Sustainability: myth, reality, future – planning and renewable energy management

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Abstract

The paper describes the process of appropriation of sustainability principles through critical approach at the regional/local scale. The work is aimed at displaying the complexity and environmental sensitivity related to the development of renewable energy production facilities using the example of the area of Greater Poznan. It refers individual, site-specific work to more theoretical deliberations on environment and sustainability principles. It provides a rational background to planning and decision-making to acquire long-term positive effects in the future – a better quality, safer environment.
Keywords: spatial planning, sustainability, renewable energy planning and management.

1 Forty years of contested paradigm

Sustainability, now for several years, has become the primary supply within the field of urban development as well as spatial planning and management. Despite the fact that its grounding concepts were introduced over 40 years ago and its definition was established worldwide in the Rio Declaration on Environment and Development 20 years ago, following the adoption of the Brundtland Commission proposal [1] of understanding sustainable development as complex civilization process that allows to meet the needs of the present without compromising the ability of future generations to meet their own needs, the term remains elusive and ambiguous. This allows freedom of interpretation and, as expected, generates a wide variety of implementations including, on the one hand, great practices and applications, and on the other hand, exposing extreme abuse of the notion of sustainability, reducing it to mere marketing package defective products and services are wrapped in. In other cases, this term is used


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to legitimize otherwise hard to implement and controversial political, socio-political or socio-economical projects. This problem has been addressed as soon as at the turn of the 20th century. On the one hand, Jacobs [2] pointed out that multiple valuable ideas have not contributed to the emergence of a solid concept of sustainability thus allowing to debase and ignore important contents. On the other hand, researchers like Patterson [3] or Richardson [4] noticed, that sustainable use may be turned into a term describing any kind of process of exploiting the environment regardless of its environmental consequences, cloaking it under a protective banner of only seemingly "green" efforts and enterprises. Important arguments raised by Jacobs display how flexible the interpretation of sustainable principles may become and how principles themselves may be altered to acquire goals almost contrary to originally formulated ones.

While the aforementioned Brundtland Commission report entitled Our Common Future [5] has established a three-tier conceptual structure of sustainability concept defining the relationship between ecological, economical and socio-political aspects of human activities, it is more and more common to replace an older scheme with a new one, four-tier, splitting socio-political area into two distinct areas, political and cultural. This emphasizes the influence of policies to direct and manage cultural and economical activities of societies. It also uncovers an intentional ignorance of many governmental or administrative boards to attempt to treat sustainability as a serious, complex problem, observed not only in Poland, but in countries with more grounded systemic approaches to similar issues, how Connelly [6] put it, like, for example, the UK.

Spatial planning, organization and management of urban development becomes therefore the area of struggle. It is not only between the old becoming obsolete yet lingering and the new introducing better solutions and higher quality, this conflict goes on, but between new truths and new lies contaminating the truths, being collateral victims of the latter. One of the few areas of crucial importance to our future is the issue of urban development combined with energy management and distribution affecting our environment. Reasonable desiderata of energy management suggest the transformation of the energy sector and migration to renewable energies with environmental and ecological gains expressed as significant goals. The climate and energy package adopted by the EU is a good example of a dissonance between good assumptions and dystopian reality of the implementation of this agenda, while the fundamental problems it generates are both anchored within the structure of the document and its principles, and in national implementations which often deform the original intentions.

2 Distilling the definition and applicability of sustainability

There are few fundamental issues the concept of sustainability must address if the notion of sustainability is expected to have both significance and real benefit for people as well as the environment:

1. Tangible definition of sustainability which may be established for particular task – task and/or site specific.
2. Sustainable development and its relevance to (environmental) sustainability as well as identification of stance towards the sustainability model within the task.
3. Applying appropriate methods of implementation, planning results, planning for problem solving.
4. Practical results and thus the actual acquisition of sustainability goals with a set of criteria (becoming the basis for verification and evaluation).
5. Monitoring of both short term and long term effects of the implementation of sustainable mechanisms available for public verification.

