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Efficiency and the Rebound Effect in the Hegemonic Discourse on Energy

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Abstract: The aim of the article is to discuss the unintended consequences of energy efficiency, in the context of defuturization, by addressing the phenomenon of the rebound effect. The energy discourse is presented as ideological discourse protecting the status quo, even if it contemplates alternatives solutions. The interpretation of energy efficiency in the light of the Luhmannian concept of temporal structures in the modern society is proposed, and two types of expert narratives on the rebound effect are outlined: the mechanistic rebound effect and the systemic Jevons paradox. Finally, we explain why none of them are noticeably reflected in public discourse on energy policy and are limited to the scientific milieu.

Keywords: defuturization, energy efficiency, futurization, hegemonic discourse, rebound effect

Energy efficiency, in the context of rising environmental concerns and the perennial alarm regarding energy security, is more than the merely serendipitous result of technological progress within the narrow field of energy processes. It is not simply one of the many possible manifestations of innovation accessible only to practitioners, technicians, and scientists. During an energy or environmental crisis, energy efficiency as a concept suddenly appears on the political agenda and in the public communication domain, cast as advancing progress and expressing a collective sigh of relief for a long-awaited remedy. We argue that this paradigmatic occurrence is one of the foundations of the post-hegemonic discourse that seeks to legitimizes the liberal social order and the current model of the growth economy. This is not to say that energy efficiency per se is a concept circumscribed by the culture underpinning liberal economies; it was also a fundamental ingredient of the autarchy myth of the state-based national economy. In either case, efficiency and economic growth have been wedded since their inception. It is worth noting that the concept of efficiency came to life during the same period in which growth appeared in the public discourse. It was with the invention of the steam engine and the resulting need to formalize the conversion of heat into work—humanity's

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most remarkable achievement since the mastery of fire—that scholars, scientists, and entrepreneurs from the dawn of thermodynamics, such as Sadi Carnot, were compelled to introduce the modern concept of efficiency. It was also during this period that the idea of progress superseded the steady state, and society was lured into imagining its constant, unlimited growth. In the words of Adam Smith (1976: 99), only "the progressive state is cheerful" and the "stationary is dull; the declining melancholy."

As seductive as it was, the idea of unlimited growth has always inevitably been a harbinger of resource depletion, for which efficiency represented the only remedy. What was once a question of resources is today a problem of resources and where to *sink* the waste: the environment. Energy efficiency is and always has been vital to the goal of preserving economic growth while preventing its undesired detrimental consequences on health and the environment (or on the rate of resources depletion, before environmental awareness became a major concern). At stake is the future of capital on the one hand and of human beings on the other, the reconciliation of which must be attained by virtue of energy efficiency in the same way that labor-saving technological progress was needed to prevent social conflict in the past.

The management of the temporal structures attained by the affirmation of efficiency is achieved in communication as a form of reality control in society. The incumbent energy future is uncertain, and energy efficiency presents itself as an effective form of discursive control to impede departures from the current path that could be engendered by visions of the future other than those now present and dominant. From this perspective, therefore, energy efficiency can be interpreted as a discursive construct securing control over reality and thereby be discussed in the context of the dichotomy between futurization, the creation of alternative future scenarios, and defuturization, the reduction of the options available in the future.

The futurization/defuturization process is predicated on a high degree of, if not complete, predictability and, even more importantly, on results corresponding to intentions.

The unintended consequences of an action loom ominously in the making of the future. Any wishful projection is gauged by its probability, but unexpected and computable outcomes are more acceptable for a positive narrative of the future than unintended ones. The unexpected can be estimated in terms of error or disturbance, and thereby reduced to a probabilistic anomaly and reconciled with the desired outcome in terms of deviation. The unintended raises questions about the nexus

between the event and what is desired. The unexpected is the result of external factors, and the unintended is an intrinsic flaw in the intended action. The unintended consequence par excellence in the field of energy studies is the "rebound effect," or the "Jevons paradox." The rebound effect is "an increase in consumption which may occur as an unintended side-effect of the introduction of policy, market and/or technology interventions aimed at environmental efficiency improvements. The increase is caused by behavioural and /or other systemic responses to the interventions, in particular where the efficiency gains bring reduced costs" (Maxwell et al. 2011).

