

Abstract

An attempt is presented to provide at least a partial answer to the question of why energy is a scarce resource. Scarcity is a fundamental concept in the science of economics. If resources, goods or services were not in scarce supply, we need not economise when utilising them. Indeed, free commodities we need not pay for, their prices are zero, we attach no economic value to them, and their supply is in abundance – at least beyond the point at which our needs and wants are satisfied. If *energy economics* is to cover a body of meaningful concepts and questions, energy will have to be regarded as a scarce resource. But energy – as such – is not scarce. Yet, we are willing to pay a price for our energy deliveries, implying that energy in some sense is scarce, a phenomenon we are all undeniably aware of.

Energy economics would therefore be the area covering the pricing of, the supply of, the demand for, and the allocation of energy as a scarce resource used in consumption, for running manufacturing processes, or to be employed for producing services, all having the ultimate objective to provide a means for meeting and satisfying the needs and wants of consuming households and individuals constituting society.

Energy as a quantity exchanged in the economic system is usually measured in British thermal units or in kilowatt hours, or similar units, and its price is measured in money units per Btu, or by some similar ratio. Pricing according to this convention, therefore relates a number of economic value units to a unit amount of energy.

However, in accordance with the laws of physics, energy as such is indestructible (in particular, if we take the relativistic identity of energy and matter into account). Thus energy as such exists in abundance. *Energy as a scarce resource* must be considered in other terms than energy amounts alone. This must be a necessary requisite for defining the concept of energy, as it would appear in any scientific field named *energy economics*.

To describe energy as a useful and therefore a valuable quantity, to which a price may be attached, energy will thus have to be characterised in further dimensions than energy content alone. Apart from quantity, there is a need for a uniform qualitative measure of energy. The obvious field to revert to for such considerations is *thermodynamics*, the branch of physics dealing with the transformation of energy between its different forms.

Today, we are becoming increasingly aware of the fact that *oil* is a scarce resource. And we need *electricity* for lighting lamps and for running computers, and we need *heat* for keeping our living environment at a comfortable temperature. However, oil is not equivalent to energy, and electricity and heat are indeed very different.

This speech will try to explain the basic relationships between what is considered as resources bearing energy, and energy itself. We also address how a *qualitative* property may be attached to energy, so that we can distinguish why energy in different forms should have different economic values. The *Second Law of Thermodynamics (the Entropy Law)* offers a method for defining a uniform measure for the qualitative content of energy. This measure is named *exergy*, but is this concept all that is needed?