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Editorial

Bioenergy: A Sustainable Shift

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The European Commission emphasised that a bioeconomy is an economy that uses renewable biological resources from the land and sea (e.g., animals, crops, fish, forests and microorganisms) to produce energy, food and materials [1]. Consequently, the topic of bioenergy must be included within the sectors of the bioeconomy, which also includes traditional sectors (e.g., agriculture and forestry) and innovative sectors (e.g., manufacturing). Europe plays a key role in the evolving bioeconomy, but the performance of individual countries shows different values in terms of turnover, added value and personnel [2]. The aim is to support the development of these sectors globally in order to reach the 17 Sustainable Development Goals [3] with a special focus on circular bioeconomy [4].

Bioenergy, derived from biomass is applicable in all energy sectors (heat, electricity and transport). Human vulnerability to climate change—amplified by the COVID-19 pandemic—is a very serious threat to modern societies that requires urgent action. Given the complexity of the challenges, the efficient and sustainable usage of all resources is needed. The question we start with is: if people consume energy, are they responsible for environmental pollution? We believe that this is not the correct question to be posed, but certainly consumers are expected to engage in responsible behaviors. Similarly, should producers be expected to generate and use clean energy even if this leads to economic losses? Again, we believe this is not a valid question, yet producers are urged to make forward-looking choices when defining their production strategy—able to incorporate social and environmental (external) costs along with private costs.

Technological progress in transitioning to renewable energy-based systems is proving the greater competitiveness of these green resources that in various scenarios have become competitive with respect to gray resources, especially in the context of the fact that more than 10,000,000 people die each year due to air pollution, most of which is due to combustion of fossil fuels [5,6]. These and many climate-change related costs that are currently externalized must be integrated into our transition policies, practices and timetables.

Thus, we envisage two levels of analysis: first, all externalities should be properly identified; second, a sound and agreed upon methodology able to assign values to each of these externalities should be developed. However, this second phase is complex because not everything can always be translated into economic terms and because the value assigned may not be objective. While for the first problem, the solution may be to compare with comparable items, the second is simpler because it only requires alternative analyses to be carried out alongside the baseline ones.

The balance sheet associated with renewable energy tends to assign a positive value to externalities, but how high is this value? The social cost of carbon still has a low value, but in recent years it has grown significantly. Is the social component actually included in this externality? Unfortunately, we have to give a negative answer. It is precisely this absence that weighs on policy choices. How much do the exploitation of minors, the low

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rates of schooling, the serious poverty in which some families live, the lack of healthcare, the inefficiency of the Public Administration and some judicial criticalities really cost? For all these reasons, we can and should act now. This editorial focuses on the energy part which is only one component of this great revolution. Renewables should not compete with each other, as they are all required to replace fossil sources. The rapid advances in efficiency and falling prices of wind and solar power make them increasingly cost-effective. Sourcing and efficient usage of bio-energy based materials is also improving in many ways.

Analyzing bioenergy specifically, the International Energy Agency (IEA) concluded that a reduction in environmental impact occurs in the following scenarios: (i) "Biomass is grown sustainably or based on waste/residues"; (ii) "Converted to energy products efficiently"; and (iii) "Used to displace GHG-intensive fuels". Bioenergy includes several potential feedstocks (e.g., organic residues and waste; forestry and agriculture), production processes (e.g., fermentation; anaerobic digestion; gasification; pyrolysis; pelletisation; advanced biofuel processes; chipping and torrefaction), products (e.g., biodiesel; bioethanol; biogas; biomethane; renewable diesel; woodchips; pellets; pyrolysis oil; bio-synthetic gas; refuse derived-fuel and other advanced biofuels) and final energy use (e.g., biofuels for transport; combustion for electricity; combustion for heat and biomass-based materials and products) [7].

The literature has shown an exponential growth in the number of papers published on the topic of bio-resources for energy applications [8] and it has been documented that economic growth is influenced by the productivity of resources, including bioenergy [9]. Thus, it is evident that the growth of the bioenergy industry helps to reduce pollution and unemployment [10]. However, bio-resources have many other potential attributes that must be analyzed. Several authors have concluded that bioenergy can play an important role in the decarbonization of society. Thus, the uses and trade-offs of bioenergy must be explored from multiple perspectives.

It is essential to identify decision-making models that support both policy-makers and other stakeholders by comparing different alternatives [11]. The development of bioenergy must be integrated within emerging markets that support ecologically sound economic development of these territories based upon sustainable models [12]. In this direction, the comparison among countries is valuable in helping researchers to identify which business models have shown the main advantages [13].

