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AGRO-ENERGIES AND SUSTAINABLE DEVELOPMENT: AN ECONOMIC AND LEGAL ANALYSIS

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INTRODUCTION

Today, “sustainable development" and "renewable energy" are keywords in the international debate, which has the aim to support a wide improvement of living conditions and to ensure equal access to the available resources.

In the recent years, the sustainability issue has gradually become more important thanks to the support of a new economic and social environment that has encouraged its growth. In particular, at the beginning of the twenty-first century, the European Union called attention to the climate change and to the importance of reducing greenhouse gas emissions. On several occasions, it has been emphasized that a global commitment is necessary due to the fact that this is an issue that affects the entire planet.

For this reason, it is important to cite the Climate Change Conference that was held in Paris on December 2015, which included the involvement of the leading spokespeople of all the major industrialized countries. In the final agreement text of the conference, a series of actions were decided upon, all with the aim to reduce greenhouse gas emissions. One of the most important goals set forth by this conference was to keep the temperature increase "well below two degrees" as compared to the pre-industrial era. In addition, the industrialized countries committed to an aid package of $ 100 billion (by 2021) to help developing countries introduce eco-friendly tools into their economies. Finally, the agreement also scheduled regular meetings in order to increase the participating countries’ commitment to reduce CO_2 emissions.

Climate change, the environment, and sustainable development are issues that characterize the 21st century. These topics not only draw the attention of international experts, but they involve all sectors of our economies.

The present-day importance and urgency of these issues has attracted my interest and prompted me to reflect upon them. Based on this, tracing the origins of the concept and its evolution, the question I started with was how to

implement sustainable development practices. In order to answer this question, the actors that account for it were examined, focusing then on how they pursue this target. Also, what are the most effective tools from a legal point of view?

The issue calls into question - albeit with some differences - a large number of sectors (legal, economic, business, social, but also the ones of ethics, philosophy and psychology). Thus, the debate views the participation of people with different backgrounds and involves issues such as globalization, internationalization of markets, human rights, as well as workers and consumers' protection.

Therefore, this issue has facilitated an interdisciplinary approach. It should be noted that the one I used was of an economic and legal nature. The reasons for this choice lies in my economic background (acquired through my Master's degree) and juridical specialization (acquired through my doctoral education.)

It is also necessary to state that my research is the result of a PhD program at Roma Tre University in Rome and at Columbia University in New York. During my time in the United States, I was able to attend courses on specific subjects I was interested in. In particular, I took part in lectures given by Professor Heal entitled "New developments in the Energy Markets" and "Business in Society: doing well by doing good" during the first semester of the 2014/2015 academic year. I also participated in a course taught by Professors Pham and Shmitt entitled "Consumers Behavior" and another by Professor Wilson entitled "Investor influence on Corporate Sustainability".

In this regard, I believe it is interesting to dedicate a few lines about the differences I noted between the Italian and the American system. One of the things that impressed me most was the different way each educational system chose to conduct their courses. In the United States, the debate between professors and students is one of the most important aspects of a class, as well as the debate among students themselves. To this end, the lesson material is provided in advance through an online platform which reproduces a virtual classroom. The lessons are also interspersed with presentations put together by

groups of students. They prepare a speech on a specific topic that they then present in front of the class. In order to do this, they have to plan group meetings, library events, and debates, thereby solidifying a continuous interchange between students.

By the end of my time at Columbia, I came to the conclusion that although the American educational systems has some obvious merits, it also presents certain shortcomings. The theoretical training that characterizes the Italian University system - something that is clearly lacking from the American one - has strong merits. However, there is no doubt that the American system is able to prepare students for the working world, where meetings, think tanks, and teamwork are now used as words on the agenda.

In an ideal world, we would be able to have the best of both worlds, preserving our theoretical education but also integrating it with other more practical aspects. However, it is important to stress that in the Italian scenario there are already Universities in which the theoretical and practical approach have been combined.

In any case, the courses I followed at Columbia have strengthened my interest in innovative subjects such as the ones related to the agro-energy sector. In fact, the energy sector embraces numerous economic and productive sectors, including agriculture and forestry.

Therefore, my research has focused on the relationship between agro-energy and sustainability. In order to analyze this further, we must first reflect on the meaning of sustainable development and agro-energy. Then, we must identify the responsibilities of the different actors of the system.

Therefore, the work started with the analysis of the concept of sustainable development - how it was born, its evolution, and the response of the European regulation. Today, it is recognized that the sustainable development (SD) is directly linked to the concept of Corporate Social Responsibility (CSR). In fact, in its semantic evolution, CSR has become a synonym of SD, as recently stated by the European Commission.

From a legal point of view, the analysis – which started from CSR concept - was more complicated. This is due to several reasons. First, the argument is particularly elusive because of the lack of a well-defined legal framework and secondly because of the non-unique positions of the experts of the sector. In fact, Corporate Social Responsibility is a complex phenomenon - an expression of the changed relationship between the state, enterprises, and citizens. It is the subject of (self) private regulation, public-private (co) regulation, and public regulation. Its complexity lies especially in the fact that the changed relationship has resulted in the introduction of new policies and directives - all with converging objectives intended to create a long-term, efficient, competitive, and sustainable market.

The interweaving of the market rules and liability rules has made it necessary to deepen the relationship between CSR and Soft law. That relationship is examined in the second chapter in order to determine whether the social and the legal responsibility may be considered as separate or complementary issues.

In the second section, and particularly in the third chapter, the focus shifts to the agro-energy sector. The analysis aims to describe the types, the issues linked to them, and the future prospects of a fast growing sector. In fact, agro-energy refers to any form of energy that originates, directly or indirectly, from agricultural activities. Unlike common forms of energy coming from fossil fuels, agro-energy derives from biomass, such as organic substances. Among the various forms of energy obtainable from biomass, the most common ones are heat, electricity, and biofuels, which represent an alternative to fossil fuels. The main difference with the latter lies in the fact that such forms of energy ensure a lower environmental impact thanks to the low production of carbon dioxide.

However, it should be stressed that the debate on the subject is still controversial. The advancement of research has debunked the myth of the total emissive neutrality of these forms of energy. Another aspect that has greatly

fueled the debate on agro-energies is the trade-off between energy and food production.

If the sustainability of the agro-food sector is already an important topic, it becomes even more urgent when we consider the expectation of population growth in developing countries. In fact, if we do not take the right measures, the resources could become insufficient to feed the world's population.

However, research has achieved important results in the identification of new forms of agro-energy that could be produced in sufficient quantities to meet the demand for energy without using resources intended for food use too. The reference is to biofuels of third and fourth generation which, although not yet on the market, promise to be able to comply with environmental sustainability criteria.

In the fourth chapter, the Life Cycle Assessment, the work continues entering into the merits of the biofuel production cycle and its analysis. A complete examination entails the assessment of environmental impacts at each stage of the process, starting with the extraction and taking into account the raw materials, the methods used, and the destination of the soil. However, the stages of production are equally important to the logistics and the transport. All of these factors must be taken into account when assessing the sustainability of the production process because they imply the involvement of all parties of the supply chain.

The third section of the study aims to be the "synthesis" of the first two, as it puts together the concepts analyzed in the previous parts. It attempts to answer the initial research question by explaining the relationship between agro-energies and sustainable development and who are the subjects responsible for them, by what means and in which ways.

In order to be concrete, the analysis focuses on the subjects that meet sustainable development at the national level. To this regard, it is possible to anticipate that there are many actors involved in the sector, starting from the institutions, the competent authorities, as well as the companies and the

consumers themselves. Each of them plays a specific role that is fundamental for the functioning of the system as a whole.

PART I

From Corporate Social Responsibility to Sustainable Development

CHAPTER I: CSR BETWEEN PROMOTION AND CRITICISM

1.1 Evolution of the definition

Historically the concept of "responsibility"[1] has been influenced by at least three different traditions, greek-roman, christian and modern traditions, and it was developed in order to define the answerabilities related to negligent conducts[2]. During the centuries it has gradually evolved and it reached a broader meaning as long as it was applied to different fields.

Thus, in the contemporary thought, the concept has become a cornerstone of the social action. Its application to businesses was not so easy to define. Generally, using one of the most recent definitions, Corporate Social Responsibility is thought to be "that behavior of businesses which seek to solve social problems in the wider society that would not ordinarily be addressed in the pursuit of process"[3]. CSR represents the progressive incorporation between legal, organizational aspects and values not directly connected, or at least not exclusively connected, with mere individual profit. In other words, CSR symbolizes the link between ethic, economics and law as it refers to the interaction between corporate behavior and civil society and it influences how the companies structure their own incentives on social and environmental issues[4].

[1] Conventionally, the term civil responsibility indicates the liability to be called upon to respond to an action at law for an injury caused by a delict or crime. It establishes the obligation for the subject to compensate the injured. Since the '60s, the concept of civil liability has evolved considerably, despite rules and content still refer to earlier models, in particular those of the Roman tradition. Today, we admit the responsibility also for the injuries of a legitimate interest which are not classifiable whithin the subjective right, leaving room for new changes and evolutions. For further details see G. Alpa, *La responsabilità civile: Principi*, Utet, 2010

[2] A. Addante, *Autonomia privata e responsabilità sociale dell'impresa*, Napoli, 2012, p.1

[3] O.F. Williams, *Corporate Social Responsibility, the role of businesses in sustainable development*, Routledge 2013 p.5

[4] G. Heal, *When Principles Pay: Corporate Social Responsibility and the Bottom Line,* Columbia Business School Publishing, 2008

Even if there have been many attempts to define CSR, there is no universally accepted definition. This observation is not new, in fact, in 1973, Votaw wrote: «CSR means something, but not always the same thing for everyone. For some it conveys the idea of legal responsibility, for others it means socially responsible behavior in an ethical sense, others equate it to a charitable contribution, some call it social awareness (....) Some see it as a sort of fiduciary duty imposing higher standards of behavior on the part of employers towards the citizens in general»[5].

However, it should be stressed that the definitions of CSR describe a phenomenon, but they fail to present any guidance on how to manage the challenges within this phenomenon. Therefore, the challenge for companies lies not in defining CSR but rather in understanding how to build it in a specific context and develop it within the business strategies[6].

In order to better understand the modern interpretation of CSR it is necessary to retrace the evolution of its definition during the last decades.

Although the first references regarding CSR appeared in the first half of 900 (formal writings about it date back to the years '30s and '40s and took hold especially in the United States[7]), it was in the '50s and '60s that a particular interest in the subject started to spread, becoming the object of theoretical studies for academics[8] as well as practical for companies.

In the '50s the first studies on CSR referred to the concept of Social Responsibility rather than Corporate Social Responsibility. Therefore, the concept was linked to the responsibility of businessman until the role of the

[5] D. Votaw, *Genius became rare,* in D. Votaw and S.P. Sethi*, The corporate dilemma: traditional values versus contemporary problems,* 1973, p.11

[6]D. Alexander, *How Corporate Social Responsibility is Defined: an Analysis of 37 Definitions,* in *Corporate Social Responsibility and Environmental Management*, Vol. 15, issue 1, 2008.

[7]References about that include: Chester Barnard, *The Functions of the Executive (*1938); J.M.Clarks, *Social Control of Business* (1939) and Theodore Kreps, *Measurement of the Social Performance of Business* (1940)

[8] To this regard: L.J.Christensen et al., *Ethics, CSR, and Sustainability Education in the Financial Times. Top 50 Global Business Schools: Baseline Data and Future research Directions*, Journal of Business Ethics, 2007

modern company was recognized. It is commonly accepted that the publication of the book "*Social Responsibilities of business*" of Howard Bowen (1953) marked the beginning of the modern period of the CSR literature. According to Archie B. Carroll, one of the leading scholars in the field, Bowen can be considered the father of CSR[9]. Bowen developed the idea that companies are vital centers of power, whose decisions have a significant impact on people's lives. In particular, because of the power of large businesses, there was a corresponding responsibility to care for society. He states that «it refers to the obligation of businessman to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society»[10]. Many studies on the subject in those years depart from Bowen's observations[11]. Without pursuing the intent to analyze each one of them, a few references are worth mentioning.

The '60s marked a fundamental decade for the success of CSR and for its meaning. K. Davis, one important pioneer in the field, developed what he called the "Iron Law of Responsibility". He argued that CSR must be seen in the long-term run, within such decisions can lead to an economic return connected to the corporate image. Companies who have power but not use it in a way that society considers responsible will lose that power. Moreover, a few years later, with a great foresight, Davis added to his thesis that the essence of CSR lies in the concern that the consequences deriving from one person's actions can damage the interests of others. His vision anticipated the idea that would be maintained in the following decades.

In the same years W.C. Frederick defined CSR as a commitment of the employers who manage an economic system that meets the expectations of society; while J.W. McGuire assumed that an enterprise has certain

[9]For a complete reconstruction of the CSR definition see A.B. Carroll, *Corporate Social Responsibility, Evolution of a definitional Construct*, in Business and Society, 1999 p.270
[10]H.R.Bowen, *Social responsibilities of the businessman*, New York, Harper&Row, 1953
[11]Regarding that subject see: B.M.Selekeman, *Moral Philosophy for management*, McGraw- Hill, 1959; M.Heald, *Management's Responsibility to Society: the grow of an idea,* Business History Review, Vol. 31, Issue 4, 1957; R.S.Eells, *Corporate giving in a free society*, Harper, 1956

responsibilities to society that go beyond mere legal and economic obligations. He pointed out that companies should be interested in politics, welfare, training and "happiness" of their employees.

Moreover, C. Walton, among others, advanced the idea that a corporation is really as much a "social and political entity as an economic unit".

Part of Walton's ideas were echoed in the document published by the Committee for Economic Development[12] (CED) in 1971. In "*Social responsibilities of business corporation*"[13] the CED pointed out that the "contract" between business and society was changing substantially: the companies in fact required to assume greater responsibilities and to take care of a series of human values, such as to contribute improving the quality of life of citizens instead of offering only goods and services. The CED articulated three concentric definitions of CSR: the inner circle included basic responsibilities for the efficient implementation of the economic functions (goods, jobs, economic growth). The middle circle included the pursuit of economic functions with a greater awareness of social priorities. The outer circle included new responsibilities, still under development, that companies would have to take to actively improve society.

Interestingly, in 1979, the CED published another document titled "Redefining Government's role in the market system" that came back to the traditional position of the efficient market per se. The different approaches showed in the two documents gave evidence that a consensus between businessman had not been reached yet.

If from the '50s to the '70s CSR literature was largely focused on defining the concept, from the '80s onward the definitions reduced, researches increased and new themes were developed.

[12] Since its creation in 1942, the CED has promoted economic growth and development. During the '70s the social problems of communities became particularly important and the Trustees commit to influence corporate governance. As a matter of fact, today the "sustainable capitalism" is on the top of the list of the core principles of the Organization. For a complete overview of their activities on this subject see: https://www.ced.org/projects/single/sustainable-capitalism-project/policy-position

[13] The pdf of the document of 1971 is available at: https://www.ced.org/reports/single/social-responsibilities-of-business-corporations

In 1991, Carroll proposed the famous "pyramid" of CSR stating that economic, legal, ethical and descretionary responsibilities should be represented as a pyramid in which the economic category is the base and it is followed by the legal, ethical and discretionary categories[14].

The interest in CSR was then renewed in time, and with it new business studies and alternative concepts were proposed, such as the stakeholder theory, business ethic theory and corporate citizenship[15]. Moreover, we will see that the concept has evolved up to the point of incorporating the concept of sustainable development.

A few words on each one is noteworthy.

a) Stakeholder theory

With regard to the stakeholder theory[16], the term seems to have been invented in the early '60s, with a deliberate pun on the word "stockholder" to indicate that, as well as those who held the capital, there were also parts that still have an "interest" (stake) in the decision-making process of the company.

The first definition of stakeholders is attributed to the Stanfort Research Institute. According to the Institute, Stakeholders are all those who have an

[14] For a complete analysis see A.B.Carrol, *The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders*, in Business Horizon, Vol.43, Issue 4, 1991

[15] Some scholars have compared these new concepts to the classic notion of CSR. For corporate sustainability see: M. Van Marrewijk, *Concepts and Definitions of CSR and Corporate Sustainability: Between Agency and Communion*, Journal of Business Ethics, Vol. 44, Issue 2, 2003; for corporate citizenship: D.J.Wood and J.M.Lodgson, *Business Citizenship: From Domestic to Global Level of Analysis*, Business Ethics Quarterly, Vol. 12, Issue 2, 2002

[16] Since the publication of Freeman's Landmark book, *Strategic Management: A Stakeholder approach,* in 1984, several books and articles have been published, in both the academic and professional world. An article I would refer - in order to have a picture of the stakeholder theory at the first stages - is the one of Thomas Donaldson and Lee E. Preston. In fact, in 1995, they retrace the development of the theory, analyzing the three aspects that they considered the theory is composed by: descriptive accuracy, instrumental power and normative validity. See: T-Donaldson, E.Preston, *The stakeholder theory of the corporation: concepts, evidence and implication*, Academy of management Review, 1995. Further important contributions have been: R.K.Mitchell, B.R. Agle, D.J. Wood, *Toward a theory of stakeholder identification and silence: defining the principle of who and what really counts*, Academy of management review, 1997; T.M. Jones, *Instrumental Stakeholder theory: A synthesis of ethics and economics*, Academy of Management review, 1995

interest in the activities of a company and without whose support the organization would cease to exist, also including groups not bound by an economic relationship with the firm.

In 1984, Edward Freeman[17] distinguishes between two definitions of stakeholders: in a narrow and in a broad sense. According to the former, Freeman used the definition proposed by the Stanfort Research Institute. By considering stakeholders those on whom the organization depends for its survival, he included shareholders, employees, customers, suppliers, and government agencies. As defined in a broader sense, the stakeholder is by definition a group or individual who can affect or be affected by the achievement of the objectives of the company in terms of products, policies and processes. In this case stakeholders can be considered: public interest groups, protest movements, local communities, government agencies, business associations, competitors, trade unions and the press.

Over the years the concept of stakeholders has been taken over several times and dealt with in different ways.

Max BE Clarkson[18] considers stakeholders as those who have or expect property, rights and interests in respect of an enterprise or its present and future activities. These rights or interests may be legal or moral, individual or collective. But the important distinction made by Clarkson lies in the consideration of two groups: primary and secondary stakeholders. For the first category he recalled the narrow definition of Freeman considering stakeholders: shareholders, investors, employees, customers, suppliers, on the one hand, and on the other, public stakeholders, namely governments and communities that provide infrastructure, markets, laws and regulations. The second category, however, includes those that affect or are affected by the enterprise but are not engaged in transactions with it or are not essential for its survival such as the media,

[17] E.Freeman, 1984, cited.

[18] M.B.E. Clarkson, *A Stakeholder Framework for Analyzing and Evaluating Corporate Social Performance*, The Academy of Management Review, Vol. 20, Num. 1, 1995

future generations and a number of special interest groups that still have the ability to influence public opinion in favor or against the firm's performance.

With this brief introduction it is evident that it is not always easy to trace a group of interest in one or the other category and, in addition, this classification could vary in time and depending on the aspects taken into consideration.

Stakeholder's theory has been used in a lot of different ways, implying different methodologies and evaluation criteria[19].

There is a natural fit between corporate social responsibility and stakeholders' organization. The concept of stakeholder personalizes social responsibilities by outlining the specific groups or individuals that the companies should consider to orient their CSR policies. Thus, the managers should reconcile their goals with claims and expectations made by the various stakeholder groups, ensuring that key stakeholders of the company reach their goals.

With the aim of defining the basis for the stakeholder management, in 1991, Carrol individuated five questions:

1. Who are our stakeholders?
2. Which are their interests?
3. Which are their opportunities and challenges?
4. What kind of responsibility (legal, ethical, discretionary…) do we have for them?
5. Which decisions/strategies do we have to follow in order to comply with these responsibilities?

[19] In detail, Donaldson and Preston in *The stakeholder theory of the Corporation: Concepts, Evidence and Implications* (1995) identified four different ways of application of the theory:

1. As descriptive theory: this model is used to describe all the interests related to the companies and their management.
2. As instrumental theory: it is used to find the connection between the stakeholder management and the achievement of the traditional objectives of the company.
3. As normative theory: it is used to identify the correct behavior the company should follow considering that every category of stakeholder has a value which has to be taken in consideration.
4. Management theory: it is used to suggest the stakeholder management.

According to the authors the first three aspects (descriptive, instrumental and normative) are one within the other. First, there is the descriptive level, second the instrumental one and finally the normative level.

Answering these questions would help to develop the right strategies to follow. Thus, this framework perfectly shows the link between stakeholder and CSR considering that the perspective "stakeholder-responsibility" is closer with the new way of conceiving a company characterized by a pluralistic environment.

b) Business ethic theory

The business ethic theory is also strictly linked with CSR. it is based on moral philosophy and its history goes back as far as business and ethics[20].

In the business field the theory rise in the United States in a particular historical moment, such as the '60s. This period saw, in fact, the development of the Civil Rights movement and the growth of ecological problems. Moreover, this period saw the rise of the consumerism movement. As a result, the public opinion was more sensitive to moral values and the theory spread to the academic world, where the first courses on social issues appeared[21].

During the '70s the development of the field of business ethics began and it consolidated one decade later. As De George wrote, «what differentiates the development of business ethics by this time, as opposed to abortive and isolated attempts at developing a field earlier, is the fact that business ethics became institutionalized»[22]. In fact many societies, colleges, journals and centers of various types provided courses and sponsored the field.

Today, generally speaking, the theory entails the study of morality and immorality, the study of business within the free enterprise model and the

[20] This subject would need a separate dissertation but it is worth noting, at least, that the theme has been analyzed since the ancient time. Thus, Aristotle in the *Nicomachean Ethics* (V, 5), wrote of justice being the exchange of equals for equals. In the *Politics* (I, 8–10) he discussed the art of acquisition, trade, and usury as part of the ethics of the household. Moving to a more recent era, John Locke (1690) developed a defense of private property as a natural right based on the labor one applies to securing it. Several economists approached the topic too. Adam Smith, in *A Theory of Moral Sentiments* wrote about the ethics of business. David Hume, John Stuart Mill, among many others, wrote on the morality or ethics of the enterprise in the economic system.

[21] Recently, Harvard University introduced a specific program on Corporate Social Responsibility, in order to help executives refocus corporate social responsibility and sustainability efforts in ways that benefit society and the business.

[22] R.T. De George, *The status of business ethics: past and future*, Journal of business ethics, April 1987, p.203

morality of individuals in economic and business interaction. It is based on the principle that management is a normative discipline and, as for the other social aspects, it is necessary to apply ethical norms to business. The field is obviously interdisciplinary and can be analyzed from the economic, sociological, psychological, and other social scientific perspectives. It requires the theory of organization, management and business activity but also the systematic development and application of moral norms and normative theory.

c) Corporate Citizenship

As for Corporate Citizenship, the term is often used as a synonym for CSR but its proper focus is on the rights and duties of a firm as part of society. In particular, the term is used to stress that companies have rights, duties and responsibilities in the society in the same way as citizens do. Following the law, caring for the environment, making the community a better place are considered citizenship responsibilities. Corporate citizenship has emerged in the management literature of US since the '80s, dealing with the social role of business. Since then it has begun to enter the language of the global business community[23].

According to Carroll[24], Corporate Citizenship is an extension of the role of business in society. In its early usage, and still very much in evidence today, Corporate Citizenship is identified as charitable donations and other forms of corporate philanthropy undertaken in the local community. Carroll considered "being a good corporate citizen" a specific element of CSR.

[23] The content of contemporary understanding of corporate citizenship is critically analyzed in an interesting article: D.Matten, A.Crane, *Corporate Citizenship, Toward an extended theoretical conceptualization*, Academy of management review, Vol. 30, Num. 1, 2005, in which the authors analyze the evolution of the term and the current usage of corporate citizenship in management literature. They conclude that a more robust conceptualization is needed. As a reference for the academic work dedicated to corporate citizenship see J.Andriof, M.McIntosh, *Perspectives on corporate citizenship,* J. Andriof & M. McIntosh Eds. 2001

[24] A.B. Carrol, *The four faces of corporate citizenship*, Business and Society review, 1998

Corporate Citizenship is therefore a discretionary activity beyond what is expected of business, a choice to "put something back" into the community. However, since Carrol's statement, the field has further developed in the years later. A landmark in the field is the Global Compact which, in 2001, referred to Corporate Citizenship as a radical model of business which incorporated concerns for human rights, labor standards and environmental protection as being at the heart of business strategy and operations. «Corporate citizenship can, therefore, be seen as a systemic approach to corporate responsibility which requires a wide understanding of the political place of the company»[25].

d) Sustainability

Finally, sustainability is the most used term by companies to discuss their CSR activities[26]. It is related to the idea of sustainable development, which has become a central concept in international environmental politics. The term was defined by the Brundtland Commission in 1987 in the Report on the World Commission on the Environment and Development: «Sustainable development is development that meets the needs of the present without compromising the ability of the future generations to meet their own needs». Thus, sustainability focuses on the long term contribution of business to society and the impact of that activity on future generations.

It is noteworthy, however, that the ideas behind sustainable development are much older and date back to the preservation and conservation movements

[25] M. Mc Intosh, *Corporate Citinzenship*, in The A to Z of Corporate Social Responsibility, 2007

[26] The evolution of the points of difference and congruence between CSR and Corporate Sustainability during the past decades is summarized in an interesting article which provide a general overview of the literature on the subject. Specifically, the author quantifies the papers on the subject in specialized journals and analyzes their differences and points of overlaps. In fact, as he states, "although CS and CSR have evolved from different histories, they are pushing toward a common future". For further details see: I.Montiel, *Corporate Social Responsibility and Corporate Sustainibility, separate past, common future*, in Organization and Environment, Vol.21, Num. 3, September 2008

of the 18th and 19th centuries[27]. Today, sustainability remains a debatable concept, which is related to different fields such as human development, sustainable development, corporate citizenship, social responsibility and environmental, ethics and stakeholder management.

Thus, sustainability may be defined as a values-laden umbrella concept which entails the link between the environment and society and the idea of ensuring that human needs are met without destroying the life supporting the ecosystems on which we depend[28].

Its evolution has been accounted by the European Parliament which, in a Resolution of 2013, affirmed that CSR and sustainable development may be considered as synonyms, stating: "the concept of CSR typically used in the EU institutions should be regarded as largely indistinguishable from the related concepts of responsible or ethical business, environment, society and governance, sustainable development and corporate accountability"[29]

In the light of the above, it is clear that all those theories have developed during the years, different approaches have been used and they evolved in different directions.

However, it is worth stressing that these ideas were not greeted universally with the same enthusiasm. This aspect will be analyzed in the next paragraph.

[27] For further details see: H.E.Daly, *Sustainable development: from concept and theory to operational principles*, Population and development review, 1990; J. Elkington, *Towards the sustainable corporation: win win win business strategies for sustainable development*, California management review, 1994

[28] W. Visser, *Sustainability*, in The A to Z of Corporate Social Responsibility, 2007

[29] European Parliament resolution of 6 February 2013 on Corporate Social Responsibility: promoting society's interests and a route to sustainable and inclusive recovery (2012/2097(INI))

1.2 The (prevalent?) success between the corporatists and the skepticism of jurists

As we have seen, during the last century CSR theory has been developed as an interdisciplinary topic as it concerns several subjects[30]. Consequently, the debate involved different categories of scholars. Regarding this analysis it is interesting to investigate the position that corporatists and jurists assumed during the last decades.

Over the years the position of the corporatists has changed substantially. If, in fact, the theory which considers the company as the center of investment was already entrenched almost everywhere, CSR theory did not benefit the same success. Instead, it oscillates between ethical reflections and considerations for business efficiency.

However, most business experts have noticed how CSR has been transformed from an irrelevant and often frowned upon idea to one of the most orthodox and widely accepted concepts in the business world during the last twenty years[31].

Even so the process was not so simple, it takes several decades to obtain this result. Between corporatists there have always been two schools of thought: one against and one in favor of CSR.

Regarding the former, the main criticisms come from the capitalists who believe in a *laissez faire* system, where businessmen have to maximize shareholder wealth, while social problems has to be faced by politician and social society. The famous "Invisible hand" concept proposed by Adam Smith in 1776 perfectly shown this perspective. It is clear that A. Smith never spoke about CSR,

[30] The interdisciplinary nature of CSR implies that it makes use of concepts from different disciplines like corporate citizenship, social performance and sustainable business, leading to a self-regulating mechanism for businesses to ensure compliance with the law, ethical standards and international norms. Furthermore, these concepts push the companies to have a positive impact through its activities on the environment, consumers, employees, communities etc. Thus, "the best concepts from the other disciplines helped CSR in the deliberate inclusion of public interest into corporate decision-making and the honoring of a triple bottom line – people, planet, profit". For a recent analysis of the concept see: Dr.J.Valli, *CSR: a multidisciplinary concept*, 2015

[31] Min Dong Paul Lee, *A review of the theory of Corporate Social Responsibility: Its evolutionary path and the road ahead*, in International Journal of Management Reviews, 2008

as the concept was not developed yet and the economic life was really far from how we conceive it in the modern days. However, he set out a framework that would be widely developed later and that is also useful today. In fact he argued that in a competitive market economy «every individual (…) neither intends to promote the public interest, nor knows how much he is promoting it. He intends only his own security, his own gain. And he is in this led by an invisible hand to promote an end which was no part of his intention....By pursuing his own interest he frequently promotes that of society more effectively than when he really intends to promote it[32]». It is evident that if Smith had answered about corporation's responsibility he would have not seen any positive elements, as for him it is the self-interested behavior by corporation that leads to the social goal. In this perspective, CSR reduced the efficiency of the business and consequently of the general wealth of the society.

Two centuries later, this idea was applied to CSR by Milton Friedman, who considered himself a descendent of A. Smith. Friedman's theory on the social responsibilities of business was very influential. His famous proposition was first announced in "*Capitalism and freedom*" in which he affirmed that the one and only obligation for business is to maximize its profit while engaging «in open and free competition without deception or fraud»[33].

Besides Friedman theory, other scholars saw CSR as a cost with uncertain outcomes. One of the most critic perspective came from D. Vogel who stressed that even if a market for virtue exists it has different limits. In particular «the main constraint on the market's ability to increase the supply of corporate virtue is the market itself. There is a business case for CSR, but it is much less important or influential than many proponents of civil regulation believe. CSR is best understood as a niche rather than a generic strategy: it makes business sense for some firms in some areas under some circumstances. Many of the proponents of corporate social responsibility mistakenly assume that because some companies

[32] A. Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, 1776
[33] M. Friedman, *The Social Responsibility of Business is to Increase its Profits*, The New York Times Magazine, September 13, 1970

are behaving more responsibly in some areas, some firms can be expected to behave more responsibly in more areas. This assumption is misinformed. There is a place in the market economy for responsible firms. But there is also a large place for their less responsible competitors» [34].

Another interesting perspective is offered by R. Reich who argued that «corporate social responsibility is as meaningful as cotton candy. The more you try to bite into it the more it dissolves»[35]. In his paper he also argued that even if for many years he has talked about CSR as something profitable in the long run, because responsibility and profitability converge in the long term, he was never able to prove that proposition nor find a study that confirms it.

In the light of the above, it is clear that today many experts of the field and managers are still skeptical about CSR, there are doubts about its cost-effectiveness and its voluntary system.

However, as a matter of fact, by the late 1990, CSR has grown exponentially and it has been promoted by most governments, corporations and non-governmental organizations. In this regard, emblematic are the words wrote recently by B. Horrigan: «The world is reaching a turning point at which the inevitability of CSR overtakes the remaining oppositions to it»[36].

Anyway, this second school of thought took some years to develop, there was progressive rationalization of the CSR. In this direction, researchers' studies positively influenced corporatists' opinion. In fact, they moved from macro-social effect analysis and ethical oriented studies to organizational level analysis on financial performance[37].

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[34] D. Vogel, *The market for virtue: the potential and limit of corporate social responsibility*, The Brookings Institute, Washington D.C., 2005

[35] R.B.Reich, *The case against corporate social responsibility*, Goldman School of Public Policy Working Paper, 2008

[36] B. Horrigan, *Corporate social responsibility in the 21st Century. Debates, Model and Practices Across Government*, Law and Business, Edward Elgar, Cheltenham, 2010, p.341

[37] F.L.Reinhardt et al., *Corporate Social Responsibility through an economic lens*, in Review of Environmental Economics and Policy, Vol. 2, Issue 2, 2008. The article is part of a symposium composed by three articles on corporate social responsibility and the environment which provides an overview of all the major issues related to CSR. It analyzes CSR form a theoretical and

In greater detail, as we have touched on before, during the '50-'60s Bowen talked about CSR as part of his broader idea of a better American society, where economic and social goals reinforced each other. Chronologically Bowen's publication coincided with the legalization, by the new Jersey Supreme Court, of corporate contributions other than a direct benefit to business. Moreover, during this period the consumer rights movement was created and it directly influenced corporate power.

During the '70s the discussion moved to a more concrete and observable level of organization. In 1979, Carroll proposed a new three dimensional model based on CSR, social issues and social responsiveness, in which both corporate objectives are integrated into the framework of social responsibility of business (which includes economic, legal, ethical and discretionary categories). In this way he considered the practical relationship between business and its environment but the theory lacked in the capability of measuring Corporate Social Performance[38] (CSP).

It took two more decades to create a new theoretical framework and to adopt it. Thanks to the development of the stakeholder theory the measurement problem was ridden out, as the theory has the advantage of testing closer the actors and their position in relation to one another. As we have seen, at the center of the theory there is the survival of the company that depends not only on shareholders but also on other stakeholders as employees, customers and governments. Thanks to that vision, new categories of stakeholders were created and we assisted at the implementation of, among others, environmental responsibility, transparent accounting action.

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empirical perspective. For further details: P.R.Portney, *The (not so) new corporate social responsibility: an empirical perspective*, Review of Environmental Economics and Policy, 2008 and T.P. Lyon, J.W.Maxwell, *Corporate social responsibility and the environment: A theoretical perspective*, Review of Environmental Economics and Policy, 2008

[38] In 1991, D. Wood proposed a definition of CSP taking into account the attempts done previously by other authors. She wrote that CSP could be considered as "a business organization's configuration of principles of social responsibility, processes of social responsiveness, and policies, programs, and observable outcomes as they relate to the firm's societal relationships". See: Donna J. Wood*, Corporate Social Performance Revisited*, in The Academy of Management Review, Vol. 16, Num. 4, pp. 691-718, 1991

However, as Michel E. Porter and Mark R. Kramer affirmed in an important article[39], «the fact is, the prevailing approaches to CSR are so fragmented and so disconnected from business and strategy as to obscure many of the greatest opportunities for companies to benefit society», but, if companies use the right strategies, than CSR can be much «more than a cost, a constraint or a charitable deed, it could be a source of opportunity, innovation and competitive advantage»[40].

