important to remind that these kinds of platforms try to exploit the long tail concept. This term was used by Anderson to describe the fact that niche products can occupy a significant share in the whole market: thanks to the Internet it is easy to sell specific products and satisfy specific needs that would have not been satisfied in traditional shops. This is very important because the model is based on the idea that few sales of thousands of products can generate a higher value then thousands of sales of few products.

2. Full exploitation of goods

Usually people buy durable goods, but their potential is not fully exploited because of the lack of time or because of the abundance of goods. The result is that people own lot of products that are underutilized, for example clothes that are used only in specific occasions or products that are used once in a year. The Sharing Economy offers the possibility to extend the usage of those products, thus optimizing the cost and maximizing their potential. For example, the aforementioned platform Zip Car allows people to rent their car during the day, promoting the usage of the good and, in addition, having an economic return. The focus of activities that fall into this category is to create an easy access for users, lower the costs and give them the possibility to gain some money.

3. Exchange of services

In this category we find all the platforms that match supply and demand of services. A good example is the platform Fiverr[18]. The platform is a marketplace where people can offer their time and services to other people: we can find design experts, cooks, gardeners, or even retired

[18] https://www.fiverr.com/

people. It is not a tool that help people to find a job, rather it is a tool that help users to follow their passion and have extra cash for personal uses.

4. Sharing productive assets

In the last category we find all the platforms and services with the aim of sharing assets and spaces in order to produce rather than to consume. The practice of co-working is becoming very popular: through these platforms, companies can advertise their projects establishing budgets, timeframes, and rules and freelancers can collaborate sharing spaces and ideas. The intent is to exploit underutilized resources, innovate faster, and cheaper. Usually offices are big open spaces where people can work independently or share tools, machinery, and thoughts with other people. This kind of working model is more suited for startups or small companies because usually they are in a fast-moving industry or they have economic constraints.

Figure 4 General overview of Sharing Economy platforms. Source: http://wiprodigital.com/scaling-customer-experience-in-the-sharing-economy/

1.6 Collaborative Consumption and Circulation Systems

As we said before, the Collaborative Consumption is an arrangement in which participants mutualize access to products or services, in addition to finding original ways to individual ownership. The phenomenon stems from consumers' increasing desire to be in control of their consumption instead of passive 'victims' of hyper consumption. This model refers to resource

circulation systems which allow a consumer two-sided role: they may act as both providers of resources and obtainers of resources. The exchange may be performed directly on a Peer-to-Peer basis, or indirectly through an intermediary; online or offline; for free or for other compensation (ex. money, point, or services). [19]

Originally, in 2010, Botsman and Rogers identified three resource circulation systems within the sharing economy.

1. ***Product Service System.***
   This model is based on the fact that heterogeneous people are willing to pay in order to use resources instead of buying them. In practice, through the platform people can share goods or services (ex. carsharing). Consequently, the resources have a longer life cycle, the usage of the product is optimized, and the environment benefits from this because waste is reduced.

2. ***Redistribution Market.***
   This model aims to create a secondary market for goods in which the transaction can happen for free, in exchange for other goods, or in the traditional way with cash. Even in this case the life cycle of the product is extended. This logic is changing the relationship between supplier, distributor, and consumer: The consumeristic view is declining, and the role of the intermediaries is increasingly at risk.

3. ***Collaborative Lifestyle.***
   Thanks to the Sharing Economy everything can be shared, starting with time, goods, money, space, and competences. A collaborative environment is created thanks to confidence, relationships, and the sense of belonging to a community.

1.7 Profit Generation

On one hand, we can say that in the Sharing Economy the economic aspect is of secondary importance. On the other hand, it is true that we cannot deny the need of the system to sustain

[19] Botsman, Rogers. (2020). *What's Mine Is Yours: How Collaborative Consumption is Changing the Way We Live by Rachel Botsman and Roo Rogers (2011-02-03)*. Collins.

itself. How platforms generate profit can be very different and here below are explained the most common revenue models used by them.

Most of the platforms have a revenue model based on a Service Fee: it means that a percentage is charged on the total cost of the service/goods shared. The charged fee can vary based on the transaction value and the type of service offered and usually the supplier is the one affected by it. The typical example in this case is Airbnb.

Another common revenue model is based on a Flat Membership Fee. In this case the user must pay a monthly or yearly fee in order to use the platform and access to its services. Spotify is a streaming music platform that operates with a revenue model based on this system. Some other platforms ask a Tiered Subscription: the fee depends on the frequency of use and the amount of services the user asks to have access. This kind of customization tries to fulfill different customers' needs.

The revenue model called White Label is used most of the time in the Business-to-Business market. One organization, usually a software startup, creates an online platform that can be used by other companies to organize their own business. The company that uses the platform pays a fee based on the customization level and time required to adapt it.

The last common revenue model is the Freemium model. In this case the organization offers a basic platform for free to everybody and in parallel the organization offers premium benefits, functionalities, and services that require the payment of an extra fee.

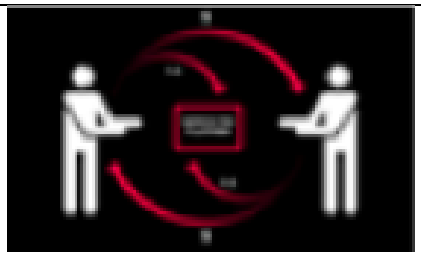
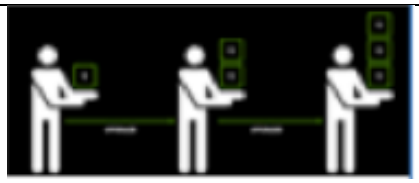
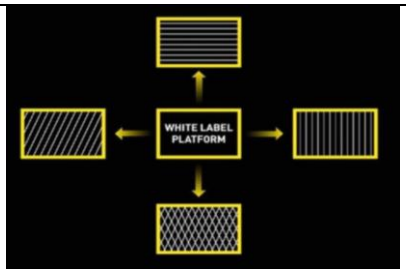
Service Fee: a percentage is charged because the two counerparties have the possibility to access the "matching service".	
Flat Memebership Fee: a basic fee is paid in order to access the service.	
Tired Subscription: a fee is paid based on the level of service chosen by the user.	
White label: the organization sells a back-end platform that companies can customize and use	
Freemium: a basic version of the platform is offered for free and extra services are accessible paying a fee	

Figure 5 Common Revenue Models. Source: personal elaboration from Google

Given the description of the main aspects of the Sharing Economy, the following chapter will describe the Utilities and Energy sector in order to understand if the model is applicable in this industry.

CHAPTER 2

UTILITIES AND ENERGY INDUSTRY:

General Description and Focus on the Electric Power Market

CHAPTER 2

UTILITIES AND ENERGY INDUSTRY:

General Description and Focus on the Electric Power Market

2.1 Energy: Definition and Characteristics

Using the term Energetic Resources, we include all the phenomena created by the environment from which useful energy can be extracted or recovered either directly or by means of a conversion or transformation process. These phenomena are defined resources thanks to the technology and scientific progress that create the possibility and opportunity to use them.

The word "energy" derives directly from the Greek (érgon = work) and it is the main source that led the economic development of our society. Several studies demonstrated that there is a positive correlation between economic growth and energy consumption.[20]

However, it is not easy to define what energy is. Scientists tried to do that starting from its visible effects and they ended up saying it is the quantitative property that must be transferred to an object in order to perform work on, or to heat, the object.[21] In fact, the SI unit of the energy is the Joule, which is the same SI unit of the work.

Most of the energy we use (99%) derives directly from the solar energy, the most powerful source of heat that constantly flows on the Earth surface. Almost all of this energy creates the weather and the remaining part is transformed into chemical energy through chlorophyll photosynthesis carried out by plants, the only converters capable of intercepting solar energy and transforming it into food. Finally, a minimal amount of energy (0.02%) comes from tides and from the inner heat of the earth.[22]

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[20] Sharma, N. (2019, October 28). *The decoupling of GDP and energy growth: A CEO guide*. McKinsey & Company. https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-decoupling-of-gdp-and-energy-growth-a-ceo-guide

[21] Wikipedia contributors. (2020a, June 14). *Energy*. Wikipedia. https://en.wikipedia.org/wiki/Energy

[22] Visconti, A. (2005). *Risorse energetiche*. Homolaicus. https://www.homolaicus.com/economia/geografia/geografia-antropica/2.htm

2.2 Resources Classification

When we talk about energy resources, a first distinction can be made between primary and secondary resources.

Primary resources are suitable for end use without conversion to another form. The energy produced by those resources is called primary energy and it is contained in raw fuels, wind power, solar power, oil, natural gas, and other forms of energy received as input to a system.

In contrast, secondary resources are the ones that require substantial conversion from a primary source. Secondary resources are those such as electricity, hydrogen, or other synthetic fuels.

Another important classification is based on the time required to regenerate an energy resource.

"Renewable" resources are those that recover their capacity in a time significant by human needs. Examples are solar power, hydroelectric power, wind power, geothermal power, or biofuels when the natural phenomena that are the primary source of energy are ongoing and not depleted by human demands. In the following lines I will describe the main features of these renewable sources and how they are converted into energy.

Solar Energy.[23] Solar power is the concept of energy. It is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaics, solar thermal electricity, solar architecture and artificial photosynthesis. Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include "orienting a building to the Sun", selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise. These advantages are global".[24] Photovoltaics (PV) is a method of generating electrical power by converting solar

[23] *Energy*. (2016). Royal Society of Chemistry. https://www.rsc.org/campaigning-outreach/global-challenges/energy/

[24] IEA (2011), World Energy Outlook 2011, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2011

radiation into direct current electricity. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. . Due to the increased demand for renewable energy sources, the manufacturing of solar cells and photovoltaic arrays has advanced considerably in recent years. Driven by advances in technology and increases in manufacturing scale and sophistication, the cost of photovoltaics has declined steadily since the first solar cells were manufactured, and the levelized cost of electricity (LCOE) from PV is competitive with conventional electricity sources in an expanding list of geographic regions.

Hydroelectricity. Hydroelectricity is electric power generated by hydropower, the force of falling or flowing water. In 2015 hydropower generated 16.6% of the world's total electricity and 70% of all renewable electricity and was expected to increase about 3.1% each year for the following 25 years. Plants are usually formed by a basin for the water collection, a system that conveys the water to the turbines, and finally by generators that transform the kinetic energy of water into electricity. The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. Hydro is also a flexible source of electricity since plants can be ramped up and down very quickly to adapt to changing energy demands. However, damming interrupts the flow of rivers and can harm local ecosystems, and building large dams and reservoirs often involves displacing people and wildlife. On the other hand, once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gases than fossil fuel powered energy plants.[25]

Wind Power. Wind power harnesses the power of the wind to propel the blades of wind turbines. These turbines cause the rotation of magnets, which creates electricity. Wind towers are usually built together and the plant takes the name of wind farms. There are offshore and onshore wind farms. The former are constructed in huge platforms on the water, usually in the ocean, to harvest wind energy to generate electricity, while the latter are built on the land. Higher wind speeds are available offshore compared to on land, so offshore wind power's electricity generation is higher per amount of capacity installed.[26]

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[25] REN21. (2011). *Renewables 2011 GLOBAL STATUS REPORT*. https://www.ren21.net/wp-content/uploads/2019/05/GSR2011_Full-Report_English.pdf

[26] Madsen, H. (2018, June 11). *Energy from Offshore wind farm*. SlideShare. https://www.slideshare.net/Piruntharagavan/energy-from-offshore-wind-farm

Biofuels. A biofuel is a fuel that contains energy from geologically recent carbon fixation. These fuels are produced from living organisms. Examples of this carbon fixation occur in plants and microalgae. This biomass can be converted to convenient energy containing substances in three different ways: thermal conversion, chemical conversion, and biochemical conversion. This biomass conversion can result in fuel in solid, liquid, or gas form. Biofuels have increased in popularity because of rising oil prices and the need for energy security. Examples of biofuels are bioethanol and biodiesel. The International Energy Agency has a goal for biofuels to meet more than a quarter of world demand for transportation fuels by 2050 to reduce dependence on petroleum and coal.[27]

Geothermal Energy. It is generated and stored in the Earth. The geothermal energy of the Earth's crust originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%). The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface.[28] Geothermal energy has been used for bathing since Paleolithic times and for space heating since ancient Roman times, but it is now better known for electricity generation. It is cost effective, reliable, sustainable, and environmentally friendly, but it has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of fossil fuels. The Earth's geothermal resources are theoretically more than adequate to supply humanity's energy needs, but only a very small fraction may be profitably exploited. Drilling and exploration for deep resources is very expensive. Forecasts for the future of geothermal power depend on assumptions about technology, energy prices, subsidies, and interest rates.[29]

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[27] *Transport Biofuels – Analysis*. (2020). IEA. https://www.iea.org/reports/transport-biofuels

[28] *How Geothermal Energy Works*. (2014). Union of Concerned Scientists. https://www.ucsusa.org/resources/how-geothermal-energy-works

[29] Glassley, W. E. (2010). *Geothermal Energy: Renewable Energy and the Environment* (1st ed.). CRC Press.

Non-renewable resources are those that are significantly depleted by human usage and that will not recover their potential significantly during human lifetimes. Examples of non-renewable energy sources are coal and oil, which does not form naturally at a rate that would support human use. In the following lines I will describe the main sources of this kind of energy: fossil fuels and nuclear power.

Fossil fuels. Fossil fuel sources burn coal or hydrocarbon fuels, which are the remains of the decomposition of plants and animals. There are three main types of fossil fuels: coal, petroleum, and natural gas. Heat from burning fossil fuel is used either directly for space heating and process heating, or converted to mechanical energy for vehicles, industrial processes, or electrical power generation. The use of fossil fuels in the 18th and 19th Century set the stage for the Industrial Revolution. They make up the bulk of the world's current primary energy sources: in 2018, around 60% of the world's energy needs was met from fossil sources.[30] Liquid fuels derived from petroleum deliver a great deal of usable energy per unit of weight or volume. However, fossil fuels are non-renewable resources, which will eventually decline in production and become exhausted. While the processes that created fossil fuels are ongoing, fuels are consumed far more quickly than the natural rate of replenishment. Extracting fuels becomes increasingly costly as society consumes the most accessible fuel deposits.