All these issues are obviously applicable in the case of the implementation of renewable energy projects introduced as part of urban development and claimed to support or substantiate the principles of sustainability (or sustainable development, depending on selected interpretation of that definition as explained below).

So-called renewable energies evidently refer to sources of energy that cannot be easily depleted or that their depletion is generally independent of human decisions. They provide the opportunity to produce energy and supply people with the intention to minimize the impact on the environment which in this case should be understood as an environment comprising of natural and civilization components, including cultural and social contents. But, despite being equipped with the label of environmentally friendly technologies, renewable energy sources and enterprises are not free from significant environmental (and social or cultural) risks. These risks however are often purposefully ignored, omitted. Decisive bodies present nothing, but gains; they are primarily interested in economic results only, caring little for environmental or cultural impacts, and as Giddings *et al*. [7] describe it, there is much more concern and weakly grounded speculations on how many people will supposedly get employed as a result of developing a, for example, renewable energy project, than reliable analyses balancing positive and negative impacts of that project.

If particular endeavor is being undertaken than it seems indispensible not to define it as sustainable, but to define how (and why) it fits in the sustainability concept and what it means – how a particular task achieves this outstanding, privileged status.

The second issue refers to the possible contradiction between the significance of sustainability and sustainable development. As Woods [8] explains, while sustainable development is strictly connected to human activities and therefore is predominantly defined by a human approach to environmental issues, sustainability per se should rather be seen as feature independent from man, a potential of the environment to thrive and simultaneously to accommodate changes imposed by man without losing the ability to regenerate.

In the case of renewable energy projects, the project itself is in fact a trigger of various environmental impacts (an element of stipulated, but not yet proven sustainable development) introduced with the assumption that it will not hamper the said regenerative properties of the environment. It is not unlikely that a

renewable energy project will be more the result of development, than of sustainability.

These issues equally refer to a scientifically determined basis to evaluate how a renewable energy project may really work and to ideological and political stances, quite often subjugated to particular goals derived from the social envelope. According to Hattingh [9], among others, there is strong correspondence between approach to sustainability ideas and personal inclinations related to social (or political) affiliation. Despite a variety of possible interpretations of tasks and duties related to sustainable projects, interested parties tend to follow so-called radical or conservative understanding of sustainable principles. Although the radical aims at protecting the natural resources and other significant spatial attributes as non-renewable values necessary for the well-being of men, often regardless of the socio-economical consequences to local (or regional) communities, conservatives preferably pursue more economically-oriented goals with an allowance for weaker environmental gains (if any).

In the case of renewable energy projects implemented in proximity to urban areas, these stances still define the field of rarely constructive conflicts between zealous proponents of those kinds of enterprises and ecological activists and local community leaders who return the one-sided approach with their a priori rejection, often with a motive entitled "just in case anything could go wrong in the future".

It seems natural to propose seeing renewable energy projects as complex in details, yet simple in decision on methodology or tools used to evaluate potential impacts and assess whether the project can fulfill its mission and deliver a spatial solution that will ultimately improve the environment.

The above mentioned question of taking a specific position in relation to the problems of sustainability (regarding renewable energy projects) requires one more explanation which refers to expert knowledge and its entanglement with business connections. The current predominant model of environmental impact assessment requires an investor or developer to employ an expert who will conduct the assessment procedure. Dos Santos Martins [10] notices rightfully however, that the investor/developer – expert relationship is not liberated from the powerplay between agents struggling for domination over space. The contest for power is exposed by – again – commonly observed arrangements between investors and local administration bodies with a tendency to exclude local communities from the discussion. Local departments see that kind of discussion as an unnecessary opening of issues few understand and many are eager to interfere with, to spoil a particular development.