When we consider the position of the jurists regarding the implementation of CSR policies, we discover a different perspective[41]. In the US, the debate between jurists advanced together with the one between economists and different theories were developed.

Within the stakeholder theory, for example, on the basis of which managers should consider in their decisions the interests of all the constituencies of the company, different scholars developed the idea that it exists an hypothetical contract between the society and the companies, through which the companies can be structured as corporation in exchange for the promotion of the social well-being[42].

The notion of the social contract, introduced by political philosophers in order to establish the moral legitimacy of particular forms of government and to define the obligations of both governments and citizens, has been applied in the past two decades also to the economic organizations, to define the nature of the obligations of the companies to the society as a whole. Therefore, economic organizations exist to satisfy the interests of more than just a privileged group of the society. More importantly, the reference to the social contract provides a

[39]Michel E. Porter and Mark R. Kramer, *Strategy and Society. The link between competitive advantage and Corporate Social Responsibility*, in Harvard Business Review, December 2006

[40] *Ibidem*

[41] Moreover, it is worth noting that there is not an extended literature on the subject. The reason is that for the jurists CSR is an evasive topic. See: K.Buhmann, *Corporate social responsibility: what role for law? Some aspects of law and CSR*, Corporate Governece Law Review, Num. 6, 2006; D MCBarnet et al., *Corporate social responsibility beyond law, through law, for law*, The New Corporate Accountability, 2009

[42] E. D'Orazio, *Responsabilità sociale ed etica d'impresa*, in Notizie di Politeia, XIX, 72, 2003

normative criterion for measuring, from a moral perspective, the corporations' performance.

In 1994, Freeman and Evan developed the theory on social contract. With explicit reference to the theory of justice of Rawls[43], they supported the thesis of the "original position" that is considered to be a fair and impartial point of view adopted in the reasoning about fundamental principles of justice. From this perspective, everyone should be able to agree upon and commit to principles of social and political justice. Moreover, the main feature of the original position is "the veil of ignorance": to insure impartiality of judgment, the parties are deprived of all knowledge of their personal characteristics and social and historical circumstances; they know the main conceptions of justice drawn from the tradition of social and political philosophy and they are assigned the task of choosing, from among these alternatives, the conception of justice that best advances their interests in establishing conditions that enable them to effectively pursue their final ends and fundamental interests. According to Freeman and Evan, if rational stakeholders were placed behind a "veil of ignorance", they would adopt certain principles of "fair bargaining". In fact, all contractors would be motivated to choose the principles that govern the activities of the company to ensure the highest level of profit compatible with major social guarantees for the other stakeholders.

In Europe, the reaction of the jurists to the new theory of CSR coming from the American society, was not so enthusiastic, at least at the beginning. Differences of corporate governance models between United States and Europe[44] made the CSR theory less urgent to adopt. Anyway, the consonance with the other legal protection themes made easier for European Commission to insert CSR in its agenda. Consequently, the same happened for each European Country[45].

[43] J. Rawls, *A theory of justice*, Harvard University Press, 1971

[44] Principal differences consisted in a minor weight of the financial markets and in higher protection of workers by Trade Unions.

[45] In Italy, at the beginning the juridical culture totally refused CSR theory. As a matter of fact, in 2003 it was ignored in the Corporate Reform and it has always suffered the opposition of the

Anyway, still today, by analyzing themes related to CSR, jurists have several doubts and pose preliminary problems.

Why the juridical academia is so reluctant? Most of the problems raised by jurists derives from theoretical considerations[46]. One question regards if it is possible to consider CSR as a law policy or it has to be analyzed only as part of the business strategies related to ethical and social criteria.

Concerning the first aspect, the theme is linked with the idea that responsibility has to be exclusively interpreted as a negligent or malicious conduct or nevertheless as an undue damage. As for the second one, jurists have to face another problem that is to define the role of law in a matter in which the voluntary (and extra-juridical) element is postulated.

The role of law would thus appear confined to the construction of a regulatory environment in favor of the development of CSR, through the use of the promotional law.

However, as some others noticed, it is misleading to limit the scope of CSR to a mere instrument for the integration of voluntary behaviors in business management. In fact, the conduct that today belongs to CSR, tomorrow may become the subject of a legal obligation, without necessary lose its origin in ethical framework of business. The postulates of CSR, in fact, often anticipate,

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Academics. «Such orientation, substantially homogeneous, is probably entrenched in the ideal strength of Italian corporate contractualism (...) It can be explained as the classification of the business law in the corporate system by the juridical culture during the fascist period». See: M. Libertini, *Economia Sociale di mercato e responsabilità sociale dell'impresa*, in Orizzonti del Diritto Commerciale, anno I – 2013. In the original language: "Il formarsi di un tale orientamento, sostanzialmente omogeneo, trova probabilmente le proprie radici nella forza ideale del contrattualismo societario italiano (…) che si spiega come reazione all'adesione entusiastica che buona parte della cultura giuridica del tempo fascista aveva prestato all'idea di un inquadramento del diritto dell'impresa nell'ordinamento corporativo e alla sua relative legittimazione delle teorie istituzionalistiche dell'impresa".
However, more recently, the legal framework has changed in Italy as well, by adopting the Law 11 *November* 2011 n.180 (so called corporate statute). This law states that companies have to "promote the inclusion of social and environmental problems in the development of their activities and in their relationship with the society". Moreover, it ratified the "principle" of acknowledgement and appreciation of the statutes of the companies based on principles of equity and solidarity.

[46] Obviously, the existence and development of CSR cannot be done without Jurisprudence. The CSR promotion from moral norm to legal norm depends also on the Jurisprudence, together with the legal value and the economic analysis of law. To this regard see Social Science, *Research on Corporate Social Responsibility in the Perspective of Jurisprudence*, in Law, 2012

through recommendations, best practices or standards of conduct, principles or standards that are declined later in binding acts[47].

Thus, even if valid, the fear that CSR practices should be only an empty formulation does not seem to be legally insurmountable. This argument will be deeply analyzed in the next chapter.

1.3 The European approach to CSR: recent history and state of play

As we have seen, the concept of the CSR has been effectively developed in the US since the '60s. The European reaction at CSR theories was not as enthusiastic as the American one[48]. The principal reason of this difference takes root in a different cultural tradition. In Europe, in fact, the role of the public Institutions and Trade Unions was stronger than in the United States[49] and different models of Corporate Governance were implemented. This is why, at least at the beginning, the adoption of CSR did not seem so urgent as in the United States. Nor it is a coincidence if these theories developed in Europe at the same time of the company's financial theories, as if a counterweight was needed.

It is possible to affirm that the interest in Corporate Social Responsibility by the European Communities dates back to 1993 with the adoption of the White Paper "*Growth, Competitiveness, Employment. The challenges and ways forward into the 21st century*". This Paper of the European Commission represented a first step towards the promotion of ethical behavior by companies within a new

[47] A. Addante, *Autonomia privata e responsabilità sociale dell'impresa*, Napoli, 2012, p.7

[48] To this regard see I. Maignan, D.A. Ralston, *Corporate social responsibility in Europe and the US: Insights from businesses' self-presentations*, in Journal of International Business Studies, 33(3), 2002; R.Welford, *Corporate Social Responsibility in Europe, North America and Asia*, Journal of Corporate Citizenship, 2005; JP Doh, TR Guay, *Corporate Social Responsibility, public policy and NGO activism in Europe and the United States: an institutional stakeholder perspective*, Journal of Management studies, 2006

[49] As known, in the United States, Trade Unions have always had a different space within the society. During the 19th Century, only two per cent of the total labor force and less than 10 percent of all industrial workers, were member of unions. An interesting article which compares pros and cons about the two systems is provided by S.Nickell, *Unemployment and Labour market rigidities: Europe versus North America*, Journal of Economic Perspectives, Vol.11, Num. 3, 1997

economic model that developed a societal project for a higher quality of life in the Community. The Commission stated: «A more adequate policy should therefore be able to offer society a better quality of life with a lower consumption intensity and as a consequence with a reduced stress on environmental resources. In this same context, the creation of more challenging jobs is to be situated, as well as the valorization of human capital in local networks, fostering individual responsibility and social participation. The new development model for the Community therefore has to address the inefficient use of available resources in a wide perspective, i.e. taking into consideration the overall quality of life of the citizen»[50].

At a later time, in 1999, the European Parliament adopted the "*Resolution on EU standards for European enterprises operating in developing countries: towards a European Code of Conduct*"[51] with whom the Parliament welcomed and encouraged voluntary initiatives by business and industry, trade unions and coalitions of NGOs to promote codes of conduct, with effective and independent monitoring and verification, and stakeholder participation in the development, implementation and monitoring of these codes.

However, it is with the beginning of the new century that the attention on Corporate Social Responsibility grew substantially. In fact, in 2001 the Commission presented the Green Paper titled "*Promoting a European framework for Corporate Social Responsibility*". The Paper introduced new subjects stating that an increasing number of companies were adopting corporate social responsibility strategies in order to respond to the different categories of stakeholders whom they interacted. After a short introduction, CSR is defined as

[50] White Paper "*Growth, Competitiveness, Employment. The challenges and ways forward into the 21st century*", COM(93)700, 5 December 1993, p.146. The document is available at http://europa.eu/documentation/official-docs/white-papers/pdf/growth_wp_com_93_700_parts_a_b.pdf

[51] European parliament Resolution, *Code of conduct for European enterprises operating in developing countries*, Texts Adopted by Parliament, final edition 15/01/1999. The document is available at: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A4-1998-0508+0+DOC+XML+V0//EN

a concept whereby companies integrate social and environmental aspects in their management and on voluntary basis.

Specifically «being socially responsible means not only fulfilling legal expectations, but also going beyond compliance and investing more into human capital, the environment and the relations with stakeholders»[52].

The definition offered by the Commission recalled the ones offered earlier by other scholars[53]. Moreover, for the first time the Commission emphasized direct and indirect effects related to the economic impact of CSR. Thus, positive direct results included a better working environment able to lead to a more efficient workforce, while positive indirect results consisted of the growing attention of consumers and investors in order to enlarge opportunities in the markets.

However, the increasing number of multinational companies involved in these practices implied the need of an extended agreement related to the type of information to be disclosed, the format to be used and the reliability of the audit procedure. In order to facilitate the creation of such framework, the Commission started a debate on the concept itself. The aim was to define a common ground from which national CSR policies would converge, allowing companies to integrate social and environmental concerns in their business operations[54].

To the Green Paper followed more than 250 responses from companies, trade unions, consumer's associations and academics. Each category expressed their need in order to create the basis for an effective CSR. In particular, enterprises emphasized that would not be "one-size-fits-all" solution but, as CSR is on voluntary basis, every company should have developed his own innovative strategy. On the other side, trade unions and civil society emphasized the need

[52]Green Paper "*Promoting a European framework for Corporate Social Responsibility*", COM(2001)366 final, 18 July 2001, p.6. The document is available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERVpercent3An26039

[53] For more details see paragraph 1.1 Evolution of the definition, in this chapter.

[54] See A. Voiculescu, *Green Paper to new uses of human rights instruments*, in The new corporate accountability, Corporate Social Responsibility and the Law, Cambridge University Press, 2007

of a regulatory framework, while consumers' organizations underlined the importance of transparency and information.

As a follow-up to the Green paper, in 2002, the Commission presents the Communication "*Corporate Social Responsibility: A business contribution to Sustainable Development*"[55] in which presents the European strategy to promote CSR. Moreover, it is worth noting that for the first time the Commission stressed the link between CSR and the concept of sustainable development: «There is today a growing perception among enterprises that sustainable business success and shareholder value cannot be achieved solely through maximizing short-term profits, but instead through market-oriented yet responsible behavior. Companies are aware that they can contribute to sustainable development by managing their operations in such a way as to enhance economic growth and increase competitiveness whilst ensuring environmental protection and promoting social responsibility, including consumer interests (….) businesses need to integrate the economic, social and environmental impact in their operations»[56].

In the light of these considerations, the Commission encouraged the development of knowledge about the impact of CSR on the financial results of the companies and, in order to respect the transparency, it also encouraged the adoption of Codes of conduct, management standards, measurement, reporting and assurance, labels and Socially Responsible Investments (SRI).

Finally, the Commission set up the European Multi-Stakeholders Forum on CSR[57] to provide a platform for discussion and mutual learning by the main stakeholder groups at European level and to promote the integration of CSR in all European policies (employment and social affairs policy, enterprise policy, environmental policy, consumer policy, public procurement policy, external

[55]Communication from the Commission concerning "*Corporate Social Responsibility: A business contribution to Sustainable Development*", COM(2002)0347 final, 2 July 2002.
The pdf of the document is available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2002:0347:FIN:en:PDF

[56]*Ibidem*

[57] Further details as well as the the full text of the Executive summary of 2015 CSR forum is available at http://ec.europa.eu/growth/industry/corporate-social-responsibility/index_en.htm

relations policies, including development policy and trade and public administrations).

Following the Commission's Communication, in 2003 the Parliament submitted its Resolution[58], welcoming the attempt to define an European framework and emphasizing that companies should be required to contribute to a cleaner environment by law rather than solely on a voluntary basis; the importance of facilitate convergence between European countries. It underlined that the integration of CSR into EU policy-making must be fully in line with the integration of sustainable development as agreed at the Gothenburg European Council, regretting that the Commission Communication does not pay sufficient attention to the role of business in the sustainability of the physical environment and land-use. Finally, the Parliament invited the Commission and Member States to promote the environmental performance of companies, to raise the awareness of both producers and consumers in order to make full use of the existing instruments in the market for sustainable development and to build consensus for international accepted principles and to improve transparency with regard to companies' environmental and social performance.

The European activity continued in 2006 with the Communication from the Commission "*Implementing the partnership for growth and jobs: making Europe a pole of excellence on corporate social responsibility*"[59]. In this document the Commission stressed the work done since the Lisbon Treaty and proposed new strategies in order to develop CSR.

In particular, the Commission decided to work more closely with the business and launched an European Alliance on CSR. The Alliance "is a political

[58] European Parliament resolution on the Communication from the Commission concerning *Corporate Social Responsibility: A business contribution to Sustainable Development*, P5_TA(2003)0200, 13 may 2003. The document is available at: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P7-TA-2013-0049+0+DOC+XML+V0//EN

[59] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, *Implementing the partnership for growth and jobs: making Europe a pole of excellence on corporate social responsibility*, Com(2006)136 final, March 2006. The full text of the document is available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0136:FIN:en:PDF

umbrella for new or existing CSR initiatives by large companies, SMEs and their stakeholders. It is not a legal instrument and is not to be signed by enterprises, the Commission or any public authority. It is a political process to increase the uptake of CSR amongst European enterprises". The Alliance is conceived for creating new partnerships and supporting stakeholders in developing their capacity to evaluate CSR practices. The policy also identified 8 priority areas for the European action: awareness-raising and best practice exchange; support to multistakeholder initiatives; cooperation with Member States; consumer information and transparency; research; education; small and medium-sized enterprises; and the international dimension of CSR.

Furthermore, in 2007 the European Parliament published its Resolution *on Corporate Social Responsibility: a new partnership*[60]*,* in which it proposed to the European Commission critical comments and requests regarding corporate social responsibility.

In 2011 the Commission presented a new Communication with the aim of giving a new stimulus in favor of CSR policies. Moreover, the Commission introduced a new definition of CSR as «the responsibility of enterprises for their impacts on society (…) to fully meet their corporate social responsibility, enterprises should have in place a process to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders»[61].

For the purpose of this analysis it is important to remark that one of the Commission's proposal regarded the issue of misleading marketing related to the environmental impacts of products (so-called "green-washing") in the context of the report on the application of the Unfair Commercial Practices Directive which

[60]European Parliament Resolution, *Corporate social responsibility: a new partnership,* March 2007; available at ttp://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&reference=A6-2006-0471&language=EN

[61] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A renewed European strategy 2011-14 for corporate social responsibility*, Brussels, 25.10.2011 COM(2011) 681 final

considers the need for possible specific measures on this issue. This concept will be developed further in this analysis.

The Commission also launched a public consultation on CSR in order to gather critics and suggestions for future actions and strategies, whose summary has been the basis of the plenary meeting of the multi-stakeholder forum on CSR organized in Brussels on February 2015[62]. Moreover, the European Parliament approved the proposal for a directive which provides for the "disclosure of non-financial information and diversity".

Finally, in 2013, the European Parliament approved two important Resolutions on *Corporate Social Responsibility: accountable, transparent and responsible business behavior and sustainable growth* and on *Corporate Social Responsibility: promoting society's interests and a route to sustainable and inclusive recovery*[63] which symbolize that CSR has become a strategic element in order to reach "Europe 2020" objectives.

On the basis of this process, it is possible to add some considerations. First of all, it is clear that the concept of CSR grew relatively late in Europe, following the international initiatives developed in the years before.

Secondly, the concept reached different European countries before doing so at an European level. In fact, by 1994 the Danish Minister of Social Affairs launched a campaign about CSR and created the Center of Copenhagen in relation to CSR. In the UK, in 2002 the Minister of CSR was created and, in France, different legislative texts, such as the Barnier Law (1993), the LOADDT

[62] The executive summary of the meeting con be consulted at: http://unfccc.int/resource/docs/2015/cop21/fre/l09f.pdf It stresses the main objectives to pursue divided by the different policy area.

[63] Which are, respectively, 2012/2098 (INI) and 2012/2097(INI). The former was adopted by The European Parliament with the Resolution P7_TA(2013)0049 of the 6th February 2013. The latter was adopted by the European Parliament with the Resolution P7_TA(2013)0050 on the same date. As for the first one it is interesting to stress that the Parliament "Calls on the Commission to take further initiatives to unlock and strengthen the potential of CSR in tackling climate change (by linking it to resource and energy efficiency), e.g. in the processes companies use to purchase raw materials". As for the second one, the Parliament "warns that businesses can only be sustainable in the future if they exist within a sustainable economy, and that there can be no alternative to adaptation to a low-carbon future, which also encompasses the preservation of the world's social and natural capital, a process in which CSR must play a decisive role".

(orientation law for territorial planning and sustainable development – 1999), and the NRE law (new regulation of enterprise) were approved.

At the European level, instead, it is only at the beginning of the 20th century that the Commission set up the basis for a major attention to the issues related to CSR.

Finally, probably because of the lateness by which the European community took into account this concept, CSR was regarded as the parameter of a more global European strategy[64]. In particular, it seems that CSR was included in a more global concept such as sustainable development. If, at first, some authors stressed that CSR could be understood "as an element among others enhancing the issue of sustainable development"[65], recently, the European Parliament affirmed that the two concepts can be considered as synonyms[66]. This concept will be further analyzed in the next chapter.

1.4 How companies communicate their sustainability strategies

So far we have seen how the Corporate Social Responsibility is at the center of several economic policies in the EU as well as in the US and we will further see how the renewable energies play an important role within those programs.

This section will focus on how the companies communicate their responsible strategies. What are the available instruments they have to communicate them?

[64] In fact, the Commission in its Communication (COM 2002 final) admitted that: "CSR may be a useful instrument in furthering Community policies…there is a role for Community Action to facilitate convergence in the instruments used in the light of the need to insure the proper functioning of the internal market and the preservation of a level playing field"

[65] L. Eberhard-Harribey, *Corporate Social Responsibility as a new paradigm in the European policy: how CSR comes to legitimate the European regulation process*, in Corporate Governance, Vol.6 Num. 4, 2006, p.363

[66] European Parliament resolution of 6 February 2013 on *Corporate Social Responsibility: promoting society's interests and a route to sustainable and inclusive recovery* (2012/2097(INI))

When firms decide to publicize their commitment[67], they can do it using several ways. The next section is dedicated to analyze each one of them.

[67] Green marketing is a broad concept, one that can include consumer goods, industrial goods and even services. Yet identifying a single definition is not a simple assignment. However, one of the most accepted definition considers green marketing such as: "all activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants, such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment". This definition includes the protection of the interests of the organization as well as the protection of the natural environment. However, it is important to stress that the impact on the natural environment has to be minimal: therefore, green marketing does not imply eliminating environmental harm but minimizing it.
The term became more popular during the '90s when, both in Europe and the United States, the companies have discovered that consumers will buy products, or avoid their purchase, based upon environmental considerations. In those years, The Economist ranked the 12 European Community member countries regarding the national environmental policies. They found that the most well-developed policies were in The Netherlands, West Germany and Denmark. In the middle of the ranking there were Britain, France and Belgium, while at the bottom there were Greece, Portugal, Spain, Ireland and Italy. Historically, European business has had a better public image than US business with regard to the environment. However, during the '90s, US business cooperated more with the environmental community.
What were the factors that influenced the greening of several companies in both sides of the Atlantic? Generally speaking, the factors were the same but they differed in timing and degree. Among others, the most important factors were the environmental damage carried to the public by the media; the relative scarcity of natural resources (especially in Europe); the damage to the Earth's ozone layer and the global warming. Public concern has led to the development of green political power and green consumerism which, together, have given rise to the concept of green marketing. In parallel, green political power pushed toward the proliferation of environmental laws. In addition to all those forces described (politics, law and consumers), investors and employees also made some pressure on business to protect the environment.
Therefore, this process implies that in the past decades green marketing has become a response to the environmental effects of the design, production, packaging, labeling, use, and disposal of goods or services. However, it is worth noting that the companies which decide to follow these strategies are not only influenced by governmental bodies, moral sense or employees: often there are other reasons for firms to increase the use of green marketing. In fact green marketing can be an opportunity to exploit as the demand is changing. It appears that both individual and industrial consumers are more aware of the natural environment and this factor could give the respectful company a competitive advantage over firms that are non-environmentally responsible. Moreover, a "greener" behavior allows also companies to have substantial cost savings, for example reducing harmful wasting. "When attempting to minimize waste, firms are often forced to re-examine their production processes. In these cases they often develop more effective production processes that not only reduce waste, but reduce the need for some raw materials. This serve as a double cost saving, since both waste and raw material are reduced"(Miryala 2015). Nevertheless, when firms use green marketing they have to consider several potential problems that could take place. One of them is that their advertising must not be misleading to consumers or industry and they should be respectful of any of the regulation related to green marketing. Otherwise the firm can incur the phenomenon of green washing.

1.4.1 Sustainability reports

Similarly to the concept of CSR, also for CSR reporting there is not a single, agreed-upon definition. First of all, they differ on their name[68]. For the sake of simplicity I will refer to them as sustainability reports.

Therefore, "whatever name they go by, corporate social responsibility reports are attempting to serve one essential purpose: they portray the relationship between a corporation and society. They seek to improve communications between the corporate world and the broader society within which companies report"[69]. Furthermore, the sustainability report is one of the most common instrument used by companies in order to show their commitment to environmental issues[70].

However, even if most of the companies – at least the biggest ones - produce a sustainability report, experience shows that there could be a big difference between them.

Firstly, they can differ on shapes: sometimes they are no more than a few paragraphs in a company's annual financial report, others they are long stand-alone reports.

Secondly, they differ on their content. In fact, beyond the mere decision to publish a report, its content can give an important insights into how the company perceives corporate sustainability issues and what factors matter the most for the management.

But, before entering this subject, it is interesting to understand why some companies still decide to not report at all. Behind this decision, there can be several reasons. For example it could be either that the stakeholders do not

[68] To this regard it is interesting to note that CorporateRegister.com breaks them down into nine separate categories. Moreover, it also shows that the number of CSR reports grew from 26 in 1992 to more than 3000 in 2008.

[69] Institute for Responsible Investment*, How to read a Corporate Social Responsibility Report,* 2010

[70] To this regard see: C.A. Ramus, I. Montiel, *When are corporate environmental policies a form of "greenwashing"*? in Business & Society*,* Num. 44, Issue 4, 2005; D.Stamaoulakis, L.Bridwell, *BMW's approach to Global Warming and Environmental Management: Corporate Social Responsibility or Greenwashing?*, Competition Forum, Vol. 7, Issue 1, 2009

make enough pressure or the company has a modest social or environmental impact. Also, the cost of the report can be higher than the benefits, or the company could be concerned of disclosing any important information that can be used by competitors, letting them gain commercial insights to the business.

However, due to the growing importance of CSR, more and more, investors are less likely to look favorably on these companies, because the quality of management could be doubt. On the other side, there are a lot of companies that publish reports[71], which it is usually seen as a confirmation that environmental and social issues are on the corporate agenda. In fact, whatever the form and content they may have, "they are all part of the same effort to extend the definition of a corporation's obligation beyond the simple generation of profits for investors to the true enrichment of the full range of a corporation's stakeholders"[72].

Not uncommonly, companies in the early years of social responsibility reporting choose to focus on the aspects of their business where more data is available, or on a subset (geography, business segment, issue etc).

It is important to stress that there could be different reasons that drive the enterprises to publish a report. In fact, beyond the mere satisfaction of a stakeholder's request, they can use the report as a more strategic form of

[71] It is interesting to cite the list published in 2016 by Fortune on the world's most admired companies at the following link: http://fortune.com/worlds-most-admired-companies/
At the top of the list there are Apple, Google and Amazon. Recently, in the same perspective, an interesting example to cite is the company Gap Inc. that, in January 2016, set ambitious new global goals to reduce absolute greenhouse gas emissions, by 50 percent from 2015 to 2020. In fact, the Senior Director of Sustainable Innovation at Gap said "As we look to integrate our sustainability efforts more deeply into our business strategies and policies, we recognize the potential to create tremendous positive change for the people touched by our business while unlocking new possibilities to grow our global enterprise. We recognize that much work lies ahead of us, but we remain steadfast in our commitment to help ensure the safety and well-being of the people who make our clothes, to advocate for greater equality, and to foster more sustainable communities in the places we live and work." Source: http://www.csrwire.com/press_releases/38638-Gap-Inc-Sets-Ambitious-New-Climate-Goal-to-Foster-Cleaner-Global-Business-and-Deepens-Efforts-to-Help-Protect-Human-Rights-Across-Global-Supply-Chain. Moreover, at the beginning of 2016, the Ethisphere Institute (who defines the standards of ethical business practices) recognized Rockwell Automation, a an industrial automation and information company, as a 2016 World's Most Ethical Company.
[72] *Ibidem*

communication[73] that "allows the company to present a comprehensive account to key stakeholders such as government, investors and civil society organizations of how it has delivered on its environmental and social policy commitments"[74]. In particular, the report shows where the company sees the limits of its social and environmental responsibilities[75].

Despite the differences, there are a few primary elements that it is likely to find in every sustainability report. The first section is usually dedicate to a letter from the CEO or the Head of the CSR program. The second one includes the mission statement and the goals of the firm. However, the most important part is the one dedicated to key facts and figures, as they provide the readers with an effective way to determine the company's records[76]. Finally, many CSR reports include a GRI[77] index and a GRI grade. In fact, GRI developed a standardized

[73] Moreover, another possibility for the businesses is to join global collaboration among companies, international organizations, NGOs and civil society. As an example the "Impact 2030" can be considered. As indicated on its website, "The purpose of IMPACT 2030 is to align companies and their employee volunteer efforts with the Global Goals, advance the practice of employee volunteering, and create real and sustainable change". In fact, this initiative was created as a response to the United Nations' call to a more active enrollment of the private sector in the pursuing of the global goals. For further details see: http://www.impact2030.com/about-us.html

[74] R. Sullivan, *Valuing Corporate Responsibility: how do investors really use corporate responsibility information?*, Greenleaf publishing, 2011

[75] Responsible green marketing has evolved into a complex, integrated, strategic and tactical process. Companies which decide to undertake this process have a number of different option in order to show their commitment to responsible activities. Menon and Menon suggested that companies have three different ways to apply green marketing: strategic, quasi strategic and tactical.

The strategic greening implies a substantial change in corporate philosophy (i.e. redesign all the production process of a product), while the quasi strategic entails a substantial change in business practices (i.e. hotels that ask guests when they want their towels to be washed). Finally, the tactical greening is related to functional activities, such as promotion. In the light of the above it can be deduced that each company can decide the best strategy, according to its goals and the market it serves. Moreover, It is possible that a company, even if implementing responsible strategies, decides to not publicize the point. This is the case of Coca Cola and Walt Disney World. However, when firms decide to publicize their commitment, they can do it using several ways.

[76] In particular those elements are more effective when they include: a) both absolute and normalized figures, b) year-over-year comparisons, c) progress reports versus previous goals, d) data relative to industry peers.

[77] GRI stands for Global Reporting Initiative. It is an organization that operates in the sustainability fields. It has developed a framework for sustainability reporting which includes the reporting guidelines, sector guidance and other resources.

reporting framework based on 90 indicators. Ultimately, they can include interviews and surveys.

1.4.2 Environmental Certifications

Companies have developed quantitative measures for its business goals based on both outputs and outcomes. With the aim to reach this goal, they implement key performance indicators and assess performance. Many companies apply for environmental certification in order to demonstrate that their management system respects and functions as intended according to the standards. In fact, the certification is the result of a process conducted by a third party on the effectiveness of the implementation of a company's management system and processes. Therefore, achieving certification is often used as a key performance measure for the organization's environmental and social management efforts.

Moreover, certifications give a signal to consumers and investors demonstrating that the company has decided to allocate substantial resources to the implementation of those policies. In many cases, in fact, investors who give a particular positive value to environmental and social performances will rate more highly the companies with those certifications than the ones without.[78]

Besides, there are other issues related to certifications that it is important to consider. In fact, they are usually applied to the system that is implemented but they do not verify its effectiveness. Furthermore, certifications are usually developed on a facility level: this implies that, even if a facility respects certain standards, it does not mean that those standards are respected elsewhere. In those cases, then, it is necessary to verify what percentage of the company's facilities was certified.

[78] However, even considering the positive added value of the companies with environmental certifications, it does not mean that those companies are seen as a better investment, at least not always. In fact, different studies show that the evidence does not provide a clear cut about those evaluations.

Within the priorities established in the European strategy, there are, among others, the objectives related to the promotion of a more efficient use of resources . That implies improving the environmental performance of production activities. Therefore, in this context, the tools for the analysis, evaluation and communication of the environmental performance of products and organizations, such as environmental certification, assume greater importance.

There are different kind of environmental certifications, as assessed below.

1. Environmental management systems (EMAS) and ISO[79] 14001;

The EMAS Regulation (Reg. 761/01 EC) is a scheme adopted by the European Commission in 1993 with the aim of implementing an Environmental Management System (EMS) by any organization. The EMS was originally proposed by the European Commission and by the ISO as the frontrunner of a series of policy tools that enable companies to simultaneously pursue environmental objectives and competitive targets in a synergetic way[80].

Thus, in Europe many firms are registering their EMS according to the Eco-Management and Audit Scheme (EMAS). This scheme is one of the most diffused and reliable environmental voluntary certification and it provides a third-party

[79] The International Organization for Standardization (ISO) is an independent, non-governmental membership organization that provides international standards, in order to ensure that products and services are safe, reliable and of good quality. Concretely, a standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose. ISO published over 19500 International Standards which are divided in several categories. Among them, the most relevant are the ones related to Quality management (ISO 9000), Environmental management (ISO 14000); Social responsibility (ISO 26000); Country codes (ISO 3166); Energy management (ISO 50001); Risk management (ISO 31000); Food safety management (ISO 22000); Information security management (ISO 27001); Occupational health and safety (ISO 45001).
It is not possible here to analyze each of them but a few words on the first ones are noteworthy. Thus, the ISO 9000 standard relates to quality procedures. Companies with this certification have implemented a rigorous set of quality processes for manufacturing or customer service. The ISO 14000 standard certifies a company's facilities against a set of environmental process management protocols. ISO 26000, unlike ISO 9000 or ISO 14000, it does not include specific requirements for CSR certification but is intended to provide general guidelines and to encourage CSR practices without stopping the development of innovative approaches.

[80] FIraldo, F.Testa, M.Frey, *Is an environmental management system able to influence environmental and competitive performance? The case of the eco-management and audit scheme (EMAS) in the European Union*, Journal of Cleaner Production, 17, 2009

guarantee which is able to give an advantaged position (with respect to their competitors) to those organizations that, by adopting them, commit themselves to improve the environmental performance.

ISO 14001 is an environmental management standard and it represents an integral part of the European Union's Eco-Management and Audit Scheme. It provides guidelines for the companies allowing them to design and implement an EMS that identifies the organization's environmental policy, the environmental aspects of its operations, legal and other requirements, the objectives and targets for environmental improvement, and an array of environmental management programs[81]. ISO 14001 also requires a system of implementation and operation, a system of checking and corrective action that includes monitoring and measurement, reporting non-compliance, and record-keeping with regard to environmental management.

The EMAS and ISO 14001 are similar in components and requirements but they differ in various aspects. Generally speaking, EMAS is more demanding if considering performance, compliance and reporting. In fact:

- it requires organizations to produce an environmental statement;
- it is more rigorous in mandating reductions in environmental impacts to levels not exceeding those corresponding to economically viable applications of best available technology;
- it requires organizations to make much more information publicly available, thereby enhancing a facility's transparency.

Moreover, the EMAS registration is provided by a State authority and it requires to report environmental effects and legal requirements at the site. By contrast, ISO certification is provided by a private registrar and it allows the company to decide how to have its EMS verified and what information should be disclosed.

According to EMAS requirements, there must be an internal system of compliance and performance audits, and once every three years an external

[81] For further information see: S.L. Jackson, *The ISO 14001 Implementation Guide: Creating an Integrated Management System*, Wiley Series in Environmental Quality Management, 1997

verification must be conducted. Instead, ISO only suggests system audits against internal benchmarks.

Briefly, ISO 14001 and EMAS have different aims. On one hand, ISO 14001 provides guidelines that can be implemented by almost any type of organization in any country and it was designed primarily to improve management. EMAS, on the other hand, is designed to bring about changes in environmental performance[82].

However, it is noteworthy that during the past years EMAS was applicable only at the site level. By contrast, ISO 14001 was applicable at the facility, company or organization level.

Nevertheless, EMAS was revised and now can be applied across entire organizations[83].

2. ISO type I, regulated by ISO 14024: Environmental labels

ISO Type I is a multi-attribute label developed by a third party. It provides guidance on developing programs that verify the environmental attributes of a product. They are based on a multi-criteria that considers the entire life cycle of the product. The criteria establish different values to be met in order to obtain the trademark.

The authority who releases the label can be public or private. Examples of labeling of type 1 are Eco-labels. Eco-labels were introduced in 1992 by adopting the European Regulation n. 880/92 and they were modified later with the new Regulation n. 1980/17 July 2000.