This article provides a conceptual model of how the phenomenon of the rebound effect, considered as the unintended consequence of energy efficiency, interacts with defuturization interpreted as a mechanism of complexity reduction in energy governance. As a conceptual analysis, this article will not introduce new data or the results of any original discourse or narrative analysis but instead will only focus on a novel interpretation of the energy discourse in relation to efficiency as observed in the scientific literature and the public sphere. First, we present this discourse as an ideological discourse defending the status quo, albeit one that incorporates some alternative discourses on energy transition. Then, we propose an interpretation of the concept of "energy efficiency" in the light of the Luhmannian idea of temporal structures in modern society, which helps us understand this concept's incredible career in the field of energy policy. The theoretical framework is supported by examples of the Jevons paradox and the rebound effect. The Jevons paradox was the first attempt to focus attention on the nexus between energy efficiency and growth in energy consumption, highlighting the contradiction encapsulated in the complexity of the interactions between society and economy.

We then illustrate how the problem of whether the idea that energy efficiency actually leads to reduced energy use surfaced several times in the twentieth century (and even in more recent decades) in the form of the rebound effect debate, which renewed the Jevons paradox in a more positivist sense. We will show how the rebound effect theory was mostly intended to disentangle growth from efficiency or, more precisely, economic growth from energy growth. We will provide some examples of how the public and scientific discourses on the rebound effect were mostly meant either to reject or downplay it, by limiting the phenomenon's temporal, spatial or systemic scope in order to re-establish the hegemony of energy efficiency over the narrative of the future. Finally, we try to explain why none of these phenomena are

noticeably reflected in the public discourse on energy policy (Font Vivanco et al. 2016) and are limited to the scientific arena.

Post-hegemonic Discourse on Energy: Energy Efficiency

The concept of energy efficiency over the past 40 years has become vital to global energy policy. It functions both as an objective reflected in OECD and EU (EC 2014) strategic documents and as intrinsic value: any efforts to improve energy efficiency are desirable. This is a part of the modernization discourse, which treats economic growth and technological development as autotelic values (Nisbet 1980). Howard Geller, in an article published in *Energy Policy* in 2006, writes emphatically, "Without energy efficiency improvements, the OECD nations would have used approximately 49% more energy than was actually consumed as of 1998" (2006: 556).

This refers to energy use as the level of unexploited capacity that would otherwise have been used were it not for the energy efficiency improvements. The definition of energy efficiency in Wikipedia (2018), a prominent repository of collective knowledge, refers to the European Union definition: "the amount of energy saved by measuring or estimating consumption before implementing a measure to improve energy efficiency. And after its implementation, while ensuring the normalization of external conditions that affect energy consumption." Thus, energy efficiency can be interpreted as a concept relating to temporal structures, identifying the difference between past and future. It can also be seen as the horizon of never realized possibility. In this sense, we will talk about energy efficiency as a process of implementing measures that are desired and conceived. Energy efficiency appears to be a precautionary measure against excessive energy consumption, with the excess referring to a state in which consumption would have been significantly higher had the restrictions not been imposed.

This horizon of goals that will never be achieved is reminiscent of a modern, critical view on democracy. Bart Cammaerts (2015), referring to Derrida, has called democracy "an empty signifier," a horizon that has not been yet captured. He stresses the processional character of the notion of democracy and arrives at some critical conclusions. In his opinion, the orientation toward developing a better, more equitable, more participatory democracy is not accompanied by efforts to change the current social order. On the contrary, the public discourse largely preserves the existing economic structures and liberal order. Discourse

is understood here as referring to both a system of meaning and social practice. It is penetrated by power-knowledge relations (Foucault 1981). While "discourse" refers to the hidden rules of using language and creating social reality, the narrative is linked to the story, which is a sequence of events, actors, and things embedded in the particular situation, place, and time. This determines the method of analysis: narratives are reconstructed and interpreted within the discourses, which create a set of meanings and affect the dispositions of people to act.

