Greener cities and territories: Brief notes on socio-economic acceptance to renewable energy sources

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Abstract

Over the last two decades the use of renewable energy sources has rapidly increased due to energy safety and/or economic issues (i.e. dependence from energy producer countries, energy price volatility). Also, at international level, recent EU and US regulations have helped the adoption of renewable energies across countries and the re-shaping of the energy sector. No doubts that this scenario has favoured the development of greener cities and economies. Nonetheless, it has caused several challenges on the landscape. The installation of large scale solar photovoltaic (PV) panels, for example, implies, among other things, land use change against the production of agricultural commodities. Similarly, the establishment of wind farms affects land use change and impacts wildlife preservation and aesthetic views.

The existence of these landscape changes poses several questions on the sustainability of cities and territories. The present paper discusses the existence of socio-economic dilemmas in view of renewable energy projects for the growth of greener cities and territories. To respond to the research question above, this work aims at investigating: i. How the use of renewable energies (e.g. wind and solar PVs energy) affects social acceptance across consumers and the economy of a territory; and ii. What implications exist at policy level to close the gap between effective and perceived use of renewable energy sources.

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Keywords

Renewable energy, Social acceptance, Sustainable economic growth, Greener cities, Greener territories.

Introduction

According to the International Energy Agency (IEA, 2012) cities are responsible for around 70% of the world's energy production and 70% of world greenhouse gas (GHG) emissions. Over the next 40 years urban population growth can be responsible for the rise in future carbon emissions unless a break in current trends takes place (IPCC, 2014). Nevertheless, the implementation of green policies, better planning strategies and new and green neighbourhoods, often let cities play a leading role for sustainability (Premalatha et al., 2013). In addition, the role of the energy sector enables cities to growth and guarantees a more competitive and sustainable energy solutions for businesses and families' development in order for the society to benefit of the green economy potentials. Generally, urban areas are more capable of innovative businesses than smaller centres or marginal areas due to an easier administration of private or public funds (OECD, 2012). This renders cities a generator for green transformations.

One of the examples of green city networks is the C40 initiative developed by the Global Leadership on Climate Change which includes 40 cities worldwide committed to sustainability. At EU level, in 2009, the Covenant of Mayors (www.covenantofmayors.eu/index_en.html) movement has seen local and regional authorities around Europe committed to the use of energy efficiency and renewable energies within their territories. This initiative aims at reaching the so-called 20-20-20 EU voluntary strategy to the Kyoto Protocol (European Commission, 2009). The 20-20-20 strategy, initially promoted by a large EU public consultation and a direct comparison with institutions, aims to offer an analysis and energy policy

indications for decarbonisation, future growth and improvement of quality of life in EU by focussing on renewable energies as strategic sector to reach sustainability issues. The objectives, among other things, include energy safety, stable and long term green jobs creation, healthier indoor and outdoor environments and improved quality of life, increased sustainable economic competitiveness and energy independence.

The switch of energy supplies to renewable sources is not a process without limitations. There has been an increasing debate over the last 30 years, although only the last 15 years have seen an intensification of the issue, of potential barriers to the development of renewable energy use (in particular wind and solar energy) due to social acceptance. In the 1980s, during the first stages of renewable energy investments, green projects took place between local authorities, private investors and companies (Carlman, 1984). The rise of asymmetries between stakeholders, policy makers and the general public about landscape issues in relation to installations, socio-economic benefits, and pollution (including acoustic pollution from first generation wind turbines) has brought the question of social acceptance of renewable energies to the attention of the scientific international community. The debate, so far, strongly focuses on empirical evidences worldwide and critical assessments to the conceptualization of *acceptance*, including, for example, economic (markets), regulatory and technological (innovation) meanings.

The present work, embracing the above views, is structured as follows: Over the next two sections we highlight social and economic acceptance of renewable energies with particular reference to wind and PV panels; next, we illustrate the role played by technology and innovation in consumer perception of RE; finally, we draw relevant implications for the decision-making process for greener cities and territories from existing gaps between perceived and effective use of renewable energies and conclude the work.