Nuclear power. it is the use of nuclear fission to generate useful heat and electricity. Fission of uranium produces nearly all economically significant nuclear power. Nuclear power is the second-largest source of low-carbon electricity today, with 452 operating reactors it provided 10% of global electricity supply in 2018. There is an ongoing debate about nuclear power. Proponents, such as the World Nuclear Association, the IAEA and Environmentalists for Nuclear Energy contend that nuclear power is a safe, sustainable energy source that reduces carbon emissions. Opponents contend that nuclear power poses many threats to people and the environment.

[30] *Data & Statistics*. (2019). IEA. https://www.iea.org/data-and-statistics?country=WORLD&fuel=Energy%20supply&indicator=Total%20energy%20supply%20(TES)%20by%20source

2.3 General Structure of the Industry

When we talk about "utilities" we refer to all the organizations that deal with the distribution and management of public environmental services to citizens, like the distribution of electricity or gas, water cycle management, disposal of waste, and maintenance of green areas. The industry is a fast-moving one and in the past few years deep changes happened. Among the most important we can cite:

- the liberalization of the electric power market;
- the transformation of municipal utilities in public limited companies (most of the time listed in the stock market);
- the increase of M&A operations;
- the entry of new foreign actors in the industry (usually in partnership with Italian companies).

The structure that is emerging is always more concentrated with big groups of companies that aim to increase the number of clients. The industry is also characterized by lot of investments in productive assets, a great focus on services innovation, delivery methods, and employed technologies. At the same time, organizations are interested in minimizing the internal costs reaching high levels of efficiency both in the organizational structure and in the supply chain creating partnerships with the producers. In any case, especially in the last few years, organizations are focusing on the customer. Communication is a central element, satisfaction and retention are created through emotional engagement, and they work in order to increase the service level and the offer.

As we said before, the industry includes many different actors. We can analyze all of them under three different perspectives.[31]

1. ***Geographic perspective.*** This dimension refers to the spatial extent in which the organization operates.

   Within the public services industry, most of the organizations are characterized by a local dimension. A strong link with the territory and its deep knowledge are the baseline for a potential development of the business. In this category are included most of the former municipal companies that operate at a regional level.

[31] Cerrato, D. (2004). *I percorsi di sviluppo delle «public utilities». Risposte strategiche alla liberalizzazione nel settore dell'energia*. CEDAM.

The national dimension includes all the organizations that developed their business in the entire country. To underline their social and economic importance, these companies are also called “national champions” and usually are publicly owned. The most famous example in Italy is Enel, but among European countries several examples are available: usually they are former national monopolists that developed their business thanks to national governments.

Finally, the international dimension characterizes big organizations that seek a business improvement outside the country since many years. Different reasons pushed those companies: they tried to increase their bargaining power, or they tried to build strategic alliances with foreign organizations. However, the main driver of this internalization process was the liberalization of the industry in different countries. For example, the German company E.On has acquired important market shares in countries where it was possible in order to increase profits.

2. ***Business perspective.*** This dimension refers to the business strategy and services offered by the company. We can have four different cases.

   Monoutilities are specialized in one sector of the industry, for example their strategic focus can be in the electricity or gas sector. Usually they seek the territorial expansion and they try to integrate the supply or/and the distribution process.

   Biutilities operate in two sectors, often because they can exploit synergies created by them. A typical example in this case is given by the synergies created between the electric and gas energy: the supply and distribution of these two products can be combined thanks to new technologies and industry regulation.

   Multiutilies draw their strength from the linkage with the territory trying to develop a horizontal diversification offering different services. They exploit commercial and technical synergies that arise from clients’ portfolio management and administration. This is the case of Iren: in addition to the supply of electricity and gas, the company offers services for the boiler maintenance and contracts for the supply of neon bulbs for example.

   Finally, multiservice organizations exploit the territorial presence and the consolidated customers portfolio in order to develop new activities. Typical examples are credit card services, insurance services, and facility management services. This strategy breaks the link with the territory to build a direct relationship with the customer based on loyalty.

3. ***Ownership perspective.*** this dimension refers to the economic subject that owns the organization. Traditionally the industry is strategic and essential for the country, that is why usually the ownership of these organizations is public. However, the panorama

changed during the years and now we can find five categories of organizations based on the ownership dimension:

- Companies with shares that are owned by the public are former municipal organizations that were transformed into public limited companies. This process allowed the companies' flexibility growth. However, if we look at the Italian market, we can say that most of the companies are totally owned by the local municipality: this is the proof that a formal privatization is not implemented in the real world.
- The second option includes companies that are majority-owned by the public (at least 50% of the share capital). Usually public shareholders have a direction and control role, while the private entity is entrusted with the operational management. The aim of this model is to converge financial, technological, and human resources toward common goals.
-Finally, there are two types of companies that represent a minority in the industry: companies with a share capital majority-owned by private entities and companies with a share capital wholly owned by private entities. Generally, they are small organizations, specialized in one service, and they participate in competitions for the granting of the management of the service in different municipalities.

2.4 Electric Power Market

Because of its physic and economic features, the electricity is considered a particular good and this influences the market and the regulator's policies.

First, the electric energy is not visible, and it is primarily distinguished by its voltage and frequency. It is employed in every activity of the humankind: lighting, transport, heating, cooling, and many more. It is produced in different ways, based on the primary source utilized. The European Regulation[32] defined the electric energy as a good subject to the "free market rules". So, the first "revolution" is the reclassification of the electric energy as a good and no more as a service and it will be traded in markets with no monopolists. Moreover, the regulation faced two problems:

[32] *REGOLAMENTO (UE) 2019/943 DEL PARLAMENTO EUROPEO E DEL CONSIGLIO del 5 giugno 2019 sul mercato interno dell'energia elettrica*. (2019). https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:32019R0943&from=EN

- The need to maintain a real time equilibrium between the supply and the demand. The presence of a coordinator is required in order to put in practice all the necessary activities to reach the equilibrium;
- Transportation problems arise because the electricity is transported through a shared national infrastructure that has limits based on its capacity.

In general, the demand for electricity is characterized by wide fluctuations both during the year (based on the season) and during the day (based on what time it is). Simultaneously, the demand has a low degree of substitutability with other energetic sources. In fact, as we can see in the biannual report presented by Terna, the Italian organization responsible for the transmission of electric energy across the country, the demand will increase at least until the year 2040.[33] In addition, the energetic theme is increasingly coming to the attention of the public, national, and European institutions. For example, in 2007 the European Commission developed The European Strategic Energy Technology Plan (SET Plan), a key stepping-stone to boost the transition towards a climate neutral energy system through the development of low-carbon technologies in a fast and cost-competitive way.[34]

The Value Chain includes all the stages that start with raw materials and end with the utilization of the good.

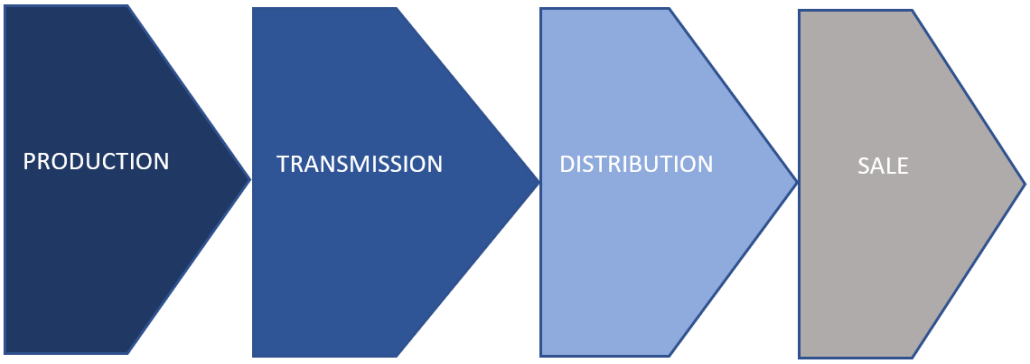

Figure 6 Electric power Value Chain. Source: personal elaboration from Google

[33] Terna. (2018). *DOCUMENTO DI DESCRIZIONE DEGLI SCENARI EDIZIONE 2018*. https://download.terna.it/terna/0000/1016/83.PDF

[34] *Strategic Energy Technology Plan - European Commission*. (2020, March 10). Energy - European Commission. https://ec.europa.eu/energy/topics/technology-and-innovation/strategic-energy-technology-plan_en

Everything starts with the production. In this segment of the Value Chain companies are specialized in the transformation of primary or renewable sources into electric energy. As explained in the previous chapter, electricity can be produced by thermoelectric plants, nuclear plants, geothermic plants, hydroelectric plants, or wind farms. Following the regulation established by the European Commission, the market is a competitive one, with several companies and groups that battle for the leadership. In Italy, the most famous organizations are Enel Group, Eni, and Edison, followed by many other smaller players.

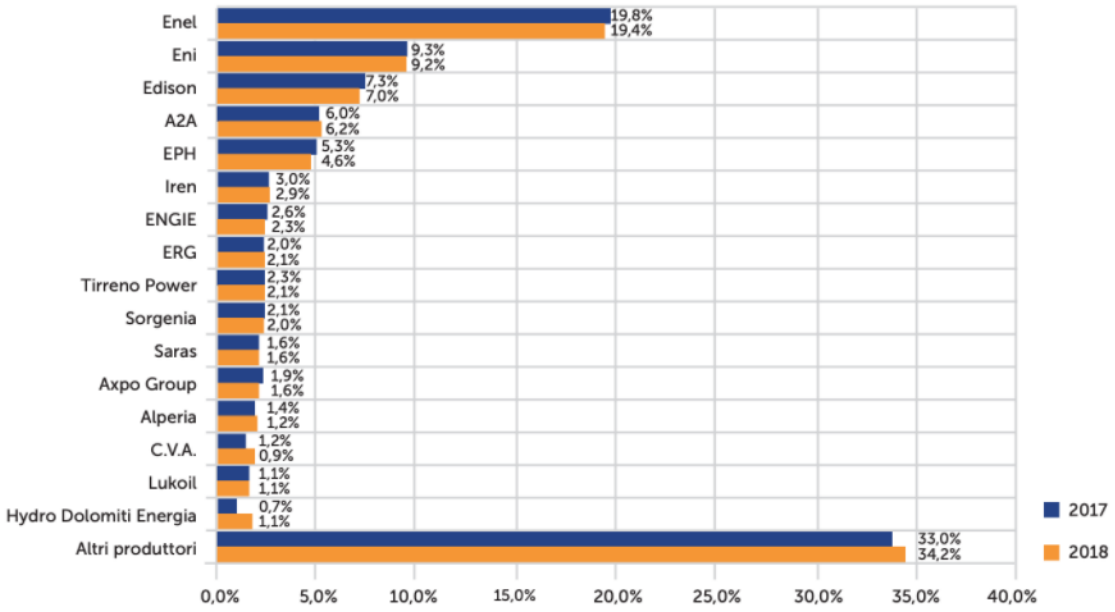

Figure 7 Contribution of the largest organizations to gross national production of electricity. Source: ARERA.

The second step of the Value Chain is the transmission. Electricity needs to be transmitted from the producer to the electrical substation where the end users are connected. The interconnected lines which facilitate this movement are called transmission network. The electricity is transmitted with a high voltage, in order to avoid an excessive dispersion. In Italy, the market is dominated by a monopolist that is responsible for the whole process. This because the transmission network is an essential facility: it means that the structure is not duplicable except at very high costs and in any case the construction of new traits has limitations for the environmental sustainability of the process. The monopolist that controls the network is called

Terna and it is the biggest European player that operates in the electricity transmission market. It offers a public service that is essential to ensure electricity to the country.[35]

Electric power distribution is the final stage; it carries electricity from the transmission network to individual consumers. Distribution substations connected to the transmission system lower the transmission voltage to medium-low-voltage with the use of transformers that are close to customers' premises. In this case the market competition is based on tenders and the winning player can operate in that specific province or region for a set period of time (usually two years).

The last step of the Value Chain is represented by the selling process. Even in this case the market is characterized by free competition. Usually, companies that manage the distribution process are also responsible for the selling process; in other cases, they build alliances with organizations involved in the distribution process. Companies that compete in this segment are responsible for the invoicing and the customer service. It is important to say that this stage was deregulated to open up the supply of electricity to competition: this trend continued and the role of electricity retailing changed from what was essentially an administrative function within an integrated utility to become a risk management function within a competitive electricity market.

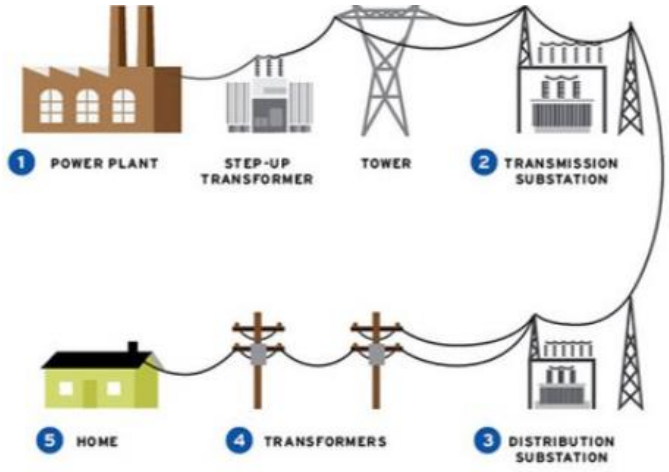

Figure 8 Electric power life cycle. Source: Google

[35] *Home - Terna spa*. (2020). Terna. https://www.terna.it/it

2.5 New Market Trends

The coronavirus, the medical emergency, and the lockdown have changed all the forecasts made for the electric power market in 2020. The information provider company IHS Markit estimates that there will be 290 gigawatts (GW) of net power capacity added in 2020, globally, 5% more than in 2019. Grid-connected solar and wind net additions are projected to account for about 65% of the total, while coal and gas combined account for only 25%.[36]

As renewable penetration increases, it pushes wholesale prices down in organized power markets. Simultaneously, emerging markets are achieving low renewable auction prices with cost declines but face implementation challenges owing to infrastructure and regulatory constraints. Consequently, additions in 2020 and the extent to which government and corporate ambitions are realized will depend on seven trends that stem from three interconnected drivers: policy, technological advancements, and new business strategies and revenue streams.

