Human, Environmental, and Global Health All Benefit from Energy Efficiency

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Editorial

The over/under use of energy at the level of the human body and the industrial metabolism of humanity are strikingly similar. Human, environmental, and global health are all affected by both types of energy consumption. Excessive fossil-fuel consumption, as well as excessive food energy consumption individually, are both responsible for a slew of interconnected negative consequences, including global warming, extreme weather, ecosystem damage, biodiversity loss, widespread pollution, obesity, cancer, chronic respiratory disease, and other lethal chronic diseases. Data, on the other hand, reveal that efficient energy use-in the form of food, fossil fuels, and other resources-is critical for human, environmental, and planetary health as well as long-term economic development. While it is not news that efficient energy and food use can help solve some of the world's most pressing challenges, there has been little research and no unifying framework to bring these concepts of sustainable system management together from several scientific domains into a unified theoretical body [1]. To stimulate comprehensive improvements in the use of the world's natural resources, insights beyond reductionist notions of efficiency are needed, with the goal of achieving a wiser use of energy, better farming systems, and healthier dietary patterns. This viewpoint identifies a number of scientifically supported options for cost-effective pro-growth and pro-health policies that use less energy and natural resources.

Several interrelated challenges now confront the world, including (1) providing adequate food, clean drinking water, and nonrenewable energy resources in finite supplies to an exponentially growing population; (2) developing a sustainable global economy that does not destroy the environment or jeopardize human health; and (3) limiting the negative socioeconomic and health effects of the worldwide epidemic of unhealthy nutrition and obesity. What are our options for dealing with these difficulties? We believe that today, the best solution too many of these issues is to use energy, food, water, and other natural resources more efficiently and wisely. The current economic model can no longer be sustained. As we shall argue in this paper, relying on technology to create more food and energy to promote economic growth may be effective in the short term, but it has long-term, grave consequences for human and environmental health, as well as social well-being. Energy efficiency, on the other hand, can help to promote human, environmental, and planetary health as well as long-term economic prosperity. The word "energy efficiency" refers to devices or built systems that produce the same level of output or benefit while using less energy [2]. However, mounting scientific data suggests that energy efficiency is a key factor in maximizing physiological functioning in both basic and sophisticated species, including mammals. Hundreds of research has found that animals with mild energy restrictions live far longer and are in better condition than animals with unlimited dietary energy. When the activity of energy-sensing cellular pathways (such as the insulin and insulin-like growth factor signaling pathways, and the mammalian target of kanamycin pathway) is lowered by genetic manipulation or pharmacological inhibitors, a similar result is observed.

Energy and resource efficiency are also critical at the societal and biosphere levels, in a way that is not only analogous but organically and causally related. Reduced consumption of nonrenewable energy and other natural resources is critical for environmental health and sustainable economic development, but it also has significant consequences for human health [3]. Excess energy consumption from fossil-fuel sources encourages extensive pollution and global warming, and is an indication of economic and public ill-health and inequality. Even if it is carbon-free, squandering energy resources has negative consequences, such as increased exposure to cadmium or other hazardous substances, increased mining and demand for rare earths and other precious elements, water depletion, and resource waste, all of which diminish well-being. Energy and other resource waste, in general, is a telltale symptom of a system that is failing to meet fundamental requirements or foster innovation, ultimately harming the ecosystem and human health. Correcting excessive dietary energy intake to achieve optimal body weight and health, as well as deploying more energy-efficient buildings, vehicles, appliances, and industrial equipment, are all part of a larger set of actions that have the potential to cut the world's projected energy needs in half and become the primary drivers of pollution and global greenhouse gas emissions control. Producing and consuming more fossil-fuel and food-energy energy, on the other hand, leads to a vicious cycle of harmful emissions, global warming, floods, droughts, land degradation, water shortages, and, ultimately, decreasing crop yields.

We claim that there is a fundamental parallel between over/under energy consumption at the human body level and at the biosphere level, and that this connection has significant consequences for human and environmental health. While it is not news that efficient use of energy and other resources can help solve some of the world's most pressing problems, there is little or no unifying framework in place to bring together and harmonies these concepts of sustainable system management from various fields (such as biology, medicine, ecology, economics, engineering, information technology, and so on) into a single theoretical body. New methods and policies that support integrated improvements in the use of the world's natural resources are clearly needed, with the goal of achieving more efficient energy use, better farming systems, and healthier dietary patterns. We believe that more complex analysis models based on a multi-objective set of constraints are required. In most industrialized countries, life expectancy at birth has nearly doubled in the last century, with the oldest group (aged >65 years) being the fastest increasing portion of the population [4]. The increase in average life span is, however, significantly bigger than the increase in healthy lifespan. Approximately 80% of older persons worldwide have at least one chronic disease, and 50% have two or more chronic diseases (e.g. cardiovascular disease, stroke, cancer or type 2 diabetes). Chronic diseases, which are generally preventable, are the primary cause of morbidity and mortality, as well as important contributions to economic losses and a source of societal costs, according to the World Health Organization (WHO). These issues are compounded by the present obesity and overweight epidemic, in which excess adiposity is causally linked to an increased risk of type 2 diabetes, cardiovascular disease, cancer, and disability. As a result, our (unpublished) findings, based on a large dataset of Italian patients seen by general practitioners through the National Health Search Network, show that being overweight is associated with a significant increase in health-care costs, which could very well lead to the health-care system's bankruptcy.