Social acceptance of renewable energies

Within the debate of renewable energies a particular stream of international scientific evidence is based on the valuation of *public or social acceptance* (Ekins, 2004; Longo, et al., 2008; Krohn and Damborg, 1999; Bergmann, et al., 2008; Strazzera, et al., 2012; Caporale and De Lucia, 2014) as one of the main factors affecting the success or failure of renewable energy projects.
On the success side, there exist common and largely approved benefits and potentials for renewable energy projects such as competitiveness, sustainability, lower energy costs, energy independence, employability and local and regional development (RSE, 2011). On the other hand, often, local communities tend to contrast the development of renewable energies due to the relevant costs these have on the society. For example, the relative visual and acoustic impacts and biodiversity losses (bird deaths) undermine the viability of some projects. Social costs appear not sufficiently counterbalanced by adequate social benefits. To overcome this problem several studies over the last 30 years have concentrated on the relationship between wind energy technology development and consumer perception and only the last 15 years have seen an increase in the international scientific debate (Thayer and Freeman, 1987; Lee, et al., 1989). Some studies have contributed to the analysis of consumer's perception of wind farms and/or the international acceptance of wind energy (Krohn, and Damborg, 1999; Ek, 2005). Other studies (Kaldellis, 2005; Warren, et al., 2005; Ladenburg, 2008;) have focused on the *public acceptance* in relation to the spatial localization of wind farms, making a clear distinction between on-shore and off-shore farms, and marine renewable energies (Kontoggianni et al., 2014). More recent studies value *public acceptance* based on people's experience living nearby wind turbines (Lilley, et al., 2010; Swofford and Slattery, 2010; Ladenburg and Krause, 2011; Ladenburg and Möller, 2011) or large PV panels and biomass plants (Zoellner et al., 2008).
Some studies (Dimitropoulus and Kontoleon, 2009; Meyerhoff, et al., 2010) show relevant factors affecting people's perception due to ex-ante or ex-post implementation of renewable energy

projects. In particular, technology as well as the surrounding environment/ landscape of a given territory such as for example the size of wind farms or the spatial density of a territory would play an important role in determining people's reactions and perceptions.

The study of Devine-Wright (2007) adds the existence of socio- and psychological factors to public acceptance and defines three main factors which generally influence the social consensus for a renewable energy project: (i) personal factors (demographic and socio-economic factors); (ii) psychological and social factors (consciousness/awareness/information, environmental awareness, cultural identity); (iii) contextual factors (procedural judgements and trust levels, equal distribution of benefits).

Furthermore, other contributions (Wüstenhagen et al, 2007; van Os et al, 2013) introduce the concept of "triangle of social acceptance". These studies split the renewable energy perception into three different categories which interact to each other to define the concept of social acceptance: (i) social-political acceptance (i.e technology and supporting framework by policy makers, key stakeholders and the public); (ii) market acceptance (i.e prices, investments and profits by investors companies and consumers); (iii) community acceptance (i.e activity and proponents by host community and local stakeholders).

Nevertheless, the above analysis of social acceptance by Devine-Wright (2007) and van Os et al (2013) shows a conflict of considerations and interests to explain the individual perception. This conflicting background can be addressed with a series of essential behaviour criteria. Leventhal's (1980) "process procedural justice" can be observed in terms of the renewable energy context based on six criteria: (i) consistency; (ii) bias-suppression; (iii) accuracy; (iv) correct ability; (v) representativeness; and (vi) ethicality.

These may be considered as the foundation for a socially acceptable renewable project of greener cities and territories.

Economic acceptance of renewable energies

Wüstenhagen et al (2007) argue that social acceptance to renewable energy projects is also perceived as economic acceptance in terms of market's adaptation to innovation. In his pioneering work, Rogers (1962) explains that innovation is spread across markets and the social system through proper channels such as trust, regulatory system, benefits to the society, information and that the process of diffusion follows a logistic shape in which adopters follow one other at given stages of the diffusion curve.