The seven trends are described in the following lines.

1. ***Changing subsidies.*** Most markets have already shifted from feed-in-tariffs (FiTs), in pursuit of market-driven pricing through renewable auctions. Key markets such as China, Japan, and Vietnam will however sustain solar and wind FiTs or FiT caps into 2021. At the same time, seasoned-auction markets are going a step further by complementing technology-specific auctions with neutral and mixed- technology auctions
2. ***Market reforms.*** Markets such as Brazil, Japan, Vietnam, India, and Belgium will continue to revise recently designed wholesale power markets to attract investment in the power sector.
3. ***Renewable cost improvements.*** Renewable costs will continue to decline in 2020 and convergence across markets and technologies will accelerate. As a result, IHS Markit expects renewables' levelized cost of energy to be within the range of marginal fossil fuel costs in an increasing number of markets.
4. ***Emerging technologies:*** Bifacial solar panels are entering the mainstream for PV, the battery storage industry continues to grow rapidly, and floating offshore wind is taking

[36] Shpitsberg, A., & Sala, E. (2020, March). *Policy, technology, company strategies, and the COVID-19 wildcard: Seven trends to watch for in global power and renewables in 2020*. https://ihsmarkit.com/research-analysis/seven-trends-to-watch-for-in-global-power-renewables-in-2020.html

off. As a result, solar, wind, and battery technologies will continue to build scale and accelerate cost and performance improvements in 2020.

5. ***New market players.*** Over 200 companies have formally committed to RE100, a global corporate initiative to cover electricity usage with 100% renewables before 2050. Of the 211 members, over 50 joined in 2019, marking a record year. We expect corporate activities to continue and to see movement in retail competition in markets such as India, South Africa, and China, in 2020.

6. ***Utility adaptation strategies.*** Revenues streams for power generators are evolving as governments move toward competitive bids, renewable price cannibalization increases, and merchant power markets come under pressure as renewables penetration increases. As a result, utilities are adapting their business strategies to compete in this new environment and are aiming to capture new revenue streams generated by new stakeholders.

7. ***COVID-19 shock.*** The year 2020 will be remembered by the ripple effects of the coronavirus (COVID-19). IHS Markit expects the virus to decelerate power demand growth around the world, leading to intensified competition among generation technologies (coal, gas, nuclear, and renewables).

2.6 The Italian Context

Knowing the evolutionary history of the Italian Energy Industry is of great cultural and strategic value. As Gramsci said, “who does not know the history is doomed to repeat it” and in a sense he was trying to say that people that do not know the history will repeat the same errors.

In Italy, the nationalization process started in 1962. The main driver was the “electrification” of our country: the aim was to supply the territory with an electric service that was organized, reliable, and suitable for citizens and companies. At the time, the industry was highly fragmented, with several players that were unable to realize such a project by their own. After long discussions, the government decided to start the nationalization process electing a “national champion” able to work on the national energy strategy. The company charged with this important assignment was Enel. Italy was not the only country working on that. The international context was similar and characterised by strong solidarity; in fact, France and England had already undertaken this process. In addition, the nationalization boosted the development of the electromechanical industry and Enel was able to build an efficient distribution network. However, Italy was strongly dependent by primary sources imported from

other countries, like petroleum and coal. Because of this dependency, in the 1970s the oil shocks hit the country very hard. Even in this case, after a long period of discussion, a new process was undertaken in order to change the rules of the industry. In 1999, pushed by the European legislation, public policies of liberalization and competition were introduced (Decreto Bersani): several players entered the market and the government decided to issue new rules to align their goals to the general interest of the system. Moreover, all the companies like Enel involved in the progress of the previous process, were transformed in normal players, although with positions of advantage and incumbent sizes compared to other operators.

During the last few years, another driver is changing again the industry: environmental sustainability and renewable energies. In 2019 renewables satisfied more than one-fifth of the demand and enabling technologies are creating new opportunities, both for companies and consumers, to create a new market model.[37] In addition, a national plan presented in 2018 called "Piano Nazionale Integrato Energia e Clima" (PNIEC) is promoting the energy efficiency as one of the most important goals to reach. Support policies were adopted like tax allowances for the energy upgrade of buildings or the adoption of renewables for new buildings.

All of this is helping our country to reduce the dependency on foreign energy sources. Even if the share of domestic energy needs met by imports is high (74%), it has been decreasing and now is below historical values.

Today the structure of the market is the following:

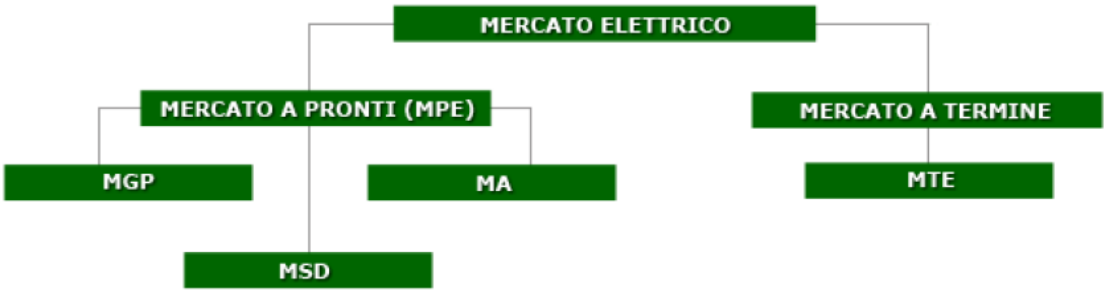

Figure 9 Structure of the Italian market. Source: ARERA

[37] *La situazione energetica in Italia: si consolida il ruolo delle energie rinnovabili e diminuisce la dipendenza estera*. (2019). Mise. https://www.mise.gov.it/index.php/it/198-notizie-stampa/2039948-la-situazione-energetica-in-italia-si-consolida-il-ruolo-delle-energie-rinnovabili-e-diminuisce-la-dipendenza-estera

The liberalization polices establish that all the transactions between the operators must be done in the Italian Power Exchange (IPEX). In addition, the demand was gradually opened to the free market: some eligibility criteria had to be met in order to participate in the IPEX. Until the 2004, the participation was based on minimum levels of consumption and only from 2007 all the entities with specific characteristics were considered eligible to participate in the IPEX.

IPEX. The Italian Power Exchange, that operates since the 2005, is an organized marketplace for the wholesale exchange of electricity. Here, demand and supply meet, creating the benchmark price for the whole country. The supply consists of producers or traders, both Italian and foreign. The demand consists of eligible consumers, so entities that meet specific technical and legal requirements to operate in the IPEX. All the final consumers that do not meet those requirements cannot participate in the market and are forced to stipulate supply contracts with eligible operators that offer the service. Everything is controlled by the "Gestore della Rete di Trasmissione Nazionale" (GRTN): the aim of this entity is to ensure continuity, security, and equal treatment, including tariff treatment, throughout the national territory.

The IPEX is divided into "Mercato a Pronti" and "Mercato a Termine", but for the aim of this thesis I will focus only on the first one.

Mercato a Pronti (MPE). This market is divided into "Mercato del Giorno Prima" (MGP) and "Mercato di Aggiustamento" (MA). In the MGP, the players propose sale and purchase offers for every hour of the day after, defining in this way prices and quantities that will be exchanged. In the MA, the players can modify their purchase and sale commitments, in order to meet the real demand of the final users. The "Mercato per il Servizio di Dispacciamento" (MSD) is the market in which every supplier presents for each hour of the day its offers for the availability of electricity that was established on the energy market the day before. Thanks to this mechanism, the GRTN can ensure that the balance between inputs and outputs of electricity is maintained.

CHAPTER 3

ELECTRIFIYNG THE SAHRING ECONOMY:

The Future of the Electric Power Market

ELECTRIFYING THE SHARING ECONOMY:

The Future of the Electric Power Market

3.1 Introduction

The sharing economy allowed the development of new companies that completely changed the rules of traditional industries by using digital technologies, establishing new market mechanisms, and capitalizing on products and services in a decentralized manner.

Uber and Airbnb for example are two companies that have disrupted the mobility and hospitality sector, respectively. Together with companies that offer carsharing, tool sharing, skill sharing, or crowdfunding platforms, organizations in the energy industry are emerging and are considered part of the sharing economy.

At the same time, capacities of distributed renewable energy generation and storage facilities are increasing and new business models and coordination mechanisms in the energy sector are needed. In the context of these two distinct but possibly synergetic improvements, several researchers and pioneers have started to transfer principles and ideas of the sharing economy to the sector. This chapter focuses on innovations brought about by the sharing economy in the field of energy and electricity generation. New trends that include distributed energy generation by prosumers (individuals that produce and consume electricity) who use renewable energy sources such as wind or solar power make the principles of sharing economy to penetrate the solid and locked market of energy. In fact, peer-to-peer (P2P) electricity trading is gaining popularity in small communities around the world and is shaping up the way for the future trends.

In this environment, researchers have the possibility to drawn on ideas of the sharing economy for a more profitable and efficient use of demand-side energy technologies, for example using energy storages. Others have focused on developing market designs where prosumers may share their energy and resources in energy communities or microgrids. To build such a model prosumer needs should be considered, regulatory barriers need to be overcome, and the energy transition can be driven forward.

However, a more general understanding of what the sharing economy means in the context of the energy sector is still missing. Specifically, this means understanding electricity as a very

complex good where P2P sharing might not be easily implemented, and different challenges compared to shared cars, rooms, or digital content may arise.

3.2 Distributed Generation

For over a century, power has been generated in large and centralized facilities using oil or coal, and later nuclear power. From there, power is transmitted around the country and distributed to households, who pay the utility company for the service. In the last decades, renewable energy sources are emerging, and people can generate power locally through solar panels and wind turbines. It is possible to define the Distributed Generation as the electricity generation and storage performed by a variety of small, grid-connected devices referred to as Distributed Energy Resources (DERs). DER systems are decentralized, modular, and more flexible technologies that are located close to the load they serve.

Advancing technology has diversified the grid, adding new sources of energy generation and two-way power flows. Utility-scale wind and solar farms are supplying an increasing proportion of our power demand and smart meters are changing the way we consume electricity, allowing users to reduce consumption during peak periods and help to balance the grid. This distributed generation method has an obvious drawback: it only works when the sun is out, or the wind is blowing. To solve this problem, battery technologies are rapidly evolving. Modern batteries can store the surplus energy generated when the conditions are right, stockpiling power so it is available when the conditions are not favorable.

Therein lies the opportunity for the sharing economy.[38] The distribution model would go from a vertical one, with the producer and the consumers, to a horizontal one, where each producer is also a consumer. In 2016, the world first peer-to-peer energy transaction took place through the blockchain technology in New York, USA. With the help of TransActive Grid, a platform jointly developed by LO3 Energy and Consensys Systems: two neighbors in Brooklyn shared the surplus energy produced by rooftop solar panels.[39]

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[38] M. (2020, May 20). *Electrifying the sharing economy - From the Exosphere*. Medium. https://medium.com/from-the-exosphere/electrifying-the-sharing-economy-54a452c217bf

[39] Wang, J., Zhong, H., Wu, C., Du, E., Xia, Q., & Kang, C. (2019). Incentivizing distributed energy resource aggregation in energy and capacity markets: An energy sharing scheme and mechanism design. *Applied Energy*, *252*, 113471. https://doi.org/10.1016/j.apenergy.2019.113471

The increasing penetration of DERs into the grid comes with different benefits and opportunities for the power system and its participants.

Affordability is one. Customers with access to DER assets can expect to pay less for electricity as they sell power back to the grid or are compensated for allowing their storage systems to help stabilize the grid, especially during peak periods. Reduced network costs could also lead to a fall in the overall cost of energy. A study made by IRENA, an intergovernmental organisation that supports countries in their transition to a sustainable energy future, highlights that investments in DERs could reduce network expansion costs by nearly 60% by 2050.[40]

Reliability is another benefit. In areas where there is a high reliance on variable energy resources like wind and solar, DERs can be deployed to help balance the grid and improve its reliability, either reducing demand or providing energy to help smooth out intermittent supply. A limiting factor is hosting capacity, or the amount of DERs which can be connected to a distribution network and operated within its technical limits. DERs can be incorporated into the grid where no threats to safety, reliability or other operational features exist and no infrastructure upgrades are required. However, in many cases grid modernization is necessary to safely integrate DERs into the network. The flow imposed by DERs in between independent entities is bi-directional and this cannot be handled by today's existing distribution systems. Some modifications in the existing grid need to be done to accommodate the DER sources.

A basic component of the system is the Microgrid. It is a localized grouping of electricity generation and energy storage systems that normally operate connected to a traditional centralized grid.[41] Microgrids have seen implementation in several communities over the world. For example, Tesla has implemented a solar microgrid in the Samoan island of Ta'u, powering the entire island with solar energy. This localized production system has helped save over 380 cubic metres of diesel fuel. It is also able to sustain the island for three whole days if the sun were not to shine at all during that period. This is a great example of how micro-grid systems

[40] *Global energy transformation: A roadmap to 2050 (2019 edition)*. (2019). IRENA. https://irena.org/publications/2019/Apr/Global-energy-transformation-A-roadmap-to-2050-2019Edition

[41] Compiled by TheCapitol.Net, By (author) Stan Mark Kaplan, By (author) Fred Sissine. (2020). *Smart Grid: Modernizing Electric Power Transmission and Distribution; Energy Independence, Storage and Security; Energy Independence Security Act of 2007 (EISA)*. TheCapitol.Net, Inc.

can be implemented in communities to encourage renewable resource usage and localized production.[42]

3.3 Challenges and Opportunities

The advent of DERs is changing the way power is generated and transmitted to the electric grid. The movement toward an integrated grid, with efficiency and consumption working together for mutual benefit, is advancing rapidly. Moreover, big data are playing an important role allowing the flow of information among multiple parties, facilitating dynamic adjustments to real-time market and operational conditions, and promoting efficiencies for transmission and distribution networks.