Renewable energy projects are a relatively comfortable subject for the researcher while checking implementation conditions, planning results of the implementation, both positive and negative, appear much simpler than e.g. cultural or social processes aimed to improve sustainability of the environment. Herein, the energy component provides at least a significant opportunity to find objectified and parametric means to assess the impact.

The complexity of sustainability should not be constrained to fulfilling assumed parameters only and clearly spatial issues combine a variety of problems to be solved when planning any extensive renewable energy project – like a wind farm, biofuel processing plant or any other development of a similar kind. Influence on cultural landscape, natural landscape, social reactions or processes (e.g. social interactions, social inclusions or exclusions), often refer to aspects beyond the quantitative, as recognized by Hattingh [9], who calls them implicit or qualitative. However, when it comes to quantitative elements, they may be established as an important basis for the reliable objectivization of results. Todorov and Marinova [11] postulate *sustainometrics* as a means to counter the ambiguity of the definition of sustainability. The *sustainometrics* is expected to provide selected tools to evaluate the effects of the implementation of sustainability concepts with the help of a global system defining the correlations between co-evolvents, agents in the process of co-evolution, as well as simulation models.

Paralelly with the concept of Todorov and Marinova, there is the Dos Santos Martins idea of using design thinking within sustainable development concepts. Dos Santos Martins proposes similarly to use general systems theory and combine it with a holistic approach instead of a reductionist approach presented in the majority of disciplines. He claims that pursuing sustainability (and thus planning and building many renewable energy undertakings) should encourage men to employ mechanisms denying the opportunity to narrow the environmental issues to pure statistical formulas, allowing us to abandon manipulation and selective presentation of results, more appropriate from an ideological or political point of view.

Many researchers agree that one of the most important problems of sustainability is the lack of an agreed system of criteria to evaluate the results of the implementation of a project. While this common system of evaluation could prove beneficial, it doesn't mean one cannot support analyses of efficiency of sustainable developments by an individually targeted criteria matrix with a set of criteria selected from multiple available considerations of what plays an important role within the environment.

One can find extensive proposal in Jacobs' elaboration, who – as quoted before – sees weak and strong interpretations in reference to degree of environmental protection, (social) equity and participation, and scope of subject area. There is a more brief summarization of soft and hard sustainability brought by Drummond and Marsden [12], defined by five descriptions. Agyeman, Lehtonen, Cuthill or Davidson, among others, also contributed to the formulation of criteria to define sustainability, as collected by Bostrom [13] in an attempt to distill substantive and procedural aspects that establish sustainability.

Particularly renewable energy sources give the opportunity to use a selected set of criteria while modeling expected results, thus granting the ability to define the shape of environmental impacts one is going to accept as costs, and to estimate precisely benefits being the result of implementation of that particular technology or development.

Finally, observing how information circulates between scientific and political bodies, it should be recommended to introduce strict monitoring by third parties, socially involved, institutionally approved to perform critical analysis of any ongoing project while in the phase of incubation or in the phase of its exploitation. This bottom-up driven monitoring mechanism accompanied by restrictions and requirements related to solid, measurable results, should become an ultimate protection against politically driven mistakes that cost billions of public money, like in the case of bioenergy and the EU. While it is acceptable that errors may appear even in the high ranked scientific teams such as the one from Copenhagen supporting the work of the European Environmental Agency, it is objectionable, that mistaken data provides the basis for a widespread policy through the EU for years, and its correction is distant from being rapid and conclusive. It becomes particularly obvious when referring to EEA reports [14, 15] and the quiet presence of EEA Scientific Committee opinion [16] recommending withdrawal or at least restraint in implementation of selected bioenergy related policy elements due to serious errors in previous documents.

3 Problems of renewable energy projects and sustainability

Renewable energy sources constitute one of many significant means to achieve the goal of sustainable development in a truly sensitive way. But their implementation must pose serious and significant questions that are individual and site-specific when one is to consider a particular project to be implemented. Approval for renewable energy source location in a selected area, even a preliminary one, evokes the employment of various bodies interested in the realization of that particular task. While general constraints are spoiled by the construction of a legal framework as they refer to the execution of green-labeled developments instead of "green" effects within the environment, even the problem of planning sites for renewable energy projects, considered here below, becomes unnecessary but almost every case scenario struggles to separate the facts from the myth.