[82] D.Morrow, D.Rondinelli, *Adopting Corporate Environmental Management Systems: Motivations and Results of ISO 14001 and EMAS Certification*, European Management Journal Vol. 20, Num. 2, 2002

[83] The final publications of ISO 9001 and ISO 14001 standards have been revised and this marks the start of the three-year transition period during which certified organizations should switch to the new versions. The new standards have not received major changes but they are better aligned with the business environment and the contexts in which organizations operate. The adoption of Risk Based Thinking, enhancement of leadership involvement in management systems and the use of common structure are some of the main modifications. The transition period ends in September 2018.

Therefore, those labels represent a voluntary instrument that companies can use in order to demonstrate that their products and services respect ecological and performance criteria established at the European level.

Thus, the label constitutes a certificate of performance which is released only for those products that have a reduced environmental impact. The criteria are regularly revised and made more restrictive, to promote the continuous improvement of the environmental quality of products and services.

3. ISO Type II, regulated by ISO 14021: Self-declarations

ISO Type II is a single-attribute label developed by the producer (i.e. Mobius loop). Those kind of environmental labels and declarations report environmental information declared by manufacturers, importers or distributors of products, without any intervention of an independent certification body. However, the regulation calls for several constraints that have to be respected related to the disclosure of the information and the content itself.

4. ISO Type III, governed by ISO 14025: Environmental Product Declarations

ISO Type III is an eco-label whose awarding is based on a full life-cycle assessment.

Those claims report information based on established parameters that contain a quantification of the environmental impacts associated with the life cycle of the product calculated through a LCA process.

They are subject to independent scrutiny and presented in a comparable way. Examples of ISO Type III are, among others, the Environmental Product Declarations or EPD.

1.4.3 Socially Responsible Investment Index

The terms socially responsible investing and environmental social investing, by now, are part of institutional and retail investors. More importantly, "the world of responsible investing has moved from a practice of negative screening and exclusion of certain types of investment to one of seeking or encouraging certain characteristics in portfolio companies"[84].

In particular, there are three main categories of responsible investing: Socially Responsible Investing (SRI), Impact investing and Environmental, Social and Governance Investing (ESG), which have different purposes. Thus, if SRI and impact investing use investments to express institutional values, ESG wants to improve investment performance by making additional resources available for purposes considered to be good. For this reason, ESG are considered especially with a long term perspective.

However, SRI has been for a long time the most widely used among the three approaches. Therefore, a few words on it are noteworthy.

The SRI index is a weighted listing of stocks that is typically constructed by filtering a broader stock index according to a set of social or environmental criteria[85]. Indices are typically developed via a partnership between:

- An index provider (such as Dow Jones, FTSE, MSCI etc);
- An SRI research provider (such as an SRI agency or a fund manager).

[84] CommonFund Institute, *From SRI to ESG: the changing world of responsible investing*, September 2013

[85] To retrace the origin of the socially responsible investing movement we have to go back to the '60s, when several boycotts of firms occurred in South Africa. The idea behind this process was that it was possible for groups of individuals to influence companies' practices through the mechanism of the market. The starting point for the success is to act in unison, meaning that many individuals have to sell the share of a specific firm which acts in a irresponsible way. During the decades the weight of the socially responsible investing grew exponentially, reaching the 10percent of all managed assets in 2006 and going beyond it in the years later. According to the Social Investment Forum, from 2012 to 2014, sustainable, responsible and impact investing enjoyed a growth rate of more than 76 percent, increasing from $3.74 trillion in 2012. More than one out of every six dollars under professional management in the United States today—18percent of the $36.8 trillion in total assets is involved in SRI. See: Report on Sustainable and Responsible Investing Trends in the United States, 2012 that can be consulted on http://www.ussif.org/sribasics

They are usually included in the CSR report and they stand for a positive overall CSR record. Among the most widely cited SRI indexes, there are the Dow Jones Global Sustainability indexes, the FTSE4Good Index global series, the KLD Research & Analytics indexes, the Jantzi Social Index of Canadian companies and the JSE Socially Responsible Investment Index in South Africa.

These indices are most usually maintained by SRI research firms or national stock exchanges. They are intended both to encourage CSR among corporations and to serve as the basis for financial products. They tend to contain substantial numbers of companies across multiple industries, and can consequently include companies with a combination of strong CSR initiatives and controversies. They differ in the emphasis they place on social characteristics.

Socially investing can follow three different strategies: screening, social advocacy or community investment[86].

Based on that there are three principal types of sustainability indices[87]:

- Ethical exclusion indices: they are constructed by screening out companies exposed to "less desirable" industries and business activities or companies that contravene religious principles. Examples of those indices are, among others, FTSE4Good, JSE SRI Index, MSCI Europe ESG Index, NASDAQ.

[86] Screened funds have either negative or positive screens. Those with negative screens are usually firms that produce disagreeable goods and services, such as tobacco, alcohol, gambling, defense etc. Moreover, negative screens happen to firms that operate in countries with human rights abuses or repressive regimes.
On the other hand there are funds with positive screens. Those firms usually have policies and practices lauded by the firm's employees, customers, and other stakeholder groups.
A second focus of socially responsible investing is social advocacy. One example of social advocacy is the Investor Network on Climate Risk (INCR). The INCR is a network of over 60 institutional investors concerned with climate change. It consists of representatives from major institutional investors, a number of states, and over 15 countries. The INCR holds conferences, funds research, and it advocates in the area of climate change. On occasion, it also lobbies for climate change legislation.
Finally, another strategy of SRI is community investing. In this case funds focus their investments in areas such as non-profits, cooperatives, small businesses, community facilities, and affordable housing. The principle behind community investment is to make investments that will strengthen local communities. For further details see P.L.Cochran, *The evolution of corporate social responsibility*, in Business Horizons, Num. 50, 2007

[87] http://www.sri-connect.com/index.php?option=com_content&view=article&id=610&Itemid=1154

- Broad sustainability indices: they are constructed from top-down by filtering a conventional market index through broad-based sustainability screens. Examples of those indices are, among others, ASPI Eurozone, DJSI World, Ethibel Excellence Europe, EURO STOXX Sustainability.

- Specialist thematic indices: they are constructed from bottom-up by identifying stocks exposed to specific activities or issues. Renewable and clean tech indices are very common and climate change indices are becoming more important. There are also a number of other single-issue indices such as human capital management indices etc. Examples of those indices are, among others, ALTLEX Global, HSBC Climate Change, GANEX FTSE4Good, ISE Green energy Index.

CHAPTER II: CSR IN THE JUDICIAL SYSTEM

2.1 CSR and Soft Law

So far we have seen the meaning of the concept of corporate social responsibility, its development over the past decades, as well as its evolution within the market. The analysis also focused on the controversial debate on the subject, identifying the opinions of several experts that often diverge from each other.

In this regard, a topic that is important to further analyze is the relationship between CSR and the law. CSR, in fact, is a complex phenomenon but, in the juridical scenario, that complexity is even more evident. This makes its analysis particularly interesting[88].

CSR is the evidence of a changing market and of the new balance between the power of the Public State and the citizens/consumers. Therefore, it implies different types of regulation. Within this scenario, consumers also play a central role, as a key element of the market.

Thus, CSR is the expression of this new concept: enterprises are required to operate in the market in an ethical and responsible way, sometimes even going beyond law requirements and self imposing certain standards or codes of conduct.

[88] The subject links many field of the law, such as international law and european law, corporate law and corporate governance, tort law and contract law, procedural law, labour law, environmental law and criminal law. All of them affect – even if in different ways – the development of CSR and, consequently, the involvement of different actors. Thus, "laws have been drafted to promote socially responsible behaviour by companies. International organizations have promoted principles. Companies have adopted CSR mission statements and programs and are sharing their efforts through sustainability reports. NGOs have contacted companies and pointed out how they can operate in a more responsible way, and academics have analyzed all". See T.Lambooy, *Legal Aspects of Corporate Social Responsibility*, Utrecht Journal of International and European Law 1, 2014. Available at: http://dx.doi.org/10.5334/ujiel.bz

If, on one hand, this new reality enriches the legal scenario, on the other, it imposes to analyze the value of these acts at the regulatory level: does CSR have to be considered separate from the legal responsibility? Or are we in front of two sides of the same coin?

In order to provide a complete answer to this question we need to take a step back and make explicit the connection that exists between corporate social responsibility and an important principle: the principle of subsidiarity.

The analysis can start from this principle because CSR is nothing more than the affirmation and expansion of the principle of horizontal subsidiarity. Going in order, the etymology of the word expresses by itself the value that the principle has assumed in our system over the years. In fact, *subsidium* means help and it intervenes every time it is necessary to find the most appropriate level of territorial government, in the case there is a shared competence on a specific matter.

Briefly, there are two types of subsidiarity: vertical and horizontal one. In the first case, subsidiarity is the expression of the distribution of competence between different levels of territorial government and it implies that the intervention of the higher local authorities occurs only if the performance of the duties by the minor body is inadequate to achieve the objectives. By contrast, horizontal subsidiarity stems from a different premise, because it is based on the fact that private citizens (whether alone or associated) can provide by themselves for the treatment of certain collective needs of general interest. In those cases the authorities provide only subsidiary activities such as planning, coordination or management.

At the European level, the principle of subsidiarity is made explicit in the Maastrich Treaty[89], in the 5th Article. It appears alongside 2 other principles that are also considered to be essential to European decision-making: the principles of conferral and the principle of proportionality. As known, it determines when

[89] An analysis of the principle of subsidiarity within the Maastricht Treaty – that also highlights some objections on its incorporation in the Treaty is given by A.G.Toth, *The principle of subsidiarity in the Maastricht Treaty, Common Market Law Review*, Num. 29, 1992

the European Union is competent to legislate, and contributes to decisions being taken as closely as possible to the citizen[90].

In Italy, the principle is reported in the Constitution (art. 118.1) which regulates vertical subsidiarity, stating that administrative functions are attributed to the municipalities. However, when an uniform management is needed, those functions are conferred to provinces, metropolitan cities, regions and State, on the basis of the principles of subsidiarity, differentiation and adequacy.

In the same article, at the 4th paragraph, horizontal subsidiarity is regulated. The article establishes that the State, regions, metropolitan cities, provinces and municipalities should promote the autonomous initiatives of citizens, individual or group for the performance of activities of general interest, as suggested by the principle of subsidiarity.

Thus, horizontal subsidiarity expresses how to allocate responsibilities between local authorities and private individuals: the performance of activities of general interest lies with individuals or associations and the local authority has a subsidiary role in coordination, monitoring and promotion. However, the institution can take the complete power if the objectives can be carried out more efficiently and effectively.

Said all that, it is now clear why CSR can be seen as an extension of the principle of subsidiarity: because it symbolizes the new relationship between the public and private sectors, where companies are entrusted with the task of pursuing objectives of public general interest[91].

In fact, in the global economic transformations, the regulatory power of the state has become increasingly decentralized. Indeed, "the hierarchical

[90] Thus, the principle establishes if the European Union has to intervene in case of a shared competence with the European Countries. In any case the European Union will be competent only if its action could be more effective than the one of the member State. It is integrated with the principle of conferral which establishes that the European Union has only those competences that are conferred upon it by the Treaties. The principle of proportionality, instead, means that the actions implemented by the European Union in order to meet the objectives set by the Treaties cannot go beyond what is necessary.
See: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriservpercent3Aai0017

[91] To this regard see: M.S. Ablander, *Corporate Social Responsibility as Subsidiary Co-Responsibility: a macroeconomic perspective*, Journal Business Ethics, Num. 99, 2011

command and control regulation is being replaced by a mixture of public and private, state and market, traditional and self regulation institutions that are based on collaboration among the state, business corporations and NGOs"[92].

So, if in the past those polices were imposed by the adequate authorities, today, they are addressed through participation, negotiation and dialogue between the public and private sectors[93].

Consequently, the regulatory tools themselves are changing, as a broader array of them is now available. In this scenario, it is possible to distinguish two different kind of regulation: regulation of business and regulation for business. The former refers to regulation that imposes restrictions on corporate business for the common good (i.e. minimum standards for working conditions), while the latter refers to norms that protect or promote business interests (i.e. subsidies or contract laws). Thus, corporations may be in favor of regulation, both soft or hard, when it satisfies corporate self-interest.

Thus far we have seen that CSR has increasingly become a vehicle for integrating social and environmental concerns into the business decision-making process, and regulation in the social and environmental domain is usually considered regulation of business[94].

However, despite the general assumption that corporations prefer the regulation to be minimal, the experience shows that, when it is perceived to be

[92] A.Gill, *Corporate Governance as Social Responsibility: A Research Agenda*, in Berkeley Journal of International Law, Vol.26, Issue 2, 2008

[93] See e.g., D.Hess, *Social Reporting and New Governance Regulation: the prospects of achieving corporate accountability through transparency*, 17 Business Ethics Q. 455, 2007

[94] The principle of subsidiarity is recognized as a fundamental principle in the Maastricht Treaty, which does not solve the problems of competences within the Union but it structures them. Moreover, it represents "an attempt to resolve the inherent tension in the objective of integrating the Member States while at the same time preserving the identity of the constituent parts of the Union". See: N.Bernard, *The future of european economic law in the light of the principle of subsidiarity*, Common Market Law Review, Num. 33, 1996. Other interesting articles that analyze the different facets of the principle of subsidiarity are: P. Spicker, *The principle of subsidiarity and the social policy of the European Community*, Journal of European Social Policy, Vol. 1, Num. 1, 1991; K.Lenaerts, *The principle of subsidiarity and the environment in the European Union: keeping the balance of federalism*, Fordham International Law Journal, 1993; A.Jordan, T.Jeppensen, *EU Environmental Policy: adapting the principle of subsidiarity?,* Environmental Policy and Governance, Vol. 10, Issue 2, 2000

highly likely, corporations assume a pro-regulation approach and promote strategies in order to influence regulatory design.

Thus, the mixture of responsibility and governance has led to a growing set of rules and norms. In fact, on one side, corporate governance has been used for ensuring the public interest and for implementing good practices in business. On the other side, CSR supporters have been focusing on corporate governance in order to apply those good practices in the long term. While the debate about how to generate global governance to support sustainability is still open, there is a large consensus in favor of choices in this direction. This is why during the past decades several institutions, intergovernmental organizations, NGOs and associations have tried to define a framework in order to create a shared and efficient global governance.

The mutual interaction between social responsibility and corporate governance encompasses two of the most important socio-legal patterns: self regulation and meta regulation[95]. With regard to the former, it emerges as a complement to (and sometimes even a substitute) formal governmental regulation. In fact, the popularity of CSR has driven to a shift in norms as business increasingly accepts responsibility for its social and environmental impact, applying those practices on a voluntary basis. Examples of self regulation are the codes of conduct and the non financial reporting. Both of them are the expression of the link between governance and responsibility. As for the latter, it does not depend on the mechanism adopted by companies to govern their own policies, but they are pursued by external social actors to control companies' self regulation from the outside. Thus, meta-regulation is driven by social groups that

[95] Today, law and regulatory enforcement are used (by institutions, consumers, employers and NGOs) to enforce corporate economic, social and environmental responsibility. Thus, the law "is (directly or indirectly) requiring companies to implement governance measures such as compliance systems, whistle-blower protections, CSR reporting initiatives, stakeholder complaints and consultation processes etc, in order to build up their corporate conscience, to build values that transcend narrow self-interest into the practice and structure of the enterprise". See. C.Parker, *Meta-Regulation: Legal Accountability for Corporate Social Responsibility,* in The New Corporate Accountability: Corporate Social Responsibility and the Law, Doreen McBarnet, Aurora Voiculescu and Tom Campbell, eds., Cambridge University Press, Forthcoming. Available at SSRN: http://ssrn.com/abstract=942157

participate in the process, it makes self regulation more effective and, lacking the enforceable legal frameworks, it uses non legal instruments such as ground level activism, advocacy and media campaigns. Meta-regulation, then, becomes "a vehicle through which corporate governance and social responsibility merge and create a regulatory synthesis"[96].

In other words, companies can use two primary instruments: a) voluntary standards that serve as equivalent to formally legislated law and regulation; b) informal institutions at the international, transnational and national levels that depend on the participation of their members.

Therefore, many CSR initiatives in the past decades have developed into soft law[97] institutions with co-regulation through multistakeholder participation. As an example it is possible to mention the UN Global Compact[98] and the OECD Guidelines for Multinational Enterprises[99]. The former does not present strict compliance mechanisms, while the latter has more stringent elements.

Consequently, today business associations are embedded in layers of rules stemming from different sources. Those sources include both hard law and soft law. However, the need to find a faster solution has led to prefer soft law solutions. Therefore, "in the absence of hard laws and legal frameworks to

[96] A. Gill, cited.

[97] The generic term *soft law* refers to a wide array of instruments of different nature and functions. A commonly accepted definition does not exist but, generally speaking, it entails soft rules included in treaties, nonbinding or voluntary resolutions, recommendations, codes of conduct, and standards. The concept is analyzed in detail in the next pages.

[98] The UN Global Compact is an initiative to encourage businesses to adopt sustainable and socially responsible policies and to report on their implementation. It established ten principles in the area of human rights, labour, the environment and several strategic actions in order to advance broader societal goals such as the UN Sustainable Development Goals, with an emphasis on collaboration and innovation. The complete information is available at: https://www.unglobalcompact.org/

[99] The OECD Guidelines for Multinational Enterprises are a set of recommendations on responsible business conducts provided by the governments which aim to encourage and maximize sustainable development and social progress. The Guidelines are addressed to multinational enterprises operating in or from adhering countries. They provide voluntary principles and standards in areas such as employment and industrial relations, human rights, environment, information disclosure, combating bribery, consumer interests, science and technology, competition, and taxation. The Guidelines were first adopted in 1976 and have been reviewed 5 times since then to ensure that they remain a leading tool to promote responsible business conduct in the changing landscape of the global economy. See: http://mneguidelines.oecd.org/

govern the global economy, CSR emerges as an alternative approach to global governance, based on self-regulations and soft law mechanism"[100].

Generally, it is not always clear what is the link between CSR, soft law and hard law and there is no general consensus about whether or not CSR is able to create hard law.

Then, it is important, at first, to clarify some concepts. What are hard and soft law? What are the differences? Do they coexist or converge?

Hard law is defined as a "regime relying primarily on the authority and power of the state (…) in the construction, operation and implementation, including enforcement, of arrangements at the international, national or subnational level", while soft law is defined as "regimes that rely primarily on the participation and resources of nongovernmental actors in the construction, operation and implementation of a governance arrangement"[101].

Therefore, soft law refers to all the phenomena of regulation that cannot be considered hard law for the presence of two characteristics: on one hand, unlike the traditional standardization of instruments (laws, regulations etc) they are not the result of a formal and typical process of law production by the appropriate bodies (parliaments, governments, etc); on the other hand, they are characterized by the production of standards without a direct binding effect[102]. Instead, they impose themselves by way of effectiveness.

Soft law comes in many different forms such as codes of corporate responsibility, sustainability reports or even certifications or eco-labelling schemes. In any case soft law relies on two core features: a wide multistakeholders dialogue and investigation, public reporting and technical assistance.

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[100] M.Gjolberg, *Explaining Regulatory Prederences: CSR, Soft Law or Hard Law? Insights from a Survey of Nordic Pioneers in CSR*, in Business and Politics, Vol. 13, Issue 2, 2011

[101] J.J.Kirton, M.J.Trebilcock, I*ntroduction: Hard Choices and Soft law in Sustainable Global Governance*, in Hard Choices, Soft Law. Voluntary Standards in Global Trade, Environment and Social Governance, Ashgate Publishing Limited, 2004

[102] From another perspective, soft law can be seen as a technique used by States and International Organizations to achieve collective goals with limited constraint. At the international level in both the formation and the subject of soft law norms, the relation between the States is implicated.

The experience shows that soft law initiatives offer many advantages. First of all, soft law is easier to achieve and it goes further and faster than hard law. Secondly, it has a lower cost for governments and it is backed by a real dialogue between stakeholders. In addition, soft law is able to spur normative changes, creating the ground as an intermediate step to hard law.

However, soft law also presents several disadvantages. Indeed, it can be difficult for small groups to implement and to comply with voluntary standards. Also, sometimes particular stakeholders may be left out, compromising a democratic process. Finally, probably the biggest problem is the issue of compliance. In fact, an effective surveillance and enforcement mechanism is still missing. This can lead to incertitude, as competing sets of standards are available and there is no certainty about when governments might intervene and impose a potentially different mandatory regime[103].

Thus, the boundary between CSR and soft law is not that clear and sometimes it happened that soft laws initiatives have even acquired hard law characteristics[104].

Anyway, it is important to stress the characteristics of soft law that are evidently in contrast with the ones of hard law. First of all, soft law regimes do not imply any formal, legal and regulatory authority of governments. Second, the regime is voluntary, meaning that there is not a sanctioning power of state authority. Third, a consensus-based decision making is at the center of the process. Said all that, it follows that soft law can acquire several forms, including the ones in which governments participate in the definition of the regime but they do not dominate it.

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[103] In particular, soft law is often unenforceable because the parties retain discretion over the content of the obligation or over its exigibility. But this discretion – also called subjectivity – has a limit. Where the limit is established depends on whether the soft law is legal or not. In the first case, legal soft law is found in international agreements, or decisions of international organizations, which legally bind States which are parties to them. Non legal soft law, also found in international agreements, is not legally binding upon the parties. See: T.Gruchalla-Wesierki, *A framework for understanding soft law*, McGill Law Journal, 1984

[104] K.W. Abbott, D. Snidal, *Hard Law and Soft Law in International Governance,* International Organization, 54, issue 3, 2000; V. Haufler, *A public role for the private sector, Industry self regulation in a global economy*, Canergie Endowment for International Peace, 2001

In contrast, hard law implies that governments can act with their full authority, producing legitimacy, strong surveillance and the enforcement mechanism[105].

It seems, then, that hard law and soft law are the antithesis of each other. However, in the reality, hard law and soft law may be more complementary than competitive. In fact, sometimes they overlap and they are able to reinforce each other, completing the framework of the global governance. "These transitions between CSR, soft law and hard law, indicate that CSR is indeed relevant to the study of global governance and that the relationship between the three is better described as a continuum rather than as a dichotomy"[106]. In fact, sometimes soft law has been a stimulus for decisions or regulations attaining hard law versions.

Ultimately, it is clear now that many factors can influence soft law development. Thus, the society and the market forces, in the new form of intense globalization, are a major driver as they can expand and make soft law effective.

In the light of the above it is interesting to provide some solution for a more complete global governance framework. It is widely accepted that a single set of global soft law standards is more than desirable. That would reduce the uncertainty created by several standards and schemes. Some scholars, in fact, have pointed to a more hybridized and synthesized body of laws and norms regulating corporate practices[107]. In order to do that, the participation of economic multilateral organizations is needed.

In an interesting study[108] of the dynamics between CSR, hard law and soft law in the Nordic European area, the analysis shows that Nordic CSR pioneers prefer stricter and mandatory standards. In fact, the current structure of CSR does not seem effective in terms of causing responsible behavior but only in

[105] G.C.Ahaffer, M.A.Pollack, *Hard Law vs. Soft Law: alternatives, complements and antagonists in International Governance*, Minnesota Law review, 1994
[106] *Ibidem*
[107] A. Gill, cited.
[108] M.Gjolberg, cited.

terms of communicating it. However, CSR initiatives remain important as they can create an institutional platform where alliances can be made between governments, companies and NGOs. This could stimulate a more comprehensive and harmonized set of standards for the companies.

2.2 Soft law rules: codes and standards

As we have seen, soft law rules can be divided in two groups: published and internal regulations. Published codes contain specific rules of conduct that are part of the applicable law. They are codes of conducts, guidelines or agreements and they usually are on behalf of the employees and on behalf of the organization. The internal regulation includes highly ethical rules that are intended to operate beyond the law. They usually are on behalf of the subjects with discretionary power and include regulation in contracts, management handbooks or internal organization rules.

The codes

They can have different forms and contents. The most common and famous forms of codes are:

- The Code of Ethics: it is the charter of values of the company in which the company express its mission and the philosophy to which it is inspired in the conduct of the business. Those codes outline a set of principles that affect the decision-making process of the company[109].

- The Code of Conduct: it defines the conduct, the duties, the obligations and the ways of conduct to be followed. It entails a detailed behaviors list. This

[109] According to the International Labour Organization, there is great variance in the ways these codes are drafted. However, today, on the website of each multinational company it is possible to find one. To this regard see: Amazon - http://phx.corporate-ir.net/phoenix.zhtml?c=97664&p=irol-govConduct; Apple - http://www.apple.com/supplier-responsibility/; Google: https://abc.xyz/investor/other/code-of-conduct.html

way it governs the action of the company, outlining specific behavior that are required or prohibited. Legally speaking, it is the most relevant. Indeed, the European legislator often refer to it, recognizing its legal significance. The first definition of Code of Conduct appeared in the Directive 2005/29/EC on unfair commercial practices between businesses and consumers (incorporated in article 18 with cons, c1, letter f). It states that the Code has to be established voluntarily, once adopted it is binding and the company is obligate to inform consumers of its existence. Consequently, it is particularly relevant as its disrespect constitutes an unfair trade practice. That also explains the introduction of a Head of Code.

The Standards

The standards are rules of conduct of private production and voluntary adoption, that enable an organizations to realize its commitment beyond the law. They can be classified in several ways:

1) they can be general or specialized, according to their nature and object;

2) they can be behavioral standard or standard of the process, according to their content. In the first case they contain substantive requirements in terms of compliance, or in terms of levels of measurable performance through the use of specific indicators. In the second one, they contain requirements related to the quality of the process;

3) they can be relevant at a national or industrial level, depending on if they are oriented only to certain actors or to a specific industrial sector;

4) finally, there are regulatory standards that promote general principles universally recognized. They are expressed through

codes of conduct and ethical values (UN standards; Global Compact, OECD guidelines).

As for their structure, they usually come with a preamble, the principles and the rules that govern the duties. From a formal point of view they are similar to a legislative text[110].

However, to date, codes and standards appear as a container of heterogeneous rules grouped into two types: purely ethical rules, intended to operate beyond the law; and specific rules of conduct that have legal application. Nevertheless, they do not provide a legal sanction[111].

2.3 Corporate Responsibility vs Legal Responsibility: complementary or separate?

As we have seen until now, Corporate Social Responsibility is a complex concept. Its origin dates back to many years ago but it is evident that only recently, at least in Europe, the concept has been taken seriously. In fact, even if the phenomenon is not new, the globalization, the gap between industrialized and non industrialized countries, the financial crises and the increasing awareness of institutions, companies, associations, citizens and consumers who require a more equal and respectful economic system of social and environmental aspects, have led to its effective development.

However, there are still different inconsistencies and doubts about how companies practically apply CSR policies and, above all, whether and how it is possible to control them.

[110] Today, several International Standards have been developed with regard to almost all aspect of technology and business. A list of the International Standards Industrial Classification is available at: http://www.iso.org/iso/home/store/catalogue_ics.htm

[111] To this regard see: D.M. Trubek and L.G.Trubek, *Hard and Soft Law in the Construction of Social Europe: the Role of the Open Method of Co-ordination*, European Law journal, Vol.11, Issue 3, 2005; J.B. Skjærseth et al., *Soft Law, Hard Law, and Effective Implementation of International Environmental Norms*, Global Environmental Politics, Vol.6, Num. 3, 2006

We have also seen that jurists are the most skeptical about CSR and its effectiveness and, as it is based on a voluntary system, it is clear that all the instruments used to that scope should be considered in the framework of the soft law. Among them, the standards and the codes of conduct are the most widespread.

Nevertheless, the debate about the relationship between CSR and the law is still open and it is possible to individuate two extreme positions. On one side there are businesses who consider that the codes of conduct and other self-regulatory instruments create just moral obligation and they do not have any legal effect. On the other side, some academics developed the idea that the self-regulation could be a source of law at a national and at international level[112].

Therefore, It is clear that we are in a "grey zone" in which ethical and legal elements coexist.

More importantly, it is worth noting that self-regulation creates immediate obligation for those who adopt the rules which, consequently, become part of the regulatory system. It means that, in the case of a violation, the market would not be the only one reacting, as also the legal system would be implied.

This statement leads to another observation: depending on the mechanisms through which such standards take part of the regulation, it is possible to distinguish their direct and indirect relevance. The former applies when there is a formal acknowledgment of the juridical rule, which means that the juridical rule explicitly refers to the social rule. As a consequence, it becomes part of the regulatory system. The latter applies when the integration of the social rule depends on the organization. This occurs, for example, when the rules adopted contribute to define the contents of elastic rules of law: in such cases, they play a fundamental integrative function by "filling" the regulatory system[113].

[112] See C.Glinski, *Corporate Codes od Conduct: moral or legal obligation?*, in Corporate Social Responsibility and the Law, Cambridge University Press, 2007

[113] See: E. Bellisario, *La responsabilità sociale delle imprese fra autonomia e autorità privata*, in Danno e Responsabilità, 8-9, 2013; N. Irti, Due temi di governo societario (responsabilità "amministrativa" – codici di autodisciplina) in Giur. comm., 2003

Therefore, it is evident that «the rules of social responsibility have clear reflections of a public nature: they constitute interpretative and operational tools that complement and fill those "grey" or "empty" areas of the business activities, fulfilling functions that - for many reasons - neither the legislature nor the market are able to fully satisfy (…) The relevance of social responsibility does not end on the moral or social level, but it penetrates into the regulatory system» [114].

Thus, law is playing an increasing role in enforcing voluntary CSR policies and it seems that the two concepts are no longer separate, as new legal mechanisms to implement CSR are brought into play. For this purpose several actors are implied: government and intergovernmental agencies, private actors and the civil society.

In fact, even if in many cases governments demonstrated to be reluctant to make CSR requirements mandatory for the companies, they adopted an indirect strategy in order to foster CSR policies. There has been increasing intervention through, for example, the market pressure for the disclosure of a business review on non financial performance, as part of the annual reports that companies have to present every year. Firms have been required to disclose their strategies for identifying risks expressly related to social, environmental and ethical factors[115].

Another important actor for the promotion of CSR are the NGOs which have developed a significant pressure on the corporation at both external and internal level, buying shares and making themselves shareholders and exercising their rights.

Finally, civil society influenced directly the law, using the mechanism offered in private law, to make direct legal inroads on voluntary CSR[116].

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[114] *Ibidem.* The statement reported is a translation of a few lines of the cited article.

[115] That happened in Europe through the European Accounts Modernization Directive (2003/51/EC N. 2003 L178/2) and in other countries. In the US, the indirect fostering of CSR policies took place too. So, as an example, when the Foreign Corrupt Practices Act introduced tougher penalties for corruption, the Sentencing Commission introduced scope to mitigate them, if the corporation could demonstrate it had a code of conduct. Not surprisingly, these requirements proliferated very quickly.

[116] In this case one interesting example applied in the US is the Alien Tort Claims Act.

Therefore, it is clear that it exists a complicate interplay between legal, market and social forces in both governments and private actors.

These observations lead to answer the original question about how CSR relates to the regulatory system. The idea of CSR as a principle based exclusively on voluntary self-regulation provoked criticism and it certainly has some limitations. But it is evident that there has been a growing incentive through public and private initiatives for regulatory intervention that does not allow to consider CSR policies as only part of a self-regulation mechanism.

Indeed, law is being an instrument to enforce commitment by businesses to ethics, social and environmental responsibility and this is why CSR policies should be considered not only *beyond* the law but also *through* and *for* the law.

Thus, as Doreen Mc Barnet affirms in an interesting paper: «social and legal means need not be seen as alternatives for furthering corporate responsibility, but as complementary controls in a new style of corporate accountability that involves both legal and ethical standards (…) What is emerging in the arena of CSR is a complex interaction between government, business and civil society, private law, state regulation and self regulation, at national and international levels, with social, legal, ethical and market pressures all being brought to bear in ways that cut across traditional pigeon-holes»[117].

Ultimately, It seems quite clear now that CSR rules are not alternative to the rules of the legal system. On the contrary, it is possible to affirm that the two spheres are totally complementary.

2.4 Set of problems: relevance, control and heterogeneity of the rules

As we have seen, the rules of social responsibility, once adopted and made public, enter the legal system. They constitute a model, in which there is no hierarchy between the different sources and standards.

[117] D. Mc Barnet, *The new corporate accountability*, in Corporate Social Responsibility and the Law, Cambridge University Press, 2007

Therefore, a first issue to consider is how to frame the relationship of these standards with the general regulation. The rules of CSR may have direct and indirect relevance.

In the first case, the law itself refers to these rules. But even without an explicit reference these rules may still be recognized and then implemented with the state system through other mechanisms[118].

By contrast, the indirect relevance occurs when there is no explicit reference to it by the law but it is still possible to link CSR rules to the contents of general clauses or elastic norms. In that scenario, it is necessary to distinguish between those rules that are relevant only for the parts related to the contract (eg: employer/employee) and those that have a general efficacy.

Moreover, their degree of relevance is bound to change in relation to the various categories of stakeholders (internal/external) and depending on the role (active/passive) they assume.

In other words: the rule stemming from the autonomy is likely to assume the character of legality when there is a formal attachment to the law itself; alternatively, it can be indirectly linked to the law every time the interpreter is able to justify its application[119].

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[118] Examples of those mechanisms are: the reference (it can be receptive or not receptive); the assumption (by virtue of which the legal system contains provisions that recognize those of other jurisdictions); the use of elastic general clauses and standards: it allows the reference to policies that belong to other set of rules.
Some of these techniques realize a form of direct recognition: this occurs with the reference. In case of the assumption or elastic clauses there is indirect recognition.

[119] Within the Italian legislative framework there are different consequences related to the violation of a CSR rule. Clearly, the obligations have to be externalized. This means that there should be an expressed statement that put the community in a position to know them. Therefore, there are different hypothesis of violation that can be considered such as: the unilateral atypical promise (Art. 1987 Civil Code) if the commitment is linked to identified customers or the promise to the public (Art. 1989 cc) if the customers are not identified.
The most appropriate hypothesis is the promise to the public. The company is not only responsible for maintaining a certain behavior but also for ensuring the behavior of others, the violation of which may be required to respond in accordance with articles 1381 and 1228 cc and 2049 cc. On the administrative level, the AGCM (Authority for fair Competition) provides the control and repression (according to the article 18-27quater Consumers' Code) that may intervene ex officio or at the request of anyone interested. Moreover, among other hypothesis there are: promised quality (article 1497 cc), the contract with the proponent obligations (article 1333 cc), the contract in favor of third parties (article 1411 cc), the regulation of the unrecognized association (article 36 cc) or corporate regulation.

The second problem, probably the most important, is related to the lack of an adequate supervision. In fact, a proper level of transparency - able to ensure the effective application of the rules adopted - is missing. This is particularly important because it causes a damage for the businesses that act in a socially responsible manner and not for the mere image policy.