A world based on the idea of continuous progress identified with economic growth and technological development produces a dominant ideological discourse oriented to protect the status quo. Cammaerts (2015) describes this discourse as post-hegemonic in its immanence, whose perception is obvious and neutral. This characteristic also applies to energy discourse. The mainstream media often presents energy issues in the context of the economy (investment, prices, cost, and profits), as well as geopolitics (securitization, independence, and weaponization) (Wagner 2018). Issues brought to the public by alternative discourses, such as environmental protection, resource depletion, and climate problems, are incorporated and subordinated by the dominant liberal discourse. For instance, the goals of climate change mitigation are reoriented toward new or latent technological solutions that are meant to reinforce the existing economic paradigm, so narratives emerge that promote electric vehicles rather than new forms of mobility. The hegemonic discourse thus does not eliminate antagonisms but instead enters into a specific resonance with them, playing them according to their own criteria of economic and political rationality (Scrase and Ockwell 2010). The values of economic growth and technological advancement as a measure of civilizational progress are accompanied by the belief in the high-energy intensity of developed economies, and the demands of rational management of natural resources or climate policy are met by the postulate of ever-improving energy efficiency.

This concept becomes a mechanism to reduce the uncertainty related to the depletion of resources, while, at the same time, there is no action aimed at any fundamental and radical change to the power model of fossil fuels dominating the global market (Dryzek et al. 2003). Moreover, the ideological character of "energy efficiency" sheds new light on the explanation of its successful penetration into the various social subsystems (from economy through politics and law to ecology). Ideology in Niklas Luhmann's understanding can be seen as a tension-reduction mechanism caused by the various binary codes operating in different subsystems: payment/nonpayment, legal/illegal,

true/false. Ideology fails to provide a scientific or true interpretation of the world because it emphasizes only certain aspects and hides the rest (Brunczel 2010), but it supports the interpenetration of a subsystem's code. The notion of "energy efficiency" permits combining the codes of economy, ecology (linked to the good/bad moral code), and law, and reaching a structural coupling among these subsystems.

The post-hegemonic discourse produces mechanisms to control reality by recognizing the neutral criteria of rationality (subordinated economic rationality, hence the profit criterion), technological possibilities and representativeness (Cammaerts 2015). Paradoxically, the interests of large market players are identified with the common good, while the unequal/unfair distribution of risks and benefits raised by protesting actors is often labeled as particular interests being in contradiction with the common good (e.g., the NIMBY syndrome; see Devine-Wright 2005). There are various discourses in the field of energy.[1] Each creates different expectations and recalls different experiences. The visions of the future constructed by these discourses operate within different temporal structures: some call to open the future by imagining different scenarios of anticipated events, while others try to limit the number of future options by focusing on certain selected ones.

In a given communication,[2] we can observe how the future is incorporated into the present. The action undertaken is targeted at ensuring a definite effect in the future, and the future visions open new possibilities for action. This enables us to integrate the past, and thus the structures and institutions we have worked with, with the expected or desired effects. The effective management of temporal structures, according to Luhmann (1976), is a form of reality control. In the field of energy, it supports the structural coupling between the international political system and the global economy, which, despite that, remain independent spheres (Richert 2018). It serves the stability-change balance in the social system, reducing the contingency and complexity of the system's reality. Using the concept of temporal structures helps us reach beyond the perspective of a state-centric world and contribute to the discussion on how energy is governed globally.

Futurization and Defuturization and the Problem of the Unknown

Current perceptions of the future are related to belief in progress and the unrealized possibilities available to people (Luhmann 1976). However,

according to the phenomenological understanding of the future, Luhmann views this as a horizon for action. *The present* itself is the difference between what *has happened* and what *is going to happen*. It tumbles on in two stages, as an activity in the process of realization that is becoming unresponsive while simultaneously maintaining its potential for reversibility. In this sense, both the future and the past exist exclusively in the present. The future is perceived as a horizon: it is unattainable, one can flow in its direction, but never reaches it completely. Communication is a space in which the past and the future can be found in the present, in the form of experiences and expectations.