The directive from 2009, being the legal foundation of the agenda, focuses on political and economical aspects of renewable energy and instead of encouraging human invention to develop affordable technologies, popularize them and allow for efficient (relatively) low-cost exploitation, which would require supporting research and development simultaneously with applications with proven results, chooses to support industry and enterprises by imposing tax analogous economic solutions by establishing predetermined economic constraints regardless of what results administratively qualified technologies will bring. This is becoming the origin of deceit, well and commonly observed phenomenon of attributing ren-energy solutions as sustainable and environmentally friendly regardless of local context and any measurable, credible effects.

This is the general climate and both theoretical and practical conditions determining the scene in which practical implementations are performed – resulting in supplementing our landscape. It is a fascinating phenomenon, where one finds a mixture of scientific premises and wishful thinking, marketing

slogans with serious scientific achievements backed up by solidly engineered applications.

The world of responsible problem-solving of constructing ecologically sensible and socially affordable energy projects, which should shape our reality is blurred and distorted due to mythicizing the role and impacts of renewable energy enterprises. The process of myth building incorporates both contrary extremes, both irrational concepts of seeing renewable energy sources as cheap, environmentally friendly, devoid of any serious negative impacts on the one hand, and a humbug, responsible for health problems and natural disasters on the other.

The case of wind farm impacts is a good example here, when considering the relationship between a human healthy environment and infrasounds with their influence on human comfort, behavior and well-being, and when a subjective aspect is used to legitimize or dismiss the project regardless of reliable examination of specific conditions that a particular project is going to be exploited in. On the one hand, there are observations brought to public interest by Pierpont [17] or Castelo Branco [18], who claim that there is a significant connection of cause and effect related to infrasounds produced by wind farms – with arguments at least as convincing as to grant hearing from state legislature in the US. On the other hand, there are many statements – like one presented by Colby *et al*. [19] – that focus on dismissing the validity of these research efforts and claim them too narrow and inconclusive, at the same time concluding that therefore there is no scientific evidence proving claims of Pierpont or Castelo Branco. However, these statements are not backed up by the evidence being the result of original research or field testing; in fact they are rather selective literature reviews.

Another similar example may be observed even in a discourse concerning acousting conditions of wind farm exploitation display severe problems, when farms interact with urbanized areas and their distance to households becomes lower than 1.5km. Legal framework and norms provide reference – but this reference is often incomplete, as proven by Bowdler [20] in his considerations of the UK standards or as it becomes clear from obvious conclusion of missing multiple acoustic impacts, like e.g. so-called “swish” effect, among others, described by Oerlemans and Schepers [21]. As Bowdler [22] argues, there is also no legal reference to acknowledge the noise impact in relevance to background noise, and thus no legally bound mechanisms to force investors to protect people from evident influences of turbine working conditions, that can be observed clearly (not only by members of local communities), but are discarded by administration and business alike in the lack of proper regulations and in the pursuit of “ecological” agenda. These are just two narrow aspects of wind farm implementation, exemplary to display the problems any renewable energy project must consider when interacting with components of the environment, whether natural or urbanized.

4 Considering a "real life" laboratory: the Oborniki case

Poznan is one of major Polish agglomerations, with a relatively slow but steady rate of development, which contemporarily in terms or urbanization may be observed stronger in proximal communes co-shaping the agglomeration, than within the administrative boundaries of the city itself. Oborniki is one of the communes that enlisted to cooperate in consolidated efforts to build the Greater Poznan area. The main town – Oborniki – is ca. 35km from Poznan city center, with a commune administrative border as close as 28km. A large portion of the area is covered with forests, with few important environmentally protected areas being wildlife reserves, Natura 2000 areas or SCIs (Site of Community Importance). The slightly indented valley of Samica river is not only Natura 2000 related important avifauna feeding and breeding area (an extension to an already preserved area), but is considered to be one of exemplary rural landscapes, exceptionally preserved and not yet urbanized despite its proximity to both Poznan and Oborniki community areas of dynamic development.