Moreover, there are some practical problems in standards and codes. Currently, it is possible to individuate a large number of different standards that can be very heterogeneous. This makes particularly difficult to choose between them, selecting the most appropriate. Also, not all the rules are verifiable and, when they are not, the control is entrusted exclusively to the stakeholders producing a problem of asymmetric information and transaction costs.

As for the codes, their content can be vague and general, making the control function difficult to apply. This is why they are often perceived as useless because of the lack of a proper supervision.

Then, it is clear that many of the proposed solutions can be confined to the theory. The basic problem is the fact that CSR rules only rarely have the degree of specificity required to consider them a source of legal obligations. The problem is also confirmed by the very limited law cases[120].

[120] As we have seen there is no governmental regulation on CSR and this often leads corporations to adopt codes of conduct, containing principles and values that the members of the company should follow. However, even if there is no specific regulation about CSR, through the Directive 2003/51/EC (Modernization Directive) it has been established that large companies are obliged to publish financial and non financials reports, in order to show their commitment to socially responsible values. Even if the controlling of the respect of those values and parameters is easier said than done, in the past a few cases against big companies have taken place. This is the case of Coca Cola and WalMart. Regarding Coca Cola, the company was accused by an Indian NGO who reported the presence of pesticides in the beverages. The Indian government undertook various investigations and they concluded that Coca Cola had not violated any national law but, even if acknowledging that, stricter standards were needed. The controversy affected Coca Cola image and the company was pushed to take damage control measures such as its first environmental report on operations in India. It seems that the controversy represented a learning experience for the company. As another example it can be cited the one of Walmart, accused of gender discrimination. The controversy commenced as a national class action but, after different steps, the Supreme Court held that the nationwide class certification approved by the lower courts was not consistent with the Federal Rule of Civil Procedure Article 23(a) governing class actions. However, since then, Walmart has changed drastically its reporting culture. Currently, Walmart publishes a full and complete report on CSR issues called 'Global Responsibility Report' which

Finally there could be additional problems, such as the proof of the link between the cause and the damage, which indeed reduce the effectiveness of the protection, and the fact that the subjects damaged by the violation of the rules of CSR may not easily exercise the remedies offered.

In fact, the jurisprudence does not really accept those rules because of their lack of substance and because they are considered as long-term objectives. For the consumers, there are even greater difficulties, as it seems unlikely for them to act against the company that did not honor its commitment. In this case, certainly the Class Action could be more effective.

The enforcement of rules of social responsibility (control and verification of the conformity between standards adopted and their implementation and adoption of corrective measures and penalties) is primarily entrusted to the market. The control can be either internal (supervisory board and head of the code) and external (certification bodies). Compliance with the rules is guaranteed by reputational mechanisms (staff incentives, back picture, rewards and sanctions, disciplinary sanctions, loss of reputation).

Beside the enforcement of the market there is also that one guaranteed by the regulations (through independent administrative authorities, who are in charge of the public interest). The observance of the rules is entrusted to reward mechanisms (economic incentives) and sanctions (sanctions and remedies).

The idea behind the European regulation and the principle of subsidiarity is that the legal enforcement should support only the social enforcement. In fact, this would both strength the penalty system and would make sanctions more efficient, in terms of economic analysis of the regulation.

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covers three dimensions: “People, Planet, Profit”. For further details see : C.A. Cedillo Torres et al, *Four Case Studies on Corporate Social Responsibility: Do Conflicts Affect a Company’s Corporate Social Responsibility Policy?,* Utrecht Law Review, Volume 8, Issue 3 (November) 2012; T.Lambooy, *Legal Aspects of Corporate Social Responsibility,* Utrecht Journal of International and European Law 1, 30(78), 2014; A. Vives, *Corporate Social Responsibility: The Role of Law and Markets and the Case of Developing Countries,* Chicago-Kent Law Review, Vol. 83, Issue 12, 2007

However, the enforcement of the CSR rules appears inadequate not only in relation to sanctions and remedies, but also in relation to their control and, even more upstream, in relation to the content of such rules.

Then, new tools are needed, as well as actions and solutions that make the system more efficient.

In the light of the analysis, it is clear that the ethical regulation cannot escape a thorough and careful public regulation, setting out the strategies and techniques that guarantee its effective operation.

However, this can be considered only a partial conclusion that does not solve the debate about technical and policy problems.

According to the doctrine, legislation should continue to formulate principles within which private production rules may work better. Thus, hard control is needed in order to create the conditions for a better functioning of the system.

This can be achieved through the formulation of a Code that sets the general criteria for their creation and for their effectiveness, requiring companies to specify the content of their commitments and to formalize it in clear rules and to establish consistent procedures and adequate tools for monitoring and verification.

Moreover, a common framework at the European level would be desired, with fixed criteria, standards and indicators, through the creation of a network of public authorities.

Finally, the analysis shows that there is urgent need to establish more effective sanctions and to design public policies to encourage responsible consumption and investment.

PART II

Agro-energies

CHAPTER III: AGRO-ENERGIES IN THE RENEWABLE ENERGIES SCENARIO

3.1 Current developments in Energy Markets

The global economic growth, the human development, the nutrition of the future generations, the water supply and the climate change[121] represent huge challenges for the future. Those elements make necessary to develop a reliable, clean and widespread energy system.

However, there is a lot of uncertainty about the future because of the global economic and geopolitical situation and new technical innovations. Thus, the energy sector involves several actors and it is based on the development of an array of elements that are difficult to evaluate. This makes harder to predict both energy supply and demand, and environmental and social contexts[122].

The world-wide crisis of 2008 strongly affected the energy sector and it took different years to adapt to major disruptive changes and to individuate new trajectories, in order to be prepared for a more diverse set of possible futures.

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[121] The agreement was welcomed with great satisfaction of the representatives of the 195 countries who took part in the Climate Conference. However, although it is not the place to dwell on the subject, it must be shown a critical element that politicians did not reveal but which preoccupied technicians. Not by coincidence, the table was attended by representatives of political education which have replaced important climatologists. Thus, if the agreement represented a good result from the diplomatic point of view, there is not the same guarantee for the effects it will have on climate. To date it only established a general objective, which does not seem to be so binding as it has been indicated. In addition, the goal of reduction of the emissions between 70 and 95percent was abandoned. Rather, it is appreciable the introduction of a fund for developing countries but it is still early to give an opinion on this topic, since it would be necessary to know what conditions will apply to such loans. Finally, the Agreement will enter into force only from 2020 onwards.
The full text of the document is available at the following link:
http://unfccc.int/documentation/documents/advanced_search/items/6911.php?priref=6000088

[122] Therefore, after the economic crises that broke up in 2008-2009, many arguments have been opened about the role of the state and its impact on the economic policy. Which direction economic policies will take depends on the recovery of the world economy as well as how governments react to the crises. In this scenario the environment plays a crucial role, as new theoretical approaches have been taken into consideration. Moreover, as know, the development of the energy sector is strictly related to the economic growth and the environmental policies that will be adopted. For further details see World Energy Council for sustainable energy, *World Energy Scenarios – Composing energy futures to 2050*, 2012

Considering the energy outlooks provided by a wide number of Institutions and Authorities operating in the field, the only indisputable element is that the energy demand will continue to increase, due to the growth of the non-OECD countries. Nevertheless, there are no certainty about energy prices, economic trends, CO_2 emissions and technological developments. All elements that will count for the creation of a robust global policy and energy infrastructure. There is indeed great dynamism in investment signals with cheap natural gas prices de-linking from oil prices, collapsing solar prices, uncertain carbon emission prices or increasing nuclear costs affected by enhanced post-Fukushima safety requirements[123].

In the light of this scenario it is understandable why the economic policy actors are implementing strategies able to create a resilient energy infrastructure both for the short term and long term, because it has also to be able to adapt to different future scenarios and withstand technology innovation or global policy developments.

In any case, in order to make the energy future sustainable, several countries all over the world have understood that more attention had to be paid to issues such as pollution, the environment and energy efficiency[124].

Today it is clear that there is no a single-fit-for-all solution that will provide the future energy demands while minimizing the consequences on the environment. Instead, the energy production will use different sources, calibrated on their availability in different countries of the globe, according to their economic, social and environmental situations[125].

[123] *Ibidem*

[124] Thus, as the World Energy Council highlights, the energy efficiency plays a central role not only for ensuring energy supply but also for other elements such as competitiveness, social aspects and climate change. Energy efficiency can be promoted by governments in different ways. On one hand there are financial ways – loans, incentives, subsidies – and, on the other, there are behavioral approaches, meaning that governments have to make consumers aware about energy efficiency and all the issues related to it.

[125] S. Carrà, *Lo scenario energetico globale, quali sfide?* In S. Carrà (a cura di), Le fonti di energia, il Mulino, Bologna 2008

This is the reason why, as explained in the Annual Report on Energy Efficiency[126], all the major industrial countries have established strategic objectives to be pursued in the near future: China has set itself the goal of reducing by 16% its energy intensity by 2015, the United States has adopted new standards for energy efficiency, Japan attempts to reduce energy consumption by 10% by 2030, and Europe, as we will see deepen further, has committed to reduce by 20% its emissions of greenhouse gases within 2020.

The International Energy Agency individuated six main areas where action is required. Thus, it is necessary to: 1) make the energy efficiency tangible, strengthening the transparency and the quantification of the economic benefits associated with it; 2) make it a key for the decision-making processes of public and private bodies; 3) facilitate public-private partnerships; 4) develop a system of rules that is capable of discouraging less efficient forms of incentive; 5) use monitoring and verification systems; 6) invest more in capacity for governance and management of energy efficiency policies.

However, despite the good intentions, we are still far from reaching the established goals.

According to the scenario outlined by the World Energy Outlook[127], two-thirds of the global economic potential of energy efficiency are still unused. Therefore, the situation does not seem to be sustainable both in economic terms of energy security and environmental protection.

Continuous research by the major industrialized countries is necessary, as it is important to develop new efficient strategies, also taking into account the technological knowledge that, in this framework, can and should play a fundamental role.

[126] ENEA, 2015. The report can be downloaded at: http://www.enea.it/en/publications/abstract/RAEE-Executive-summary-2015

[127] International Energy Agency, World Energy Outlook 2015: http://www.worldenergyoutlook.org/

Within the energy scenario it is possible to distinguish different kind of energies. The first distinction has to be made between non renewable and renewable energies.

The first category entails fossil fuels (petroleum, gas and coal) and nuclear fuels.

Fossil fuels are derived from organic matter which has been trapped between layers of sediments within the Earth for millions of years. They have decomposed and compressed over time, leaving what are known as fossil fuel deposits. These deposits, and the materials produced from them, are highly combustible, making them an energy source.

Nuclear fuels, instead, are obtained through the mining and refining of uranium ore. It is interesting to stress that they are the cleanest energies among the non renewable ones. The process implies the gathering of the uranium and compounding it into rods, then submerged into water. When it reaches critical mass, uranium begins to break down and release energy which heats the water it is immersed in. The heated water then creates pressure which drives the turbines that generate the electricity we use.

Within the energy market, the renewable energies are those who come from natural resources such as sunlight, wind, water, biomass and geothermal heat, replacing conventional fuels in different kind of uses. Consequently, the most important are: solar, wind, hydroelectric, biomass and geothermal power[128].

[128] There are many forms of renewable energy. Briefly, a few words on each of them is noteworthy. First of all, the solar energy is the one that relies on the nuclear fusion power from the core of the sun. It can be produced by using different methodologies, such as, for example, through mirrors and boilers and photovoltaic cells. Secondly, wind power depends on the movement of the atmosphere and it can be used to pump water or produce electricity. Third, the hydroelectric energy uses the gravitational potential of water that was lifted from the ocean by the sunlight. Furthermore, the geothermal power is the result of the heat storage in the earth's surface. Finally, the offshore wind, wave and tidal energy are still under study. To this regard, a good background reading on renewable energy technologies (but not their economics) can be found in the book "Renewable Energy – Without the Hot Air" by Professor David MacKay of the Cambridge Physics Department, which is available free online in HTML or pdf. formats at http://www.withouthotair.com. It is a very good non-technical introduction to the basic engineering of energy systems and renewable energy technologies. Another basic item for background reading is the recent (June 2011) Special Report on Renewable Energy of the

Considering the scenario described above, it is clear that renewable energies will play an important role in the future. Being impossible to analyze each one of them, in the next chapters this research will focus on the renewable energies deriving from biomass.

Generally speaking, biomass is biological material derived from living, or recently living organisms. It most often refers to plants or plant-derived materials which are specifically called lignocellulosic biomass. As an energy source, biomass can either be used directly via combustion to produce heat and electric energy, or indirectly. In this case it is converted in biofuels. This conversion of biomass to biofuel can be achieved by different methods which are broadly classified into: thermal, chemical and biochemical methods. Wood remains the largest biomass energy source today; in the second sense, biomass includes plant or animal matter that can be converted into fibers or other industrial chemicals, including biofuels. This argument will be further analyzed in the next paragraph.

3.2 Agro-energies: what they are and how they work

Within the agro-energies, biofuels represent a wide range of fuels derived from biomass. They are fuels composed of or produced from biological raw materials and they serve as a renewable alternative to fossil fuels in particular in the transport sector.

Biomass is defined as "all renewable organic matter including plant material, whether grown on land or water animal products and manure; food processing and forestry by-products; and urban wastes[129]".

Intergovernmental Panel on Climate Change (IPCC): it is available on their web site at http://srren.ipcc-wg3.de/report

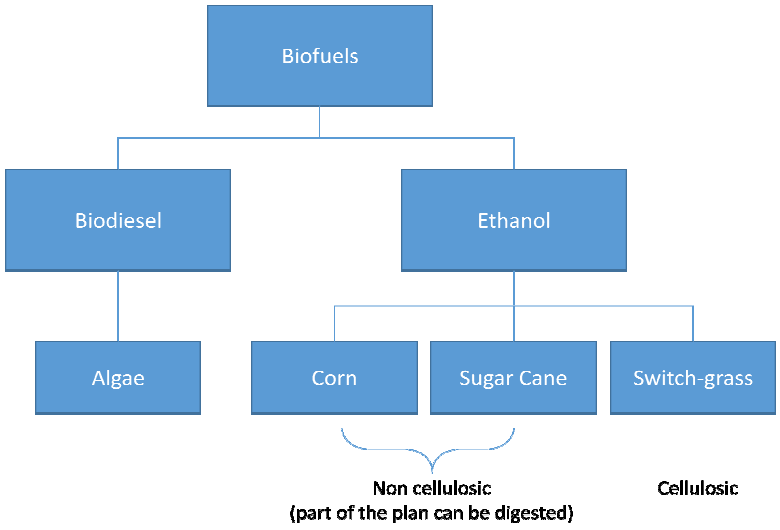
That site – www.ippc.ch - also has a short version of the report for policymakers. This report focuses on the economics of renewable energy, and it and the MacKay book provide good background reading.

[129] B. Stout, *Energy use and management in agriculture*, North Scituate, MA7 Breton Publishers, 1984

They can be located in a space where modern global challenges interlink, including mitigating climate change and the development of sustainable energy and economies[130].

There are different types of biofuels, depending on where they are derived from and on the different technology that is used in the conversion process. In order to simplify it is possible to consider biofuels as sub-divided into two large categories: biodiesel and ethanol.

Fig.1: Biofuels classification



Source: Author elaboration

The former, which replaces diesel in cars, is produced from oil rich plants (e.g. rapeseed, sunflower, algae, etc.) by mixing the vegetable oil with methanol. The conversion process is called trans-estherification.

The latter, which replaces petrol in cars, it is also known as an alcohol and it is produced from both non cellulosic ethanol (through the fermentation of sugars from cereals as corn or from sugar cane) and cellulosic ethanol (as switch-

[130] J.Tait, *The ethics of biofuels*, CGB Bioenergy, Num. 3, 2011

grass). Ethanol can be used as pure ethanol, or blended with gasoline, in order to reduce petroleum use.

An important characteristic to be considered is that, theoretically, biofuels are carbon neutral, because they do not result in fossil carbon being released into the atmosphere[131]. The idea behind that is that all of the carbon contained in biofuels is absorbed earlier from the atmosphere by photosynthesis in plants. However, different studies[132] argue that this is not completely true because it doesn't consider changes in land use. In fact, in order to allow biofuel-growing

[131] Also, biofuels can be classified depending on their "generation": first, second or third. First Generation biofuels are produced directly from food crops by abstracting the oils for use in biodiesel or producing bioethanol through fermentation. Crops such as wheat and sugar are the most widely used feedstock for bioethanol while oil seed rape has proved a very effective crop for use in biodiesel. However, first generation biofuels have a number of associated problems. There is much debate over their actually benefit in reducing green house gas and CO_2 emissions due to the fact that some biofuels can produce negative net energy gains, releasing more carbon in their production than their feedstock's capture in their growth. However, the most contentious issue with first generation biofuels is the trade off with food. As the majority of biofuels are produced directly from food crops the rise in demand for biofuels has lead to an increase in the volumes of crops being diverted away from the global food market. This has been blamed for the global increase in food prices over the last couple of years.
Second Generation biofuels have been developed to overcome the limitations of first generation biofuels. They are produced from non-food crops such as wood, organic waste, food crop waste and specific biomass crops, therefore eliminating the main problem with first generation biofuels. Second Generation biofuels are also aimed at being more cost competitive in relation to existing fossil fuels. Life cycle assessments of second-generation biofuels have also indicated that they will increase "net energy gains" over coming another of the main limitations of first generation biofuels.
The Third Generation of biofuels is based on improvements in the production of biomass. It takes advantage of specially engineered energy crops such as algae. The algae are cultured to act as a low-cost, high-energy and entirely renewable feedstock. It is predicted that algae will have the potential to produce more energy per acre than conventional crops. Algae can also be grown using land and water unsuitable for food production, therefore reducing the strain on already depleted water sources. A further benefit of algae based biofuels is that the fuel can be manufactured into a wide range of fuels such as diesel, petrol and jet fuel.
Four Generation Bio-fuels are aimed at not only producing sustainable energy but also a way of capturing and storing CO_2. Biomass materials, which have absorbed CO_2 while growing, are converted into fuel using the same processes as second generation biofuels. This process differs from second and third generation production as at all stages of production the carbon dioxide is captured using processes such as oxy-fuel combustion. The carbon dioxide can then be geosequestered by storing it in old oil and gas fields or saline aquifers. This carbon capture makes fourth generation biofuel production carbon negative rather than simply carbon neutral, as it "locks" away more carbon than it produces. This system not only captures and stores carbon dioxide from the atmosphere but it also reduces CO_2 emissions by replacing fossil fuels.

[132] See: D. Schneider, Biofoolish, IEEE Spectrum , Vol. 47, Issue 1, 2010

farms, several mature forests are cleared and the carbon that would otherwise accumulate in those forests ought to be counted on ethanol's balance as well[133].

Moreover, virtually, all forms of carbon neutral energy actually involve the burning of fossil fuels. In fact, some ways of producing biofuels are controversial because fossil fuel has to be used in the production process.

"Some sources of bioethanol are in this grey area, and there are also concerns about environmental damage caused by the production of biofuels from crops. Solar cells, wind and hydroelectric turbines are all produced and transported using fossil fuels to some extent. The technology exists to make these things truly carbon neutral, but it is hopelessly uneconomic at this time"[134].

The next paragraph is dedicated to analyze the different kinds of biofuels.

1. Non Cellulosic

1.a) Corn

Corn has been converted into ethanol for thousands of years, but only in the past century its use as fuel greatly expanded[135]. Corn biofuel is produced by means of ethanol fermentation and distillation. The conversion process includes grinding, cooking with enzymes, fermentation with yeast, and distillation to remove water. For fuel ethanol, two more steps are included: using a molecular sieve to remove the last of the water and denaturing to make the ethanol undrinkable[136].

On one hand corn grain makes a good biofuel feedstock due to its starch content and its comparatively easy conversion to ethanol. Theoretically it also reduces CO_2 emissions. However, on the other hand, there are several aspects to

[133] The World Street Journal, *Sins of Emission*, Review and Outlook, Oct.29 2009
[134] N.Z. Muradov ,T.N.Veziroğlu, *Green path from fossil-based to hydrogen economy: An overview of carbon-neutral technologies*, International Journal of Hydrogen Energy, Vol. 33, Issue 23, 2008
[135] An interesting overview is given by: D.Pimentel and T.W.Patzek, *Ethanol production using corn, switchgrass and wood, biodiesel production using soybean and sunflower*, Natural Resource Research, Vol. 14, Num. 1, 2005
[136] F. John Hay, *Corn for Biofuel Production*, University of Nebraska-Lincoln Extension, 2014

be considered. One of the most important is that it requires an extensive use of land, and the net result on emissions could be negative when clearing the land needed to grow the corn is taken into account. Furthermore, there are several short term and long term adverse effects of removal of crop residues for biofuel and other purposes[137].

This is why, even if nowadays corn is still the principal input used for the production of biofuels, the process leads to substitute it with other biomass which seems to be more sustainable in the long run (i.e. second generation biofuels). In fact, according to the Energy Information Administration, using the current corn-to-ethanol conversion of 2.8 gallons of ethanol from a bushel of corn, total US corn production could result in approximately 37 billion gallons of ethanol, which would provide approximately 26% of the US 137 billion gallon-per-year gasoline consumption. However, it is clear that using all the US corn for ethanol is not realistic.

Throughout history, the United States has seen a steady increase in the yields of both corn and ethanol production. But today, the commonly accepted opinion is that producing biofuel from corn is not economically and environmentally attractive and new patterns have to be followed.

1.b) Sugar cane

Sugarcane ethanol is an alcohol-based fuel produced by the fermentation of sugarcane juice and molasses[138].

The comparison with fossil fuel shows that one unit of fossil fuel energy is required to create 8.3 up to 10 energy units resulting from ethanol. Brazil and India produce almost 60% of all the sugarcane in the world, with Brazil currently

[137]See: R. Lal, *World crop residues production and implications of its use as a biofuel*, Environment International, 2005

[138] See also: CENBIO*, Market and Policy Frameworks for a Sustainable Production and Trade of Biofuels: An Assessment of the Status in Principal Producing Countries*, ICTSD Report The International Centre for Trade and Sustainable Development, 2007; S.T Cohelo, J. Goldemberg, O.Lucon, P Guardabassi, *Brazilian Sugar cane ethanol, lessons learned*, Vol. 10, Issue 2, 2006; J.Goldemberg, *The Brazilian biofuels industry*, Biotechnology for Biofuels, 2008. Those two articles, even if focused on the Brazilian market of biofuels, provide an overview on this kind of biofuel and its perspectives.

producing 35% of the global total[139]. In 2012/13, Brazil produced 588 million tons of sugarcane, which yielded 38 million tons of sugar and 23.2 billion liters (6.1 billion gallons) of ethanol. That makes Brazil the world's largest sugar producer and second largest ethanol producer, behind the United States.

It is a clean and low-carbon biofuel. However, sugarcane processing only occurs for part of the year, depending on the harvest timing for cane lines and regions. Moreover, it begins to decay as soon as it is harvested and must be processed within a few days, which implies logistical problems for transport and storage.

It has several important features that differ from corn, even if they both are a tall warm-season grass. For example, corn harvest is in the form of grain which is a condensed package of carbohydrates, protein, oil, and secondary nutritional substances that can be stored (for up to three years) and has good flow characteristics for handling and transport. By contrast, as we have seen before, sugarcane must be processed immediately after harvest. Consequently, the mills are closed down for about half of the year.

Moreover, one byproduct that is not present in sugarcane but it is present in the processing of corn to ethanol is protein. Corn is used to produce ethanol and livestock feed while sugarcane can be used only to generate edible sugar or ethanol, but not both. In consideration of the global population growing and the trend towards eating more nutritious diets with higher protein, this element does not favor the use of arable land for crop that does not contribute protein.

Despite these differences, it is worth noting that both sugar cane and corn imply the trade-off between fuel and food. Therefore, it seems that not even sugarcane represents the solution in the long run.

[139] J.McLaren, StrathKirn Inc., *Sugar Cane as a feedstock for biofuel*, National Corn Growers Association, White Paper, September 2009

2. Cellulosic

2.a) Switch grass

In the light of the above it is clear that all non cellulosic solutions imply the use of food and, consequently, the trade-off between food and energy is generated. According to Extension (America's research based learning network) switchgrass has excellent potential as a bioenergy feedstock for cellulosic ethanol production, direct combustion for heat and electrical generation, gasification, and pyrolysis. This is why the US Department of Energy (DOE) selected switchgrass as the herbaceous model species for biomass energy. The fuel produced from switchgrass feedstock is cellulosic ethanol[140]. This alcoholic fuel is created by a chemical process of breaking down the cellulose (the structure that makes up the cell walls in the plant), adding yeast to it and fermenting the compound into alcohol. Once it is refined, the ethanol produced can be used as fuel.

Switchgrass has several positive characteristics in order to use it for energy:

- it easily adapts and grows quickly. In fact, sometimes it is considered invasive;
- it has high yield compared to other species in varied environments;
- it requires minimal agricultural inputs, it is relatively easy to establish from seed;
- it is also resistant to drought and requires little, if any, fertilizer. This means that it requires less fossil fuel expended on production (i.e. for the use of tractors and pumps).

Less irrigation and less fertilizer, then, means reduced energy input, which, in turn, means less cost and fewer greenhouse gas emissions. Moreover, switchgrass is rich in cellulose. This makes it more valuable as a source of ethanol. It also contain lignin, a byproduct created when water is eliminated from cellulose. This element is still under study but it seems that it could be used

[140] M.R.Schmer, K.P. Vogel, R.B. Mitchell, *Net energy of cellulosic ethanol from switchgrass*, Proceedings of the National Academy of Sciences 105.2, 2008

as a fuel to power ethanol production plants, making ethanol processing self-sustaining.

The researcher Michael Wang (Argonne National Laboratory) calculated the energy ratio for switchgrass. He found that every one unit of energy put into cellulosic ethanol production from switchgrass created 10 times the energy output. This is much higher than ethanol derived from corn. By contrast, gasoline has an energy ratio of 1 to 0.81, which means it requires more energy to produce than it yields. Wang also found that switchgrass ethanol may require 70% less fossil fuel to produce than gasoline and E85 ethanol, a mixture of 85% ethanol and 15% gasoline, emits 86% fewer GHGs than gasoline does.

Despite all these positive characteristics, there are also negative ones. For example, switchgrass is not easy to process, as it is the harder and inedible structural part of the plant. Researchers are trying to discover the best way to convert cellulose into ethanol more efficiently. Moreover, even if such waste would not compete with food, there are several demerits of its use.

In particular, the assumption that most of the biomass for bioenergy would come from fast-growing trees and grasses planted for energy does not take into account that growing grasses and trees requires fertile lands, resulting in potential competition with food production. Even the possibility to use poorer and less fertile land tends to be inefficient as it still uses land that is important for carbon storage, watershed protection, wildlife habitat and other benefits.

However, in a research published in 2012, which compares corn ethanol feedstocks with the perennial cellulosic feedstocks switchgrass, the authors found that if perennial grasses were planted on only the land that it is currently used for corn ethanol, GHG would be reduce and the amount of carbon sequestration and biomass would increase. That happens because switchgrass needs less fertilizer than crop and it also increases carbon sequestration compared to corn. In particular, they concluded arguing that “replacing corn ethanol in the Central US with low input, high yelding perennial grasses could

potentially increase the regional productivity of food (+4%) and feedstocks for fuel (+82%) without causing additional Indirect Land Use Change"[141].

Therefore, research is promoting biofuels of second generation instead of those of first generation.

2.b) Algae

Algae is one of the most promising element in the search for a more environmentally-friendly, mass-produced product that can be converted into fuel[142]. In fact, it presents several positive elements that make it desirable:

- algae grows naturally all over the world;
- under optimal conditions, it can be grown in massive, almost limitless, amounts;
- half of algae's composition, by weight, is lipid oil.

Scientists have been studying this oil for decades to convert it into algae biodiesel, a fuel that burns cleaner and more efficiently than petroleum. After a long research, the National Renewable Energy Laboratory concluded that the high-yielding plant, if produced in large enough amounts, could replace fossil fuels for home heating and transportation purposes[143].

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[141] S.C.Davis and al., *Impact of second-generation biofuel agriculture on greenhouse-gas emission in the corn-growing regions of the US*, Frontiers in Ecology and the Environment, 2012

[142] According to the US Department of Energy the wide array of varieties of algae presents "an incredibile number of unique properties that can be harnessed to develop promising algal biofuels technologies". It is interesting to stress that the idea of using algae as a source of fuel was proposed in the early 50s. Researchers started with coltivating algae in open ponds, reaching the first significant contributions to understand how to obtain fuel from algae. However, this process stopped for a few years as a consequence of the financial crisis and the cheap oil. Recently, the higher global demand for transportation fuels, concerns about the increasing impacts of atmospheric CO_2, as well as the energy security risks, have fueled a rebirth in the interest of biofuels in general and algae-based biofuels in particular. To this regard there are many interesting articles that are worth to be read: C.S.Jones, S.P.Mayfield, *Algae biofuels: versatility for the future of bioenergy*, Current opinion in biotechnology, Vol. 23, Issue 3, 2012; R.H. Wijffels, M.J. Barbosa, *An outlook of microalgal biofuel*, Science, Vol. 329, Issue 5993, 2010. And some links: http://www.biofuelsdigest.com/bdigest/2014/10/13/where-are-we-with-algae-biofuels/; http://energy.gov/eere/bioenergy/algal-biofuels

[143] National Renewable Energy Labaratory, *A Look Back At the US Department of Energy's Aquatic Species Program: Biodiesel from Algae,* . July, 1998 at http://www1.eere.energy.gov/biomass/pdfs/biodiesel_from_algae.pdf

There are more than 100.000 different species of plantlike organisms that belong the algae family. Besides their different forms and colors they differ for the levels of oil they contain. They are easy to grow and can be manipulated to produce huge amounts without disturbing any natural habitats or food sources. They only need water, sunlight and carbon dioxide.

They can be used in order to produce biodiesel, since some species can make large quantities of lipids as their biomass under certain growth conditions[144]. The production of biodiesel depends on the type of algae being used, the way the algae is grown, and the method of oil extraction.

During the biodiesel production process, algae consume carbon dioxide. In other words, through photosynthesis, algae pull carbon dioxide from the air, replacing it with oxygen: they capture CO_2 by converting it into reduced carbon sources as biofuels. For this reason, algae biodiesel manufacturers are building biodiesel plants close to energy manufacturing plants that produce lots of carbon dioxide. In fact, recycling carbon dioxide reduces pollution.

The harvesting cycle for microalgae is very short (less than 10 days – crop once or twice a year) and the harvest could be done several times. Moreover, pressing algae creates a few more useful byproducts, fertilizer and feedstock, without depleting other food sources.

Algae is a very promising element in order to produce a new fuel. According to some researchers, the production has the potential to outperform other biodiesel products such as palm or corn. Newman wrote that «a 100-acre algae biodiesel plant could potentially produce 10 million gallons of biodiesel in a single year. Experts estimate it will take 140 billion gallons of algae biodiesel to replace petroleum-based products each year. To reach this goal, algae biodiesel

[144] R.Razeghifard, *Algal biofuels*, Photosynth Res, Num. 117, 2013

companies will only need about 95 million acres[145] of land to build biodiesel plants, compared to billions of acres for other biodiesel products[146]».

A research conducted in 2006 showed that both corn grain ethanol and soybean biodiesel production have a positive net energy balance. However, if ethanol yelds 25% more energy than the one used for its production, biodiesel yelds 93% more. Interestingly, almost all of the gain related to corn ethanol comes from the energy credit for its coproduct, which is animal feed. In fact it requires an high energy input. Moreover, biodiesel releases less noxious substances and greenhouse gas emissions are reduced 12% by the production and combustion of ethanol and 41% by biodiesel. They argue that what makes biodiesel more convenient is the fact that it needs lower agricultural inputs and the conversion of feedstock to fuel is more efficient.

With the advent of synthetic biology and, advances in process engineering, the costs of obtaining oil from algae has significantly decreased[147]. Today research in algae biofuel is increasing and over the past decade in the US, more than 2 billion in private funds have been invested in algae research and the private sector is complemented by federal and state investments. In fact, the cost of developing algal biofuel for commercialization is currently reduced by government funding opportunities in the area of clean energies, as "production of algae for biofuel can spare the much needed farms for crops since ponds or photobioreactors can be built even on barren lands".

However, the harvesting of algae and extraction of oil is a complicated technological challenge and more research is still needed.

[145] To make a more intuitive comparison it is interesting to stress that an acre is a unit of area containing 4,840 square yards and approximately the same size as one football pitch.

[146] S.Newman, *How algae biodiesel works*, 18 June 2008 at http://science.howstuffworks.com/environmental/green-science/algae-biodiesel.htm, 24 March 2015

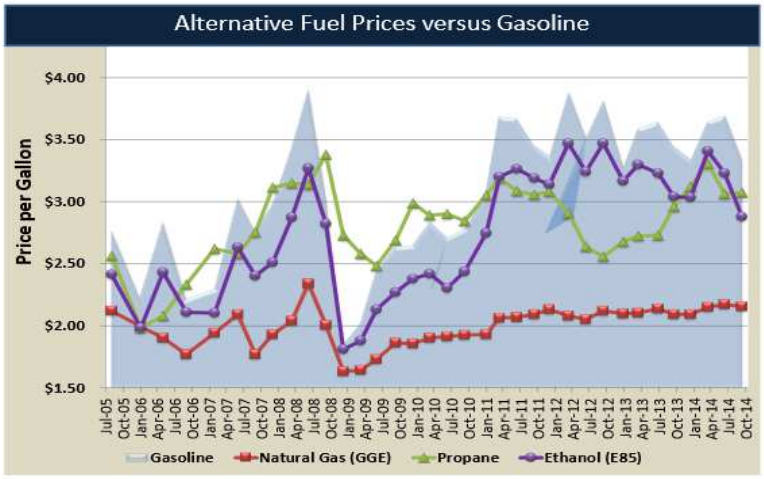
[147] R.K. Dixon, Alga.e based biofuels, Mitigation and Adaptation Strategies for Global Change, 18, 2013

3.3 Problems

3.3.1 The economic aspect of biofuels

In order to be a viable alternative for a fossil fuel, biofuels should have not only environmental benefits compared to the traditional fuel, but they also have to be economically competitive with it, producible in sufficient quantities and they should allow energy gains over the energy sources used to produce them[148]. The figure below shows a comparison between natural gas, ethanol, propane and gasoline prices in the US from 2005 to 2014. Ethanol has been competitive with gasoline prices for the last 10 years. The same cannot be said for biodiesel during the same period. However, ethanol production costs can be highly volatile because they are dependent on the cost of the corn.