In the context of adoption of renewable energy projects in a community is also important the case of investors and firms' acceptance. In the actual historical time (post economic crisis of 2008), in which public investment in world's infrastructure steadily decreases, the majority of renewable energy investors are private companies. Investments in renewable energies for small-medium sized cities are generally large scale investments and both investors and firms manage important infrastructures.

The degree of social acceptance across firms within the energy and power sector becomes a crucial factor when dealing with market entry of renewable energy utilities (Bansal and Roth, 2000). There exist significant differences in market entry and the degree of speed across these utilities varies notably. Many of these utilities are managed by international companies, which can act differently in different countries due to existing differences in environmental regulations and sustainability issues. One aspect to consider is the power these companies exploit on poor or marginal territories in terms of bargaining for establishing green energies within these areas. This power clearly affects investment opportunities of other potential (internal or external) investors. Furthermore, international companies often play an important role in determining the direction of national or regional energy policies and this affects socio-political acceptance in the creation of financial instruments for the development of territories including smart infrastructures for greening cities or access to grid systems to other firms or investors.

Furthermore, fiscal and financial incentives play a central role to the deployment of renewable energy projects contributing to catch the market's interest for green investments (Polzin et al, 2015). On one hand, if this context may be profitable to reduce the fossil fuels' dependence and improve greener territories, on the other it implies potential negative externalities in the long run. The evident consequence is, in fact, the over diffusion of renewable plants and their relative inefficiency, with a further adverse effect on social acceptance. In this regard, public and political attention/support is aimed at energy efficiency investments, usually characterized by a large number of small projects involving many sectors and technologies.

Another issue to economic acceptance of renewable energy is the potential mismatch between demand and supply. Some authors (Wustenhagen et al, 2007; Hitzeroth and Megerle, 2013) argue that although the demand for green energy may be high, indicating consumers' willingness to reduce fossil fuels dependence or energy bills, the corresponding (physical) supply (in terms of new installations and/or infrastructures) may result low. The same consumers would act against (negative social acceptance) the building of renewable energy installations or green power plants (i.e. wind farms) (Ek, 2005) within their territories.

Finally, an interesting point of investigation is consumer behaviours towards micro-generation of renewable energies. Main literature (Sauter and Watson, 2007; Watson et al, 2008; Claudy et al, 2011; Simpson and Clifton, 2015) argue about the insights of micro-generation technologies spanning from the determinant of consumer's willingness to pay for adopting these technologies given certain product attributes, to consumer's perception of green subsidies and asymmetries to regulatory information between the public and the user; to the expression of various forms of social acceptance for micro-generation through attitudes, behaviours and proper investments. The latter point, widely discussed in the pioneering study by Sauter and Watson (2007), addresses consumers' attitudes in terms of reaching a degree of autonomy in using our own energy at home, developing a general interest in the new technology, adopting

green behaviours towards the environment or saving the energy bills in the long run.
As for investing in micro-generation technologies it seems positive attitudes, as described earlier, are determinant for the decision to take up the investment as well as the feeling of being innovators for using cleaner technologies in small markets (i.e. the neighbourhood). Finally, the potential use of micro-generation technologies can raise awareness on renewable energy and induce behavioural changes in energy consumption and (home) supply.

