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Opinion

The search for better energy options has been central in the World concerns about global warming and it has become even more urgent for many European countries with the current invasion of Ukraine and the search for alternatives to Russian fossil fuels. In some cases, as in the UK, alternative options are including developing nuclear energy. However, the unavoidable safety issues and the unsolved problem of the nuclear waste management have been long-term concerns, requiring that such decisions with long lasting consequences are better evaluated before taken. In this context, the increased urgency in finding appropriate energy solutions justifies the importance of revisiting some basic assumptions and conclusions. From the perspective of global warming, the assumption that CO₂ with other greenhouse gases are its only significant cause has been the basis for all international recommendations on energy options. Based on such understanding, fossil fuels should be gradually replaced by renewable energy sources that do not result in significant CO₂ emissions, and nuclear energy, in spite of the well-known concerns, has been now reconsidered in that light as a “clean” or “green” energy option. However, the assumption of cause-effect relation between CO₂ and global warming is not so clear, as there is also a reverse causality process where temperature increases also cause CO₂ increases at various temporal scales [1]. Moreover, CO₂ concentrations in the atmosphere are very homogeneous around the globe whereas temperature anomalies are spatially quite variable with urban or regional “heat islands” indicating that other factors also play a significant role. Arrhenius already indicated, in 1896, the importance of considering all factors in the energy balance of any point of the Earth. In his work, while focusing “on the influence of carbonic acid in the air upon the temperature of the ground”, Arrhenius already included in his model “the quantity of heat that is conveyed (by other sources) to the air at the point considered”.

We know for a long time that there are significant quantities of heat resulting from energy consumption that are causes of local or regional warming. Several scientists from different regions and approaches independently proposed the importance of the contribution of this heat source for global warming. In Sweden, Nordell (2003) [2] concluded already that thermal pollution causes global warming. In the US., Chaisson (2008) [3] discussed long-term global heating from energy usage. In Germany Arnold (2016) [4] analyzed global warming by anthropogenic heat. More recently, in Canada, Bian (2020) [5] also concluded that waste heat is the dominant root cause of current global warming. All these scientists agree, using different energy balance approaches and different terms (anthropogenic heat flux, thermal pollution, or waste heat) that, rather than greenhouse gases it is the waste energy from consumption by man that constitutes the dominant cause of, atmospheric warming. Disentangling, from the statistical perspective, the relative contribution of greenhouse gases and waste energy in global warming is extremely difficult because fossil fuel combustion releases at the same time CO₂ and heat. In any case, reduction of fossil fuel use is positive since it decreases both heat release and CO₂ emissions to the atmosphere. The change from fossil fuels to surface renewable sources from water, solar or wind energy is also considered positively as these sources do not release CO₂ and are already occurring in the current Earth-atmosphere energy system. However, if energy use and waste heat are the dominant factors of global warming rather than greenhouse gases, the focus should shift from reducing greenhouse gas emissions to reducing energy use and waste. This can be achieved by changing personal and social behavior and by reducing waste heat by increasing energy conversion efficiency. Recovering and reusing waste heat from environment, and promoting development of surface renewable energies are vital. In this perspective, nuclear energy, introducing extra energy in the Earth-atmosphere system, will be clearly detrimental to global warming and should be avoided. Energy options, with long-term consequences, have to be built on the most comprehensive and available scientific bases. In spite of several important scientific contributions, the role of anthropogenic and waste heat in global warming has been clearly underestimated. Now, when important decisions on energy options are being made, it is urgent to revisit the assumptions and the resulting conclusions. This is the only way to avoid decisions that may significantly affect for a long time future generations and compromise the significant efforts already made to mitigate global warming and to avoid its consequences. The scientific community, the international organizations, the governments, the environmental organizations, the general public should all be fully aware of these different perspectives. There are already informal groups discussing these matters. Global warming continues to occur and energy options are discussed. A strong and open debate on this issue by the scientific community is now more urgent than ever. This is the final purpose of this opinion article.

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