Figure 2: Alternative Fuel Prices vs Gasoline



Source: Alternative Fuel Data Center 2014

[148] Moreover, whether a biofuel provides net benefit to society depends on many factors including a thorough accounting of the direct and indirect inputs and outputs for their full production and life cycles. See: J.Hill and al. *Environmental, economic, and energetic costs and benefit of biodiesel and ethanol biofuels*, The National Academy of Sciences of the USA, Vol.103, Num. 30, 2006; W.G. Festel, Biofuels – economic aspects, Chemical Engineering & Technology, Vol. 31, Issue 5, 2007; G.R. Timilsina, D. Zilberman, *The impacts of biofuels on the economy, environment and poverty: a global perspective,* Resource Management and Policy, 41, 2014; M. Dos Santos Bernardes; Economic effects of biofuel production, In Tech, 2011

In general, the competiveness of biofuels varies across countries and continents. United States and Brazil are the world leaders in the production of ethanol, while the largest producer of biodiesel is Europe. However, it is important to consider that United States and Europe have to manage different costs of raw materials. Thus, if in Europe they account for 80% of biodiesel manufacturing cost, in the US corn ethanol contributes only for 50% of these costs[149].

A comparison between biofuels and fossil fuels prices in Europe is shown in the table below. We can see that the difference in price between biodiesel and diesel is larger than the difference in price between ethanol and gasoline.

Table 1: EU Biofuel Wholesale Prices vs. Fossil-Fuel Prices (Untaxed)

Average EU price per litre, Euros 2011			
Ethanol (EUR cent)	,63	Biodiesel (EUR cent)	,90
Ethanol adjusted for energy content (EUR cent)	,85	Biodiesel adjusted for energy content (EUR cent)	,99
Gasoline (EUR cent)	,72	Diesel (EUR cent)	,77
Difference per litre - energy adjusted (EUR cent)	,13	Difference per litre - energy adjusted (EUR cent)	,22

Source: GSI and IISD 2013

However, Europe has not developed yet the full economies of scale potential of biofuels and there are also expectations for technological improvements. Nevertheless, even if according to different studies biofuel's cost could drop significantly in the future[150], others show a more pessimistic scenario[151].

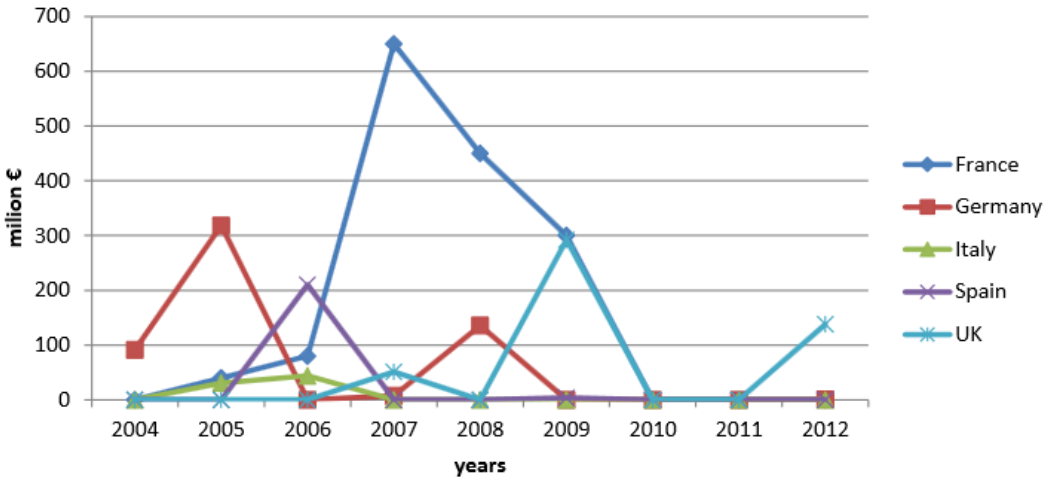
[149] INRA, Annual Report, 2007

[150] *Ibidem*

[151] For example, Festel et al., affirmed that even in 2020 biofuels will not be competitve with oil at a price of 50 euros. However, biodiesel from waste oil, from palm oil, and bioethanol from lignocellulosic waste are the most promising in terms of competitiveness by 2020. See: Festel et Al. (2013); Festel, Würmseher, Rammer, Boles, Bellof, *Modelling production cost scenarios for biofuels and fossil fuels in Europe,* Journal of Cleaner Production; Elsevier; 66, 2014; p. 242-253

As for the investments in biofuels, the trend of the principal European countries[152] is reported in figure 3.

Figure 3: Investment in Biofuels in the EU 2004-2012



Source: GSI and IISD 2013

3.3.2 The controversial trade off: food – fuel

Negative environmental consequences of fossil fuels have promoted the search for renewable transportation biofuels. In fact, they should provide a net energy gain and several environmental benefits. However, as we have partially seen above, not every kind of biofuel has been greeted with the same enthusiasm.

In fact, since the beginning of their development, crop related biofuels have been subject to several critics for the intense global competition for land and the cost of not using that land for food.

The modern discussion dates back to the '70s when some countries adopted alternative energy sources to petroleum and in the early '80s studies

[152] For further details see: Biofuels Research Advisory Council, *Biofuels in the European Union, A vision for 2030 and beyond*, 2006, available at: https://ec.europa.eu/research/energy/pdf/biofuels_vision_2030_en.pdf

conducted in Brazil demonstrated the direct (through shifting areas of cultivation) and indirect (through increasing prices) impacts of biofuels development. The subject lost some attention during the last part of the '80s but, during the '90s, the need for environmentally sustainable economic growth led the academic and the business world to focus again on the competition between agriculture for food and biofuels production. Moreover, the debate reached global significance, while at the beginning it was restricted to Brazil and US. Thus, according to several published studies[153], biofuels are considered as one of the principal factor of increasing feedstock and food prices. In this regard, it is interesting to mention an econometric study[154] by Roberts and Schlenker on the effect of the biofuels mandates on food prices. In particular, by estimating demand and supply elasticities of agricultural commodities, the authors evaluated the impact of ethanol subsidies and mandates on food commodity prices.

Briefly, what they found can be summarized as follows. Considering that the policy implemented in the US had redirected 5% of world caloric production into ethanol production, the authors estimated that corn price will increase of 30%[155], if none of the corn is recycled. Otherwise, the price increase would be lowered. Recently, another study showed two levels of impact (first and second order impacts) of land use for agro-energy. Thus, the shift of lands from production of wheat to corn and soybean to sugarcane, the increased price of land, the conversion of forests and pastures, are some of the first order impacts. Among the second order elements, there are the increase in the price and fall in

[153] See: D.Mitchell, *A Note on Rising Food Prices*, World Bank Policy Research Working Paper Num. 4682, 2008; Scott Baier et al., *Biofuels Impact on Crop and Food Prices: Using an Interactive Spreadsheet*, International Finance Discussion Papers Number 967 March 2009; HLPE, 2013. Biofuels and food security. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome, 2013

[154] M.J.Roberts and W. Schlenker, *The US biofuel mandate and world food prices: an econometric analysis of the demand and supply of calories*, 2010

[155] It is noteworthy that the authors took into consideration other factors for the increase of corn price, such as: the rising of oil prices, the increase in the demand for basic calories from emerging economies (i.e. China), the decrease in supply due to detrimental weather, the devaluation of the dollar (as the US is the largest exporter of agricultural commodities), the commodity price boom (even if this element is still debated) and the temporary export bans in Vietnam and India.

the stocks of wheat and soybeans, with respective decline of exports, the increase of food prices and land values.

However, it is important to stress that also rising oil price, unfavorable weather conditions and increase in demand from developing countries have contributed to the rise of the prices.

On the other hand, there are scholars who argue that there is not effective competition for land use between food and biofuels[156], pointing out several elements to prove their thesis. In particular, they consider that nearly all the lands incorporated for biofuels have been marginal. Moreover, among other arguments, they consider the promising development and use of cellulosic ethanol, the increase of agricultural productivity, the existence of land available to be incorporated and the incorporation of pasture lands[157], as elements that, in the long run, would minimize the impacts from this competition. "Although logical, such arguments cannot be taken as factors to deny the likely existence of competition in the short run, until the alternatives indicated for development of new crop varieties and products are actually available on a commercial scale. Hence, in the short term there is no way to avoid some degree of competition[158]".

Nevertheless this dichotomy of positions, nowadays the concern about the foreseen population growth and the consequent environmental problems is acquiring more importance.

Worldwide, out of the total 13 billion hectares of land area on heart, the percentages in use are: cropland, 11%; pasture land, 27%; forest land, 32%; urban, 9%, other, 21%. This last percentage is mostly useless because it is too infertile or shallow to support plant growth or the climate is too adverse. Currently, "the use of biomass covers about 13% of the global primary energy demand, and biomass supply potential is very dependent on the land availability,

[156] R. Rathmann, *Land use competition for production of food and liquid biofuels: an analysis of the arguments in the current debate*, Renew Energy, Num. 35, Issue 1, 2010
[157] *Ibidem*
[158] *Ibidem*

crop yelds, population growth, food demand, economic development, food production efficiency and competing biomaterial products"[159].

According to a recent study of the World Resources Institute, the world needs to close a 70% gap between the crop calories that were available in 2006 and the calorie needs anticipated in 2050[160]. Moreover, the Institute considers a growing demand by more than 80% for meat and dairy and for commercial timber and pulp. This is why the authors have a very skeptical view about the use of bioenergy in order to combat climate change and to achieve a sustainable food future. Interestingly, they also argue that if crop-based biofuels were totally eliminated, the 2050 crop calorie gap would decrease significantly, from 70 to 60%. But they specify this prevision is based on FAO biofuel projection and they consider it to be modest, as it does not take into account that some of the largest fossil fuels regions, such US and Europe have established some targets to achieve that imply the use of 10% of biofuel transportation by 2020 (today it is estimated that biofuel from food crops provide approximately the 3% of world transportation).

Thus, they argue that if this scenario is confirmed, the crop calorie gap will increase from 70% to about 90%. "Assuming perfect energy conversion efficiency, meeting 10% of this amount with biofuels would require about 24% of the energy contained in all the world's crop in 2010. Conversion inefficiencies would raise this figure to 29%. These calculation ignore the additional net fossil energy needed to produce biofuel, which means that a 10% biofuel target (…) would probably produce less than 2% of global delivered energy on a net basis"[161].

Therefore, the conclusion of the authors is that for meeting the need of food and, at the same time, the bioenergy target by 2050, it would be necessary

[159] A.Ajanovic, *Biofuels versus food production: Does biofuels production increase food prices?*, Energy, 36, 2011

[160]Searchinger T. and R. Heimlich, *Avoiding Bioenergy competintion for food crops and land*, Working Paper, World Resources Institute, January 2015

[161] *Ibidem*

to at least double the world annual harvest of plant material in all forms and they find it both unrealistic and unsustainable.

Are there alternatives?

Researchers have been studying different alternatives in order to avoid all the problems related to crop biofuels. In fact the large-scale use of biofuels will probably not be possible unless second generations technologies, based on biomass that requires less arable land, can be developed commercially.

One of the most accepted solution is using cellulosic biofuels, which are usually referred as second generation biofuels. In fact, several analysis show that biofuels would provide greater benefits if their biomass feedstock were producible with low agricultural input, on a land with law agricultural value and with a low-input energy.

Nonfood feedstocks (i.e. switch-grass) offer advantages in these sense, complying with the energetic, environmental and economic criteria. However, most plans for those biofuels rely on planting and harvesting fast-growing trees or grasses which still needs relatively flat and fertile lands. This means that there is still some competition with food, even if it is lower.

An alternative would be harvesting existing forests or grasslands or woody savannas. In this case the negative aspect is that it would reduce the forest's carbon storage and its ability to support biodiversity.

Other options could be using abandoned farmland or degraded land. But in both cases they are lands that, even if abandoned or degraded, are still important to people, climate and biodiversity.

Ultimately, there are other possibilities which can be considered, such as crop and forest residues left behind after harvest, municipal solid waste and urban wood waste, unused manure, timber processing wastes and methane from the decomposition of organic matter in landfills. However, estimates on these wastes vary and they do not seem reliable yet. Finally, solar energy would

be better but it is more expensive than burning biomass and third generation biofuels such as algae are still under studying.

3.4 Future scenario

The future of biofuels is of keen interest worldwide, as it can change the globally energy scenario. Since the 2000 its production has multiplied, reaching approximately 30,8 billion gallons in 2013, of which 23 of ethanol. However it still covers only the 3% of the global transportation fuel, while its potential is much higher. Its rapid expansion had indeed risen expectation about substitutes of oil-based fuel, but there have been also increasing concerns about the impact of rising commodity prices. According to the International Monetary Fund, world food prices rose 10% in 2006 because of increases in corn, wheat, and soybean prices, primarily from demand-side factors, including rising biofuels demand.

Therefore, "the outlook for global biofuels will depend on a number of interrelated factors, including the future price of oil, availability of low-cost feedstocks, sustained commitment to supportive policies by governments, technological breakthroughs that could reduce the cost of second-generation biofuels, and competition from unconventional fossil fuel alternatives"[162].

Thus, the future of biofuels is still full of uncertainties such as the development of unconventional fossil fuels alternatives (i.e. oil sands and heavy crude oil, and the conversion of coal to oil) and concerns about environmental trade-offs. However, one crucial element is the extent to which the land intensity of current biofuels production can be reduced. "The amount of biofuel that can be produced from an acre of land varies from 100 gallons per acre for EU rapeseed to 400 gallons per acre for US corn and 660 gallons per acre for Brazilian sugarcane. Cellulosic ethanol could raise per acre ethanol yields to more than 1,000 gallons, significantly reducing land requirements".

[162] W. Coyle, *The future of biofuel, A global Perspective,* Economic Research Service, Vol. 5, Issue 5, 2007

The question remains: is there a positive environmental balance in using biofuels (including the potential to reduce emissions)?

If it is true that biofuels are theoretically carbon neutral (as we have seen before, they in fact release CO_2 recently absorbed from the atmosphere by the crops used to produce them), in their evaluations it is also important to take into account a life-cycle analysis that considers not only the combustion phase, but also the production and processing of the feedstock into fuel. This aspect will be analyzed in the next chapter. Here, it is worth noting that "most studies indicate that the net energy balance of biofuels is positive (energy output is greater than energy input), but estimates vary widely. Net balances are small for corn ethanol and more significant for biodiesel from soybeans and ethanol from sugarcane and from cellulose. The biofuel with the highest net energy balance reduces GHG the most when compared with that for gasoline". Considering its importance, this topic will be analyzed separately in the next chapter.

Another fundamental element for the future of biofuels would be the technological progress and the efficiency gain in order to reduce the economic cost and the environmental impacts of biofuels production.

To summarize, the future of biofuels will depend on a number of interrelated factors, first of all its profitability which, in turn, depends on several elements, such as oil price and feedstock prices. Some authors argue that the role of biofuels in global fuel supplies is likely to remain modest because of its land intensity. In fact, in the US, replacing all current gasoline consumption with ethanol would require more land in corn production than the one used for all agricultural production. But it is also true that technology will play a central role in the future of biofuels. In fact, "if the energy of widely available, cellulose materials could be economically harnessed around the world, biofuel yields per acre could more than double, reducing land requirements significantly".

In order to be a viable alternative, biofuels should provide a net energy gain, have environmental benefit and be producible in large quantities without

reducing food supplies. Thus, global demand for food will play an important role within the coming 50 years and the development of renewable energies that do not interfere with food supply are needed. Therefore, biofuels that are not food based are likely to be of greater importance in the long term because of their potential to provide fuel supplies with less environmental damage.

Within this scenario, the role of the governments in defining the regulatory marks regarding the use and the distribution of the land is of the utmost importance[163], also considering that the amount of land available worldwide is limited. Thus, it is necessary to establish the fraction of farmland that could be used for the production of biofuel, without compromising important sources of nourishment. Also, implementing biofuels certification standards considering aspects such as land use and management and farming techniques, could be another pattern to follow.

It is important to individuate specifically identified lands with a potential to grow high biomass and taking into consideration a long term perspective.

In the last decades biofuels production has been driven by governmental policies such as mandatory blending targets, tax exemptions, subsides and import tariffs. "It will be a demanding task to couple capacity expansion with environmentally sustainable production while limiting biofuels' burden on national targets"[164].

Finally, according to the OECD/FAO Agricultural Outlook 2014, it is likely that the policies considered both in the US and Europe are not going to reflect the reality of the next decade. They, in fact, "may face explicit downward revisions in the future[165]". However, the main uncertainty for biofuels is related to the availability of advanced biofuels whose development depends strongly on current research and new technologies.

[163] J. Escobar et al., *Biofuels: Environment, technology and food security*, Renewable and Sustainable Energy Reviews, 13, 2009

[164] G. Sorda et al, *An overview of biofuel policies across the world*, Energy policy, 38, 2010

[165] Biofuels, OECD-FAO Agricultural Outlook 2014, Chapter 3, it can be consulted at: http://www.agri-outlook.org/publication.html

CHAPTER IV: BIOFUELS CHAIN PRODUCTION AND LIFE CYCLE ASSESSMENT

4.1 Biofuels Production Chain

According to the FAO definition "biofuel production chain describes the production process starting from the production of biomass to the technological transformation of biomass to biofuel"[166]. A biofuel production chain is characterized by the type of biomass feedstock and the energy carrier produced (fuel).

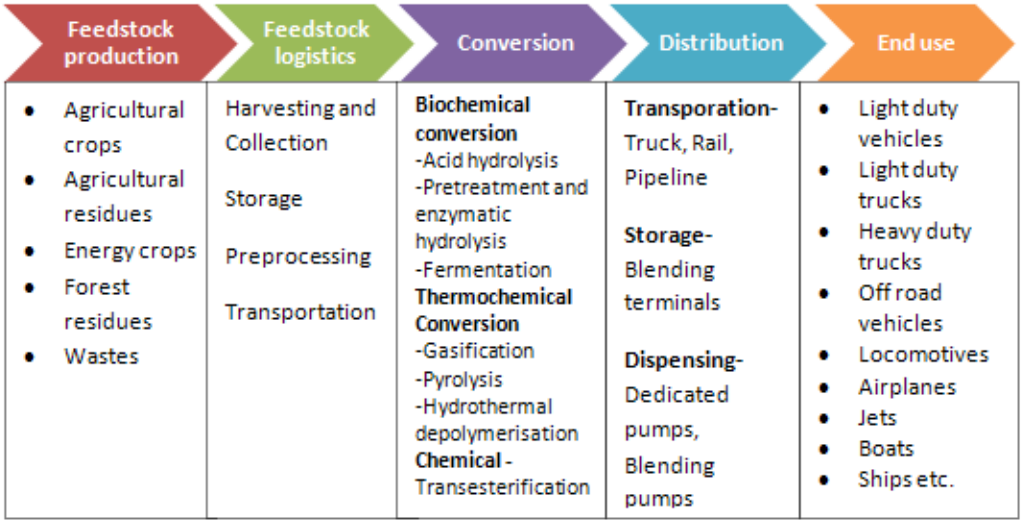
Analyzing the biofuel production chain provides a general overview of the production system, allowing to identify potential issues related to the process, considering biophysical, technical and economic parameters[167].

The production chain entails 5 steps: feedstock production, feedstock logistics, conversion, distribution and end use. The figure below synthesizes the different phases of the process.

[166] FAO, Climate, Energy and Tenure Division (NRC) publications, *Bioenergy and food security*, 2010. Available at: http://www.fao.org/docrep/013/i1968e/i1968e02.pdf

[167] To this regard it is important to cite the Report published within the framework of the European Commission for the project "*Clean views on clean fuels*" which had the aim to provide a structured and clear data on the performance of biofuels and the best strategies for their production on a large scale. For further details see: E Van Thuijl, R Van Ree, TJ De Lange, *Biofuel Production Chain*, *Background document for modelling the EU biofuel market using the BIOTRANS model*, 2003

Fig.4 : Biofuels production chain



Source: FAO

The study of the production chain of biofuels is particularly significant in an international scenario in which the environment, the climate change and its mitigation are a very important, if not dominant, topic[168]. Consequently, one global way of combating this problem is the use of biomass, since it offers numerous environmental benefits. However, such benefits are accompanied by a series of possible ecological drawbacks. For instance, agricultural production of biomass is relatively land intensive, and it partly involves higher transport costs than fossil fuels. There is a risk of polluting water with nitrates, phosphates and

[168] During the United Nations Framework Convention on Climate Change that was held in 1992 in Rio de Janeiro it was established that "Parties to the Convention should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with common and differentiated responsibilities and respective capabilities. Accordingly, the developed Parties countries should take the lead in combating climate change and the adverse effects thereof". Thus, it is clear that, already 20 years ago, the problem of the climate change was at the center of the international debate. Since then, many steps have been taken and substantial progress have been reached, although it has been highly variable across goals, countries, and regions. Recently, the UN published a new agenda, *"Transforming our world: the 2030 Agenda for sustainable development"*, which is a plan for people, planet and prosperity, encompassing 17 goals and 169 targets. As for the ones related to the planet, the Summit commit to protect the planet from degradation, including through sustainable production and consumption and sustainably managing its natural resources (goal 12 and 13). To consult the complete document: https://sustainabledevelopment.un.org/post2015/transformingourworld

also pesticides and plant protection agents. Finally, there is the danger of reducing biodiversity if biomass is cultivated in monocultures.

Thus, considering that environmental impacts do not only arise during the energy conversion in power stations or in the combustion plant itself, but they can also result in the course of the entire life cycle of the energy source in question from its origin to the final use, this type of analysis must be carried out for the overall life cycle, from the production of the raw materials, their supply, right up to the end sink[169].

Therefore, it is clear that the biomass-to-energy process options imply an intricate matrix of choices based on feedstock options, technology availability and end-use applications. The choice between them will depend on the types, quantities, and qualities of biomass feedstock available as well as the most suitable and economically-viable type of biomass to energy processing technology locally available.

Thus, considering the first steps of the process, two types of approach can be distinguished. In the first scenario the pathway to be follow can be chosen considering the available feedstock, and then, the technological options for its conversion. In the second scenario, the preferred energy carrier can be chosen considering the energy market needs, and then, the most appropriate technology and the feedstock options available to produce it.

With regard to the technology conversion routes available for converting biomass to biofuel it is important to stress that there are three main processes: thermo-chemical, physical-chemical and bio-chemical processes. Thermo-chemical processes are based on the use of thermal energy to carry out the chemical conversion of biomass to an energy carrier. The most common thermo-chemical technologies include combustion, gasification, pyrolisis and/or carbonization. Physical-chemical technologies involve physical and chemical processes such as the production of crude vegetable oil and biodiesel from oilseed crops or from used cooked oil and animal fat. Biochemical conversions

[169] Kaltschmitt et al., *Life cycle analysis of biofuels under different environmental aspects,* in Biomass and Bioenergy, Vol.12, Num. 2, 1997

are based on biological processes commonly through the use of microorganisms or enzymes to mediate the conversion of biomass or organic waste materials to produce ethanol or biogas, respectively.

Ultimately, the last components in the biofuels supply chain are the fuel distribution and the end-use systems. They both ensure that biomass-derived fuel products can reach their market and be used by consumers as a replacement for petroleum-based fuels in an efficient and sustainable way [170].

4.2 Methodology and application of Life Cycle Assessment

The life cycle assessment is one of the latest methodologies developed in order to make ecologically sustainable human activities, using preventive instruments every time is possible.

The definition of LCA, at first proposed by SETAC (Society of environmental and Toxicology and Chemistry) and then included in the standard ISO 14040 (UNI EN ISO 14040, 2006) recites as follows: "LCA is a technique for assessing the environmental aspects and potential impacts associated with a product, by:

- compiling an inventory of relevant inputs and outputs of a product system;
- evaluating the potential environmental impacts associated with those inputs and outputs;
- interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives of the study.

LCA studies the environmental aspects and potential impacts throughout a product's life (i.e. cradle-to-grave) from raw material acquisition through production, use and disposal. The general categories of environmental impacts needing consideration include resource use, human health, and ecological consequences"[171].

[170] D.Yue at al., *Biomass-to-bioenergy and biofuel supply chain optimization: Overview, key issues and challenges*, in Computers and Chemical Engineering, Num. 66, 2014

[171] International Standard, *ISO 14040, Environmental management, Life cycle assessment, principle and framework*, 1997. For further details see: http://web.stanford.edu/class/cee214/Readings/ISOLCA.pdf

Therefore, LCA is basically a quantitative technique that allows to determine the input (raw materials, use of resources, energy, etc.) and output (energy consumption, waste generation, emissions) factors of each product by assessing the resulting environmental impacts.

It has developed fast over the last three decades, being a merely energy analysis at the beginning and becoming a comprehensive environmental burden analysis[172].

The definition makes clear that a product must be analyzed during all the phases of the process. In fact, by modifying only one phase of the process, the negative environmental impact could be moved elsewhere. In other words, the benefits obtained with the improvement implemented on one phase would be balanced in a negative way by the problems caused on the other phases.

Thus, through this method it is possible to identify the critical issues of every step, the individuals involved and the information that is necessary in order to perform the improvements.

The standardization of LCA took place thanks to ISO 14000 (14040 and 14044) which describes the general criteria and methodology whose to address an LCA. It is of considerable interest both for the private and public sector and it is applicable to several internal management tools, such as:

1. help, identify, quantify, interpret and evaluate the environmental impacts of a product or service;

[172] The environmental Life Cycle Assessment has developed fast during the past decades. The first studies recognized as LCA date from the late '60s. At the beginning they encompassed only the energy analysis which took into account energy efficiency, pollution control and solid waste. Soon, they extended to a more comprehensive model, including environmental and costing analysis. So, from the '70s to the '90s, several LCS studies were published, using different approaches, terminologies and results. This is why in the next decade (1990 – 2000) the scientific world looked for a more standardized method coordinating users and experts in order to harmonize the LCA framework, the terminology and the methodology. It is important to stress that, since 1994, the International Organization for Standardization (ISO) has been involved in the standardization of methods and procedures. Nowadays different International Standards are available. For further details see: J.Guinee et al., *Life Cycle Assessment: past, present and future, in Environment Science Technology*, 45, 2011; ISO 14040 International Standard, *Environmental management - Life cycle assessment - Principles and framework*, International Organization for Standardization, 2006; ISO 14044 International Standard, *Environmental management – Life cycle assessment - Requirements and guidelines*; International Organization for Standardization, 2006

2. select the relevant indicators of environmental performance using them to compare the products with the same function;

3. compare the environmental impacts of a product with a reference standard;

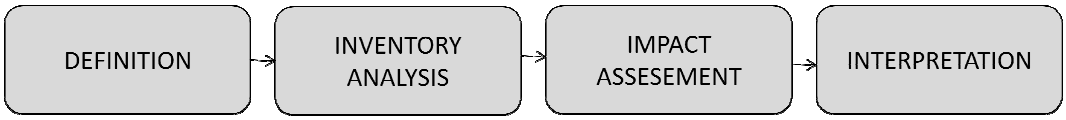
4. identify opportunities for improving the environmental aspects of a product, selecting the phases of the life cycle that have a higher environmental impact;

5. assist private industries and the public administration in the decision-making process (i.e. strategic planning, priority setting, planning or redesign of products, processes or services);

6. communicate the environmental information (i.e. through EMAS or marketing strategies such as eco-labels, advertising of products compatible with the environment).

An LCA study encompasses four phases: a) The goal and scope definition phase; b) The inventory analysis phase; c) The impact assessment phase; d) The interpretation phase. They are shown schematically below:

Fig. 5: LCA process



Source: Author elaboration

The first phase consists in the definition of the scope, meaning that the boundary of the system is established as well as the level of detail for the LCA. Obviously the depth and the breadth of a LCA can differ considerably depending on its goal.

The second phase consists in the life cycle inventory analysis (LCI). It is an inventory of input/output data with regard to the system being studied. It involves collection of the data necessary to meet the goals of the defined study.

The life cycle impact assessment phase (LCIA) is the third phase of the LCA. During this phase additional information on the product's system is gathered in order to better understand its environmental impact.

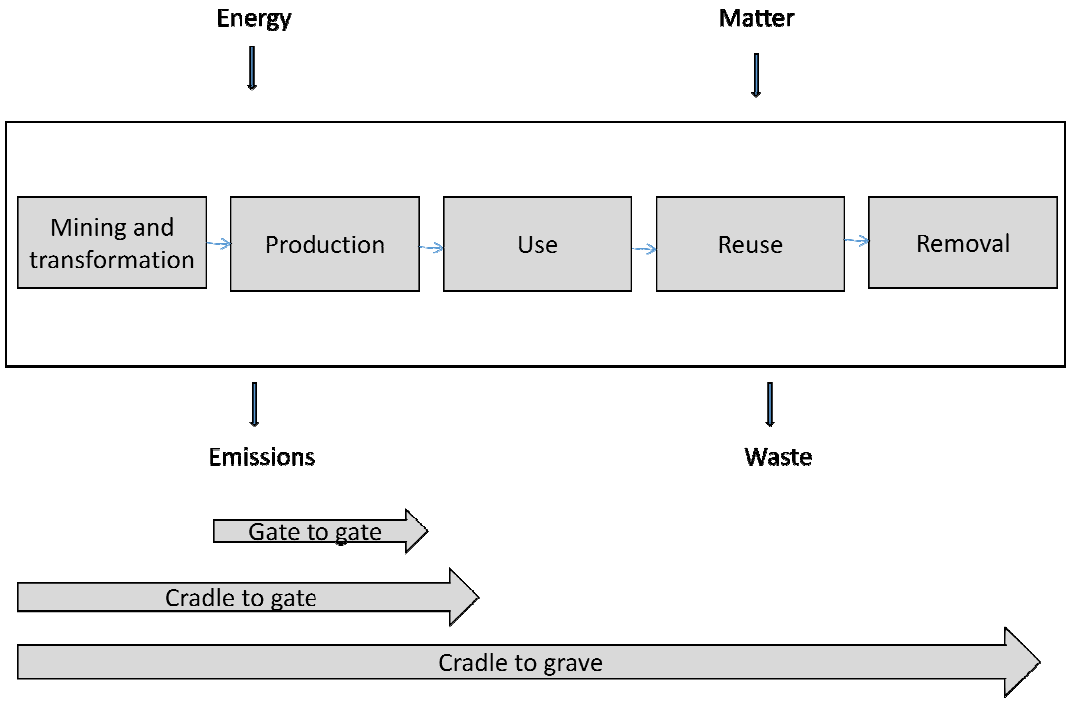
Finally, life cycle interpretation is the final phase of the LCA procedure, in which the results of the LCI or the LCIA, or both, are summarized and discussed as a basis for conclusions, recommendations and decision-making, in accordance with the goal and scope definition[173].

Performing an LCA through the all process can be both complicated and expensive, in terms of time and money. This is why at the international level, different methodologies to simplify LCA have been developed, to make it faster and cheaper, without compromising its completeness and the results.

The intervention is possible at two different levels: on the process, by developing software tools able to manage the LCA; and on the methodology, by limiting the objectives, eliminating phases of the life cycle by reducing the amount of data required: gate-to-gate or cradle-to-gate instead of cradle-to-grave.

[173] See: P.Muredzi, *ISO 14040 Life Cycle Assessment (LAS) as a tool for effective environmentally friendly waste management in the Food Industry*, School of Industrial Sciences and Technology Harare Institute of Technology, Ganges Rd, Belvedere, 2009

Fig. 6: LCA Phases



Source: Author elaboration

As shown in the figure above, the gate-to-gate LCA, focuses on the production phase without considering the others. The cradle-to-gate LCA considers the first two phases of the life cycle, such as mining-processing and production, while the cradle to grave LCA considers the life cycle as a whole.

By eliminating one or more parts of the process, the assessment is obviously simplified but in this case it is particularly important to ensure that the robustness of the analysis is guaranteed. In fact, "on one hand, these simplifications can make the overall assessment and interpretation of final results easier but, on the other hand, approximation and fixed approaches may have the drawback of misleading and inaccurate conclusions"[174].

[174] F.Cherubini, A.Stromman, *Life cycle assessment of bioenergy systems: State of the art and future challenges*, Bioresource technology, Num. 102, 2011

4.3 Life Cycle Assessment of biofuels system: state of art, results and future perspectives

Biofuels have been proposed as an ecologically benign alternative to fossil fuels[175], but there is a lot of uncertainty about their ecological benefit[176]. With the aim to get to a clearer answer, in the past decades there have been an abundance of studies analyzing the different biomass resources, conversion technologies, products and environmental impact[177]. The desired outcome would have been to identify a biofuel production process able to: a) have greater energy efficiency; b) have a positive effect on the ecosystem; c) have a low impact on the land conversion.

However, only ethanol have been deeply investigated in LCA studies and very often the literature is focused only on GHG emission.

Moreover, the results about GHG emissions and energy balances vary significantly even among individual species, making the goal more difficult to reach.

Further, as we have seen in the previous paragraph, the LCA can be applied on different phases of the process. Accordingly, many topics can be studied and many research have been developed considering several aspects of the process. There have been attempts to develop a standardized LCA methods but, to date, too many discrepancies still exist, causing wide variation between LCA results.

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[175] S.Davis et al., *Life-cycle analysis and ecology of biofuels*, in Trends in Plant Science, Vol.14 Num. 3, 2009

[176] The growing interest in biofuels has led many researchers to investigate on their sustainability. The larger use of them, in fact, implies concerns about economic, environmental and social issues. Since there are different definitions of sustainability, there are different way to assess it. To this regard see: R.A. Diaz-Chavez, *Assessing biofuels, aiming for sustainable development or complying with the market?* In Energy Policy, Num. 39, 2011; J.M. Amezaga, G. von Maltitz, S. Boyes, *Assessing the Sustainability of Bioenergy Projects in Developing Countries: A framework for policy evaluation*, Newcastle University, 2010; J. Feehan, P. Jan-Erik, *A framework for evaluating the environmental impact of biofuel use*, in Organization for Economic Co-Operation and Development. Biomass and Agriculture: Sustainability, Markets and Policies, 2004.
A review on the latest development on the main initiatives for the sustainability certifications for biofuels is given by: N.Scarlatt and J.Dallemand, *Recent developments of biofuels/bioenergy sustainability certification: a global overview*, Energy Policy, Num. 39, 2011

Recently, in an interesting paper[178] the authors provided a summary of the literature about this topic. Regarding the scope of the studies, half of them is focused only on GHG and energy balance without considering any further impact categories. Few studies included in their impact assessment the land use category. Among transportation biofuels there is a similar number of studies evaluating 1st and 2nd generation biofuels[179]. The majority of papers regards bioethanol and biodiesel production and a few focus on synthetic biofuels. By contrast, there is a lower number of studies evaluating the environmental performances of biomass for heat and power production.