DER technologies, such as solar arrays, wind turbines, microgrids, combined heat and power systems, and energy storages, bring with them challenges along with benefits. The challenges include the threat to utilities from reductions in revenue, as the amount of electricity generated by power plants lessens while the operating utilities still must invest in the infrastructure to maintain the grid. The benefits include cost savings to customers, a reduction in emissions in the move away from fossil fuel-generated power, and more control by consumers of their own power. Companies are finding opportunities to invest not only in generation such as solar and wind, but also in areas such as battery storage, software, market design, operations, and more. Utilities are looking at ways to capture those opportunities with their own products and services, trying to maintain a dominant position in the market.

As we said before electricity demand will grow each year until 2050, driven by population and GDP growth, and by the increased use of electric vehicles. In addition, distributed generation could lead to even greater increases in supply. Experts will expect this scenario if local generation becomes very common, if improvements in technology and energy-efficient appliances mean that households will routinely produce more electricity than they need, and if sharing platforms become widespread. If all those conditions hold, distributed generation could outstrip the growth of total electricity demand and become the large-scale generation method that supplies the national grid.

[42] *How a Pacific Island Changed from Diesel to 100% Solar Power*. (2017, February 23). Nationalgeographic.Com. https://www.nationalgeographic.com/news/2017/02/tau-american-samoa-solar-power-microgrid-tesla-solarcity/

Historically, grids have been unable to store electricity, so they have been constructed to meet demand peaks. Most of the time this creates surplus capacity, and therefore underutilized assets. According to the World Economic Forum, in the US, the average utilization rate of the majority of generation infrastructures was below 55% in 2015. A decrease of 10% in peak demand could create up to $80 billion of value by increasing the overall utilization rate of infrastructure.[43] If distributed generation technology takes off, and supports the national grid, then we can expect to see reductions in peak demand and better use of our national infrastructure.

Distributed energy resources mean that we do not have to rely solely on electric utilities for supply our homes. But the benefits of DERs go beyond the individual home. This is because groups of DERs can be easily managed: they can be disconnected from the larger grid network in the case of an outage, providing reliable and resilient power all on their own. In the near future, a growing number of standalone distributed resources could put an end to the days of massive, region-wide power outages. In addition, one of the biggest inefficiencies in current electric grids is the energy loss that happens when electricity is transmitted across long-distance, high-voltage power lines. Distributed energy resources can easily be located close to where the energy that they produce is actually needed. This reduces the amount of energy that is lost when it flows from where it is generated to where it is used. By using distributed resources, we save energy and save money.

DERs can significantly reduce pollution in two main ways. First renewable DERs reduce the amount of electricity that must be generated at centralized plants, which generally use highly polluting fossil fuels, like coal. Second, DERs like wind and solar release no harmful emissions.

These trends may see consumers being charged less for electricity, and potentially enjoying better service. If stored power could be deployed to reduce the load at peak times, then there is less need for utility providers to buy expensive wholesale energy to deliver to households during periods of peak demand. Furthermore, the rise of prosumers would put market power in

[43] *Power to the People: How the Sharing Economy Will Transform the Electricity Industry*. (2017). World Economic Forum. https://www.weforum.org/press/2017/03/power-to-the-people-how-the-sharing-economy-will-transform-the-electricity-industry/

the hands of consumers. Competition would increase at the retail level: this would force the electricity providers to drop prices, offer better services, or compete in some other way to survive.

Those various impacts all sound positive but we need to proceed with caution, to avoid unintended consequences. Take the issue of pricing. If people start generating power themselves, and there is reduced demand for power from traditional sources, then the price of power set by the market could be lower than the cost of production for traditional, centralized utility companies. This will affect the profitability of them, including those partially owned by the State that will lose revenues.

A large penetration of DERs also creates operational problems in distributing networks. For efficient operation of the distribution networks, different approaches are being considered. One approach would be to break the network into smaller entities such as Microgrids and CELLs. The P2P approach promotes regional trading and demand response to available resources in the local area, and this increases the efficiency, flexibility, and responsiveness of local resources. Due to the hierarchical nature of the distribution networks, the P2P energy trading can be carried out in three levels[44]:

Level 1: P2P within a Microgrid;

Level 2: P2P within a CELL (multi-Microgrids);

Level 3: P2P among CELLs (Multi-CELLs), as shown in Figure 10.

In Level 1, each customer (normally in an low voltage network) is considered as a peer; in Level 2 each Microgrid is a peer (Level 2 is normally a medium voltage distribution network); finally each CELL is a peer in Level 3.

[44] *Feasibility of Peer-to-Peer Energy Trading in Low Voltage Electrical Distribution Networks*. (2017, May 1). ScienceDirect. https://www.sciencedirect.com/science/article/pii/S1876610217306860

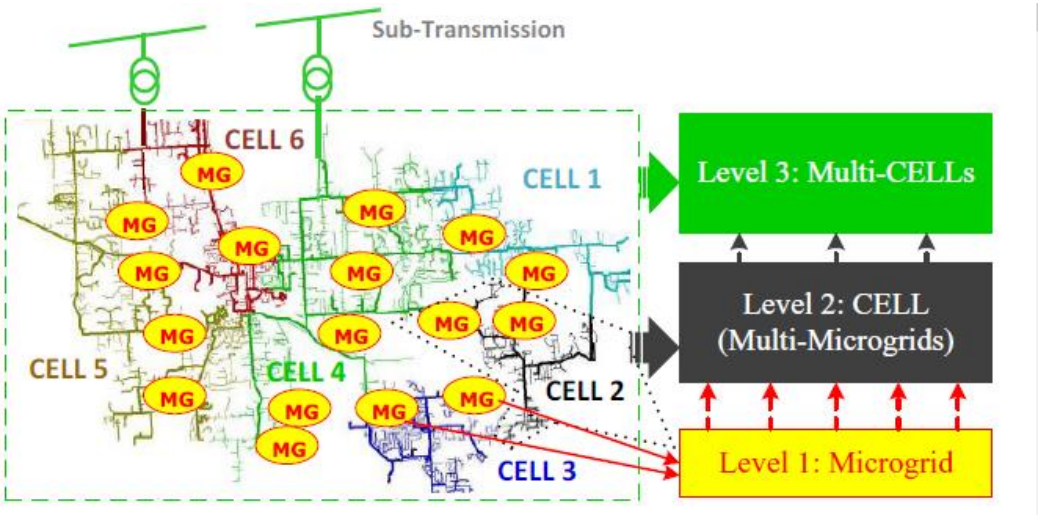

Figure 10 Structure of P2P energy trading. Source: https://www.sciencedirect.com/science/article/pii/S1876610217306860

This model also raises questions around the social impacts of personal generation. There will also still need to be ongoing investments in the national transmission system to ensure electricity can flow around the country. Currently this is paid for through users' monthly electricity bill. But as more people start to generate their own power or move to more localized distribution, then this raises questions about who should and who can pay to maintain the national network.

3.4 Energy Community and Energy Sharing

The idea of energy sharing is to meet individual energy needs through renewable energies and to sell excess energy within a sharing community when households produce more electricity than they need. By sharing energy generation and demand, prosumers could see cost savings and become more self-sufficient. Platforms provided by companies like Beegy, Buzzn, Vandebron, Sonnen, or Piclo, offer their customers the possibility to "share" their excess energy with other community members or with buyers. However, it must be pointed out that, due to the complexity of the physical electricity grid, most P2P platforms and sharing energy communities enable forms of virtual energy sharing and trading, where electricity is "shared" on a balance sheet but not physically. In microgrids, on the other hand, the financial trading might correspond with the actual physical flows of electricity. These concepts might even gain more attraction due to blockchain technology, which drives down the transaction costs and reduces the necessity of intermediaries.

With the directive EU 2018/2001, the European Commission defined an Energy Community as a legal entity based on open and voluntary participation. It is controlled by shareholders or members located in proximity of the production plant. This model allows the association of citizens, businesses, or enterprises with the aim to produce electricity from renewable sources and share it among the members. Only plants with a total power up to 200 Kw are considered for this purpose and the produced energy must be consumed in close proximity to the location it is originated or stored in storage systems. The main objective is to provide environmental, economic, or social benefits at community level to the members and local areas in which it operates, rather than financial profits. In fact, every entity can participate in the community: physical persons, enterprises, and municipalities.

The second directive EU 2019/944 defines the collective self-consumption model, more suited for citizens and small entities. Even in this case the community is a legal entity based on open and voluntary participation and controlled by the members. This model allows participants to share the investment to build the plant and to consume, store, or sell the renewable energy produced, thus saving money. Only families and other entities (like offices and small organizations) located in the same building can participate to the project and the plant can have a maximum power of 20 Kw.

Typical participants of a local market are those sellers who have renewable source installed capacity, hence the ability of self-generation; and a group of buyers who lack such self-generation capabilities, thereupon depend on procurement. Participants who supply the local market intend to sell their surplus of energy, if available, and their peers are willing to buy their requirement from this surplus; if sold to the utility, the surplus energy returns the feed-in tariff per kW/h to the supplier. The first group of participants, the so-called *prosumers*, are revenue seekers who pursue a price higher than the feed-in tariff for their surplus energy. The second group of participants who buy from the local market, the so-called *consumers*, are cost pruners who seek for a price which is lower than the utility price.

Realization of the above mechanism is underpinned by four important enabling technologies. The first one is an energy transmission framework which can operate in consonance to the main grid, the so-called microgrid. The second one is an energy storage capacity that captures the intermittent generation and fluctuation characteristics of this framework. The third one is an aggregator entity reprocessing transactions between prosumers and consumers, from there on coordinates the energy sharing and transmission accordingly. Finally, the last one is a

trustworthy and secure ICT platform that can manage data flow, transactions, contracting and circulation of money between prosumers and consumers.

One appealing aspect of the sharing economy is that entry barriers are relatively low. Participating in the distributed electricity storage market requires some investment in solar panels and batteries, and the outlay is still being met by an increasing number of people.

Energy communities are combined processes of both energy transition and social innovation. As decentralised and renewable-based energy projects take off, they can promote sustainable energy production and consumption practices. As consumer-empowerment and community-driven initiatives growth, energy communities can play a key role for social innovation as they reflect a fundamental shift in consumer behaviour. The traditionally passive consumer is becoming an energy prosumer, co-owner of renewable energy facilities and member of an energy community.

An energy sharing community includes various participants from utility companies to prosumers. An example of this can be the microgrid operating in Brooklyn: The Brooklyn Microgrid (BMG).[45] It allows its participants to engage in a sustainable energy network and choose their preferred energy sources, locally. Within the BMG a blockchain-enabled platform allows for energy transactions through an online marketplace. Participants include energy companies, solar communities, residential and business consumers, as well as residential and business prosumers.

[45] *Brooklyn Microgrid | Community Powered Energy*. (2020). Brooklyn Microgrid. https://www.brooklyn.energy/

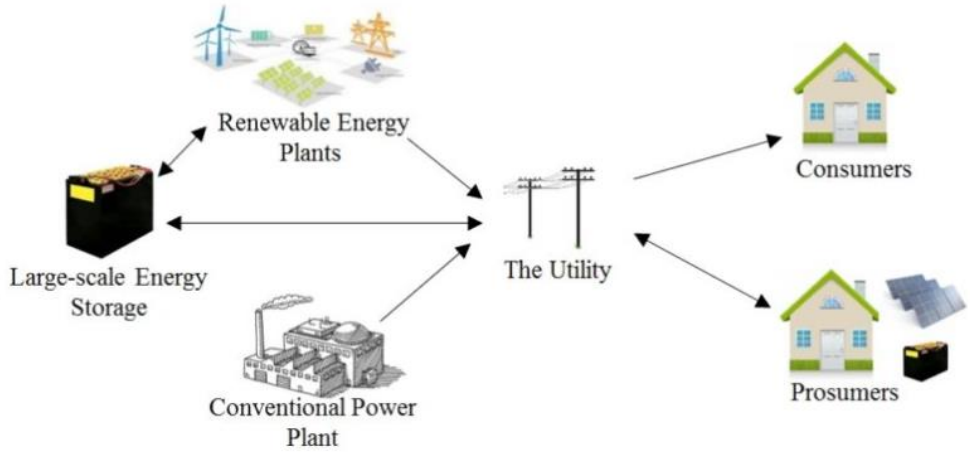

Figure 11 Example of energy sharing community. Source: https://www.renewableenergyworld.com/2019/01/02/the-sharing-economys-next-frontier-energy-sharing/

A critical point is that each prosumer of a sharing community will need a home energy management system to help them participate in the sharing community. In addition, energy sharing also requires a system that manages the energy sharing at the community level. Utility companies could play multiple roles in energy sharing systems. Without building additional infrastructure, sharing communities will need utility companies for their energy distribution network. The communities may also need to rely on utility companies to serve as coordinators of the sharing systems. Utilities provide end-users with not only electricity, but also infrastructure and coordination services for energy sharing, and these services will likely be new revenue streams for the companies.[46]

In Europe, there are about 3500 so-called renewable energy cooperatives, a type of energy communities, which are found mostly in North-Western Europe. This number is even higher when including other types of community energy initiatives such as cooperatives, eco-villages, small-scale heating organisations and other projects. Germany and Denmark, two countries with strong traditions of community ownership and social enterprises, have the highest number of citizen-led energy organisations. Several studies show that community energy projects exist in different forms across Europe. The most widespread involve energy generation. Examples include school buildings or farm roofs equipped with solar panels, windmills installed by residents in a village; further small biomass installations, heat pumps, solar thermal, and district

[46] Potter, S. (2019). *The Sharing Economy's Next Frontier: Energy Sharing*. Renewableenergyworld.Com. https://www.renewableenergyworld.com/2019/01/02/the-sharing-economys-next-frontier-energy-sharing/

heating networks are popular technologies for some community groups. An increasing number of projects is also getting involved in energy efficiency and energy services that return profits to the community.[47]

3.5 Policy implications of decentralization

Distributed resources can play a crucial role in a transition to a renewable electricity future boosting renewable supply, reducing, or shaping demand, and enabling the integration of different renewable resources. The implications for regulators and policymakers are clear: achieving a renewable electricity future is not just a matter of driving new investments in large-scale renewable electricity supplies and transmission assets via supply-oriented policies such as renewable portfolio standards or tax incentives for renewable generation. Distributed resources are key enablers of a high-renewables future in almost any scenario and they may, provide the engine for a far-reaching transformation of the electricity sector toward a cleaner, more secure, and resilient future.