The role of technology and innovation

Many world's programs are leading to adapt cities to climate change. However, an efficient strategy needs teamwork between cities around the world to exchange best practices. Furthermore sustainable urban planning needs a series of partnership with regional and national governments and a solid national and international legal framework. At the same time, technology and innovation is essential to drive the renewable energy integration and system transformation for a sustainable growth worldwide (RES, 2011).
The technology challenge needs increasing interaction among the economic sectors to improve system efficiency, stability and security of supply, but also the aesthetics views. Smart energy solutions exist, but they are not enough without clear political decisions and the development of policy frameworks at all level of governments.
Technology and innovation play an import role in the social acceptance of renewable energies. History teaches us that the adoption of technology leads society to wider social benefits at aggregate level. Lawhon and Murphy (2012), consider the socio-technical transition approach as part of a multi-level vision structured on a socio-technical regime, a socio-technical landscape regime and innovation niches. The first regime can be identified as a framework of institutions, networks, practices which put into place specific social functions as healthcare,

electricity and water services, education, to cite a few. This framework represents a meso-level of analysis. At higher levels, a landscape regime is the context in which the socio-technical regime works and operates. That is, the economic structure, the political culture, the natural environment, the spatial context of cities (Geels and Schot, 2007).

Finally, the innovation niches are the micro-level perspective where the new technology is experimented, learnt, powered. Powering takes place through networking. The higher is the density level of the network, the higher the probability that the new technology is adopted and spread across the community. As a consequence, the higher is the degree of social acceptance among agents.

A recently EU-FP7 project, SUSTOIL[1], on the application and use of biofuels from rapeseed, olive and sunflower has, among other things at EU level, analysed the case study of the degree of acceptance across various stakeholders in South-Eastern Italy of first biofuels markets within the territory of the province of Foggia in Apulia Region. The assessment of the degree of acceptance has revealed the potential of expansion of the biofuel niche market towards a larger market, within and outside the region, should all actors be involved in the networking process (Morone et al, 2011). In fact, the development of technology cooperation through the continuous interplay of various sectors and agents seem to be the most effective in the social acceptance process of renewable energies (Mallet, 2007). Notwithstanding, most part of this process, within the innovation niche, is as informal and tacit and needs knowledge mechanisms through direct interaction among its members to take off and stabilise through time.

An important question therefore arises in this context and that is who should provide with all the necessary information in the network of innovation niches such that knowledge can be acquired by all its members and affect social acceptance? Next, we shall illustrate, among other things, this issue.

Implications of social acceptance in the decision-making process

The previous sections have identified that social acceptance mainly expresses through three channels such as community acceptance, market forces, and socio-political will. In order to link these dimensions, Allmendinger (2009) highlights that the decision making process should consider an optimal path through which minimising failures and side effects; the quality and quantity of information within the community; and the level of knowledge across various stakeholders should be easily accessed such that these can communicate and share information to each other. In this way, problems may be identified, defined and solved more efficiently in the short run.

There is an element in the decision making process outlined above to consider and this is unexpected factors, which can come from within (internal shocks) or outside (external shocks) the community and that influences the 'management' of risk and uncertainty in the social acceptance of renewable energy projects. Hitzeroth and Megerle (2013) analyse the case of uncertainty for the expansion of a renewable energy infrastructure in Germany in 2011 and through a standard survey technique studied local peoples' perception to the planned project. In this study the authors underlines the importance of 'indecisiveness' of people to play a key role in the social acceptance mechanism. The survey revealed that although most of the sample (350 interviewees) was in favour of the project location, nearly 50% of people actually did not know anything about the whole project and could not express themselves on the efficacy of the project. Risks could not be totally perceived and uncertainty remained high among respondents.

Therefore, a trend that the majority of studies reviewed earlier and in the previous sections has in common, is to argue in favour of a lack of public acceptance. The larger the absence of a public participation in the planning strategies for the approval of renewable energies promoting sustainable growth processes within cities and territories, the more people feel to oppose these

projects. A negative correlation would exist between perceived and effective use of renewable energies.

Transparency of communication and information in renewable energy planning process is a relevant strategy to determine a certain degree of justice between local population, investors and the regulatory system. Zoellner et al (2008) stress on the importance of public relations initiatives in all stages of renewable energy projects; campaigns, guided tours, local festivals are example of public participation to get people informed and attract consensus. Also, the study demonstrates the importance of perceived justice on peoples' opposition or support for renewable energies. This perception should be seen according to specific considerations given to the contexts of the territories or cities under analysis.