Regarding the array of biomass materials, most of the papers still deal with lignocellulistic biomass, sugar cane or palm oil, while there are not a lot of studies available about more promising biofuels such as algae. To this regard, one possible explanation is that, as biofuels from algae are not commercialized yet, a lot of estimations has to be made, making more difficult to apply a life cycle assessment to them and to get to an unbiased result[180].

Concerning the LCA outcomes, the determination of the environmental performances is complex, and different combinations of feedstocks, conversion routes, fuels, end-use applications and methodological assumptions may lead to a wide range of results. Consequently, it is not often possible to compare the

[178] *Ibidem*

[179] An authoritative review of the key issues in biofuel LCA compares GHG emissions intensity of second generation biofuels to first generation biofuels. To that scope, the authors use the outcomes of previous LCAs, concluding that the second generation ones are better than the first ones. See: E.Wiloso et al., *LCA of second generation bioethanol: a review and some issues to be resolved for good LCA practice,* Renew Sust Energy Rev 2012.

[180] To this regard, it is interesting to cite a couple of recent studies on the subjects. The first one investigates the global warming potential and the energy requirement of a hypothetical operation of algal biodiesel production in the United Kingdom, using a combined method of displacement and economic allocation in co-product allocation: A.Stephenson et al., *Life-cycle assessment of potential algal biodiesel production in the United Kingdom: a comparison of raceways and air-lift tubular bioreactors,* Energy Fuels 2010. The second one compares algae biomass to terrestrial feedstocks, showing that in order to be sustainable, algae production needs to use wastewater as source of nutrients. Otherwise algae biomass production produces more GHG emissions than conventional crops' production: A. Clarens et al., *Environmental life cycle comparison of algae to other bioenergy feedstocks*, Environmental Science & Technology, Num. 44, 2010

available studies and to extract an univocal answer about the best solution for the environment.

In fact, with concern to the results of those analysis, it is possible to affirm that, to date, there is not a general consensus about the benefits or ecological consequences of using biofuels relative to fossil fuels[181].

Many times even if a biofuel seems to be a preferable option - considering, for example, its GHG emission - it ceases to be so when other impacts are considered. In fact, environmental impacts are highly dependent on several characteristic of the production chain considered[182]. Thus, conclusive results on biofuels are very difficult to achieve because of the variability in outcomes and "no pathway can conclusively be selected as preferable"[183].

A clear assessment of the environmental consequences of producing biofuels is essential for determining their sustainability compared to fossil fuels.

To this regard it is important to stress that a recent work conducted under UNEP/SETAC Life Cycle Initiative has led to a new method (BES) which takes into consideration the land impact and the change on biodiversity and ecosystem services[184]. There is no doubt that this is the right perspective to follow in order to develop a more comprehensive and reliable analysis on biofuels.

Obviously, the inconsistencies have a negative influence on the policies adopted by governments for the promotion of bioenergy and biofuels. In fact, most of them stems from the assumption that, by using biofules, a certain

[181] S.Davis et al., cited

[182] I.Munoz et al., *Life cycle assessment of bio-based ethanol produced from different agricultural feedstocks*, in International Journal Life Cycle assessment, 2013

[183] A.Kendall, J.Yuan, *Comparing life cycle assessment of different biofuels options*, in Current Opinion in Chemical Biology, Num. 17, 2013

[184] In particular, the aim of the UNEP/SETAC Life Cycle initiative is to extend the LCA methods and practices beyond their original scope. In fact, the (environmental) LCA has the objective to evaluate the potential impacts to the environment - as a result of the extraction of resources, transportation, production, use, recycling and discarding of products – but it leaves aside some elements. Thus, in this document they extent the LCA combining the three pillars of sustainability - environmental, economic and social – and defining the LCSA. For further details: UNEP/SETAC, *Towards a Life Cycle Sustainability Assessment: Making informed choices on products*, 2011.
It is possible to download the document at:
http://www.unep.org/pdf/UNEP_LifecycleInit_Dec_FINAL.pdf

amount of GHG emission savings will be achieved. Therefore, the legislation requires certain results and a standardized GHG accounting procedure, encompassing the inclusion of indirect emissions in the life cycle of bioenergy.

In order to cover this gap, several methodological standards have been proposed but they usually reduce the assessment to a very limited number of indices and indicators.

Therefore, the right solution is not easy to achieve. In fact, if on one hand a certain degree of simplicity would be necessary in order to develop the best practices for climate change mitigation, on the other, this uncertainty about the scientific results may lead to inefficient or counterproductive methodologies.

In this scenario the only way to go seems to be a common strategy in which engineers, economists and policy makers work together on the different aspects of the biofuel production system. Thus, a strong international collaboration between the global scientific community - together with international governmental bodies - is needed, in order to avoid a spectrum of different approaches, standards and methods.

What can we expect from the future? Surely LCA will be elaborated in many directions in the next years: new impact assessment methods will be designed, and methods for uncertainty analysis will be improved.

However, more importantly, the developments in technology will be the real protagonist of the new scenario. This improvements will allow to develop the life cycle sustainability analysis, offering a framework for questions at different levels (products, sectors, and economies) and for addressing these questions to the full sustainability scope.

PART III

Agro-energies and sustainable development

Introduction

The aim of the last section is to be the "synthesis" of the previous ones. Thus far, we have seen how the agro-energies sector works, its positive and negative aspects and the different environmental issues related to it. It is clear that the analysis should not leave out any phase of the process, as every step has a relative influence on the final environmental balance. In the second section, we focused on the evolution of the concept of Corporate Social Responsibility and the increasing attention that the European Institutions have dedicated to this subject. The current framework is the result of the evolution of the society and the new relationship between State, corporations and citiziens/consumers. In this evolved scenario, corporations have the responsibility of taking care of the society as a whole, pursuing different and new objectives, in the perspective of sustainable development.

Therefore, agro-energies and sustainable development should be considered as strictly related because the energy plays a central role in reaching long term objectives of sustainability for the environment, as we will analyze in the first paragraph of the next chapter.

At the beginning of the analysis the research questions were: who are the subjects in charge for the sustainable development? How do they accomplish their role? What are the most effective instruments? Which role consumers have in this scenario?

As for the first question, so far, it is possible to answer that there are many actors who are responsible for sustainable development, starting from the macro level and reaching the micro one.

Thus, the European Institutions play a fundamental role, in promoting initiatives and giving directions and guidelines to be followed by the Member States. Consequently, at the national level, the government, together with the Authority of the Energy, put in practice the strategies proposed by the European Union. At the next level there are all the actors of the production chain who are

in charge of pursuing those objectives. The result is a network-system in which every actor has to respect certain parameters.

How all this happens? In the next chapter we will analyze those elements, starting from the European action in the sector (Chapter 5). Further, we will see the implementation of those policies in Italy considering both the activity of the Authorities and the small and big companies. Finally, we will analyze the role of consumers in this scenario (Chapter 6).

At the end of it we will be able to answer all the research questions done at the beginning.

CHAPTER V: AGROENERGIES AND SUSTAINABLE DEVELOPMENT

5.1 CSR/sustainable development and renewable energies

So far we have seen that, along the decades, in the academic and business debates different definitions of CSR have been proposed and, in each of them, the environment is considered as one of the fundamental elements of CSR. As some authors declared «after all, it seems intuitive that voluntary actions that internalize environmental externalities are socially responsible[185]».

The new concepts lead to the generation of a business framework that promotes sustainable growth. In fact, as we have seen in the previous chapters, the three aspects of CSR (economic, social and environmental) are strictly related to sustainability and they have been translated into the approach that companies have to be concerned with.

Actually, today CSR and Sustainability are considered as synonyms, as the European Union recently confirmed in one of its Resolution[186]. In fact, they both demonstrate the inclusion of social and environmental concerns in business operations and interactions with stakeholders. However, it is important to understand which environmental issues deserve priority treatment and which patterns have to be followed.

Thus, as shown in the simple illustration below, Corporate Responsibility and Sustainability are two parts of the same whole.

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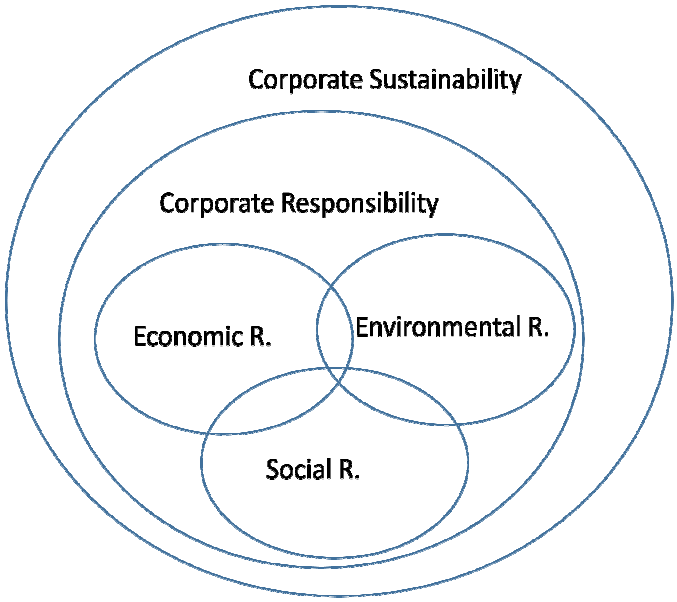
[185] Thomas P. Lyon and John W. Maxwell*, Corporate Social Responsibility and the Environment: A Theoretical Perspective*, Review of Environmental Economic Policy, Issue 2, 2008

[186] In 2013 the European Parliament stated: "the concept of CSR typically used in the EU institutions should be regarded as largely indistinguishable from the related concepts of responsible or ethical business, environment, society and governance, sustainable development and corporate accountability". See: Resolution of 6 February 2013 on *Corporate Social Responsibility: promoting society's interests and a route to sustainable and inclusive recovery* (2012/2097(INI))

Figure 7: General model of Corporate Social Responsibility and Corporate Sustainability



Source: Lassi Linnanen and Virgilio Panapanaan, Helsinki University of Technology

It is interesting to stress that, above all in the past, CSR and sustainable development have been accused of being contradictory, assuming that corporations are incapable of social responsibility and that sustainability of the planet is incompatible with economic and, in some cases, social development[187]. The truth is that both CSR and sustainability have been contested concepts because of their complexity, because of the extent of their definition and because they also differ according to the national, social, economic governance and environmental system in which they are located. This is why the related

[187] This argument has been debated for a long time. J.Moon analyzed the extent to which CSR can contribute to sustainable development. Briefly, he argued that CSR offers contribution to SD because it brings incentives for corporations to act socially responsibly. However, even if responsible business is a necessary condition, it is not sufficient for sustainable development. For further details see: J. Moon, *The contribution of corporate social responsibility to sustainable development*, Sustainable Development Journal, Vol 15, Issue 5, 2007; M.V.Marrevijk, *Concepts and definitions of CSR and Corporate Sustainability: Between Agency and Communion*, in Journal of Business Ethics, Num. 44, 2003, in which the author analyzes the trends within companies and within societies that support the development of Corporate Sustainability.

policies and their goals need to be "rigorous enough to be effective, but flexible enough to adapt to circumstances as priorities evolve"[188].

Stuart L. Hart suggested how to understand the potential contribution of CSR to sustainable development. He argued that a key driver of resources and capability development is the natural environment. Specifically, he said that "strategy and competitive advantage will be rooted in capabilities that facilitate environmentally sustainable economic activity. Thus, by severing the negative link between the environment and economic activity, large firms can adopt sustainable development"[189].

Certainly, the issue of CSR is now challenging the business strategies of the world's leading organizations and the energy industry is one of most involved in this process. In fact, many governments and societies started a wide campaign to ensure that companies which use natural resources have a clear and articulated strategy in the long term, to be both profitable and responsible at the same time.

According to the definition of Sustainable Development given by the Brundtland Commission in 1987 in the *Report on the World Commission on the Environment and development*: «Sustainable development is development that meets the needs of the present without compromising the ability of the future generations to meet their own needs»[190]. Thus, sustainability focuses on the long term contribution of business to society and the impact of that activity on future generations.

Promoting innovative renewable applications and reinforcing the renewable energy market will contribute to preserve ecosystems by reducing emissions at local and global level. This will also contribute to the amelioration of

[188] T. Strange, A.Bailey, *Sustainable Development: linking Economy, Society, Environment*, OECD Insights, 2008

[189] S.L. Hart, *A natural-resource-based view of the firm*, Academy of Management Review, Vol. 20 Issue 4, 1995

[190] The full text of the document is available at the following link: http://www.channelingreality.com/Documents/Brundtland_Searchable.pdf

environmental conditions by replacing conventional fuels with renewable energies that produce lower air pollution or greenhouse gases.

Research into possible alternatives has been and is still being conducted to solve the problems related to the rising energy requirements. Moreover, it is necessary to handle the issue of the constantly growing world population and the global environmental pollution.

In fact, as some authors showed, at the current rate of usage, taking into consideration population increases and higher consumption of energy by developing countries, there is the risk that some natural resources will not last too long[191] and, according to the US Energy Information Administration "the global supply of crude oil, other liquid hydrocarbons, and biofuels is expected to be adequate to meet the world's demand for liquid fuels for at least the next 25 years"[192]. However, it is important to stress that unconventional resources have a more optimistic outlook[193].

The production of fossil fuel is one of the most important contributors to climate change, because of its emission of carbon dioxide (CO_2). Today, the most common products derived from oil are found in the energy sector: gasoline, heating oil, aviation fuels and diesel fuel. They account for about 84% of the total energy sources[194]. Therefore, the use of renewable energy sources and the rational use of energy, in general, are the fundamental inputs for any responsible energy policy. The energy conservation scenarios include the rational implementation of energy policies in all economy sectors and, in this regard, the use of renewable energy sources (i.e. water, sun, wind, biomass, geothermal and hydrogen) is by definition the environmental green product.

[191] A.M. Omer, *Demand for Energy Efficient, Eco-Friendly Environment, Applications and Sustainable Development,* World Essays Journal, Vol. 1, Issue 3, 2013

[192] For more information about this subject consult *International Energy Outlook 2014* at http://www.eia.gov/forecasts/ieo/

[193] *Ibidem.* EIA provided, also, projections of future liquids balances.

[194] Institute for Energy Resource, *Fossil Fuels,* it can be consulted at http://instituteforenergyresearch.org/topics/encyclopedia/fossil-fuels/

The World Summit on Sustainable Development in Johannesburg in 2002 committed itself to «encourage and promote the development of renewable energy sources to accelerate the shift towards sustainable consumption and production[195]». That entails: ensuring economic growth without environmental pollution; increasing resource efficiency, examining the whole cycle of the product, enabling consumers to receive more information, examining how taxes, agreements, subsides, regulation and information campaigns, can best stimulate innovation and investment to provide cleaner technology. However, even if the danger is global, reaching international agreements on climate change policies is easier said than done. In fact politics have to face different issues together and promoting renewable energies would imply taking into account several elements that are still under study such as, for example, the environmental costs that are not currently internalized within the market price of electricity or fuels.

To date, renewable energies contribute as much as 20% of the global energy supplies worldwide[196]. Over two-thirds of this come from biomass use, mostly in developing countries. On the technological side, renewable energies have no problems in terms of potential but there are still technical issues to solve.

In this regard, the World Energy Council (WEC) in a recent study[197] declared that without any change in our current behavior, the world energy demand in 2020 would be 50-80% higher than 1990 levels. Moreover, the US Department of Energy reported that the annual energy demand will increase from a current capacity of 363 million kilowatts to 750 million kilowatts by 2020. Such increasing demand could potentially damage the world environment. Thus, it is clear that looking for a solution to the environmental problems represents an important step toward sustainable development. In this regard, renewable energies are one

[195] The greening of economies has been promoted by United Nations as one of the major goals of the Marrakech Process – a global process established in 2003 to support the elaboration of a 10-Year Framework of Programs (10YFP) on sustainable consumption and production, as called for by the 2002 World Summit on Sustainable Development's Johannesburg Plan of Implementation.
[196] A.M. Omer, *Sustainable Energy Development and Environment*, Research Journal of Environmental and Earth Sciences, Vol. 2, Issue 2, 2010
[197] *Ibidem*

of the most efficient solutions, considering the strict link between them and sustainable development[198].

Nowadays the energy industry is developing, growing and expanding fast. Moreover, social and economic changes all over the world have pushed towards a greater emphasis on health, safety and sustainable environment. Therefore, governments and societies at large have started to promote campaigns and policies able to ensure that companies that use natural resources are addressing long term issues and follow a clear and defined strategy, in order to be both profitable and sustainable and responsible.

As a result, it is no longer possible for the companies operating in the energy sector to focus merely on the satisfaction of their shareholders. As we have seen, CSR applies to a variety of companies activities, especially those who operate at a multinational and social and environmental level.

Thus, given the growing role of environmental sustainability as a focus for corporations across different industries, it is clear why CSR principles apply to the energy sector even more than for others, because of its sensitive position with regard to the environmental responsibilities of the companies operating in the sector.

In this framework "energy companies are increasingly facing broad requirements under which they are expected to identify and respond to stakeholder and social needs"[199].

Moreover, as we have seen, the subject has a great relevance for the political agenda at the global level. In fact, developing the renewable energy sector will have an array of socioeconomic benefits as well as a positive impact on the sustainability of the country. Therefore, CSR can play a leading role in enhancing Europe's innovation potential and competitiveness[200].

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[198] *Ibidem*

[199] D. Streimikiene et al., *Corporate social responsibility for implementation of sustainable Energy development in Baltic States*, Renewable and Sustainable Energy Review 13, 2009

[200] T.Mezher et al, *An overview of CSR in the renewable Energy sector, examples from the Masdar Initiative in Abu Dhabi*, Management of Environmental Quality: An International journal, Vol. 21, Num. 6, 2010

However, according to a study that investigated the problems of CSR in the energy sector[201], there are still various barriers for its development. Some of those limits are identified in the social sphere: weak co-operation with stakeholders, weak NGOs, insufficient care in competence and motivation of personnel, low awareness of society about energy companies' activities, indebtedness of heat consumers, high energy prices comparing with low average income of population reducing initiative to pay higher price for green (renewable) energy or white energy (saved) support for socially responsible business in energy sector, and the lack of information and awareness.

To summarize, in the previous sections we have at first analyzed the agro-energies sector and the concept of CSR, taking into account different approaches and perspectives. Then, we have seen that the concept of CSR and sustainable development can be considered as synonyms and their relationship with the development of renewable energies.

The aim of the next paragraph is to answer the questions: who is responsible for sustainable development in the agro-energy sector? How are those subjects acting in this scenario?

Therefore, at first I will consider the actions taken at the European level. Secondly, in the next chapter the analysis will focus on the national scenario.

5.2 The European Renewable Energies regulation: purposes and energy strategies

The theme of renewable energy sources (RES) represents a large section of the European energy policy[202]. The aim of the public policies in this field is to meet the satisfaction of different challenges.

[201] The study is focused on the Baltic States. D. Streimikiene et al, cited.

[202] The website https://ec.europa.eu/energy/en/topics/renewable-energy offers an overview of the major topics related to renewable energies. In particular, in addition to the main topics, several studies, statistics and publications are provided, to support and explain the polices implemented by the European Union.

The role of RES has slowly consolidating during the years following a more sustainable path that aims to combine two different needs: the security of supply and the environmental protection in the production of energy. It is important to stress that the European interest in the environment emerged much earlier than the one in energy, as the European Community acquired the competence in this area in 1986 with the EUA[203].

This approach is rather due to the fear of the Member States to give up their own energy policies in name of a joint action than to a greater importance of the environment compared to the second theme.

1. TFEU

The introduction of the article 194 of the Treaty on the Functioning of the EU (TFEU) enabled the European Union, with the ordinary legislative procedure, to "promote energy conservation, energy efficiency and the development of new and renewable energies". However, it also made explicit precise limits on the exercise of the European powers in this field.

Other provisions of the TFEU are directly connected to the theme of renewable energies, such as the Article 107 and the Article 191, respectively in the field of state aid and the environment. A few words on each of them is noteworthy.

With regard to the Article 194, it is important to stress that it has an autonomous legal basis. In fact, it does not only regulate the economic initiative for the production, distribution and sale of such forms of energy but it is rather aimed at achieving public interest objectives. The article gives the European Union the power to establish a policy in the energy sector for the proper

[203] The Single European Act (SEA) - signed in Luxembourg on the 17th of February 1986 by the nine Member States and on the 28th of February 1986 by Denmark, Italy and Greece - represents the first substantial change to the Treaty which established the European Economic Community (EEC). The SEA entered into force on July 1st 1987 and revises the Treaties of Rome in order to relaunch the European integration and to complete the construction of the internal market. The Act changes the rules of operation of the European institutions and expands Community powers, in particular in the fields of research and development, the environment and common foreign policy.

functioning of the internal market, security of supply, the interconnection of networks as well as energy conservation, energy efficiency and development of new and renewable energies. Moreover, it assigns explicit powers to the European Union, filling the empty space left by the Lisbon Treaty under which the legal bases were uncertain and indirect.

Nevertheless, the same article defines the boundaries of the European power, by giving the Member States exclusive powers in the use of its energy sources, in the composition of the energy mix and the structure of supply. The most important element remains the official recognition of the role of the policies of energy conservation, efficiency and renewable energies within the definition of an European energy policy. In this regard it is important to emphasize that this recognition allows institutions to adopt an integrated approach in which the development of renewable energy is an essential component of the European energy policy.

With regard to state aid, the Article 107 TFEU states that "any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market."

However, since their initial development, RES have been subsidized, with the risk of violating the rules on state aid because, despite having a higher cost, they have a multi-strategic character.

As for the environment, the article 194 TFEU points out that energy objectives should be pursued taking into account the need to preserve and improve the environment, formalizing the close link between the two policies already recalled in the Commission documents. The legal significance is also confirmed by the several references to the regulation on the environment and energy. In fact, according to the article 191 TFEU, the Union pursues the prudent

and rational utilization of natural resources (and therefore also those of energy)[204].

2. Directives

The subject of renewable energies is particularly important also because it is at the crossroads of different objectives of the European Union. The link between the use of renewable energies and the safeguard of the environment is made explicit in the Directive 28/2009 at the clause 48 which states: "It may be appropriate for Member States, in order to facilitate and accelerate the setting of minimum levels for the use of energy from renewable sources in buildings, to provide that such levels are achieved by incorporating a factor for energy from renewable sources in meeting minimum energy performance requirements under Directive 2002/91/EC, relating to a cost-optimal reduction of carbon emissions per building"[205].

Thus, the strict relationship between the profiles regarding the regulation of the market and those of environmental and geopolitical security is the main reason of the increasing Europeanisation of the discipline of renewable energies compared to the one of conventional energies[206].

In particular, there are three public interests that justify the European initiative in promoting renewable energy, that are: environmental sustainability, security of supply and economic competitiveness. Thus, in the first place, the use of renewable energy allows to reduce the emission of greenhouse gases in the atmosphere and to combat climate change. Secondly, diversification of energy sources could help in reducing dependence on foreign imports for the supply of fossil fuels. Finally, the development of a sustainable energy policy supports the

[204] To this regard, it should be cited the sentence of the Constitutional Court "PreussenElektra" which emphasized the connection between energy and environment, as well as the benefits of renewable energy. In fact, Member States must respect those commitments under the UN Framework Convention on Climate Change and the Kyoto Protocol of 1997, which intend to protect the health and life of humans, animals and the conservation of plant species.

[205] Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

[206] M.Cocconi, *La regolazione dell'energia rinnovabile,* in Amministrazione in Cammino, May 2013

economic and technological growth and, consequently, it promotes the raise of the employment and the entry of new players in the market as well as the development of specialized chains.

In order to briefly reconstruct the steps that have led to define the legal framework of renewable energy, and therefore of agro-energies too, we must go back to the '80s, when the European Commission began to consider new plans to encourage technological development in the use of renewable sources[207].

In the '90s the European regulation in the field of renewable energy becomes more significant. In this regard, it is important to cite two documents published, respectively, in 1996 and 1997: the Green Paper on *Energy for the future: renewable sources of energy* [208] and the White Paper on *Energy for the future: renewable sources of energy* [209].

Beside them, the European Community manifested its increasing interest in the topic through the Treaty of Amsterdam which entered into force in 1999. The Treaty has the merit of making the environmental protection a transversal matter within the European integration process, particularly for the promotion of Sustainable Development (now article 11 TFEU).

However, the interest of the European institutions emerged especially in the nineties, when it becomes clearer the interrelationship between renewable energy and the other European policies. Therefore, with a slight delay, the European Union followed the United Stated in implementing biofuels and renewable fuels mandates. The first Directive dated to 2001 (Directive 2001/77/EC about the promotion of energy from renewable energy sources in the internal electricity market) and the second one to 2003 and it was about promoting the Use of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC). It established indicative targets with the aim of reaching

[207] Altener Program, decision n.93/500/CE, 1993
[208] COM (96) 576 def.
[209] COM (97) 599 def.

5.75% of biofuels in transportation by 2010 (by that time biofuels amounted to 0.5%).

However, the implementation of this Directive was problematic, with biofuel consumption levels in 2005 reaching only a 1%. In fact, those measures were characterized by a more lightweight approach, which focuses on "the promotion rather than the regulation and, coherently, it did not use mandatory regimes" [210].

After the publication of these two directives, the European institutions took a more proactive approach by allowing binding measures. Consequently, the European action started to be based on binding targets and instruments to establish a route with a precise timetable to be pursued at the national level.

Thus, once it was clear that the voluntary targets would not be met, another Directive was promulgated, with a more suitable policy alternative.

In fact, in 2009 the European Union approved the Directive on the promotion of the Use of Energy from Renewable Sources (Directive 2009/28/EC also known as Renewable Energy Directive) as part of a broader Climate and Energy Package[211] that also included the Fuel Quality Directive. The Package was launched in April 2009 and established new targets for Member States to be met by 2020:

- 20% cut in greenhouse gas emissions (from 1990 levels);
- 20% of EU energy from renewable;
- 20% improvement in energy efficiency.

It had the aim to introduce a structured framework able to correct market failures.

The element of novelty of the directive is that it presents an integrated approach, encompassing altogether the regulation on the promotion of

[210] G.M. Roberti, *Le politiche dell'Ue in materia di energie rinnovabili*, in G.Napolitano e A.Zoppini (a cura di) Annuario di Diritto dell'Energia: regole e mercato delle energie rinnovabili, 2013

[211] The Climate-Energy package includes the Directive 2009/28/EC on the promotion of energy from renewable sources, the Directive 2009/29/EC on the Community system for the exchange of gas emission allowance trading, the Decision 406/2009/EC, concerning the Member States' efforts to reduce greenhouse gas emissions by 2020 and the Directive 2009/31/EC on the geological storage of carbon dioxide.

renewable energy for the electricity generation, for the cooling/heating and for the production of biofuels for transportation.

The mandate for the transport fuel was separated on purpose from that for the total energy because the renewable energy already had a substantial presence in both the electricity and heating markets but not in the transport fuel market. As Hodson noted «without legally binding targets in transport to encourage investment in transport renewable fuels, the transport sector's singular dependence on oil, and its increasing rise of GHG emissions relative to the heating and electricity markets, was unlikely to be curbed»[212].

According to it, «biofuels are liquid or gaseous transport fuels such as biodiesel and bioethanol which are made from biomass. They serve as a renewable alternative to fossil fuels in the EU's transport sector, helping to reduce greenhouse gas emissions and improve the EU's security of supply»[213].

Moreover, unlike its predecessor, the 2009 Directive draws an explicit link between consumption of biofuels and their sustainable production[214]. In fact, fuel suppliers are also required to reduce the greenhouse gas intensity of the European fuel mix by 6% by 2020 in comparison to 2010. Also, sustainability criteria were introduced. These mandates are driven by the need to reduce greenhouse gas emissions and comply with the international commitments and to promote both technological and social development (as reported in Clause 1 and 14 of the Directive).

A second element to stress is the flexibility of the directive, which has facilitated its implementation by those Member States not already experienced in the production of RES.

[212] P. Hodson, *Renewable energy in transport (including biofuels)*, in Hodson Paul, Christopher Jones and Hans van Steen, eds. EU Energy Law. Volume III. Book One. Renewable Energy Law and Policy in the European Union. Leuven: Claeys and Casteels, 2010

[213] For more information: http://ec.europa.eu/energy/en/topics/renewable-energy/biofuels

[214] S. Alfonis, L. Stringer, *Europen Union leadership in biofuels regulation: Europe has a normative power?, in Journal of Cleaner Production*, Num. 32, 2012

Also, the measures are complemented by support schemes and cooperation measures between Member States and between Member States and third countries, in order to promote not only the development of renewable energies but also the transnational coordination.

Entering into the merits of the directive a few element should be stressed: a) the obligations of States to produce renewable energy; b) the State aid for the production of renewable energy; c) the access to networks; d) the internal administrative procedures. They will be analyzed in the following lines.

a) The Directive establishes for each Member State a mandatory share of energy to be produced by renewable sources. Unlike the 2001 Directive, in 2009, the legal approach is prescriptive and not programmatic. This is the reason why we talk about mandatory national targets instead of national indicative targets. Member States are still free to determine the energy mix through which to pursue these objectives through the National Action Plan for renewable energy. The Commission also took account of the economic situation of each Member State by weighting the objective according to the GDP. Therefore, the objective that has been attributed to Italy is a share of 17%.

In this framework, the transport sector is rather the exception. In fact, the expected share of 10% is the same for all the Member States and it has to be achieved by 2020. To achieve the objectives the Directive also promotes forms of collaboration between the Member States, both inside the European Union and outside it with third States. These schemes favor, on one hand, a real integrated electricity market and, on the other, the establishment of a market for renewable energy in neighboring geographic areas.

b) In general, the system of aids is allowed, considering the starting point of the renewable energy market. However, this must not be compromise the competiveness of the market. The Directive of 2009, unlike that of 2001, provides a very flexible approach, providing different types of tools to support the development of renewable energies. Among others, there are investment

grants, exemptions and tax breaks, tax refunds, the obligation support schemes for renewable energy and direct price support schemes, including feed-in tariffs and subsidies.

c) The regulation of the access to networks has been integrated in the new directive. It regulates the injection of electricity from renewable sources in the grid for the transmission and the distribution of electricity. According to the directive, the operators of the network have the obligation towards the producers of electricity that use renewable energy in order to not jeopardize the functioning of the national electricity market; moreover, the installation costs and rates of transmission/distribution have to follow objective, transparent and non-discriminatory parameters.

d) Finally, it is important to add some observations in relation to the mechanisms of certification of the origin and the internal administrative procedures of authorization for the production of electricity from renewable sources.

The first argument - already covered in the Directive of 2001 and deepened in 2009 – is about the principle that the origin of electricity from renewable sources must be guaranteed according to objective, transparent and non-discriminatory criteria. Those criteria must be established by each Member State and subjected to the control of authorities responsible for issuing the guarantees of origin.

The second argument concerns the administrative procedures. They were already been addressed in the 2001 Directive to make them clearer and more transparent. The 2009 Directive underlines the need to simplify the administrative procedures.

Despite those positive updates, as some scholars pointed out, the Directive failed to take into account several issues related to the negative impact that biofules could have to the environment. In particular, large scale biofuels production could compromise air, soil and water, due to the large amount of

fertilizers and pesticides required by certain first generation feedstocks[215] and the increase of their use could cause considerable land use change (LUC) both direct (dLUC) and indirect (iLUC). However, thanks to the research and new discoveries, during the past year the European Union has become more aware of those issues. The recent directive 2015/1513 is the answer to them, as we will see in the next paragraph.

3. Further steps:

Beside the Energy and Climate Package, the Third Package completes the European renewable energy scenario.

In particular, the former promotes the use of renewable energies, while the latter has the aim of developing a more harmonised European internal energy market[216].

Since the promulgation of the Directives in 2009, other steps have been taken, defining a richer and newer scenario. In fact, on the 24th of January 2013 the European Commission published the Communication[217] for the "*Clean Power for Transport: A European Alternative Fuels Strategy*", which encompasses biofuels as well as natural gas (liquefied and compressed -LNG, SNG), electricity and hydrogen.

Other initiatives have been the workshop on "*The future of Biofuels as alternative fuel for the transport sector*" held by the European Parliament Intergroup "*Climate Change, Biodiversity and Sustainable Development*"; the Communication[218] of the Commission about "*A policy framework for climate and energy in the period from 2020 to 2030*". Moreover, on April 2014 The

[215] Charles at al., *Public Policies and Biofuels: the way forward?*, Energy Policy, 35, 2007

[216] The Third Energy Package consists of two Directives and three Regulations: the Directive 2009/72/EC concerning common rules for the internal market in electricity; the Directive 2009/73/EC concerning common rules for the internal market in gas; the Regulation (EC) No 713/2009 on the establishment of the Agency for the Cooperation of Energy Regulators ACER; the Regulation (EC) No 714/2009 on conditions for access to the network for cross-border exchange of electricity; the Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks.

[217] COM(2013)17

[218] COM(2014)015

Commission introduced new guidelines on state aid for environmental protection and energy, including renewable energy and biofuels and, in September 2014 the Directive on the deployment of alternative fuels infrastructure 2014/94/EU (also known as the CPT Directive) was published. Finally, in October 2014 the presentation of The EU 2030 framework and energy security took place and at the end of December 2014 the Commission proposed the revision to the Fuel Quality Directive and Renewable Energy Directive.

The revision arrived in September 2015 when the European Union modified the Directive 98/70/EC related to the quality of petrol and diesel fuels and the Directive 2009/28/EC, in order to adapt the regulatory framework to the real situation of the Community and to safeguard the environment.

According to the new Directive 2015/1513 of the European Parliament and of the Council of 9 September 2015, in order to reach the 10% of energy consumption in transport by 2020, the proportion of first-generation biofuels (derived from crops on agricultural land) cannot exceed 7%. In fact, it is now estimated that emissions of greenhouse gases due to indirect land use change, in relation to the production of biofuels, could be significant and would thus cancel, in part or whole, the emission reductions related to individual fuels.

Particularly important are the advanced biofuels, such as algae and biofuels derived from waste that should be produced by following the principle of the waste hierarchy, in order to choose the best environmental option. In fact, as the advanced biofuels involve limited risks of change of land use, the European Union should encourage and promote their use, especially starting from research. Thus, the objective of the European Union is to reach a "recycling society" in which waste means resource.

Member States will have to comply with it by September 2017.

5.3 The problem of sustainability of biomass within the European regulatory framework

The Directive of 2009 redefined the notion of biomass at the European level and it bases the use of biofuels on two conditions: that their production is sustainable and that there are second-generation biofuels available on the market.