Ensuring that distributed resources are adequately developed to support a high-renewables future will require special attention from regulators and policymakers. Realizing the full opportunity from distributed resources will require new approaches to grid operations and system planning in parallel with new methods for measuring, creating, and capturing value. Together, these changes will have significant implications for the electricity value chain, creating new roles and sources of value for customers, utilities, and new entrants.

This subchapter discusses steps that policymakers can take to unlock the power of distributed resources to support the achievement of a renewable electricity future for greatest societal benefit. These recommendations fall in three major categories:[48]

1. ***Analyzing the options.***

[47] Caramizaru, A., & Uihlein, A. (2020). *Energy communities: an overview of energy and social innovation*. European Commission. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC119433/energy_communities_report_final.pdf

[48] *Distributed Energy Resources: Policy Implications of Decentralization*. (2013, October 1). ScienceDirect. https://www.sciencedirect.com/science/article/abs/pii/S104061901300208X

Distributed energy resources are dispersed, modular, and small compared to conventional power plants, and these different characteristics mean that they incur different costs and create different benefits. Some of distributed resources' costs and benefits do not accrue directly to the utility or to specific customers but rather to the society as a whole (environmental benefits). Regulators and policymakers should drive for comprehensive assessment of all the costs and benefits as the basis for creating a market that takes into consideration the factors that matter to customers and to society at large. Properly measuring and valuing the full range of costs and benefits is a critical step to enabling the efficient and economic deployment of distributed resources. In addition, a deeper analysis of the implications of alternative resources at the national, regional, and local level will help to support better regulatory and policy decision-making and help to find the least-cost ways of achieving a renewable electricity future. Centralized and distributed renewable resources have significantly different attributes, not only in cost, but also in environmental impact, implications for economic development, financial risk, security, reliability, and resilience. Ensuring that centralized and distributed renewable resources compete on the same playing field will be one of the most important challenges facing policymakers, regulators, and electric utility planners in the decades ahead.

2. ***Create an efficient environment.***

Today's electric utility business models are the result of decades of incremental modifications to structures that were originally designed around technologies, strategies, and assumptions about customers' needs that are largely outdated and will become increasingly so in the future. Conventional utility business models have evolved based on the control, ownership, and scale efficiency of centralized supply, transmission, and distribution. In this context, technologies were primarily limited to supersized power plants with increasing economies of scale: the larger the plant, the more efficient and cheaper the electricity generation. However, these traditional approaches are poorly adapted to the modern environment. Many utilities are unable to capture or optimize the value streams associated with DERs and instead see these resources as threats associated with revenue loss, increased transaction costs, and challenges to system operations. The increasing role of distributed resources in the electricity system will start to shift the fundamental business model paradigm of the industry from a traditional value chain to a highly participatory network made-up by interconnected business models. In supporting the evolution of new utility business

models, regulators and policymakers should consider a set of attributes that the utility should be designed to meet. Clearly, it will be necessary to make trade-offs among some of these attributes and to adapt business models to regulatory and market contexts, but a high-level list of desired attributes includes:

- ensure network efficiency, resilience, and reliability;
- create a fair playing field for competition between all resources;
- foster innovation in energy services delivery to customers to minimize energy costs;
- provide transparent incentives, where necessary, to promote technologies that result in social benefits such as job creation and local economic development, financial risk mitigation, or environmental sustainability;
-minimize the complexity that customers face in dealing with the electricity system.

A key element to consider that creates opportunities for improvements is the wholesale market. Well-structured and organized wholesale markets can allow distributed resources to compete, creating a new and more efficient market.

3. ***Encourage innovative technologies and services models to speed up adoption and integration of distributed and renewable resources.***

Microgrids can facilitate the achievement of a renewable electricity future by integrating distributed renewable resources locally and providing greater flexibility in managing resources to respond to varying grid conditions.

In addition, microgrids can protect customers from outages and support the security and resilience of the larger

system. Job number one for regulators is to determine a clear definition (or definitions, plural, if a one-size-fits-all approach proves insufficient) for a microgrid. Should a microgrid be categorized as a DER, an independent power producer, or something completely different? How big or small can a microgrid get before it ceases to be a microgrid? Only after such questions are answered can the regulator, utility, customer, and private investor make sense of how existing rules and regulations inhibit or encourage microgrids expansion. As another technology that stands to reduce demand serviced by the distribution utility, there is a potential disincentive for the utility to pursue or support investment in microgrids. However, microgrids present real opportunities to deliver system benefits to customers in the form of cost savings, improved reliability, and power quality. If evaluation and planning reveal these opportunities, the utility should be permitted to pursue and invest in them.

To improve service models, regulators and policymakers can help to reduce the costs of permitting, inspection, and interconnection to significantly reduce the total cost of ownership (TCO). For example, module costs, which have historically dominated the cost of PV systems, decrease continuously and "Soft costs", which include customer acquisition, installation labour, and permitting, inspection, and interconnection costs, can be dramatically lower as well if procedures are optimized.

3.6 The situation in Italy

When we talk about Italy we talk also about the European Union. The two directives issued by the European Commission in 2018 and 2019, contained in the Clean Energy Package[49], were crucial points for the development of the Italian legislation. As mentioned before, the reforms established the direction of the market and different objectives for every country that should be accomplished in terms of renewable resources by 2030. In addition, two legal entities were defined: energy renewable community and collective self-consumers.

The Italian legislation is following these directives, thus shaping the industry and the market. Thanks to a new law (Legge n.8 del 28 febbraio 2020) that converts the D.Lgs. "Milleproroghe", citizens and organizations can freely create energy communities and put in practice the collective self-consumption. Following the European Legislation, members can produce electricity from renewable sources using plants with a power up to 200Kw; in addition, only plants realized from the 29th of February are considered useful for these purposes. Two additional restrictions provide that:

- In the case of the Renewable Energy Communities, the consumer pick-up points (POD) should all be located on low-voltage networks connected to the same transformer booth. Essentially, only members connected to the same transformer booth can participate in a potential energy community.
- In the case of self-consumers acting collectively they must be in the same building or condo.

[49] *Clean energy for all Europeans package - Energy European Commission*. (2020, March 12). Energy - European Commission. https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

Members must use the existing distribution network and instantaneous self-consumption may also occur using storage systems built within the energy community perimeter or in the building for collective self-consumption. The advantages will be double: on the one hand prosumers can benefit from the tax deduction when they install renewable plants, on the other hand the article provides for the definition of an incentive tariff to reward instant self-consumption and the use of storage systems.

The procedure to create an Energy Community is the following. The first step is to locate the low voltage network where people are connected and find the physical space in which install the plant. At that point, the citizen can prepare the statute of what will be the community, in the form of an association or cooperative, which must remain open to new membership; then it will be possible to collect the membership from citizens who are within the area identified and find the subject who will install the plant with the tax deduction. This new legislation could finally fill the legal gap that effectively blocked the development of renewable sources in apartment buildings, productive districts, or agricultural territories and create small communities able to self-produce the energy, strictly from renewable sources.

Until now, the energy produced by a citizen using a photovoltaic system could be used exclusively by the owner of the plant itself or sold back to the utility company. Instead, the transposition of the European directive allows that the renewable energy produced by third-party systems can be used locally by each individual, to meet their needs. A great example is that of condos: according to the energy@home report presented by Elemens, in Italy there are 2.6 million condominiums potentially interested in the installation of photovoltaic systems with the aim to participate in energy communities.[50] Following the conclusion of the report, the cost-benefit analysis for the country results in a positive balance of 2 billion of euro, considering the expenses that will be incurred for the grid renovation and redistribution of system and dispatching costs. Indeed, it would be an investment shared by the whole community and for the benefit of all its members.

On September 15th the Minister of Economic Development, Stefano Patuanelli, signed the implementing decree that defines the agreed tariff to stimulate the collective self-consumption

[50] R. (2020c, June 5). *Lo stato delle comunità energetiche in Italia*. La Repubblica. https://www.repubblica.it/economia/rapporti/energitalia/lascossa/2020/06/05/news/lo_stato_delle_comunita_energetiche_in_italia-258493239/

and energy communities, thus boosting the energy and ecological transition of our country.[51] This tariff for self-consumed energy will be 100 €/Mwh for collective self-consumption configurations and 110 €/Mwh for energy communities. The incentive, recognized for a period of 20 years and managed by the Gestore dei Servizi Energetici[52] (GSE), can be combined with the Superbonus 110% (a tax allowance on new renewable plants) within the limits provided by the law. It aims to transform the current centralized electricity system in a decentralised and more efficient system, powered by renewable energy.

It is a "new era", as Legambiente writes, which has brought down the last barriers that still prevented the proper advancement of renewables in our country. In the recent report "Renewable communities"[53] the association has drawn up an updated picture of the state of the art of our country and has gathered several experiences already active, or about to start, of energy communities or project of collective self-consumption. Here, I will cite some of them.

Energy Community Pinerolese: In Piedmont, the Consorzio Pinerolo Energia (CPE), together with the Polytechnic of Turin and Acea, is laying the foundations for an Energy Community between several municipalities in the metropolitan city of Turin. Public and private users, companies and municipalities will be involved in a project that aims at 100% renewable (today it is 42%). The technologies involved will be a hydroelectric plant and a biogas plant, able to produce about 80% of the energy needed by the community.

Energia Agricola a Km 0: Thanks to the collaboration between Coldiretti Veneto and the company Forgreen, 514 companies and users that own renewable energy plants, have created what is considered the first agricultural Energy Community in Veneto. In this case, farmers in possession of a plant produce energy both for their own consumption and to sell it to third parties. All the energy is collected and managed by Forgreen, making it available to the community at advantageous conditions.

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[51] *Energia, incentivo per l'autoconsumo e le comunità energetiche da fonti rinnovabili*. (2020). Mise. https://www.mise.gov.it/index.php/it/198-notizie-stampa/2041436-energia-al-via-incentivo-per-l-autoconsumo-e-le-comunita-energetiche-da-fonti-rinnovabili

[52] *Gestore dei Servizi Elettrici*. (2020). GSE. https://www.gse.it/

[53] R. (2020d, June 18). *Comunità rinnovabili. I dati sull'innovazione energetica in Italia e 32 progetti di comunità rinnovabili nel report di*. Legambiente. https://www.legambiente.it/comunita-rinnovabili-i-dati-sullinnovazione-energetica-in-italia-e-32-progetti-di-comunita-rinnovabili-nel-report-di-legambiente/

Energy Community GECo: An acronym for Green Energy Community, this project will lead to the creation of the first Energy Community in Emilia Romagna. The core of the community will be a residential area of 7,500 inhabitants, a commercial area with an agri-food park, two shopping centres and an industrial area of over 1 million square meters. For the realization, a 200-kW photovoltaic system (maximum allowed), a storage system and a biogas plant for the treatment of organic waste will be installed.

Energy Community of Roseto Valforte: We are in Puglia with a project that will have the particularity of using renewable sources and more technological systems such as smart meters, microgrids and power-cloud. Each installed system will in fact be equipped with an intelligent counter that will manage the inputs and outputs. Thanks to microgrids it will be possible to integrate and manage different generation systems, mainly from renewable sources, creating a multi-generation system, which also includes storage elements. The various systems integrated with each other will bring the community to go from 35% of self-consumption from renewable sources to 100% thanks to the connection of the "smart" grid to a 3-megawatt wind farm.

CHAPTER 4

HOW NEW ACTORS ARE SHAPING THE VALUE CHAIN: Three Italian Cases

HOW NEW ACTORS ARE SHAPING THE VALUE CHAIN:
ANALYSIS OF THREE ITALIAN CASES

4.1 Introduction

As we saw in the previous chapters, the traditional value chain of the electric power market is composed by: companies specialized in the production of electricity from primary or renewable sources, the transmission of electricity from producers to the electrical substations where users are connected, the distribution of electricity through substations and transformers, and finally the selling process. The European Legislation is shaping this structure, and new actors with new technologies and business models are entering the market. New phenomena are emerging, pushed by new technologies, and the hierarchical and centralized market is slowly changing to a more decentralized structure.

In this chapter I will focus the attention on new actors that are enabling this transition and I will try to understand where they are positioning themselves in the new environment and potential value chain.

In particular, I will focus on a startup located in the Netherlands that offers a digital platform through which users can choose their supplier of green electricity. The aim is to understand where this company is positioning itself within the new value chain and try to understand the potential of this business. In this case, even if I did not have the opportunity to interview a company's representative, I decided to discuss it because I think the organization plays a crucial role and offers an important product useful for the functioning of the Energy Community.

Then, I will describe another company headquartered in my hometown, Correggio, that produces a patented storage system that is connected to the photovoltaic plant and allows people to manage their consumption, thus saving money. Moreover, the company offers the possibility to interconnect these storage systems with each other, creating a sort of community and bringing to costumers even more benefits and independency from the retail supplier. In this case, I had the pleasure to interview the CEO of the company, with the aim to understand the peculiarities of the product, the challenges they are facing in the development of their activities, the benefits they can bring to the society and to the environment, their position in the new value chain, and finally their expectations for the future.