Also, the degree of the involvement of government representatives, is a factor that contribute to increase people awareness to renewable energy projects and create more positive attitudes towards the choices of external investors to build, for example, a wind farm, a biomass plant or PV solar panels nearby cities and their surrounding territories.

Ultimately there are two factors that influence local acceptance: firstly, the perceived economic valuation (i.e. costs and benefits) of renewable projects; secondly, the involvement of local community into the decision making and planning process (Zoellner et al, 2008). The latter is strictly linked to the importance of trust for the acceptance of renewable energy systems. This becomes an issue when actors involved in the decision making process are investors from abroad or large energy companies (Wüstenhagen at al, 2007). In this case, trust may rapidly flaw due to scarce interests of these companies in the territory other than pure profit making.

To build a rational dialogue with all stakeholders, particularly with the local population (and most times before submitting a project to the local authority), is an essential process to provide an efficient mechanism of trust and favour social acceptance.

Summary and conclusions

To better understand the transformation of territories and cities to renewable energy issues, organizational, structural, institutional and economic drivers should be investigated to capture and determine a higher degree of social acceptance among stakeholders. This paper has briefly described and reviewed the existence of main dilemmas in the society and economy in view of renewable energy projects.

Under an economic point of view, social acceptance should also be seen in terms of firm acceptance given the potential changes occurring in terms electricity prices and the functioning of existing services of water and electric utilities in cities and territories; furthermore, the market entry issue is another element to consider when barriers to entry are low and baby-energy firms are influenced by the bargaining power of multinational companies which more often use their power on royalties, and in some cases, energy policy at national or local level. This, in turn, poses serious effects on investment opportunities by external firms and on other firms' acceptance to renewable energy projects.

In terms of community acceptance current literature shows that often local communities have a tendency to contrast the development of renewable energy projects although this should be analysed differently in different contexts and territories. Various studies stresses on the importance of site location as a determinant to the visual impact for the success of wind farms and PV plants (Zoellner et al., 2008; Lilley, et al., 2010; Swofford and Slattery, 2010; Ladenburg and Krause, 2011; Ladenburg and Möller, 2011; Kontoggianni et al., 2014). Caporale and De Lucia (2014) in a case study of the potential trade-offs on landscape of wind energy in the Province of Foggia (the greatest incubator of wind farms in Italy) highlight the existence of contrasting perceptions on final users of the landscape. This is due to a lack of information between producers, consumers, and local policy makers within the territory. A key element to consider is the integration of the project with the territory and authorities under study. We have seen in the previous sections a strong

dependence of social acceptance on information, transparency and participation and on the benefits received or perceived by local residents. Also, the lack of fairness and the absence of good faith behaviours are strictly linked to the disinformation and quality of communication which are the main causes of disputes arising in establishing photovoltaic systems and wind turbines within a territory.

Furthermore, the process of perception and evaluation of renewable energy systems is always dependent on previous experience and knowledge.

Current literature captures the existence of other factors such as socio and psychological to public acceptance and defines that personal, social factors as well as contextual factors influences the social consensus to renewable energy projects.

Second, the role of technology and innovation is essential to determine social acceptance. Transitions to sustainability need to be accurately analysed through various aspects which take into account a meso-, macro- and micro-level approach. Under the meso view, a socio-technical regime should be identified in order to contextualise innovation practices at higher levels such as the economic structure or the spatial contexts of cities and territories. The micro-level view needs to be further explored because it is at this stage that innovation may take-off across the members of a community. The networking degree results an essential component for the innovation to be spread across its users.

Who should start with the networking process?

This should be seen under a wider process of the decision-making where the quantity and quality of information need to travel at a certain speed such that an adequate level of knowledge can be accessed and operated across all actors involved. In this way, a lower level of risk and uncertainty may favour indecisive people to play a part in the social acceptance of renewable energy projects and act favourably towards greener cities and territories.

[1] http://www.york.ac.uk/res/sustoil.

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