Particularly, in the recitals 12-14, and from 65 onwards, and in articles 17 onwards, the Directive deals with biomass sources in great detail, giving the Commission specific control tasks to be carried out together with the committees with technical expertise to assess the sustainability and environmental impacts. The reduction of the negative effects on the climate is in fact in line with the Directive and the European environmental policy and the relative procedures should be guaranteed through assessment, planning and licensing of renewable energy plants, as well as through the evaluation of the sustainability of biofuel production. Moreover, «sustainability affects not only the verification of the shares of contribution to saving GHG emissions, and share of use of energy from renewable sources, but it also legitimate or not the granting of support schemes»[219].

The problem of sustainability of biomass production, and bioliquids in general, is the most important element that acts as a counterweight to the incentives for the production of energy from such sources. As we have seen, in fact, the problems reside mainly in the destruction of biodiverse lands and in altering the ecological balance and endemism. This phenomenon, which is known as ILUC (Indirect land use change), contradicts the myth of neutrality of biomass to climate change, because it shows that the use of biomass can actually lead to the alteration of the land, generating not indifferent emission effects in relation to the release of carbon from the soil of which is mutated.

[219] P.Brambilla, *La pianificazione della produzione sostenibile di energia da biomasse tra modelli cogenti e modelli volontari*, in Rivista giuridica ambiente, fascicolo 3-4, 2013

The European Union did not fail to take into consideration these aspects, seeking to calculate, in the assessment of the climate-changing effects, the emission of carbon, resulting from the impact of biomass and bioliquids on conversion of land to prevent its production if the net effect is negative.

The criteria established, provided in article 17, differ depending on whether the biofuel is produced from waste and residues from agriculture, aquaculture, fisheries and forestry, rather than agricultural biomass in the strict sense. In the first case, in fact, the criteria are less stringent, thanks to the lower environmental impact associated with them.

The directive has, however, established standard values for systems of normal production of biofuels, that can change according to scientific and technological progress, which serve as a reference to assess the level of reduction of emissions of greenhouse gases. In particular, Annex V of the Directive gives different rules for calculating the impact on the climate, depending on whether it is biofuels, bioliquids and fossil fuels[220]. Reducing emissions of greenhouse gases obtained from the use of biofuels and bioliquids is expected for at least a share of 35%, and from January 2018, for at least a share of 60% for biofuels and bioliquids produced in installations in which production started from 2017 onwards.

In conclusion, despite the credit for trying to regulate a difficult sector, the regulation still presents a number of limitations that arise because the problems involve different disciplines and require continuous monitoring and updating. This element is highlighted in the article 24 of the directive which introduces the platform of transparency, that is a database open to the public and updated on European policies on renewable energies, which include plans, reports, state and institutional relations.

[220] Communication from the Commission on *the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels*, 2010/C 160/02

At the national level, different problems emerged at the moment of the introduction of these policies[221]. This aspect will be analyzed in the next chapter.

5.4 Some hints about the regulatory systems and the strategies applied in US vs EU

In the United States the renewable fuels targets were introduced in the 2005 Energy Policy Act (EPA). The regulation was not exempt from criticism but different reasons led to the success of the pro-biofuel coalition. Among others, there were reducing dependence on foreign energy sources, the idea that domestically produced biofuels would promote rural and local development, the reduction of greenhouse gas emissions and the development of new technologies that could increase the American economic competitiveness. According to the EPA, gasoline/petroleum fuel suppliers have to blend ethanol with gasoline. By 2012 the Renewable Fuel Standard (RSF I) required 7.5 billion gallons of renewable fuel to be blended with gasoline annually and corn ethanol was the renewable fuel able to reach this target. Consequently, its production enormously increased, multiplying five times[222].

Following the EPA, in 2007 the Energy Independence and Security Act (EISA) was enacted in order to «move the United States toward greater energy independence and security and to increase the production of clean renewable

[221] In Italy the interventions in the sector have taken place in a fragmentary way and with many delays. In fact, the European Directive of 2001 was implemented by the Legislative Decree n. 387/2003 (modified later by Legislative Decree n. 28 of 2011, implementing the Directive 2009/28/EC). The 2001 Directive required Member States to change and make administrative practices faster, in order to develop plants for renewable energy sources. Thus, the Legislative Decree n. 2003 identified the Regions as the appropriate level for the rationalization and acceleration of the authorization procedures. The directive of 2009 was acknowledged in Italy through the Legislative Decree n. 28/2011. According to the article 2, letter e), the biomass is "the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetable and animal substances), forestry and related industries, including fishing and aquaculture, the cuttings and prunings from the public and private green, as well as the biodegradable fraction of industrial and municipal waste". It is important to note that, while in the 2009 directive - on the promotion of energy from renewable sources - the use of biomass, bioliquids, biofuels and biofuel has a central role, the Italian Decree does not incorporate the subject in the same way. It actually entails numerous gaps.

[222] R. Schnepf, B. D. Yacobucci, *Renewable Fuel Standard (RFS): Overview and Issues*, March 14, 2013

fuels», showing stronger environmental considerations. The EISA set the New Renewable Fuel Standard (RFS II) to reach 36 billion gallon by 2022. Moreover, it divided this amount among different renewable fuels: conventional biofuel from corn (up to 15 billion gallon), advanced biofuel (21 billion gallons) such as biodiesel from vegetable oils and cellulosic biofuels from crop residues, wood waste and algae (16 billion gallons has to come specifically from cellulosic biofuels).

Furthermore, the EISA introduced a new element, not considered before. In fact it entailed the environmental sustainability standards. These standards required biofuels such as ethanol and biodiesel to demonstrate to reduce GHG emissions compared to conventional oil. These reductions were also established in the same Act: 20% for conventional biofuel, 50% for advanced biofuel and 60% for cellulosic biofuel. Interestingly, the Act also restricted the use of virgin lands being used to produce biofuels. In particular, it required feedstock crops used for biofuel production to be «harvested from agricultural land cleared or cultivated at any time prior to (December 2007) that is either actively managed or fallow, and non forested»[223].

In the light of the above it is possible to delineate some elements that US and EU have in common, as well as others in which they differ.

Regarding their similarity, both regulations impose sustainability criteria on biofuels for transport and non transport purposes. These include greenhouse gas emission savings, land use requirements, cross compliance with the environmental requirements related to agricultural issues (In Europe: Common Agricultural Policy). Moreover, in both policy, to receive national support schemes biofuels must demonstrate an initial CO_2 emission saving (35% in EU and 20% in the US). Required GHG emission reductions for biofuels are over their life cycle (of cultivation, processing and transport/distribution) and land with high biodiversity and high carbon stocks, such as primary forest and other wood

[223] Section 201 (o) (1) (I)

land, cannot be used to produce feedstocks that count toward targets and receive government support. In both cases there are grandfather clauses: the sustainability criteria is not applied if the biofuel is produced on lands converted on this use before January 2008. In these cases, in fact, the criteria has to be met by April 2013, in order to give the producers time to improve their production processes.

Regarding the differences, there are a few elements that diverge in the policies. First, the European Directive requires the Commission to report on the social sustainability of biofuel policies by measuring their impact on the availability of foodstuffs at affordable prices, which it does not happen in the US. Second, even if the rationales are similar in both mandates, the environmental ones seem to be more important in Europe than in the US. This is probably because, unlike in the US, in Europe there was a wide debate about environmental issues that led to the legislation in 2009, taking into consideration not only the environmental aspects but also the legal obligation that Europe has to reduce GHG emissions under the international Kyoto protocol. Moreover, early US biofuels mandates were mainly subsidies to farmers who are politically important in the US: even if farm states have few people they have the same number of senators as other states.

Finally, there are some differences in sustainability criteria in the US and the EU and in their applications. It probably depends on a more skeptical view of the role of biofuels in Europe than in the United States, as well as the different timing of the legislation. In fact, in the US the regulation was approved in December 2007, before the debate about the trade-off between fuel and food security started. This subject was particularly important to the Green Party in the European Parliament and they created pressure to add more sustainability criteria to the legislation, imposing to report on both ILUC (Indirect Land Use Change) and social sustainability effects.

As for their application, the European legislation considers three ways for the Member States in order to comply with the sustainability criteria: through

national legislation, through international agreements and through voluntary legislation schemes, specifically approved by the European Commission. By November 2011 only Germany and Sweden had national legislation for auditing compliance with the sustainability criteria. Regarding the voluntary schemes, the European Commission approved some of them that include social sustainability monitoring.

Ultimately, in the US, the biofuel sustainability criteria are administered centrally by The Environmental protection Agency, while the EU use a "Chain of Custody" approach requiring feedstock/biomass producers and processors as well as biofuel producers to keep track of certified biomass use for auditing purposes[224].

[224] In 2010, the International Energy Agency published, in collaboration with the OECD, the Carbon Capture and Storage (CCS) Model Regulatory Framework, a document which had the aim to highlight the need of an ambitious growth of the energy efficiency on the global scale. In order to reach this goal, several changes in the regulatory framework are needed. In fact "regulatory frameworks are required to ensure the effective stewardship of CO_2 storage sites over the long term, the protection of public health and the environment, and the security of CCS activities. Appropriate regulatory frameworks are also required to clarify the rights and responsibilities of CCS stakeholders, including relevant authorities, operators and the public. Additionally, regulations are needed to underpin performance and associated incentive schemes, commercial transactions relating to CCS operations, and also to build public confidence in, and acceptance of, the technology". All those elements together lead to taking into account the key principles already developed in those countries that can be a good example for addressing the broad range of regulatory issues.
Therefore, the document provides a scheme for the comparison of the European and the American model, their policies and related legislations. For further details see: IEA/OECD, *Carbon Capture and Storage, Model Regulatory Framework,* 2010. The document is available at: https://www.iea.org/publications/freepublications/publication/model_framework.pdf

CHAPTER VI: AGROENERGIES AND SUSTAINABLE DEVELOPMENT IN THE NATIONAL SCENARIO

6.1 The national government's activity

This section will focus on how concretely at the national level the public actors and the companies put into practice the policies related to the sustainable development. The final aim would be also to analyze how consumers perceive those strategies and their role in this scenario.

We will start from the national strategies.

Following the growing attention of the European Union to the energy sector and sustainability, the Italian energy policies implemented in recent years, entail a comprehensive and diversified array of actions that vary according to the pursuit of the different objectives.

According to the latest document published by the Ministry of the Economic Development about the Italian energy situation during the 2014[225], the energy demand in the last year has dropped 3.8 percentage points compared to 2013. In particular, the demand of fossil fuels was stable, the gas demand decreased while the demand of renewable energies raised. The reasons of this trend have to be identified not only in the economic recession but also in the new composition of the sector and in the greater energy efficiency.

Looking at the supply side, during the 2014 the renewable energy production increased of 4.7 percentage points. In fact, thanks to the incentive system, all kind of renewable energies have been used in the Italian system. In particular, 50% of the renewable energy consumption belongs to the heating

[225] Ministero dello Sviluppo Economico - Direzione generale per la sicurezza dell'approvvigionamento e le infrastrutture energetiche, *La situazione energetica nazionale nel 2014*, July 2015

sector, 45% is used for the electric energy production and the last 5% for the production of biofuels in the transport sector.

It is important to stress that according to the data disclosed by the Ministry, the total consumption of energy during the 2013 was 20.7 Mtep, weighing on the gross energy final consumption for 16.7%, only 0.3 points below the European target for 2020 of 17%.

It is clear that the framework for the energy policy is particularly wide and complicated, as many elements concur for its functioning and many of them often overlap.

However, in order to identify some general lines of policy we can distinguish between those related to: a) the development of renewable energies; b) the energy efficiency and the optimization of the system as a whole; c) the technical assistance and all the actions needed to support the technological innovation.

Specifically, at the national level, among other things, the strategy is willing to implement those action in order to support the development of renewable energies such as:

- reduce greenhouse gases;
- promote energy efficiency measures;
- increase the consumption of energy from renewable sources.

Moreover, the policies pursue objectives of energy efficiency and technological innovation such as:

- support the expansion of industrial activities, allowing new products and technologies to enter the market. In this context the development of those technologies is particularly important and it contributes to the reduction of production costs and the improvement of energy efficiency (eg. solar photovoltaic, solar thermal, wind, bioenergy, biofuels, etc.);
- facilitate the redevelopment of existing industries towards more efficient products, required by the new energy landscape;

- encourage the development of the life cycle assessment of products, in order to apply the new technologies to the industrial level and significantly reduce energy consumption, in particular in the energy-intensive sectors (eg. biotechnology, combustion technologies, etc.).

Those strategies, objectives and guidelines have been made explicit at first with the National Action Plan. At a later time, the Plan has been implemented in the Italian legislative framework with the Decree lgs. 28/2011.

The Decree represents the Italian answer to the European Directive 28/2009 on renewable energies. As known the Directive 2009/28/EC had established that in Italy in 2020 the share of renewable energy - electricity, caloric, transport – could not be less than 17% of the total energy consumed, while the contribution of renewable energy in the transport sector was limited to 10%.

Following its path, the Decree prescribes the simplification of the procedures, the rationalization of the incentive systems, the development of the grid for the effective distribution of the energy - in particular the renewable ones - and the monitoring and control of the process.

In detail, it established that biomass from agriculture and forestry can be used for the 58% of the production of heat energy, and for the 20% of the electric energy; for automotive fuels second generation fuels will be critical and they will cover 62% of energy needs with the production of biodiesel, and 20% with bioethanol[226]. The system of incentives was completely renovated for plants entering into operation from 2013. By contrast, it did not change for plants that began operating within 2012, for which the previous system continues to apply.

It should be added that the law of stability in 2013 (paragraph 364 of Law 228/12) has attributed to the holders of those plants the faculty to change the incentive system in force with effect from 1 January 2013.

[226] INEA ,Italian Yearbook of Agriculture, 2011

Another change regarded the system of the green certificates[227].

It is important to stress that the energy sources must meet the sustainability criteria established by the D.lgs. n. 55/2011, which was followed by the Ministerial Decree 23/1/12 on the "national certification system" for biofuels and bioliquids, attesting to the sustainability of materials subject to the verification system.

Furthermore, for the definition of the incentives, the origin and the traceability of the raw materials should be taken into account: both requirements are governed by the Ministerial Decree 2 March 2010, explaining the system of traceability of the biomass supply chain. The extent of the incentive should also be quantified so as to favor:

- the use of wood biomass, for the production of caloric energy;
- the use of bioliquids, as automotive fuel;
- the use of biomethane, both as fuel for injection into the natural gas grid, or as fuel for transport.

Incentives should also be suited to promote (let. H)) the efficient use of: biomass waste and by-product; biogas from livestock waste or by-products from agriculture, agro-food, agro-industrial, farming and forestry; products of

[227] The green certificates mechanism was implemented by the Italian government to support the production of electricity from renewable sources. In particular, the Leg. Decree 79/99, Art. 11, states that, as of 2002, manufacturers and importers of electricity produced from non-renewable sources are required to introduce a certain share of electricity in the grid per year, generated by plants using renewable sources. This share is equal to 2percent of the electricity produced or imported from non-renewable sources in the previous year, exceeding 100 GWh /year. Thus, the legislation established a minimum amount of renewable electricity that producers and importers have to inject into the power system every year. Basically, the green certificates represent a proof of compliance with the renewable quota obligation. The minumun share was, at first, increased by 0.35percent per annum and then by 0.75percent per annum. The validity of the certificates varies according to when the plants began operating and their number is proportional to the electricity generated by the system. It also depends on the source used. They conventionally attest the production of 1 MWh of renewable energy and are emitted by the GSE (Gestore Servizi Energetici Spa).
A producer who wants to apply for a green certificate, has to qualify his/her plants as a renewable-energy power plants/system (IAFR - it stands for Impianti Ambientali Fonti Rinnovabili). As a second step, GSE opens an ownership account in the name of the producer, depositing the certificates and tracking the information required.
See:https://www.mercatoelettrico.org/en/mercati/cv/CosaSonoCv.aspx;http://www.gse.it/en/qualificationandcertificates/GreenCertificates/Pages/default.aspx

dedicated non-food crops. The same treatment should be given to incentive biomass, bioliquids and biogas from short chains and industry agreements.

The other important element that complete the framework of the sector is the energy efficiency, which is often related to the energy savings. In fact, the ability to make better use of energy sources is one of the most important target: recent studies have shown that a reduction of 20% in energy consumption could be achieved replacing current costs for energy investments in technology rather than with reduction of the welfare.

To this regard the Italian legislation follows the path given by the Directive 2012/27/EU on the Energy Efficiency[228] which aims to remove the obstacles in the energy market and to overcome market failures that hamper efficiency in the supply and use of energy[229]. The directive attempts to concretely reduce energy consumption in Europe and relies on the leading role of the public administration, as well as businesses, professionals and suppliers. The directive also provides for a strong strategic planning that consists in preparing, every three years, the Action Plans for Energy Efficiency (EEAP) within which the governments must show the objectives, the progress made, the policies established at the national level and the assessment of their impacts. The directive does not forget also to promote the development of the energy market and to facilitate the accessibility to small and medium-sized enterprises, by means of a financial incentives as well as greater information and transparency. An important role is also assigned to large companies in order to achieve the objectives of energy efficiency and to this end energy audits are planned.

[228] The 2012 Energy Efficiency Directive establishes a set of binding measures to help the EU reach its 20percent energy efficiency target by 2020. Under the Directive, all European countries are required to use energy more efficiently at all stages of the energy chain from its production to its final consumption. European countries were required to transpose the Directive's provisions into their national laws by 5 June 2014. To help officials to implement the Energy Efficiency Directive, the European Commission publishes guidance notes: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1399375279076&uri=CELEX:52013DC0762

[229] See: E.B.Liberati, *Regolazione indipendente e politica energetica nazionale*, in Rivista della Regolazione dei mercati, Issue 1, 2014

Finally, careful protection is given to the end user. In particular, the directive stresses the need to ensure more information and transparency for the consumers. In fact, it requires the adoption of measures, such as tax incentives or access to loans, grants or subsidies, designed to «promote and facilitate the efficient use of energy by small energy customers, including households» (Article 12).

To complete the scenario, a separate argumentation has to be dedicated to the National Energy Strategy which is made explicit through the National Energy Plan[230], approved by the inter-ministerial decree on March 2013.

The Plan is the instrument of direction and planning of the national energy policy. It is not legally binding but it contains programmatic lines organized around some well-identified priorities to achieve strategic objectives. The mentioned measures are general, implying that they will be better defined once they are introduced. They include reducing the gap with other European countries, the improvement in energy supply and in quality standards. In particular, the national strategy considers seven priorities to achieve in the medium to long term, i.e. for 2020: 1. Energy Efficiency; 2. Market competitive gas hub and south-European; 3. Sustainable development of renewable energy; 4. Development of infrastructure and electricity market; 5. Restructuring of refining and fuel distribution network; 6. Sustainable national hydrocarbons; 7. Modernization of the governance system.

The document also states that in the long and very long term (2030, 2050), environmental challenges, competitiveness and security will require a more fundamental change of the system that will invest the entire operations of the company. To this end it is necessary to follow a flexible and efficient strategy that focuses on the overall reduction of emissions in Europe and which also represents the input for a global response to the problem of climate change.

[230] Ministero dello Sviluppo Economico, *Strategia Energetica Nazionale: per un'energia più competitiva e sostenibile*, March 2013. To access the document: http://www.sviluppoeconomico.gov.it/images/stories/normativa/20130314_Strategia_Energetica_Nazionale.pdf

With regard to the sustainable development of the renewable energies (the 3rd priority) the Plan considers the target of going beyond the European targets 20-20-20[231], of the economic sustainability of the sector and the development of the technologies which can positively influence the national chain production.

As known, the transport sector is particularly relevant when considering its weight on the total GHG emissions. This is why the development of biofuels has gained such importance at the European level.

So far, Italy has reached the target in the medium term (1% for 2007 and 4,5% for 2012), thanks to the different support systems provided.

Moreover, a national system of certification of sustainable biofuels and bioliquids has been established. It introduces the verification of compliance with certain criteria in order to achieve the targets for 2020 and to allow the access to the incentives.

It has to be stressed that, despite the favorable outlook determined by the growth of the sector and the international and European policies, the targets in the field of renewable energy and energy savings are going to be achieved only if they become an opportunity for the development of innovative technologies, for the identification of new markets, for the creation of new professionals and employment, for the improvement of the environment and the territory.

This should trigger a circular process that intervenes not only on the financial obstacles but also encouraging the implementation of systems through the enhancement of the socio-economic benefits associated with them and their appreciation by the population, reducing the risks that hold the gap between the investments and the targets.[232]

[231] It is worth noting that the target in the electric sector has been almost reached. In fact, in 2012, 93 TWh have been produced with a target of 100 TWh.

[232] Commission Decision, *Renewable Energy and Energy Efficiency for the intervention of the European Regional Development Fund for the objectives of "Convergence" in Italy*, 2013

6.2 The other public actors of the agro-energy sector: the activity of ENEA, local Agencies and AEEGSI

Beside the activity of the Ministry of the Economic Development, other important public actors are involved in the energy sector.

The first of them is the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA). It is a public authority, controlled by the Ministry of the Economic Development and created in 2009 through the Law 23 July 2009 n.99 (art.37). It conducts research and provides support for the public administration, enterprises and citizens. Specifically, ENEA's activities are devoted to energy efficiency, renewable energy sources and nuclear energy, hosting experimental laboratories and facilities. Its activities also entail the renewable energies sector, including agro-energies, in order to support the national industry for the technological innovation in the energy production and the development of second generation biofuels.

Currently, the main activities in the field are related to the optimized use of biomass at the territorial level as well as the development, demonstration and qualification of innovative processes, technologies and components for the co-generation of electricity, heat, and/or biofuels at the local level.

Specifically, the mentioned initiatives are aimed at: producing biogas to be used for electric power generation or in the grid as gas biofuel (biomethane) from codigestion of organic wastes, farm wastes and/or sugar energy crops; exploiting energy from digestate as an alternative to the more traditional use as a farming amendant, by drying and pyrogasification processes, and even by mixing it with lignocellulosic biomass; developing and testing of new technologies for the final use of the produced biogas, such as energy co-generation by combining energy from biogas and fuel cells, with a significant improvement in the final yields of energy conversion and greenhouse gas balance. Research and Technology Development on second-generation biofuels

is focused on the possible thermochemical and biochemical conversion processes of lignocellulosic materials such as, respectively, gasification into hydrogen and carbon oxide, and the fermentation of carbohydrates into ethanol, as well as the production of hydrogen from fermentation of humid biomass and biofuels from microalgae cultures[233].

Furthermore, it is worth noting that ENEA has contributed at the sector by developing the census of biomass at the national level, allowing to identify quantities and qualities of the biomass available at the local level and to create the National Atlas of Biomass.

The Local and Regional Energy Agencies[234] have the mission to make effective the implementation of the national policies at the local level. In particular they should manage the energy demand and promote the energy efficiency by the better use of the resources, in particular the renewable ones, and by implementing actions for the safeguard of the environment.

They have been created thanks to the European incentive through the approval of the projects: SAVE I, SAVE II and Intelligent Energy. The aim of all of them was to contribute at the local development of the energy policies.

Therefore, so far we have seen that the public actors considered focus their activities on the research and technical field. By contrast, a different scenario has to be faced when analyzing the activity of the Authority for the electric energy, gas and hydro services (henceforth AEEGSI or Authority)[235]. In fact,

[233] For further details it is possible to consult the section dedicated to biofuels on ENEA website at the link: http://www.enea.it/en/research-development/renewable-energy-sources/biomass-and-biofuels

[234] Those Agencies are located in different regions of the country with the aim to support local energy actions. A list of them is available at the following link: http://www.managenergy.net/countries/26#agencies

[235] As known, the national governance of the energy is based on a dualistic system, as it is distributed mainly between the Ministry of Economic Development and the AEEGSI. However, if on the basis of the Law n. 481 of 1995, which created the Authority, most of the costs were attributed to the Authority itself, at a later time, the powers have been redistributed, configuring both the Ministry and the Authority as regulators of the energy market. Therefore, today, the division of responsibilities has well-defined features. Generally speaking, the Authority is

the regulatory powers which belong to the Authority allow it to concretely intervene in the energy market.

As known the activity of the Authority regards several fields but in this context we will consider only the actions related to the renewable energy sector. It is important to stress that there are no specific acts related exclusively on agro-energies. However, the regulation connected to the renewable sector indirectly influence this field too and this is why those are the elements considered for this analysis.

In order to rationalize the activities of the Authority in the renewable energy field, five areas of interest have been identified:

1. connections;
2. measurement of the electric energy lead into the system;
3. measurement of the electric energy produced;
4. access to the electric system;
5. incentive system for the production of energy through renewable resources.

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entrusted with the regulation of access to facilities, the unbunding, the promotion and protection of competition, services and users; by contrast the Ministry has the general jurisdiction on the definition of the energy policy choices, security and system of incentives. However, these boundaries are often overtaken, not without criticism from some operators of the field that have exposed the incoherence and failure to not exploit the opportunities offered by the presence of regulatory authority.

To this regard, it is important to make some brief remarks on the balance that has been created in the energy field between the promotion of competition and the protection of public interests.

Thus, for example, with the approval of the SEN, it became clear that the Ministry, although acknowledging "explicitly the constraints arising from the liberalization of energy markets (....) considers his task to assume the overall direction, namely the government, sector to steer its evolution towards the outcomes deemed preferable in the general interest. The work of the dynamics of the market is certainly not denied (...) but it is clear that the basic approach is not to those who only intend to promote and regulate those dynamics, but those who retain power and duty to influence the choices of operators"(Freed, 2014).

Indeed, in the Third Energy Package of 2009 it was unequivocally reaffirmed the European choice of ensuring competition within the market. It should be also noted that, recently, the European Law 2014 was published (Law 29 July 2015, n. 115, published in the Official Gazette on Aug. 3, 2015, n. 178) and it ensured the fulfillment of the monitoring and information to the European Commission arising from EU rules on services of general economic interest. Thus, in one of the amendments of the Law it is expected to transfer some powers of the Ministry to the Authority. Therefore, it is clear that we have tried to articulate better the framework of competences between the two bodies, leaving more room for the Authority. This is in line with the legal, economic and political debate.

The Authority has provided to regulate each of those activities through different resolutions that are summarized in the table below:

Table 3: AEEGSI Resolutions

Object	Content	Measure
Connection to the grid	Technical and economic conditions for the connection	Annex A, Resolution ARG/elt 99/08
Measurement of the electric energy lead into the system	Installation and maintenance of the meters, measurement of the energy lead into the system	Annex B, Resolution ARG/elt 199/11
Measurement of the electric energy produced	Installation and maintenance of the meters, measurement of the energy produced	Annex A, Resolution 88/07
Access to the electric system:		
Transmission and distribution of the energy		Annex A, Resolution ARG/elt 199/11
Dispatchable generation		Annex A Resolution 111/06 Annex A resolution ARG/elt 107/09
Collection of dedicated devices		Annex A Resolution 280/07
Power exchange spot		Annex A Resolution 570/2012/R/efr
Incentives		Green Certificates, Resolution 17/2012/R7/efr All-embracing tariff, Annex A, Resolution343/2012/R/efr

Source: Resolutions and acts of the AEEGSI

All those actions are part of a bigger plan in which the Authority is involved that has the aim to support the transition of the energy system to a new paradigm. According to the strategic plan of the AEEGSI[236], the Italian electric system is still dealing with this transition. At the end of it, the production should

[236] AEEGSI, Documento per la consultazione 528/2014/A, Schema di linee strategiche per il quadriennio, 2014

be decentralized, particularly the systems for the renewable energies, in line with the target of a more sustainable system, in terms of economy, safety and efficiency.

6.3 Technology and renewable energies: the case of the Smart Grid

In order to achieve the targets showed above, the development of an efficient energy grid is particularly important.

As already disclosed, the Authority has defined and is defining a series of interventions involving electricity producers, grid operators and the entire electricity system, following an integrated approach that focuses on the entire smart system, rather than on its individual components (either the network or manufacturing facilities or consumption). But before entering the core of these new tools it is necessary to start from the definition of Smart Grid. There is no single definition, but according to the ERGEG (The Association of the 27 European Regulators) the Smart Grid is «an electricity network that can efficiently integrate the behavior and the actions of all users connected to it – generators, consumers and those that do both – in order to ensure economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety»[237].

In other words, as the word itself suggests, the Smart Grid is an intelligent network that can integrate the actions of all users connected (consumers and producers) in order to distribute energy in an efficient, sustainable, and cost-effective way. Thus, the management of the system, in particular that of distribution, goes from being passive to active: in fact, this is not anymore a distribution network that transports the energy in only one direction, from a few large-scale power generation to various consumption points located at the end

[237] ERGEG, Conclusions Paper on Smart Grids, 10 June 2010. The paper is available at the following link: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Electricity/2010/E10-EQS-38-05_SmartGrids_Conclusions_10-Jun-2010_Corrigendum.pdf
See also: M.Delfanti, A.Silvestri (a cura di), *Smart Grid, le reti elettriche di domani. Dalle rinnovabili ai veicoli elettrici il futuro passa per le reti intelligenti*, GieEdizioni, 2011

users. Instead, the new network is characterized by bidirectional channels and active networks, made of electronics, computing and communication.

Recently, in June 2015, the Authority published the consultation document[238] (255/2015/R/eel: Smart distribution system: selective promotion of investments in innovative distribution of electricity) in order to spread a few changes in the regulatory framework. The document is part of the consultation process initiated by the resolution on Oct. 9, 2014, 483/2014/R/eel, for the creation of measures in relation to the quality of the electricity transmission, distribution and metering of electricity and the technical and economic conditions for the connection service.

The document discusses the state of art of the operating systems of the electricity distribution also on the basis of the results of trials conducted in recent years by pilot projects. In the document, the Authority highlights that the choices made can lead to the creation of a smart system, able to perform better functions without compromising the rules of competition and market participation.

In order to test the new systems, the Authority takes into account several features of the Smart Distribution System such as the monitoring, the control, the protection and those related to the use of storage systems for networking needs[239]. The paper then considers the Authority's guidelines regarding different adjustments: a) the quality of the distribution service; b) connections; c) network losses and the reactive energy; d) the extent and for the provision of data to users in medium voltage; e) dispatching.

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[238] AEEGSI, Consultation document 255/2015/R/eel: *Smart distribution system: promozione selettiva degli investimenti nei sistemi innovativi di distribuzione di energia elettrica,* 2015

[239] The Authority takes also into account the suggestions given by the AGCOM (the Italian Communications Authority) in one investigation. The document states that the Authority appreciates the consultation that AGCOM proposed to encourage the development of smart applications. In particular, the Authority highlights the importance of: ensuring interoperability between different devices and their substitutability; orienting the adjustment so as to favor the development of smart applications minimizing the costs; preventing that the development of M2M applications can hinder the development of multi-service solutions and multi sector. For more information see the consultation document available on dell'AEEGSI website.

It also highlighted a number of preliminary actions that are necessary for the optimal implementation of the Smart Grid. Finally, the document considers the interoperability between the end users and the distribution companies through the device that will be available. For this purpose new experiments are set, in order to verify the application of innovative solutions to the management of local networks.

In the Report of the Authority on the new electricity production mix[240], it is shown that the energy production mix is constantly changing in Italy, probably because of the increasing diffusion of plants powered by renewable energy sources. In fact, the Report assesses a strong growth of renewable energies over the last decade, both in terms of installed capacity (39% in 2013 compared to 24% in 2004), and production (approximately 39% in 2013, compared to 18% in 2004) and a consequent reduction of the incidence of fossil fuels. In order to make sure that the non-programmable renewable sources participate actively in the operation of the electricity system, the Authority stresses the importance of a proper regulation, able to support the potential of these systems and to support the network operators while using those facilities for the management of electricity grids. This would allow the integration and the further spread of renewable sources, while ensuring the safety of the electrical system.

The need for modernization is strictly linked to the innovative development of the energy market and it has the new technologies, particularly the Smart Grid, at the center of this process.

Thus, the Smart Grid is the answer to the increasing demand for energy and the expansion of renewable energy. Obviously, in this area the technological innovation plays a key role, along with the interaction between the world of electricity and the ICT (Information and Communication Technology).

[240] AEEGSI, Report 308/2015/I/EFR, *Il nuovo mix di produzione di energia elettrica: stato di utilizzo e di integrazione degli impianti di produzione alimentati dalle fonti rinnovabili e degli impianti di cogenerazione ad alto rendimento*, June 2015

The new economic reality and the increase in energy demand made necessary to expand and to strengthen the electricity grid which presented the issue of the huge economic and environmental costs. The old approach, in fact, had many problems: losses along the connecting lines, inability of a dynamic management - with consequent disruption of energy flow - and failure to fully exploit the renewable sources.

However, by developing new technologies it has been possible to renew the energy system at all stages of its process: production, storage, transport, distribution and sale. In fact, the Smart Grid represents a new form of management of the electricity as the grid is able to carry along its infrastructure the information flows, promoting an intelligent energy management.

In conclusion, it is possible to summarize the benefits of the Smart Grid as follow. First, it enables the integration of Distributed Energy Resources (DER - Distributed Energy Resource) and the integration of generators, batteries and loads of energy. This integration makes possible the real-time management of active loads, through protocols and information flows, allowing to balance peaks and voltage drops. Thus, all the devices that constitute the grid become part of a control cycle at first reserved only for the central management. Also, this way, the transmission losses are strongly reduced.

Another important advantage is that it is possible to manage the moments of maximum energy demand by scheduling the biggest loads so that they are not activated at the same time. The voltage peaks can be handle by adjusting the consumption through the joint use of smart meter (digital counters able to communicate with the network) and systems of automated management of the loads to the end-user level. To give a practical example, in case of demand peaks, distributors normally kept on standby are activated to obviate the voltage drop caused by the large number of required energy in a short period of time. This not only flattens the peak of energy, but it also allows significant cost savings as in peak time the electricity costs more.

Finally, a further advantage of the Smart Grid is to be able to efficiently integrate renewable energy sources that would otherwise not be used (because of their intermittency)[241].

Thus, the Smart Grid «in addition to maintaining a high level of safety and reliability of the entire system, it is also able to deal with the numerous problems related to the management of the Diffused Generation, to the possibility of load control, the promotion of energy efficiency and strengthening the involvement of end users and lending»[242].

However, the implementation and the development of Smart Grid should be a continuous process of adaptation of the network performance.

Nevertheless, it is also important to stress some critical aspects of the new networks.

Today, the main issues that regard Smart Grids have technical nature. In fact, the distribution networks have ways of operating and automation that differ from area to area as well as from country to country, but technological barriers are similar worldwide. In particular, in the opinion of the experts, some problems are detected for the voltage control, the cyber security and the management of information flow and control within the network (i.e. the protocols to be adopted in the Powerline Communication power). Therefore, it is necessary to continue to search for the analysis of the sensitivity of the active tension; to provide for an encryption on communication signals and efficient protocols that can simplify the difficulties of the receiver.

