

Introduction

The biosphere is the world in which we live. Compared to the size of the earth, the biosphere is a thin layer surrounding the earth's surface, extending a few kilometers above and below it. This is where all living organisms and their residues are to be found. This is where mankind has developed, in intimate relation with its surroundings, what we often call the environment. We know that our life has always been dependent on it, and always will. Hence our deep concern when changes, maybe harmful to us, occur in the biosphere, possibly due to the activity of mankind.

Do these fears have a scientific basis, or are they grossly exaggerated? For instance, is climate change a real threat? And what is more harmful to the biosphere, to burn more fossil fuels, or to build and operate more nuclear reactors? Today these issues are in the public domain and, in the end, it will be the people who will decide what should or should not be done. This is why I believe it is important for everybody to understand the nature of the issues at hand.

It turns out that an intelligent discussion requires some familiarity with a concept called entropy. While everybody is familiar with the concept of energy, only a few, mostly scientists, know about entropy. In order to understand that there is a deep connection between the energy crisis, by which we mean that we may soon run out of fossil fuels, and damage to the environment, it is necessary to understand the concept of entropy. According to the laws of thermodynamics, this damage is one aspect of an increase in entropy (or disorder at the molecular scale) in the biosphere, which cannot be avoided when we burn fuel. This increase in entropy is more subtle than the loss of fuel supply, but instinctively it is the one that we fear more. As we shall see, the danger lies not so much in the fact that we are burning fuel, but rather in the rate at which we do this.

If we run out of fossil fuels it is evidently because we have been burning them so fast, and so inefficiently, and this is precisely the reason why the effects of the increase in entropy are now there for everybody to see.

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