According to Luhmann, the essence is an analytical distinction between the "present future" and the "future present." The first is a projection screen for the present (for example, utopian or dystopian visions), which indicates the present's desires, fears, frustration, and objections. This future warns or criticizes reality but cannot in fact ever happen. The second, the future present, is meant to incorporate future events into the present. It is focused on taking action to make the present a past for anticipated events. This second type is typical of the technological perspective. Technological development requires decisions, which, once taken, create a new space for the unknown. The way to deal with this type of interference is to refer to the most selectable and most up-to-date values. "To justify the choice, and more important, to justify the whole procedure of technological defuturization, we use values" (1976: 144), and thus a decision linked to technology development is often ideological.

The process of converting energy, whose intentional decrease is energy efficiency, is shaped on the one hand by current social practices, which reflect both the desire for comfort and wealth and the fear of blackout or planet degradation (present future), and on the other hand by technological possibilities (future present). Accordingly, from the standpoint of social practices, energy efficiency is a projection of the tension between the imperative of economic progress and the constraints imposed by resources depletion. It is valued positively, as all human efforts to improve energy efficiency are interpreted as sustaining security in the management of energy. Energy efficiency does not remove the tension: it shifts it into the future, beyond the horizon of tomorrow. The foggy visions of energy crisis or ecological catastrophe in our public discourse shape our values and affect some of our practices, but not in a strategic sense. We turn off the light in the bathroom because we think it is right, not because we seriously intend to avoid a catastrophic future. It is like the "memento mori"

mentioned by Luhmann (1976). This is the analytical stance posed by the present future.

From the second analytical viewpoint, the future present, energy efficiency is an imperative for technological development: devices and infrastructures. It reduces the problem of depletion of resources and devastation of the natural environment to strategic planning, policy instruments, and technology innovations. It focuses on expectations through the lens of what is possible and impossible given the current reality, rather than what must be done to change reality. Either way, the idea of energy efficiency legitimizes the progress of civilization identified with the growth in the economy, which in turn goes hand in hand with the increase in energy consumption. In this sense, energy efficiency is the product of the discourse of modernization, as it serves the integration of temporal structures: the past (and its models of economic efficiency) and the future (along with the areas of uncertainty and risk) can be found in the present. Energy efficiency, based on technological capabilities, stimulates social activities such as lawmaking.

Rzeczpospolita (2016), a leading Polish newspaper, regarding the discussion on energy efficiency during the 26th Economic Forum in Krynica (6–8 September 2016) wrote: "Energy efficiency is one of the basic solutions to achieve the desired reductions. We already have the right technology. An ambitious policy to transform the energy system is needed." Luhmann (1976) distinguishes the two analytical concepts of the future, outlining the mechanism for integrating them as a way of controlling reality in Western societies. Visions of economic stagnation or recession (the "melancholic state" of Adam Smith) and the threat of energy crisis articulated in the contemporary discourse are the present future, and, simultaneously, the improvement in efficiency via policy goals and technological development addresses the expectation of the future present. Both are used to gain control over the counterpower discourses, such as those calling for a radical civilizational change (Dryzek et al. 2003).

Luhmann also considers the possibilities for opening the future by creating alternative future scenarios—that is, the mechanisms of futurization, and limiting possible options to reduce contingency—namely, defuturization. Strategic planning, insurance, quantification of uncertainty, and transforming the unknown into risk are some of the mechanisms of defuturization. Both futurization and defuturization are ways of coping with uncertainty, however differently. Futurization can be understood as an endeavor to consider potential options, cope with different types of uncertainty and improve the ability to react to

a changing environment. Defuturization focuses on a chosen course of action and is based on the causal relationship between anticipated events. It serves to organize actions.

In documents concerning the European energy strategy (EC 2010), the future is framed as having a long-term horizon, but the expectations of the future are in fact generated based on recent past experiences. They seem to be influenced by the past and current dominant interests. Energy efficiency is often coupled with energy security. Control over areas of uncertainty, which changes people's uncertainty in the sense of security by means of decisions, can become a source of political power (Luhmann 2000: 41–43; Matuszek 2014). Such structures are produced in the course of communication: they define the communication of the present, which an actor can relate to. Nevertheless, society finds it difficult to elude the issue of the future, its design, and predictions about it. Visions of the future in relation to energy are also uncertain because of the tension between the imperatives of civilizational progress and the protection of the environment.