Between the Oborniki and Poznan-oriented border of administrative area the community faces a significant dilemma, raised by the contradiction between agglomeration development preferred directions, suggesting the consumption of the most precious rural areas, mentioned above, rational postulate of protecting non-renewable resources of both wildlife and cultural landscape, and finally extreme pressure to contribute to the 20/20/20 EU agenda by allowing to develop 40–50 2.7MW turbines on the edge of Natura 2000 in the very center of the valley Samica river. The reality displays the tensions between those environmental components that – in order to follow the concept of sustainability – should be integrated and compatible. Instead, the development of housing areas and industrial zones could stimulate socio-economic development and integration with the Greater Poznan area. More restrictive protection could result in the preservation of crucial spatial features, but at the seeming expense of current social needs. And finally, the location of a wind farm could exclude housing and industrial areas' impact on the environment (putting itself in the same area instead) and grant the community its share in an all-European effort to follow the agenda of securing the expected amount of renewable energy supply. To appease the apparent conflict in an attempt to pursue simultaneously ecological, economical and socio-political aspects of sustainable development not only a five point procedure, described in this paper as a stipulated optimization of approach to renewable energy issues is required, but also ethical questions must be solved when establishing values and goals – balancing current needs with future perspective and long term planning obligation imposed by the concept of sustainability.

While the directive to increase energy production from renewable energy sources encourages local level administration and private parties to act often under the influence of – regardless of what it would be – a blind force, social popularity contests, political correctness, it becomes particularly important to provide a meticulous knowledge-based approach to spatial solutions. The concept of sustainability can be achieved only with social support, but at the

same time two goals must be achieved: to allow to discern good from bad solutions regarding renewable energy production, namely – the applicability basis of what really serves sustainability purposes (behind mere statistics) and to protect the concepts of sustainability of being socially exploited; wasted.

In order to meet these two goals, to allow the fulfilling a the five-step procedure granting control over at least the majority of parameters defining the level of sustainability the evaluation and determination of an "RES" project allocation was implemented according to the methodology proposed by Barelkowski [23]. Local authorities decided to prepare a wide scope strategy concerning RES development in the Oborniki commune, encompassing all major renewable energy sources (RES). Wind power, solar energy, geothermal energy, water energy, bioenergy were all considered, analyzed and evaluated in an elaboration aimed to determine the spatial management for next 15–20 years, becoming the first of its kind prepared for the local level (previously similar strategies have been elaborated for four regions in Poland, however with partial coverage of RES, mostly focusing on wind energy) [24]. The study (strategy) focuses on allocation of RES projects within the Oborniki district boundaries, considering primarily spatial properties of the environment and its interaction with RES projects. The methodology considers the taxonomy of RES projects in reference to their features and then confronts these projects with potential environmental impacts – acknowledging area coverage, primary and secondary environmental effects. The simulations are superposed using GIS and CAD support to establish impact areas of particular locations of selected potential RES projects. The strategy evaluates both quantitative and qualitative effects using a renewable energy validation matrix explaining local, site-specific environmental impacts – including wildlife related effects, landscape impacts, social impacts, economic efficiency, management of conflicts. The RE validation matrix considers multiple consequences and uses the 0–10 scale to determine the rate of influence related to many factors, including, among others, the impact on the cultural landscape, type of intervention (extensive, concentrated, cumulative), interference with geological, hydrological structures, etc.