The last part of the chapter is dedicated to two Italian energy communities: Green Energy Community (GECo) and Energia Agricola a Km 0. I chose these two projects both for personal and empirical reasons. The personal reason is that GECo is located in Emilia Romagna, the

region where I live, and Energia Agricola Km 0 is located in Veneto, the region where I studied. The empirical motivation is that the two projects have different characteristics because they are in two different phases and the community members are different. In fact, GECo involves local residents, businesses, and entities to increase the production and self-consumption of renewable energy. This is a pilot project started in 2019 that aims to understand the local challenges and benefits of the project in order to implement this system in a wider perspective. Instead, the main actors in the energy community Energia Agricola a Km 0 are farmers, both owners of energy plants (prosumers) and non-owners (consumer). Even in this case the goal of the community is to produce and self-consume energy, trying to be self-sufficient. For the energy community GECo I had the possibility to interview a referent directly involved in the development of the project, while for the energy community located in Veneto I could interview two different actors that are working to ensure the functioning of the community.

4.2 The role of new actors in shaping the value chain

Technology and innovative companies are shaping the traditional energy market in several ways. They develop new distribution systems to meet the more decentralized power generation due to microgrids. Additionally, the increase in data collection is bringing many new possibilities for technology companies to exploit their capabilities and satisfy customers' needs.

Two consequences are emerging from the entrance of those companies in the energy market: the structure of the value chain is changing, and traditional utilities need to create new business models to keep current customers and add new ones.

For the purpose of the thesis I will only discuss the first aspect and I will try to imagine the position of these new actors within the value chain. In particular, I will describe the case of two companies: the first one offers a digital platform that is used as a marketplace, and the second one produces a smart storage system for photovoltaic plants.

The expected structure of the energy industry is showed in Figure 12. As we can imagine, the production of energy should change in favour of renewable resources and production plants able to exploit the features of natural phenomena. The stereotype of the big utility that produces and sells the energy to individuals is changing. In fact, the possibility for households to have their own source of energy and be self-sufficient is increasing everyday thanks to new technologies and incentives given by the policymakers. At the same time, the market and the transmission of electricity should follow a decentralized structure with infrastructures better

suited for this. Finally, thanks to the improvement of new technologies, even the distribution and consumption methods are expected to change. Prosumers can store and exchange the energy produced by their plants, or they can ask for more energy if needed, thus creating a bidirectional flow of energy.

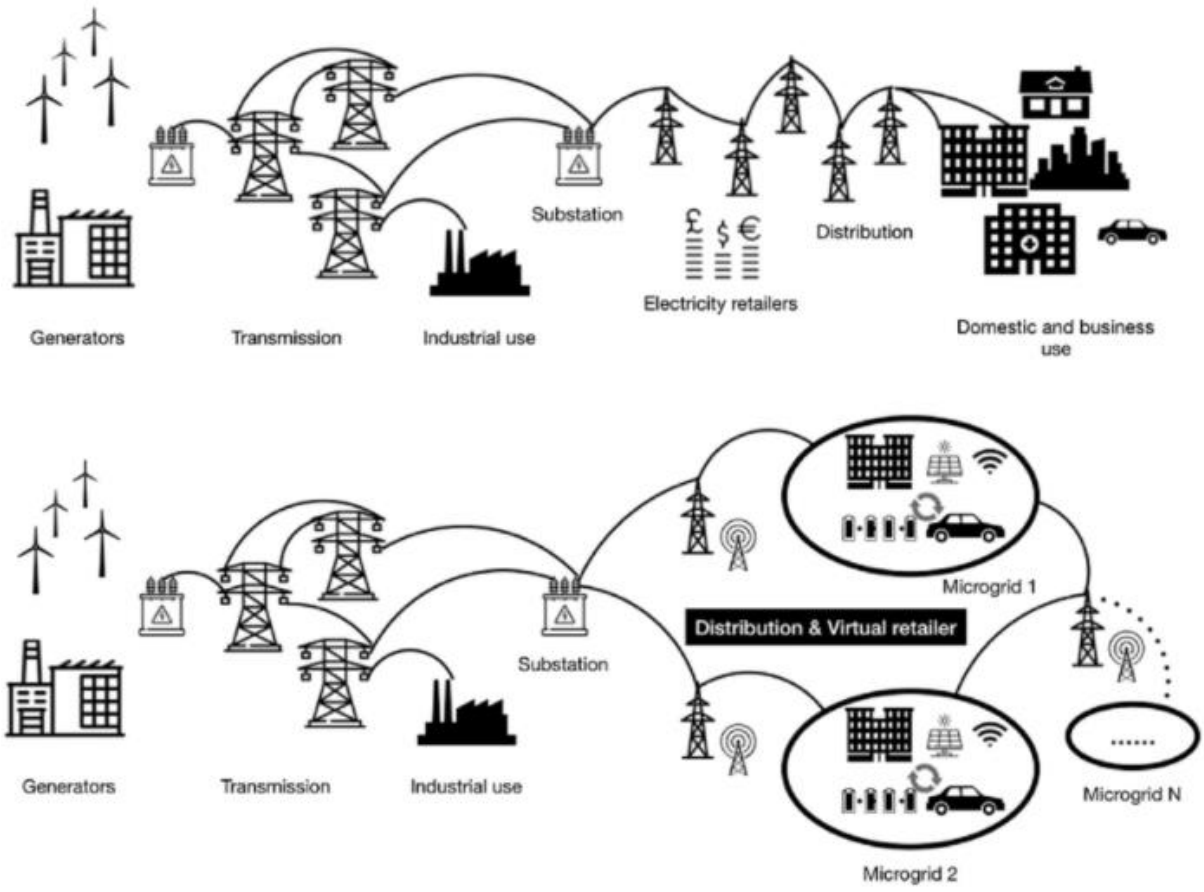

Figure 12 Expected structural changes in the energy system. Source: https://energytransition.org/2018/04/europe-must-choose-a-green-future/

The following paragraphs are dedicated to two new actors that entered the market and are shaping the value chain, creating new possibilities for users to manage their energy consumption: Vandebron and UNE. Then I will report the main considerations that came out from two interviews that I had with the energy community of Veneto and Emilia Romagna.

4.2.1 Vandebron

In this scenario, the fist organization I would like to present is called Vandebron[54] and it is headquartered in the Netherlands. Vandebron is also the name of the digital platform created by the company that brings together the supply and the demand for green energy and provides innovative functionalities that allow people to use energy in a smarter way. The company does not produce any energy by itself but thanks to agreements with local producers and thanks to the platform, Vandebron is able to sell sustainable energy generated by those independent producers. Via the digital platform, households can choose their energy source from more than 200 sustainable producers.

The company offers a solution to address the problem of uncertainty about the origin of the energy, supporting local producers of renewable energy and giving to the consumers the possibility to choose thanks to a completely transparent method.

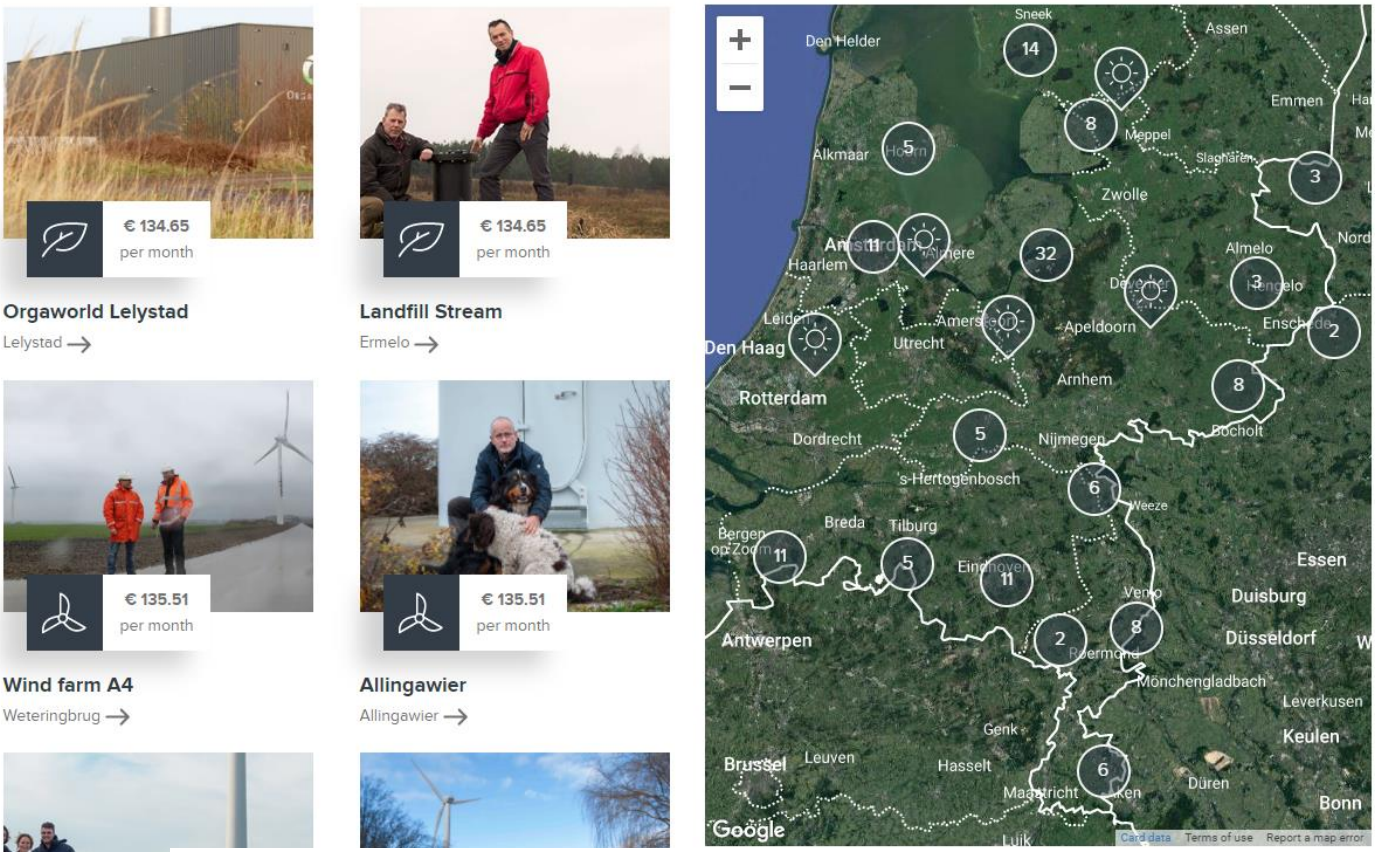

Figure 13 Vandebron's energy sources. Source: https://vandebron.nl/energiebronnen

[54] Rijn, J. U. A. A. D. (2020). *Vandebron - Duurzame energie van Nederlandse bodem*. Vandebron. https://vandebron.nl/

The position of the company in the new value chain is in direct contact with the consumers. Basically the service offered is a marketplace, and the role of the company is also related with the transmission of electricity. The technology patented by Vandebron allows the creation of tight reletionships between users and producers. The benefits of this activity are several: customers can get good energy at a good price, producers can sell the energy at a higher price compared with the feed-in tariff, and the environment is less effected by traditional and polluting production processes and consumption methods.

4.2.2 Une srl

The second company analized is UNE srl. As mentioned before, the company is located in Correggio (Reggio Emilia) and offers a smart storage system for photovoltaic plants that is able to manage the energy needs of the household. In this case I had the opportunity to interview Giuliano Scaltriti, CEO of UNE, with the aim to understand the main activities carried out by the company, the market and value chain position, the challenges and limitations encountered until now, and finally get insights about the expectations for the future. I think all those aspects are important because we can understand how a viable and profitable business can be created in a fast-moving industry that is replacing its traditional sources of energy and market structure. Here is what emerged from the interview.

The CEO defines UNE as a company that is in its startup phase. It operates in the B2B market and the product offered is called Zhero System. Basically, it is a smart storage system that through the patented software can manage the energetic flow autonomously and efficiently, thus reducing waste and costs. The product can be customized and adapted to costumers' needs, thus offering a smart solution for both big (business) or smaller (households) buildings.

The advantages of the company are built on its market strategy and on the components of the storage system. In fact, to avoid the competition of big companies in the sector, like Sony or Tesla, UNE decided to use a battery with a technology based on iodine instead of lithium or lead. Of course, there are pros and cons related to this choice, but this new technology makes the Zhero System completely green because every component of the hardware is 100% recyclable. In addition, it ensures a much safer and risk-free energy storage associated with the emission of gas, fire, or explosion and it is much more eco-friendly, thanks to the exploitation of a natural substance such as the salt.

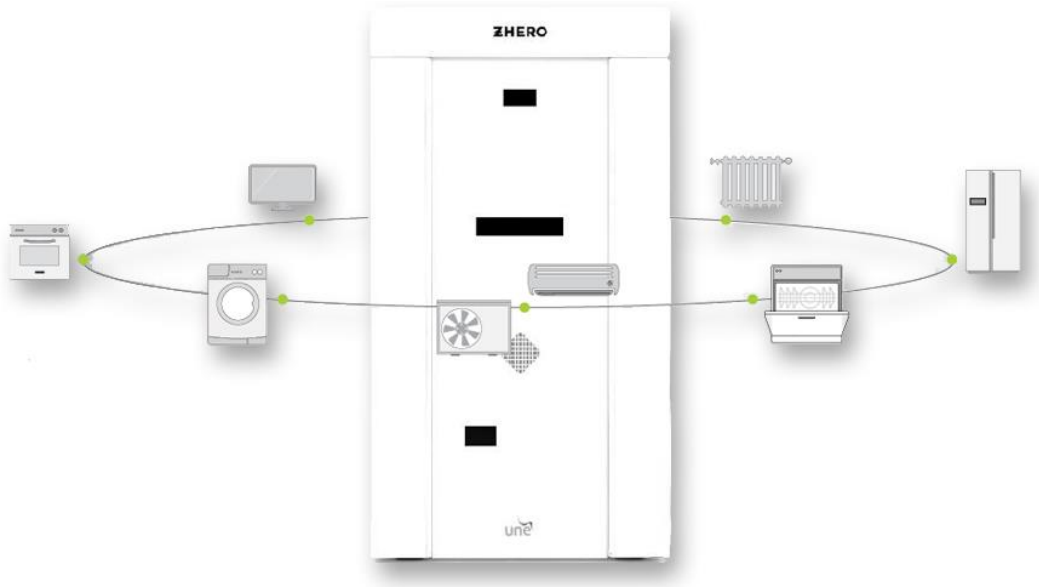

Figure 94 The Zhero System. Source: https://zherosystem.com/zhero-system/

During the day, when the energy is captured by photovoltaic panels, Zhero injects this energy directly into the house and, at the same time, stores part of the flow in the innovative battery. The intelligent management of energy is operated by the internal software that follows the most efficient criteria compared to each specific need. During the night, the stored energy is used if needed. Costumers can also use the app created by the company to program the storage system, supervise the energy consumption, and analyze anomalies from a mobile phone or PC.