Another critical element to highlight is the development and the network modeling on the territory. In order to build a secure and reliable network, in fact, it is necessary to have the resources and the appropriate technologies for the efficient management of the network. Next to these tools it is also important to develop a control systems and a performance evaluation process, in order to fill

[241] For further details see M.Delfanti, A.Silvestri (a cura di), *Smart Grid, le reti elettriche di domani. Dalle rinnovabili ai veicoli elettrici il futuro passa per le reti intelligenti*, GieEdizioni, 2011
[242] AEEGSI, Relazione 308/2015/I/EFR, cited.

any operational gaps and act promptly whenever it is necessary. In particular, this criticality emerges when it is necessary to deal with the problem of covering electricity in remote areas and islands. For this purpose the so-called microgrid has been developed. It is a network that relies on reduced power generators of small flow rate for the coverage of energy to a limited number of users within a defined area. Obviously, in order to function, the microgrid has to be connected to a greater network for the exchange of energy but it maintains the balance using the resources locally available.

In the light of the above, it is clear that the Smart Grid represents a real technological revolution in the world of energy. Among the benefits we cited, it is interesting to focus briefly on the relationship between the new Smart Grid and renewable energies. In fact, it is an aspect that often remains obscure to the final consumer, as some studies have shown.

According to the estimation of the IEA, global production of energy from renewable sources will undergo a substantial increase in 2030, thanks to a cumulative investment of 5.5 trillion dollars, «approximately half of all the projections of investment in power generation during the period considered»[243]. Despite the obvious advantages produced by the development of renewable energy sources, the storage of large quantities of energy and its production by small business owners over the country can affect the stability of the power distribution, representing a challenge to their development.

With the advent of distributed generation, in fact, part of the electricity is associated with wind and solar plants in the area. Unlike traditional power sources, however, the generation of this type of energy depends on the presence of the natural resource. Consequently, the generation of the energy is not constantly ensured, in contrast with conventional power plants. Therefore, the development of renewable energy needed a change on electricity grids that at

[243] ABB, Smart Grid, *Un'evoluzione radicale nel settore dell'energia elettrica*. The research is available at: http://www02.abb.com/db/db0003/db002698.nsf/0/79a5c19055e829d1c125786a0038c4b6/$file/EvoluzSettEnergia.pdf

the beginning only allowed the transportation of energy from a few large producers to many consumers. With the advent of renewable energies, however, an increasing number of customers may switch from consumer to producer, by installing solar panels or systems for other renewable sources in their homes.

Thus, as we have seen above, the systems were not ready to manage bidirectional energy loads, but with the advent of the new Smart Grid the interaction between producers and consumers has been possible. Moreover, consumers have enter the system becoming, sometimes, producers themselves. However, since such production is intermittent by nature (the production of wind energy is in fact characterized by periods of great productivity followed by moments of stasis; while in the case of the production of energy from the photovoltaic, productivity is less in the case of cloudy weather and at night time), it was necessary to support efficiently the variations in amount of injected and transported energy. Hence, the Smart Grid are a response to this new demand and, once fully developed, they will manage the network, avoiding waste and redistributing, when necessary, the energy on the territory, drawing from cheapest source and using energy from renewable sources when possible, reducing CO_2 emissions.

In the light of these considerations, it is possible to understand the connection between renewable energy and Smart Grid: the efficient use of these sources, in fact, strongly depends on the development of the network.

The new infrastructure focuses on the importance of renewable energy for economic, social and environmental reasons, while the technological innovation makes possible to achieve these goals. The increase of the use of renewable energy requires more investment in technology that can quickly and effectively correct the problems that may arise during the delivery.

Finally, there is another consideration to make that concerns the placement of the sources. The smaller producers, in fact, often live in residential areas with low industrial exploitation, where the network is not developed yet for the receipt and delivery of electrical energy. This is another challenge facing

the new system in order to ensure a reliable electricity supply, able to meet the demand for energy and make it sustainable in the long run.

6.4 The actors of the private sector

6.4.1 The agro-energy companies

So far we have seen that different elements will influence the future of our planet, affecting the environmental and social sphere as well as the productive and economic system. This is why at this stage of the process the involvement of all the countries (industrialized and developing countries) has become a must, in a scenario of a growing range of responsibilities**.**

Therefore, beside the action of the public authorities, it is important to investigate the answer of the private sector.

In the framework of the agro-energies, the agricultural sector can play an important role as its activity directly affects public interests and it can reduce GHG emissions, both enhancing biomass for energy purposes and adopting practices able to favor carbon sequestration in soils and plants.

From this point of view the Common Agricultural Policy promoted by the European Union is particularly relevant. It takes into account the new role that the agro-company will have in this transformed scenario in which multi-functionality and sustainability are the cornerstones of the new agro-energy dimension. In fact, the renewable energies from agricultural sources offer the opportunity to reduce energy dependency and to contribute to the mitigation of climate change.

This is why, through the PAC, the European Union has developed an array of incentives in order to stimulate the production of renewable energies from the agriculture.

The first incentive was regulated in 2003 with the reform of the PAC which introduced a special incentive regime for the production of the agro-energies[244].

In 2008 the PAC was modified, as the European Union decided to focus on a system of incentives based on the demand of energy and not on the supply side. That means that the incentive for the agricultural biomass has to come from the energy policy (i.e. through Green Certificates) that should be able to stimulate the demand. As a consequence, the supply of agro-energies will increase.

Beside the PAC, another important incentive instrument is the Rural Development Policy 2007-2013 (Reg. CE 1698/2005). It promoted, among other things, the modernization of the agricultural industries and the diversification of their activities. It also established different incentives for the agro-energy production and it has been used by several regions in order to stimulate new investments in the sector.

As we have seen until now, measuring the sustainability of the agro-energies production is never easy, as different indicators can be used and, consequently, different interpretations can be deduced. Moreover, the results depend also on the different level of application of the study: macro, micro or related to a particular aspect of the process. This implies that interests of different subjects are involved in its evaluation.

Recently, particular importance has be given to the Life Cycle Assessment that, has the merit to evaluate all the impacts of the production, in this case of the agro-energy one. However, when considering the agricultural process, other elements matter in the evaluation of the sustainability of the process, such as the sustainability of the cultures used for the biomass production or the protection of the air and biodiversity. Ultimately, when the farmer is the one

[244] It was a 45 euros incentive, per hectare for all agricultural land, if the products are for thermal energy, electrical or mechanical and/or bio-fuels and bio-fuels. The aid is limited to a maximum area at Community level of 2.0 million hectares. A farmer who wants to benefit from this aid must sign an appropriate cultivation contract with a processor stating the agro-energy target.

who makes the evaluation, economic and organizational aspects have a particular weight on the decision, as well as agro-environmental aspects.

It is important to stress that the principles underlying the functioning of the agriculture are far from the ones related to the energy sector. In fact, if it is possible to affirm that in the agricultural sector the subjects in charge of the exchange are free to decide what and how much to exchange, in the energy sector it is not the same. In this case the production rule is governed by the public authorities which control the operators of the markets, the production and the prices. All those activities are regulated by directives and administrative acts that make sure that the public interest are pursued.

In order to summarize, the elements that can be considered in the evaluation of the agro-energy production process and the different scales are indicated in the table below.

Table 4: Sustainability Indicators

Global level	Reduction of GHG emissions CO_2 balance Energy balance Biodiversity
National level	Contribution to the energy demand Energy production cost New employment Enhancement of agro-forestry areas
Environment	Soil conservation Safeguard of hydro resources Recreational value and environment
Agriculture	Economic balance Employment Steady production Flexibility of the cultures

Source: Author elaboration

Some forms of agro-energy (primarily for the use of biofuels in the production of thermal energy) have a tradition already established in the agricultural enterprises. By contrast, others are not prepared (primarily for processing into biodiesel and bioethanol), probably because of the variation of

the plant equipment and processes. In those cases, an additional effort is required, implying a thorough and proper training/education. In fact, the considerable heterogeneity of biomass results in a growing number of elements that the farmer is responsible for. Therefore, the opportunity to convert land for arable crops to energy crops constitutes one of the main issues in which technical (under the vocation of the territory), economic (related to input crop and market trends of products agricultural) and political (related to the support that the State allocates to the development of agro-energetic production) factors have to be considered. In this scenario the development of the short chain – characterized by the minimum distance between the place of production and consumption energy - can enhance the environmental peculiarities and the social circumstances at the local level. At the same time it creates opportunities for income diversification, agricultural enterprises and new employment opportunities and local development. Based on this approach, the short chain implies the reorganization model of the agricultural production, requiring several conditions such as: ensuring governance models of agro-energy system, providing sharing of agricultural businesses, other businesses, banks and institutions; the identification of suitable models from a geographical point of view, logistics, agronomic and earnings, to orient part of the agricultural productions to agro-energy plantations; the application of models of traceability and traceability of the supply chain; the promotion of energy sector in the greenhouse cultivation, floriculture, livestock and, more in general, the agricultural sector, through modernization of the plant and technological processes.

In order to reach those targets, the appropriate conditions have to be provided to the farmers by establishing a regulatory framework light and durable, which also includes the development of specific mechanisms of incentive, necessary to balance the difference in cost of production.

6.4.2. Corporations

In the previous paragraph the industries of the agricultural sector have been considered because they are the ones in charge of producing the agro-energies and they are required to follow the sustainability criteria. However, besides them, corporations in all different sectors can give their support to agro-energies and, more generally, to renewable energies and sustainable development.

This is why it is also important to dedicate a few lines to those companies that, in the Italian scenario, put their effort in using renewable energies and in applying all those practices with the aim to promote sustainable processes.

The transition process to a greener economy is characterized by eco-investments of the corporations. Eco-investments regard those products and technologies that maximize energy savings and/or have a lower environmental impact, resulting also in an improvement of energy efficiency.

In Italy, from 2008 to 2014, 372.000 companies of the industry and services sectors invested in green technologies, ensuring energy savings and a minor environmental impact. In other words, one company out of four (about the 25%) of the extra-agricultural companies were involved in eco-investments. Those trends regard several corporations in all different sectors of the industrial production. However, according to the data, in the industry sector the eco-investment is more diffused, probably because of the higher environmental impacts.

As known, the sector of energy and hydro public utilities is one of the most affected by ecological matters. Consequently, this is the field in which new technologies are demanded the most, as the environmental resources are part of their own chain productions. Thus, more than 42% of the companies of this sector invested in green technologies in the last 7 years. Other sectors particularly involved in eco-investments are the manufactory (one third of the companies), the construction (one fifth of the companies) and the tertiary sector.

It is important to stress that from 2011 to 2014 the companies' propensity to adopt green investments suffered a setback as - above all in 2013 and 2014 - the percentage of companies that planned to implement eco-investments dropped to 6-7% from higher values of 12-14% recorded in 2011 and 2012. The reason of this inversion of the trend has to be found not only in the economic cycle but also in the consideration that those investments are not usually done every year as they are mid-long term investments. Coherently, the data show that in 2015, the eco-investments are growing again, reaching the 8%. In absolute terms, it is more than 120.000 companies, an increase of 36% compared to 2014, which corresponds, to over 31,600 companies[245].

As we have analyzed in the second part of this work, the private companies who give importance to the sustainable development have different instruments in order to show their commitment to the environment and, more generally, to the society.

Therefore, in the Italian scenario several companies have voluntarily decided to invest in the sector of the renewable energies. In fact, even if the demand for renewable technologies has been driven by the energy policies and the systems of incentives, there is also a growing awareness of the benefits related to the use of renewable sources. Commonly, the decision to procure renewable energy is taken at a broader level. Most of the companies seems to prefer the direct investment in on-site generation[246]. However, also the consumption of renewable energies is increasing. According to the CREX report the sectors of financials, consumers services and consumers goods are the ones that are more likely to use renewable energies. The reason of this trend has to be found in a major sensitivity of the consumer-facing companies to the branding aspects of energy usage.

[245] Those data and further information are available in the Report of UnionCamere, *Green Italy 2015*:
http://www.symbola.net/assets/files/rapportogreenitaly2015percent20BASSA_1447064245.pdf
[246] CREX, Corporate Renewable Energy Index, 2012

Clearly, the multinational companies are the ones most interested in demonstrate their commitment to the environment[247]. In the Italian energy scenario there are several companies that produce and distribute energy that pay particularly attention to the sector of renewable energies. So, corporations such as ENI or ENEL Green Power represent a good example of those companies. In the document "Eni for Sustainable Development 2014 Progress"[248] the company shows its commitment to the environment and its support to the research in the renewable field. Therefore, the document shows that, during 2014, ENI obtained the ISO Certifications for most of their processes and established the target of getting the 100% covered by 2018. Moreover, beside the objectives or reduction of the energy consumption and the growing of efficiency, the document shows that during 2014 the first biorafinery has been implemented in Italy for the production of green diesel. The target for 2018 is to get from it the total amount of biofuels needed for ENI. Ultimately, it is important to stress that consistent investments have been made in the research field, in order to find solutions to the problems that concern the global energy scenario.

As for ENEL green power, beside its commitment to the development and generation of energy from biomass, following four lines of development with different characteristics[249], it is worth noting that in 2014 ENEL invested in the

[247] To this regard there are e few multinational companies that are worth to be cited: Unilever, which in February 2016 announces new global zero waste to landfill achievement across more than 600 sites and in 70 countries. For further details see: http://www.csrwire.com/press_releases/38693-Unilever-Announces-New-Global-Zero-Waste-to-Landfill-Achievement
Neslé Global is another interesting example because they pay particular attention to the farmers that worldwide support Neslé production, in order to ensure they meet environmental targets. See: http://reports.csrwire.com/report/Publication-2015-Nestle-Society-Creating-Shared-Value-and-Meeting-Our-Commitments

[248] The document "Eni for" is available on the website on the company: www.eni.it

[249] 1. Mini biomass plants: creation of a network of small and medium plants of 200 to 500 kWe in Italy, mainly fed using by-products (woody biomass, agricultural and agro-industrial residues) and established directly or through joint ventures with agricultural partners; 2. Hybrid plants: integration of geothermal power plants in Tuscany, Italy with biomass plants, where technical conditions make it feasible. This type of plant is the first and only one of its kind in the world and could pave the way for a new way of producing energy, via the integration of a number of renewable energy sources, designed to maximize energy production, reducing waste and using

first plant in the world able to integrate geothermal and biomass energy[250]. «This plant represents a major technological innovation with virtually no impact on the environment, as it supplements an existing industrial site, maintains the total renewability of the resource and the cycle and combines two renewable energy sources for a form of generation that opens new prospects at the international level»[251].

Another Italian company worthy of being mentioned is Mossi & Gisolfi Group. Specialized in the production of plastic packaging, they also produce polyester fibres and provide services and solutions for companies in the petrochemical, polymer, fiber, energy biofuels and environmental technology sectors. It is interesting to stress that, according to the CEO declaration, «the impetus for exploring renewable technologies came largely from M&G's packaging clients». This is why, conducting research and development efforts in the area of biofuel was seen as a logical first step to develop low carbon packaging options. «There is no possibility of reaching a solution in the chemical space, unless you first explore the grounds of the technology, and the first and the most accessible market was the biofuel market. So we have seen biofuel as the first step to arrive at a solution that is environmentally friendly, while also offering an environmentally friendly solution for packaging»[252].

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local woody waste for generation; 3. Conversion of former sugar mills: development of biomass plants conversion of former sugar mills and of their sugar-beet supply chain through the development of large-scale biomass plants (ranging from 15 MWe to 50 MWe) using dedicated crops, waste from pruning, herbaceous biomass and byproducts in short supply chain (within a radius of 70 km from the plant) in Italy; 4. Internationalization: the development prospects of biomass at the international level are ample thanks to broadened horizons that span into new countries, such as Russia, North Africa and Latin America, with the full intention and awareness of the importance to comply with the environmental and social conditions in the host countries. For further details consult: https://www.enelgreenpower.com/en-GB/doc/company/EGP_Brochure_ENG_2014_.pdf

[250] According to the project, the existing geothermal plant will be supplemented by a small plant powered with locally sourced virgin forest biomass produced within a radius of 70 km from the plant.

[251] Enel Press relase: https://www.enelgreenpower.com/en-GB/media_investor/press_releases/release.aspx?iddoc=1662787

[252] G. Heal, *The Mossi and Ghisolfi Group Monetizing Beta Renewables*, Columbia Caseworks, 2013

6.5 Energy efficiency: the role of the conscious consumer

In the last part of this work we have seen who are the actors that participate in the definition of the framework of the sustainable development, in particular considering the agro-energies sector or, when not applicable, the broader sector of the renewable energies. We considered the action taken at the European level at first, their repercussions at national level, both analyzing the strategic lines of the Government and the action lines of the Authorities and other public Agencies. Secondly, we considered the efforts and the systems of governance of the actors of the private sector in adopting those lines of conduct.

Therefore, the aspect that still needs to be analyzed is the role of the consumers[253], how they perceive those policies, how they respond to them and, above all, which role they play in the described energy scenario[254].

First of all, an element that is important to stress is that in the recent past the European Union has tried to focus more on the supply side than on the control of the demand of energy. This means that the reduction of the energy consumption is one of the element on which the policies have insisted, as this is where the energy efficiency can improve the most.

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[253] Even if in the last decades many researchers have tried to provide case-studies on how corporate responsibility impacts profitability, a few of them focus on consumers and how they evaluate the social responsibility of companies. To this regard, an interesting article analyzes the behavior of consumers that goes from unresponsive to highly responsive to CSR, proving that consumer behavior is not moved only by self-interest: L.Mohr et al., *Do consumers expect companies to be socially responsible? The impact of Corporate social responsibility on buying behavior*, The Journal of Consumer Affairs, Vol. 35, Num. 1, 2001

[254] A general scenario on the link between consumer behavior and sustainable development is offered by A.Dobson who broaches the question of how bring the behavioral change related to sustainable development. He pointed out that the strategy to communicate to consumers how bad everything was, would not be enough to obtain a change in their attitude. Thus, he considered two different approaches, the structuralist and the volutarist one. In the first case, consumer behavior is driven by deep structures that need to change before our behavior can change. In the second one, consumer behavior does not depend on the environment we live, or at least it is relatively independent. Starting from those consideration the author offered some solutions, such as fiscal incentives and education, in order to promote a more sustainable attitude among consumers, institutions and organization. For further details see: A.Dobson, *Environmental Citenzenship: toward sustainable development*, in Sustainable Development Num. 15, 2007

In fact, an outnumber of factors can influence the demand side, such as the globalization, the oil price, the climate change, the economic growing of developing countries. Those are all elements hard to control, if not impossible. This is why both the international and national policies have focused on the consumption of energy in order to reach the target of the economic and environmental sustainability of the energy system. It is definitely a long term goal but it obviously influences the decisions on the current investments.

Therefore, the responsibility for this change involves all the cited actors: the decision-makers who have to take decisions at large-scale, the businesses who have to rethink the production processes and their products and, ultimately, all the consumers who have to make their personal choices.

According to a research[255], consumers' behavior is one of the most relevant when considering the overall energy balance: in Italy the 32% of the energy is used in the civilian sector, compared to the 30% used in the transportation and the 28% of the industry (agriculture and the non-energy sectors). Thus, not only the industry has a relevant role in the energy field but, instead, end users can have a great influence on the energy output.

The changed scenario in which we live imposes to adopt policies in order to reduce consumptions for the achievement of environmental targets.

Made clear that consumers play a fundamental role[256] in the energy scenario, it is necessary to remark that they can have two kind of different influences according to the situation in which they operate.

Therefore, we can considerer one case when they act as consumers, and another one when they act as end-users.

[255] A.Lorenzoni, M.Cattarinussi, *Risparmio ed efficienza energetica, in Consumatori*, Diritti e Mercato, Focus Num. 1, 2008

[256] To this regard it is important to stress that the number of "green consumers" is growing both in Europe and in the United States, even if most consumers share concerns about environmental issues, there is still a gap between green behavior and concerns. See: C.Chang, *Feeling ambivalent about going green*, Journal of Advertising, Num. 40, Issue 4, 2011; K.E.Noonan, L.J.Coleman, *Marketing to green communities: how to successfully reach the green consumer*, Journal of Marketing Analytics, Vol. 1, Issue 1, 2013

In the first case, the involvement of consumer can be crucial: with their buying choice, in fact, they influence the corporations' behavior. Different studies have demonstrate that, when correctly informed, consumers prefer to spend more for a product that has sustainable characteristics instead of a product that does not. According to several analysis in the field[257], consumers are more and more sensitive to the sustainable policies adopted by the companies. In fact, sustainability is now perceived as a synonym of quality and it has become one of the criteria of choice for the purchasing decision. According to the GFK-Urisko Report of 2015[258], among the drivers for the reputation of a company, the sustainability comes only after the quality of the product, positioning itself as one of the most important element when evaluating a company. The same report shows that in the future both corporations and consumers will pay more attention to sustainability and that consumers who currently take those aspects into consideration are part of a "qualified" group of people: they are usually females with a good level of education, a well-qualified job and living in big cities.

Even more importantly, an aspect that emerged is that consumers not only "award" those companies which follow sustainability criteria, but, above all, they "punish" those companies which do not act responsibly. Therefore, it seems that the reputation is one of the most important aspect that influence both the decisions of the consumers (when they have to purchase a product) and of the companies (when they have to choose their lines of conduct).

Another aspect to consider concerns the choices related directly to the purchase of products that use energy. In this case, the consumer can choose between energy and technology. Usually, the difference is in the price of the product as the initial investment in technology could be higher. However, the difference in the price of the energy needed for the use of the product can be greater, but no one usually pays attention to it. Therefore, if these decisions do

[257] As an overview about studies that prove the business case for sustainability see: IFC, *Sustainability Pays Studies That Prove the Business Case for Sustainability*, May 2012
[258] GfK Eurisko, *Consumatori e sostenibilità: stato dell'arte e tendenze evolutive future*, April 2015

not influence the families' balance at the end of the year, it can be crucial when considering those decisions in a cumulative way, i.e. at the national level.

This is why, as often happens, the first step in the direction of a sustainable energy system is the information. In fact, only a conscious consumer will be able to take those decisions that are so important to reach the pursued strategic targets.

As for the second case, every individual can influence the energy scenario when acting as a end user. That does not mean that consumers have to drastically change their behavior. The change, instead, should come from investments in new technologies that allow to achieve higher levels of well-being with lower energy and environmental costs, and to innovate and create new products and sustainable production processes.

If it is true that consumers can play a fundamental role in this scenario, it is also true that innovation is as important as their propensity to adopt a responsible behavior in the purchase decisions.

Therefore, to stay on the subject, we can consider as an example the functioning of the Smart Grid. In fact, in this case, a high degree of involvement is required to the final consumer, not only as it regards commercial purposes but also - and above all - because the main feature of the Smart Grid is the interaction between the utility and the end users, due to the counters or other communication infrastructures. It is clear that a key element of the new networks will be the dynamics of the system, the real-time interaction of all the actors and the entry in the market also of those of small size.

Thus, it is not a coincidence if all research on the subject have the objective to identify the most efficient systems in order to ensure the highest level of information and interaction with the consumers. Once again, they need to be put in the position to know their energy behavior and the tools and features available on the market, in order to evaluate the offers and choose optimally among them. The end user is also required to interact with the distributor (the company that manages the electricity network) or the energy provider (the

company that deals with the sales department of energy sales) through the energy meter. The latter must be remotely managed, giving also the possibility to make recordings and updates.

Therefore, to allow the new technologies to overcome the existing barriers to the development of Smart Grids, the regulatory framework has to evolve accordingly. The authorities are pushing the logic of smart systems that can optimize the new challenges faced by the electrical system but the regulation has to move along with the evolution of the system and to intervene in the course of this development, satisfying the new market demands. This is why the AEEGSI has launched several pilot projects and consultations in order to gather comments from the actors of the system, to define the most effective guidelines that are able to respond to signals that come from the market itself.

The current structure of the system was not designed to meet these new requirements. Therefore, it is evident that there is room for improvements, considering the centrality given to the environmental sustainability, which can be guaranteed with innovative tools. Moreover, the entry into the system of a greater number of users requires the identification of roles and new rights and duties, as they can have a big influence on it.

The decision-maker is facing entirely new scenarios, which makes necessary the assessments on the costs and benefits that the company can obtain in connection with its investments, always considering the objectives of the energy and environmental policies that have to be pursued.

In conclusion, even if the two scenarios described above completely differ from each other, it is possible to individuate some guidelines that can be applied in both cases. In fact, the analysis shows that, when properly informed, consumers and users tend to choose the most responsible and sustainable behavior. Two principles seem to be the cornerstone of the analysis: information and transparency. Nowadays the price of the product is still relevant but in the last years the relation between the price and the quality has grown consistently.

Today people are willing to understand what they buy in order to evaluate the quality of the product. This is why companies are putting their effort in communicating their responsible strategies to consumers. But in order to do that, the integration between information and transparency plays a fundamental role. In fact, if the consumer feels betrayed, the reputational damage is irreversible.

Ultimately, the commitment to eco-efficiency has to be pursued at several levels: among institutions, enterprises and consumers. Environmental protection and the climate change mitigation require better information in areas such as energy and transport, in which consumers can generate concrete improvements with their actions[259]. Therefore consumer's policies can provide tools in order to make favorable choices for the environment. Moreover, especially in the long term, the conversion of consumption represents the real opportunity also for the companies which can do well by doing good.

[259] Communication of 13 March 2007 from the Commission to the Council, the European Parliament and the European Economic and Social Committee, *EU Consumer Policy Strategy 2007-2013*, COM(2007) 99 Final.

CONCLUSIONS

The analysis developed in this work has come to some conclusions highlighted in the respective chapters. Here, they are summarized.

1. First section

The first aspect that is investigated is the relationship between the social and the legal responsibility. The conclusion is that those two aspects have a complementary relationship. This is true, above all, because the instruments adopted by the companies (such as, for example, codes of conduct, codes of ethics, etc.) once made public, become legally binding. Therefore, the rules of social responsibility fall under the category of soft law - directing the activities of the recipients and linking them to the achievement of a goal. However, they often also pursue another goal by referring to other soft instruments. Consequently, they fill the spaces left blank on purpose. Thus, those standards are “soft” only in relation to their development but not in relation to their effects.

Secondly, the reputational factor - highly developed among companies - should not be underestimated, as it represents a particularly effective deterrent. Therefore, the rules of social responsibility complete the picture of the business activities by bridging those gaps between governance and law that characterize the market.

In addition, the research showed another important, yet unexpected, result that is worth highlighting. It has been found that many of the companies that compose the international scene would prefer the introduction of a hard type of legislation. This is because on one side, hard law is a path that companies considered as a "forced" way to follow and, on the other, it would also avoid the

differences in companies' behavior. Indeed, the fact that some of these are able to mask irresponsible behavior belittles the efforts of those whose commitment is real.

One of the main problems of the system is related to the system of control and sanctions. Because of its voluntary nature, the system does not include binding legislative instruments to ensure greater rigor and to increase efficiency of the rules. Therefore, it would be desirable that, at least at the European level, the legislator would take measures in this direction by defining a common framework capable of creating the conditions for a better functioning system. This objective could be achieved through the formulation of a code that establishes general criteria for the creation of behavioral parameters that are effective and, above all, binding. In fact, only clear and well-defined rules can be checked and verified.

2. Second section

In the second phase of the work, the attention focused on the energy sector. In fact, sustainable development invests all the economic sectors. Therefore, for the purpose of this research, the energy sector is particularly appropriate because it involves the direct use of natural resources. As a result, the sector is considered one of the most important for the sustainable development and environmental protection of our planet.

The research focused on the agro-energy sector, starting with their definition and analysis of their sustainability. There are different categories of agro-energy and several generations of biofuels. Today, first and second generation biofuels are overtaken by those of third and fourth generation, which although promising, are not yet on the market.

The research in this area can play a key role, together with innovative technologies. By now, it is possible to say that the premises give reasons to hope for good results. This evolution would also solve the debate on the trade-off between the needs of the energy sector and the ones of the food sector - a trade-off that is difficult to overcome without the development of new forms of energy and, above all, without the support of new technologies.

To complete the analysis of the agro-energy sustainability, the Life Cycle Assessment was considered. In fact, it is not enough just to consider the impacts on soil or the effect of emissions - a complete analysis involves all the stages of the process.

As shown in the second section of this work, today it is not possible to give a clear answer about biofuel sustainability. In fact, the analysis often takes into account different parameters and indicators, making the results not comparable and especially not entirely reliable in absolute terms. Therefore, only with the help of innovation and new technologies, will it be possible to reach unequivocal conclusions that are obviously indispensable for the establishment of an appropriate and fair energy policy.

3. Third section

Finally, the original contribution of the research is the conjugation of the agro-energy sector with the sustainable development by analyzing how the two concepts are integrating the market realities and through the responsibilities of which stakeholders.

Therefore, the third section of this work has been structured in such a way as to formulate some responses on the basis of the findings of the two previous sections. First, the analysis focused on the European legislation, and later, on the actions that have been undertaken at the national level, both in the public and

the private sphere. Since the agro-energy sector is a niche industry, its development depends on the presence of the territory of the resources needed to produce it. So, when it was not possible to identify measures or specific actions on biofuels, the wider sector of renewable energies was taken into consideration.

This research has led to the identification of several individuals who are responsible for the sustainability of the sector. First of all, there are the institutions that, with their own policies and regulations, can influence and promote socially responsible behavior and protect general public interests, such as the environment and, more broadly, the society as a whole.

In recent years, the Italian government has pursued policies in order to transpose the European directives, even if with some delays and gaps. Today, the topic is firmly accepted among the government's objectives, being sustainable development one of the key elements of the National Action Plan and the National Energy Strategy, in which the guidelines of the sector are exposed and organized around well-defined priorities in order to achieve the strategic objectives.

Aside from the actions of the government, there are those implemented by other public actors, such as ENEA, the AEEGSI, and local agencies.

ENEA lends its support to the Public Administration to achieve greater energy efficiency.

As for agro-energy, the Institute supports the domestic industry for the technological development of next-generation biofuels. Currently, the main activities focus on the use of biomass at the local level and the development of technologies to co-generate electricity, heat, and biofuels. ENEA has also contributed to the drafting of a census on national biomass that has been of great support for research, allowing to identify the quantity and quality of biomass locally available by publishing the National Atlas of Biomass.

Local and regional energy agencies also play an important role by making the implementation of national policies effective at a local level. Because of their strategic importance, it would be desirable to give them a greater development in the future.

Finally, the public actor taken into consideration is the Authority for Electricity, Gas and Hydro Systems (AEEGSI). Unlike ENEA and local agencies, which have a specific a mission of support and research, the AEEGSI owns regulatory powers, and the ability to intervene more effectively on the system. Therefore, the various orders issued by the Authority in recent years were examined.

In conclusion, those measures embrace some specific areas of intervention such as the production of energy, its measurement, the access to the system, and the regulation of incentives for the production and use of renewable energy. All of these measures still fall under a broader framework of action, which sees the involvement of the Authority in the transition of the energy system towards a new paradigm, decentralized and more sustainable, in terms of economy, safety and efficiency (see the focus on Smart Grid).

At the conclusion of this framework, it is possible to deduce that the synergy between these public actors is a cornerstone in the Italian regulatory landscape.

With regard to the private sector, businesses play an important role that is manifested through the tools of CSR and the respect of all stakeholders that are somehow connected to the activities of the enterprise. Their actions have a decisive influence on the sustainability of the Italian socio-economic system.

The analysis took into account two different business scenarios both that of the agro-energy companies, which directly produce renewable energy, and that of the companies that indirectly - in particular multinational companies - decide to adopt sustainable systems of governance.

In the production scenario of renewable energies, a farm may produce not only raw materials for the food market, but also electrical energy and biofuels. Thus,

it fully enters among the actors who are required to respond for the sustainability of their businesses.

This is why the European policy has been created with the objective of encouraging the multifunctionality of these enterprises in order to support, alongside the production of primary goods, that of renewable energies. For this reason, through the CAP (Common Agricultural Policy), the EU has developed a series of incentives to stimulate the production of renewable energy from agriculture, to reduce energy dependence, and to contribute to climate change mitigation.

However, we have seen that the analysis of sustainability varies on the basis of various parameters that are taken into consideration. It is clear that in this area a greater level of information is required because, if it is true that some forms of agro-energy have already a tradition among some agricultural businesses, for many others this is not the case. This scenario makes an extra effort necessary to promote trainings in the field in order to diversify agricultural activities and to choose more sustainable patterns of production within an effective and durable regulatory framework.

The analysis has also been extended to those companies which, although not directly responsible for the production of renewable energy, support the theme of sustainability. In Italy, about one out of four has supported eco-investments. The study found that socially responsible behaviors are pursued not only for ethical reasons but also, if not especially, to return motivations of corporate image. It has been proven by numerous studies that companies get wider benefits when they adopt socially responsible behavior. These figures explain why more than 42% of the energy companies have invested in green technologies over the past seven years. If this trend has to be attributed in part to the incentivizing policies implemented by the governments, it is also the manifestation of a growing awareness in the private sector. In fact, companies now know that they must take concrete steps in order to respect the

environment. To this regard, the obstacle that still needs to be overcome is that such policies should not only be limited to superficial strategies. To this end, consumers can also play an important role.

Consequently, the focus of this research has shifted to the consumer - intended both as a person who makes purchasing decisions and as a user who consumes energy. Therefore, through their own actions and purchasing choices, consumers can support policies that go in the direction of greater social responsibility and sustainability in the long run.

We must not forget that almost one third of the energy is used in the civilian sector, while the remainder is divided between industry and transport. It should also be noted that European policies in recent years have focused only on the supply side rather than on the demand for energy. This is because the demand depends on many factors which to date cannot be considered under control. In this case, the actions of the individual can be decisive in defining the national energy scenario. Obviously, it cannot be expected to drastically change users behavior or to obtain this result in the short term. Such a change must result from policies based on information and acquisition of awareness.

Investments in new technologies are crucial because they are the basis for the maintenance of high levels of well-being with a low environmental impact. Finally, the consumer considered as a subject who makes purchasing choices is entrusted with an important role because it can affect the performance of the market by pushing companies to adopt more or less responsible behaviors, both in the social and the environmental sphere. In particular, the consumer is crucial when deciding to boycott a company for failing to keep the expected behavior. In fact, in those cases, the loss of reputation is worth more than any sanction that the company itself can be punished with.

An informed consumer is probably the most effective weapon that we have for the pursuit of sustainability objectives in the long run. What is needed to achieve this goal? The keywords are information and transparency. In fact, only an

informed consumer can make responsible choices and influences a path that today seems almost obligatory. The way forward will make a difference both for us and, especially, for future generations.

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