Energy intake that is sufficient but not excessive is critical for promoting health and longevity at the organismic level. Both insufficient (i.e. hunger) and excessive (i.e. overweight and obesity) energy consumption result in negative changes in body composition, metabolism, and organ function, which can contribute to premature death. A moderate reduction in energy intake below usual ad libitum levels without malnutrition, on the other hand, prevents or delays a wide range of chronic diseases, results in a dramatic increase in health span and lifespan, and preserves a number of measured metabolic and physiologic functions found in experimental animals in more youthful-like states, according to data from a variety of studies [5]. Nonhuman primates have lately verified these findings. Adult rhesus monkeys given a 30% dietary reduction suffered no diabetes, a 50% reduction in cancer and cardiovascular morbidity and death, and reduced sarcopenia and neuro-degeneration during the course of a 20-year trial. Furthermore, data from recent clinical research show that DR causes some of the same metabolic and physiologic adaptations in humans as it does in DR mice when it comes to healthy longevity. Moderate DR combined with proper eating protects people from obesity, type 2 diabetes, high blood pressure, inflammation, and cardiovascular disease, as well as lowering cancer risk factors. Furthermore, it has been demonstrated that

lowering dietary protein intake lowers circulation levels of IGF-1, a critical growth factor involved in the development of prostate, breast, and colon cancer, as well as the ageing process.

This conclusion is significant because the recommended daily allowance (RDA) for protein intake is 0.83 g/kg of body weight per day, but at least half of men and women in many developed countries consume twice as much protein. The fact that the majority of protein in North American and European populations' diets originates from foods of animal origin, which encourage weight gain and are high in atherogenic saturated fatty acids, is linked to this issue. Overconsumption of animal protein in relation to other nutrients is not only a current epidemic among the wealthy, but it is also a clear aspirational goal for millions of poor people in developing countries, who are disproportionately increasing their meat and dairy consumption as their wages rise above poverty level7. The impact of this overconsumption of animal foods on water and land use is significant, with livestock feeding accounting for 70% of all land under tillage, with a 21:1 ratio of vegetable input to meat output26. In contrast, if global dietary trends changed to limit the consumption of animal source foods and encourage the adoption of a diet rich in plant-based meals, only 30 to 40% of the crops currently farmed would be cultivated [6]. Significantly reducing air, water, and land pollution (due to the widespread use of reactive nitrogen and phosphorus fertilizers and pesticides, as well as poor animal waste management in many areas), topsoil depletion, over-pumping of groundwater, agriculture-related fuel consumption, and greenhouse gas emissions would be required. Furthermore, by eating fewer empty-calorie foods, meat- and dairy-derived foods, and more vegetables, fruits, beans, whole grains, seeds, and nuts, overweight and obesity rates could be reduced, and many age-related chronic diseases could be avoided, reducing the gap between lifespan and health span, as well as health-care costs.

Significantly enhancing human and environmental health, social prosperity, and well-being is conceivable, but it will necessitate a significant shift in how we live, as well as a new industrial and economic structure that prioritizes the environment. The majority of the knowledge and technology required conducting a reshaping of our future and a new industrial revolution is currently available. To summarize, we must forsake the paradigm of producing more energy, food, and other items at lower costs in favor of a new paradigm that prioritizes less but higher-quality energy, food, and materials in order to live a better life and protect the environment. At the individual level, reducing calorie intake by increasing the consumption of a variety of minimally processed plant foods and significantly reducing the intake of animal foods will increase health span and reduce health care costs, as well as environmental pollution, soil erosion, water pollution and scarcity, CO2 production and global warming, violent weather, and associated planetary consequences [7]. Making our homes more energy efficient and resilient (e.g., wall and roof insulation, energy-efficient windows and doors, ultra-efficient lighting technologies, energy-saving appliances, solar power to heat water and produce electricity, geothermal heat pumps, etc.), purchasing lightweight hybrid-electric motor vehicles, and reducing waste by choosing reusable products over disposables all have significant effects on human and environmental health.

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