One of the functionalities of Zhero is that it can operate disconnected from the main grid (off-grid) and connect to it only if necessary, to get energy in case of low battery or inject the surplus of energy produced. In addition, thanks to its back-up system, part of the energy flow is stored in the battery and it can be used in case of a black-out, so when it is impossible to draw energy from the public grid. In this way, the necessary energy supply is always ensured. Finally, this characteristic made possible the installation of off-grid systems for the energy management of buildings that operate in particularly severe climatic conditions, like mountain lodges (as showed in figure 15): the plant is not connected to the grid, so the only energy available is collected by the photovoltaic panels and managed by the software to satisfy every need.

Figure 15 Bivacco Gervasutti, Monte Bianco. Source: https://zherosystem.com/offgrid/

The most interesting aspect of the product, at least for the focus of the thesis, is the possibility to connect different Zhero Systems with each other online. This solution allows the creation of smart grids, and thus the creation of energy communities. The new energy distribution model based on the sharing of the energy surplus produced by several connected plants is possible thanks to this storage system. With Zhero the energy flow would be governed by an intelligent system capable of managing every single building, ensuring energy supply to all of them in the most efficient way. In addition, the community would be able to stabilize the main grid managing the stored energy, lowering even more the general costs for the community.

In this phase, the company is trying to enlarge its market and get new costumers. At the moment, UNE is not collaborating with any energy community project, but the potential of the product is clear and important deals were closed during these years, even outside the Italian boundaries. Since it operates in the B2B market, typical costumers are distributors and business operating in the electric market. An additional service offered by the company to its costumers is a training program to teach them how to fully exploit the machine potential and how to satisfy in the best way the final users' needs.

The CEO is confident about the future because the society is more and more interested in environmental problems and individuals are changing their mentality.

Regarding the development of the company business, the European Directive 2018/844/UE is very important because it requires the energy performance improvement of new and existing buildings. In addition, the EcoBonus 110% is a great incentive for families to renew their houses for energy efficiency, and the storage system is included in this bonus.

4.3 Energy communities

The interview designed for the two Italian communities was not focused on the business model and the market because their goals are completely different compared to a traditional company. Thus, I decided to pay more attention on the structure and functioning of the community, trying to understand the challenges they are facing regarding the legislation and technology. In this case, I also tried to capture the benefits with a focus on the environment and society at large. I think it is important to understand the role of citizens and regulators in boosting the process to shift toward a greener and more sustainable system. Finally, I tried to collect their expectations about the future of the sector in Italy.

4.3.1 Energia Agricola a Km 0

The Energy Community created in the Veneto region is born thanks to the collaboration of Coldiretti Veneto and the company ForGreen, an organization headquartered in Verona that operates in the renewable energy sector.

For this case I had the pleasure to interview two referents. The first one that took part in the survey is Paolo Minella, Environment and Innovative Supply Chains Responsible for Coldiretti Padova. The second one is Riccardo Tessari, Market Responsible at ForGreen. Both of them, explained me in a very clear manner the basics fundamentals of the energy community, answering to all my doubts. Here is what emerged from the interviews.

It is important to mention that several energy communities were set up before the “Legge n.8 del 28 Febbraio” was issued. Because of this, in all those energy communities did not take place a direct exchange of energy, because it was not allowed before the legislation, but an economic exchange. As Riccardo Tessari explained, ForGreen is a company that develops energy cooperatives. The members of a cooperative invest money to buy big green-energy plants (even far from home) and in exchange they receive part of the economic value generated by the plant

through the sale of the energy produced. In this way, members can pay part of their bills with this incentive and, at the same time, they are formally owners of the plant.

The community is the first energy agri-food community in Italy. Everything started with the incentives that were put in place by the European Union. The Directive 2001/77/EC issued by the European Parliament, aimed at the promotion of electricity produced from renewable energy sources, was recognized by the Italian government in 2005 with the name of Conto Energia. The incentive consists of a financial contribution per kWh of energy produced for a certain period of time, up to 20 years, depending on the size or type of plant. From 2005 to 2013 were issued five different programs of incentives within the Conto Energia legislation, each of them with the aim to update and adapt the former. Thanks to those incentives, lot of new photovoltaic plants were installed in that period.

One of the main problems related with the plants' construction highlighted by Paolo Minella during the interview is that the most of new plants, especially the bigger ones, were built on the ground, in fields that now are no more cultivable. A wiser and smarter allocation of the plats could have saved thousands of cultivable hectares. Rooftops were largely used of course, but other solutions could have been implemented like roundabouts, motorway junctions and other non-cultivable areas.

A second problem arose in 2013. When all the incentives were given to farmers, industries, and citizens, the government stopped the project because of lack of funds. Consequently, most of the actors responsible for the plants' maintenance, technical and bureaucratic aspects (like energy management and fiscality) were no longer available to provide their services. At that point, many farmers started to ask those kinds of services directly to Coldiretti. The company ForGreen was interested in the project and they were able to build an alliance in order to help all the farmers. The deal was closed at the end of 2018 and they started to operate in 2019.

The scheme of the energy community Energia Agricola a Km 0 is the following. Coldiretti is an association of more than 50 thousand farmers, of which two thousand own a photovoltaic plant. ForGreen manages the energy produced, selling the surplus energy to other farmers. At the beginning only farms with photovoltaic plats were involved (prosumers) and later were included even farms without the photovoltaic plants (consumers). The project was a success and now even private citizens, and families are interested to join the community. Today, more than one thousand companies are involved in the project, both prosumers and consumers. In addition, Forgreen, technical and energy partner of the project, certifies the energy with the Guarantees of Origin and with the international brand for energy sustainability Ekoenergy. It is

important to mention that due to the reduced environmental impact, the farmers are happy to join the community even if they do not profit from selling energy.

This aspect improves the brand image and is especially important for farms that directly sells their products through local shops or websites. Moreover, through the competences provided by ForGreen, the community can offer all the technical and bureaucratic support the farmers need, in addition to favorable market conditions.

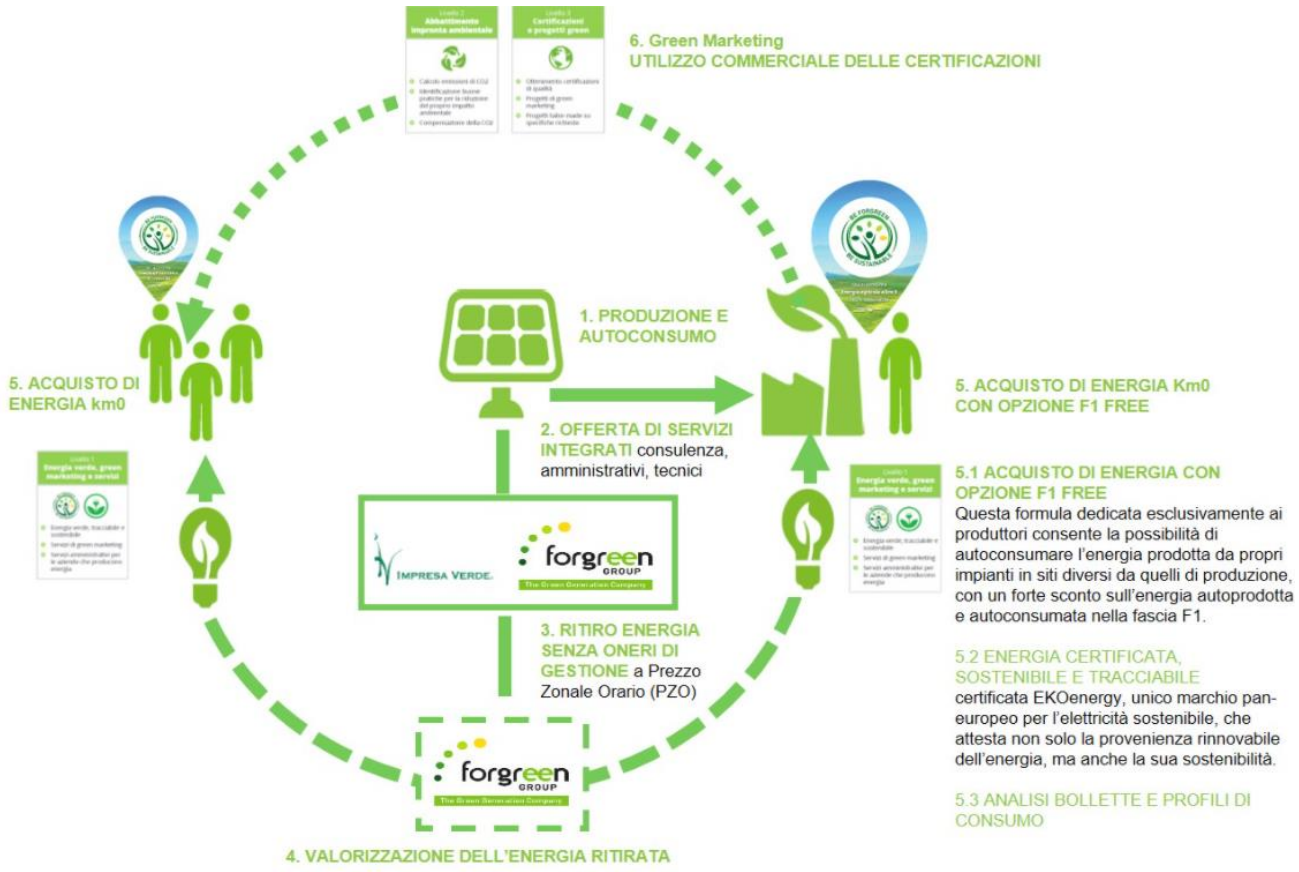

Figure 13 Structure and functioning of the energy community. Source: http://www.fattoriedelsole.org/servizi/Pagine/Comunit%C3%A0Energetica%20Progetto%20Energia%20Agricola%20a%20km0.aspx

A critical aspect faced by ForGreen was the creation of the community. The stereotype many people have about energy retailers is not good because it is hard to understand the bills and it is often hard to have a direct contact with the company. For these reasons, ForGreen organized several meetings, along with Coldiretti, to explain the project and the benefit of the community to the farmers, trying to win their trust.

The community is expected to grow in the next years and expectations are very high. In fact, Coldiretti is creating other energy communities in Puglia, Emilia Romagna, and Lombardia, in order to expand this phenomenon in the whole country. The utilized resources to produce energy change in respect with the environment. In Veneto, photovoltaic plants are highly exploited but also biogas and bio-methane plants are very common among farmers because the main resource is the farm waist.

The project was developed with the primary goal of transforming a daily need into a responsible choice. The Italian regulator, following the European legislation, decided to start the energy transition and a big amount of incentives was destined to the development of photovoltaic plants. However, a clear and smart plan for the construction and exploitation of those plants was not developed. The collaboration between Coldiretti Veneto and ForGreen was born from the desire to create a community based on a green energy culture and the need to provide a complete service to Coldiretti's members and help them in the experience of producing their own renewable energy. For farmers, the nature is the main source of revenues and the possibility to run their businesses having a low impact on the environment is crucial. At the same time, the energy community can provide efficiencies in the consume of electricity and the government is expected to issue more incentives following the European legislation and goals (Green Deal). All these aspects are fueling the project and are making it more attractive also for families. This is a virtuous circle that can only boost the spread of energy communities across the country.

4.3.2 Energy Community GECo

The Energy Community GECo is a project that in 2019 and will be ready to operate the next year. The initiative is coordinated by three main actors: AESS, ENEA, and the University of Bologna. I had the opportunity to interview Claudia Carani, EU Projects Responsible at Agenzia per L'energie e lo Sviluppo Sostenibile (AESS). AESS is a non-profit association of more than one hundred entities of the public administration, most of them located in Emilia Romagna, that offers help regarding tenders, territory upgrade, training, and other activities. In addition, the organization works on European projects with the aim to develop new and innovative activities and to replicate them in different contexts (municipalities). This is how the GECo project was born.

GECo, financed by the European fund EIT Climate-kic, was presented in March 2019 by AESS, ENEA (a research centre focused on energy and sustainable development), and the University of Bologna. One of the most important goals of the community is to help low-income people in

reducing their bills. In fact, the project will cover the area of a neighbourhood called Pilastro-Roveri, in which social housing were built for families.

The choice is also based on the interest that CAAB (Centro Agroalimentare di Bologna) showed about the project, since the organization has a big photovoltaic plant on the rooftop but a low consumption of electricity. At least other six new plants, with their storage systems, will be built in order to transform the citizens and organizations into prosumers. In particular, projects for photovoltaic plants on the condos and shopping centres' rooftops are ready, as well as a new project for a biogas plant that will be used for CAAB's waste.