In this context, it is essential to broaden and deepen the analyses of bio-energy materials that could be used to help to achieve sustainability objectives [14]; additionally, analyses must be performed that consider the bio-based system's sustainability by performing holistic analyses of the competing demands for and alternative uses of bio-based materials [15].

Analyses must be made on specific cases [16] as well as on local, regional, national and global bases for the short and long term future in the context of climate change, pandemics such as COVID-19 and one more giant factor.

What is that factor? It is that if the world's human population continues to increase at the current net increase of approximately 83 million people per year, the global population will increase from 7.9 billion to 9.7 billion by 2050 [17]. In that context, societies must factor in the increasing land that will be needed for food production and decide about the trade-offs between land for producing food and land for producing bio-based materials for non-dietary purposes.

Renewable energies are essential parts of the energy revolution in which the goal is to replace production from fossil fuels with those from renewable sources. In this framework, biomasses are the sources that can present the highest impact compared to other green sources, such as wind, photovoltaic and hydropower, but nevertheless energy consumption, both at the industrial and domestic level, are significant. Having a reduction due to energy efficiency interventions is certainly positive news; having a reduction due to a lower purchasing power indicates an economic decrease, and as such it cannot be welcomed. Biomasses are appropriate in the systems of supply and energy consumption at a local level.

This means that the production of energy from biomass obtained locally is significantly more sustainable than that obtained with biomass from other territories, in some cases even crossing national borders. This practice must be monitored and must include sustainability analyses that justify its application. In fact, the objective is to encourage the use of renewable sources to allow a circularity alongside an optimal trade-off between food production, and the production of bio-based energy resources. It must be remembered that the current transport sector contributes significant quantities of global emissions and the percentage of renewable energies in this sector has not yet achieved optimal levels [18].

Another delicate issue is certainly represented by the choice of bio-substrates. There is a perception that many of the available resources are not fully utilized, for example the proper use of forest trees, organic residues from agriculture, forestry or landscaping, or residues from the animal breeding sector. In addition, uncultivated (marginal) agricultural land could be used and the whole system could be optimized while ensuring an equitable and sustainable balance of the water–energy–food nexus.

The objective of future research should be focused on solving daily and longer-term problems; therefore, it is necessary to encourage collaboration among research centers and business structures to propose methodologies and solutions that will be able to develop answers to the food and bio-energy needs of society.

Unsustainable, intensive agricultural practices and burning forests and other vegetation are steadily increasing demands for bio-resources, and also causes serious environmental consequences. In this context, the European Commission highlighted the following points for reflection on the theme of bioenergy [19]:

(i) Can the production of bioenergy penalize citizens because it has the effect of increasing the cost of raw materials, and therefore of the final price of some foods?
(ii) Might the cultivation of some of these dedicated resources for energy purposes lead to labor exploitation?
(iii) Can the demand for land on which to grow these dedicated resources be a threat to indigenous peoples?

These issues have a much broader perspective than the issue of bioenergy itself. They concern a model of sustainable and inclusive development that depends on an enhancement of the human component, particularly the collective, empowerment-oriented to identify and solve problems and not to amplify clashes that only benefit fossil fuel-based power lobbies. Education and training can play an essential role [20] and are manifested by university courses that have belatedly begun to be provided via public seminars and webinars.

Society can be empowered to demand answers from the political world to change the status quo, while at the same time, the great global challenges are not based solely on competitiveness, but on the reality that all of us must cooperate to help to ensure truly sustainable futures for our children's children's children!

It is undeniable that the economic component has always had a primary role in the choices of powerful institutional actors, and it is necessary to find a balance that does not create short-term profitability for the few monopolies to impede the transition to equitable, sustainable post-fossil-carbon societies globally, as soon as possible! We do not have time to waste!

The concept of Adam Smith's invisible hand could be readapted to that of a sustainable hand, which, within a market, seeks the social optimum, as this is the only truly sustainable approach, in the long term. For this to happen, new social norm paradigms models and customs must be developed and implemented to help to govern social interactions to truly sustainable futures.

In this sense, bio-based materials and products for all purposes, from food to other uses, are essential renewables that require changes in one's attitudes, visions, strategies and actions, based on a principle of sharing resources. However, this challenge is very complex—and becomes even more complex in those regions of the world characterized by armed conflicts and where there are dictatorial regimes. It is increasingly serious in regions where climate change is causing dramatic changes from flooding due to the sea level rising on the one side and to rapid expansion in desertification on the other side.

We have many challenges to address, but by co-working locally, regionally, nationally and globally, we can and will make urgently needed transitions. Bio-based production for food and other purposes is essential for humans and other life-forms on this planet.

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