The elaboration of strategy posed particular difficulty not due to technical or disciplinary issues, but due to the fact that it interfered with lobbying parties interested in the implementation of the RES project and housing area developments at the same time and at the same locations. Elusive and socially perceived at least as ambiguous problems of future consequences met current short sighted, yet powerfully expressed needs with mobilization of both lobbyists and protesters of particular projects.

Particularly explanatory for the purpose of this paper is the example of a wind energy project, which in the research [24] was considered in various configurations – individual installations, small and large industrial installations (10MW level distinction). Instead of commonly used elaboration by Lorenc (in Poland) which is outdated and imprecise, both data from the report by EEA [25] and local meteorological measurements were used as the basis for the model of efficiency and acoustic impacts. Wind speed was established using hub height estimation with the result of speeds between 5m/s to 14m/s with a prevailing

speed below 8m/s. Roughness of terrain as well as urban structures – existing and planned – were taken into account affecting potential airflow (due to the scope of elaboration there was no necessity to use Corine Land estimation – model included even individual farms). Energy production and thus economic efficiency was determined, taking into account the necessity to provide supply backup for customers, possible infrastructure development scenarios, two alternative wind turbine manufacturer configurations (Vestas and Enercon) for industrial type installations. Some issues like the previously mentioned power supply backup requirement (and related costs), power supply fluctuations among other specific factors were not observed in other elaborations of a similar kind and scale by the research team, despite the presence of these issues in annual reports of e.g. the German energy company E.ON [26, 27].

Political aspects of the case forced the research team to deal with arguments of proponents and opponents of wind energy introduction in Oborniki. This discourse was elaborated using the Polish Wind Energy Association (PSEW) [28] environmental and social gains list as well as environmental and social losses list provided by local communities to be used in a parliamentary report for the Polish Senate [29]. All principle issues were addressed and explained site specific, namely related to particular areas in Oborniki, where wind turbines could be potentially located.

As a result, recommendations for local authorities excluded all industrial installations, promoting dispersed individual installations instead. The dismissal included even the installation already planned and scheduled for execution in the northern part of Oborniki administrative territory. The most challenging part of the simulation was to prove simulation of expected economic effects – investors seeing that parametric arguments threatened their plans emphasized social and economical gains referring to the myth of sustainable development of the area. It was the myth of sustainability of RES project revived.

Regardless of the fact that the production of energy, at least in Polish realities, could not support the local power supply balance (while power supply distribution is centralized and there aren't any plans in the near future to change the legal or economic framework to change the situation), 12 year economic analysis provided answers – showing clearly, that the only beneficient of the wind farm is, thanks to EU subsidies, the wind energy company intending to implement the farm, but the community receives no particularly significant gains from taxes or other wind farm related enterprises.

The strategy allows the Oborniki community to focus their efforts on the most profitable (in social dimension) projects using renewable energy – a hydro power plant operating on the Welna river in the town of Oborniki, geothermal energy available along the SE-NW diagonal of Oborniki administrative district and also available in the town, selected recommended bioenergy applications (however with acknowledgement of the remarks that the EEA Scientific Committee has made in reference of environmental impacts). The above mentioned applications are much more promising in multicriterial evaluation of environmental impacts combined with the economical aspects of those alternative projects.

5 Reality of the future or the future of myth?

Spatial planning requires dedicated mechanisms which will allow us to manage properly the issue of RES projects due to the long-term influence these projects have when allocated and built. As Dos Santos Martins proposes in the case of general use of sustainable concepts, both spatial planning and the sustainable development concept require a holistic approach and multi-scenario analyses to address the problem of implementation of sustainability principles in a non-reductionist, integrative way.

The inevitable struggle for power related to all aspects of spatial management, combined with the responsibility for fragile natural and civilization resources, susceptible to depletion, and at the same time, the necessity to remain realistic about possible routes to generate human growth and welfare make the task of predetermination to allocate RES projects much more significant and complex. To assure sustainable development requires both responsibility, sensibility and precision. The presented work is a step to optimize the human path to a future exchanging mythical foundations for real ones.

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