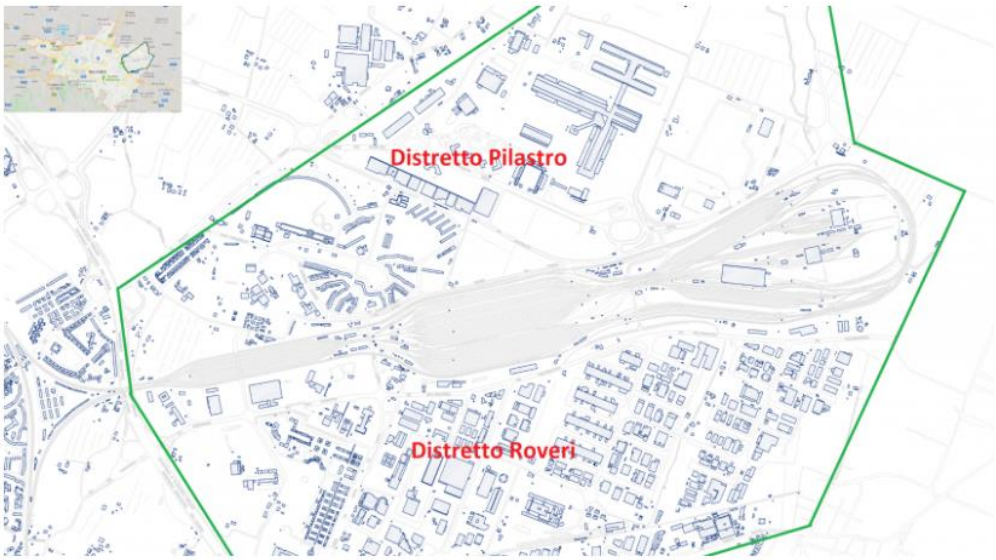

Figure 14 Neighbourhood Pilastro-Roveri. Source: http://www.comunirinnovabili.it/geco-green-energy-community/

The project of a big energy community was not considered from the beginning because of legislative and structural problems. The Italian legislation, as mentioned in Chapter 3, allows the creation of energy communities with two main limitations: all the participants must be connected to the same transformer booth and the plants can be up to 200Kw. In the Pilastro-Roveri neighbourhood there are more than two hundred cabinets, so they are forced to develop many small energy communities. Another problem is to find a way to maximize the collective consumption. To do that is necessary to have actors with different consumption profiles, thus considering only the participants within the same transformer booth is a big limitation. That is why storage systems can be useful to compensate similar consumption profiles, but at the same time costs are higher for the community. However, thanks to the "Ecobonus 110%", that allows a tax credit for the construction of plants in residential houses, including the storage system, the

financial plan of the project can significantly improve. In this moment AESS is working in order to collect data about the actors connected to the same cabinet and understand who can join the energy community.

When the energy community is developed within the same building, traditionally condos, we talk about collective self-consumption. This type of organization is more flexible and can be created without a statute; even in this case the Ecobonus 110% is a great advantage. For these reasons AESS is trying to understand if it is possible to further develop this type of project. The residential area is very big, and for those condos that are neither close to a company nor a shopping centre, it could be the perfect solution.

AESS is also working on the definition of the best legal entity for these energy communities, based on the business model and characteristics. A good choice is to look at entities of the third sector, like associations, because they can be established through a private contract, the balance sheet is quite simple, and fixed costs are low. The project aims to make the life of the citizens easier and give them economic advantages. A flexible and easy structure for the community is the best way to make them more proactive and increase their willingness to participate.

One of the most interesting aspects in the development of the community is to understand how to distribute economic benefits among the participants, and this is decided by the statute. With economic benefits we mean the incentives given by the GSE for every Kw that is produced and self-consumed by the community. AESS is studying different models to do that based on the self-consumption of every participants, the amount of the initial investment, or based on social needs (for example low-income families can have more incentives or the participants can choose to give all the profits to a school).

At the same time ENEA and the University of Bologna are working on the technologies that better satisfy the participants' needs, including the plants, smart meters, and digital platforms. The aim is to provide affordable solutions for citizens and engage them with a sense of community. The digital platform will be used for the analysis of energy flows and it will allow the members to monitor their consumption and energy contribution in the community. The ultimate goal of the community is to ensure low-cost energy supply for weak social groups.

In general, the energy community will improve the local energy consumption with a positive impact on different aspects. First of all, a smart self-consumption of renewable energy will lower the costs of the bills, as well as CO_2 emissions. Secondly, it will be possible to create virtuous paths linked to the circular economy in which, for example, production waste can be used to manage energy production locally, obtaining, for example, fuel at km 0.

Finally, a possible advantage could be the possibility to create economies of scale, both for industries and citizens: the installation of photovoltaic panels would be carried out on a larger scale, with larger numbers and benefits for the actors involved.

AESS is very positive regarding the expectations for the future: the European Commission is changing the structure of the market from a centralized to a decentralized one, and every country is starting the transition toward this model. A fundamental aspect is to understand how to build an efficient community and replicate it in different contexts. For example, in France it is possible to join the energy community if the building is one kilometre away from the transformer booth, thus reducing the problem to find different profiles within the same cabin. Also in Italy, starting from the next year, the government is expected to issue a new legislation that will extend the energy communities to large areas, so no longer linked to individual cabins as provided for by the "Milleproroghe" decree, thus increasing the possibility to develop an efficient project. In any case, Claudia Carani thinks that energy communities will be a good solution also to build a sense of community that maybe was lost during these last years.

4.4 Interviews' results

In this last paragraph I will sum up the most important information that came up from the interviews. At the same time, I will try to compare the two energy communities with the aim to understand if there are best practices that can be replicated in the other community or in future projects.

The first difference that emerged is that the two energy communities are in different phases of their lives: Energia Agricola a Km 0 started to work in 2019, while GECo will probably start next year. This difference is given by the different aims and needs of the communities. In fact, the energy community in Veneto was born because many farmers asked for technical and bureaucratic help to Coldiretti, after lot of invectives were given to them for the construction of new energy plants. The energy community in Emilia Romagna is being born because at the beginning of the year new incentives and regulations were issued by the government, and the municipality of Bologna is trying to exploit them to help families and businesses located in the Pilastro-Roveri neighbourhood.

So, Energia Agricola a Km 0 is now considered a consolidated project and many new prosumers and consumers are interested to join the community.

They can take advantage of all the services offered by the community, like costs reduction and technical support given by ForGreen, acting for the good of the environment. Instead, the GECo project is under planification and all the developers are trying to figure out the best solutions to make it affordable for families and efficient. The aim of the project is to set up an energy community and try to replicate it in different contexts.

Another big difference between the two communities is the legislation involved, and thus the rules to create and organize them. The structure of the energy community in Veneto is more similar to a cooperative because it was set up before the transposition of the European legislation. Farmers with a photovoltaic plant consume their own energy, and the surplus is managed by ForGeen that sells the energy to other members. All the members without a photovoltaic plant have two options: they can build their own plant or they can invest some money to buy a quote of an energy plant (that can be located far from home). If they choose the second option, they automatically become co-owner of a plant and they can receive part of the economic value generated by the plant. Instead, the community GECo is regulated by the new legislation (Legge n.8 del 28 Febbraio) so it is affected by two limitations: all the participants must be connected to the same transformer booth and the plants can have a power up to 200Kw. Those limits are creating several problems to the developers of the project because information about pick up points connected to the same transformers booth are difficult to find and usually buildings connected to the same transformer booth have similar consumption profiles. However, AESS and ENEA are working on these issues and they hope the government will soon modify this legislation (like in France).

One last difference is that in the Energia Agricola a Km 0 all the energy is managed by ForGreen. A well-established company that operates in the sector since several years is responsible for the energy management and bureaucratic aspects. In the GECo project the actors responsible for those aspects are AESS and ENEA. We know that GECo is still a project so everything can change, but the decision to find a local company that is responsible for the functioning of the community can be a good idea since in Veneto is working very well.

A crucial aspect for the two communities is the engagement of the members. ForGreen and Coldiretti Veneto worked together to explain the project and the potential benefits to the farmers. At the beginning it was not easy but then thanks to the reputation of the actors they could win their trust and convinced many farmers to join the community.

An important benefit for the members, along with economic incentives and technical services, is the possibility to exploit marketing services: thanks to the Guarantees of Origin and the Ekoenergy certificate, farmers can advertise their production processes and products.

Concerning the GECo project, AESS is engaging many businesses and families that are interested in the community. In this case, we can say that marketing services are not relevant for families, but they care more about the affordability of the project and cost reduction.

By the way, for both communities the results are very good. In Veneto, more and more farmers and individuals are interested to join the community. Advantages related with costs reduction and the possibility to exploit the services offered by the community, along with environmental benefits, are calling more people. In Emilia Romagna, several municipalities are interested in seeing the functioning and results of the GECo project, in order to replicate it in their territory.

CONCLUSION

CONCLUSION

In this final chapter I will connect all the information gathered from the research process and the interviews with the initial theme of the thesis: the sharing economy. I started from this concept with the aim to understand if it is applicable to the electric power market. As soon as I started the research, I noticed that a new phenomenon is emerging in the market, pushed by both policymakers and individuals. In fact, the energy communities are the possible answer to the energy transition that many countries are trying to reach, but not only this. In fact, those communities are also the starting point for other two transitions that I will explain in the following paragraph.

The Triple Transition

The interesting aspect of the energy communities is that they are putting together three different trends for the evolution of the sector and the economy in general.

The first trend is the energy transition. It is a pathway that aims to transform the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO_2 emissions to limit climate change. Decarbonization of the energy sector requires urgent action on a global scale, and while a global energy transition is underway, further actions are needed to reduce carbon emissions and mitigate the effects of climate change. Renewable energy and energy efficiency measures can potentially achieve 90% of the required carbon reductions. The energy transition will be enabled by information technology, smart technology, policy actions and market instruments.

Nowadays, almost all the countries in the world are looking for energy sources that are sustainable and policymakers are always more concerned about environmental issues. At the same time, individuals are recognizing that a transition is needed for the good of the society. The energy communities are a good answer to that. Their functioning is based on renewable energy plants and the organization is simple, that is why they can be a useful tool for the society. Traditional fossil energy plants are not suitable for this purpose because they are capital intensive, so individuals need to invest huge amount of money to participate, and they require high competences for the management of the operations. In addition, they are not sustainable as renewable energy plants.

The second trend is the combination of sustainable consumption and conscious investment. We are currently consuming more resources than ever, exceeding the planet's generation capacity. In the meantime, waste and pollution are growing. Sustainable consumption refers to the use of services and related products, which respond to basic needs and bring a better quality of life, while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants. Conscious investment refers to the possibility for individuals to collect information and evaluate all the available options in order to choose the best product and service for their needs. Thanks to the energy communities this is possible. Many incentives are issued by the governments all around the globe and several organizations are focusing on the energy market with the aim of raising awareness and inform people. All the members of an energy community have the possibility to produce and self-consume their own energy, they can save money thanks to an efficient management of the energy within the community, and finally they can act for the good of the environment. At the same time, members can build real relationships with the subjects involved, in particular with the company responsible for the energy management. The traditional hierarchic market is no longer suitable because now people have the possibility to become active actors of the process, collect more information, and trust the counterparties.

The third trend is related with the willingness of established and new companies to be closer to their customers. The energy community is the typical case that puts together individuals and businesses because to set it up a wide-spread engagement is required, and specific competences are necessary. The energy communities are a great business opportunity for companies both from a practical and a relational perspective. The company that is involved can build solid relationships with the members and long-term deals can be established. Because of those relationships, individuals and companies that join the community can take informed decisions.

We can define these trends as macro-trends because they are something that goes beyond the individual and the family: they represent an opportunity to contribute for a better future.

This evolution of the industry is related with the phenomenon of the sharing economy.

The social aspect is very important, in fact traditional values are increasingly questioned in favor of new values. Economic advantages are important in the short-term and what really matters is the relational and social aspect. Thanks to energy communities, people can build a new sense of community and contribute for the preservation of the environment.

Members can benefit from economic incentives but, as the interview with Coldiretti highlighted, they are happy to join the community even if sometimes they earn nothing. The idea to do something for the good of our society and our planet is the main driver for the evolution of the energy market.

The possibility to fully exploit underutilized resources and share products or services is a basic fundamental in the energy community. People can have economic benefits by selling the energy produced by their plants and the tight relationships with other members and actors involved in the community make the process easier and trustworthy.

Many activities related with the sharing economy started from the bottom and from the rethinking of traditional activities to respond to people's needs. In the case of energy communities, everything started from the energy transition and the willingness of people and policymakers to respond to environmental problems. Several new companies are entering the market to exploit new business opportunities and new activities are emerging globally. By putting communities and citizens at the heart of a shift to clean energy we can achieve a transition more quickly, safely, and with added benefits for the society as a whole.

As always, technology is playing a crucial role in the development of the industry. The cost, performance and deployment of many clean energy technologies have dramatically improved in recent years, accelerating the transition towards cleaner energy systems around the world. The electricity grid is undergoing a metamorphosis that everyone has experienced in different aspects of the everyday life: digitalization. We are moving from a centralized physical network, with one-to-many transmissions (the utility company that supplies energy to households), to a decentralized digital network, with one-to-one and many-to-many connections. This smart grid allows individuals to become active actors within the community, namely prosumers. The transformation of the grid is followed by innovations, like storage systems and digital platforms, that reduce the costs and enable the peer-to-peer exchange of energy. This trend has been enabled by advances in data, analytics, and connectivity. These include increasing volumes of data, due to the declining cost of sensors and data storage; rapid progress in advanced analytics such as machine learning; greater connectivity of people and devices; faster and cheaper data transmission. Those enabling technologies will be at the center of the revolution because thanks to them all the members can collect information and take decisions.

The development of such communities is only at the initial phase, but the results are very good. The energy community in Veneto is demonstrating that the expansion and sustainability of such projects is possible.

Many local entities, businesses, and individuals are interested in taking part in this revolution. In addition, the government will continue to work on the rules for the creation of energy communities and will continue to issue incentives to make this model the new standard for the industry of the future.

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