According to Luhmann, the mechanism of futurization and defuturization opens the space for actors engaged in the communication process. In this sense, energy efficiency can be interpreted as a prospect for future solutions for relaxing the tension between economic growth and the exploitation of planetary resources. It opens a space for technological development, as well as achieving economic goals and discussing environmental problems. However, the rebound effect appears here as an unmanageable and unpredictable consequence of the deployment of energy efficiency in society, contrary to its ideological and functional discursive power. As a result, it is displaced by this discourse. In the next section, we will introduce the first inception of the debate over the use of energy efficiency as a remedy to the imminent depletion of resources and how William Stanley Jevons first envisaged that energy efficiency could lead to more rapid consumption of coal rather than the opposite.

The Jevons Paradox: The Conundrum of Efficiency

In the late nineteenth century, a debate about the depletion of cheap coal and the associated threat to the prosperity of England gained public attention. The general awareness that the present wealth of the nation was sustained by coal and the astonishingly fast growth of energy-demanding devices and infrastructure generated a sudden anxiety

about the sustainability of such a prosperous course. The second wave of industrialization had not only been an age of unprecedented economic growth and rampant transformation of land and society, but it was also the moment when humankind discovered the modern concept of scarcity. Scarcity, for the first time, became an absolute: no longer bound to an unpredictable stepmother nature, but dependent on the hidden quantity of an irreplaceable resource and on the rate of its tapping. Although complete depletion was mere conjecture, the contingency itself jeopardized the foundations of the economy. Amid this gloomy perspective and general concern, many maintained that the increasing efficiency of coal use would indefinitely postpone such a disastrous fatality. The optimistic view voiced by the heralds of technology was that the growing energy efficiency of steam engines and smelting furnaces would reduce the intake of coal and lessen the rate of depletion. William Stanley Jevons's (1965) contribution to the debate was a breakthrough. With his book *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal-Mines*, first published in 1865, he broke ranks: he was neither a Luddite nor a Proudhonian anarchist, but rather a fervent supporter and a refined connoisseur of the wondrous virtues of the free market and technical progress. Nevertheless, he argued that energy efficiency was to be considered not a solution but a cause of the rapid exhaustion of coal resources—or, in his words, of the "lavish expenditure of our material energy." In his view, in a free market energy efficiency renders the use of coal more economical and thereby fosters rather than moderates its consumption: "The problem faced by mankind is therefore geological from its inception but economic in its consequences and course of action" (Madureira 2012).

Jevons's intuition went far beyond the finding of the elusive and misunderstood nexus between energy efficiency, market rules, and the rate of resource tapping. He also pinpointed the role of energy efficiency in the dynamics of the economy. Jevons thought that progress (or economic growth, in modern terminology) was the result of the subsequent steps of energy efficiency. In fact, his greater concern was never the environmental consequences of the use of coal, nor was he convinced that the other "energy of Nature," such as oil, would ever become valuable substitutes for coal, which should be considered, in his words, more as an aggravation of the drain than a remedy. Meanwhile, the growing alarm had prompted the British government to commission an accurate and widespread survey of the proven and probable resources of the Kingdom. This geological prospecting, which showed

that, contrary to Jevons's predictions, the depletion frontier was still very distant in time, calmed concerns and reassured the government, but unfortunately overshadowed the strength and scope of Jevons's message.

It is worth noting, however, how, in the light of Luhmann's analysis presented here, energy efficiency serves in the public discourse, as it did in the nineteenth century, to save prosperity (the present future) from the gloomy perspective of resource exhaustion (future present). In his time, only Jevons understood that that the optimistic and positivistic narrative was flawed.

The Rebound Effect: The Reincarnation of the Jevons Paradox

The question of whether energy efficiency should be considered beneficial or detrimental for the goals of energy conservation was revived in the early 1980s, not surprisingly at the dawn of the oil crisis, sparking a new debate about the scarcity of energy resources and dependency on foreign oil. Daniel Khazzoom (1980) is generally recognized to have been the first in the twentieth century to cast doubt on the efficacy of energy efficiency mandates to reduce energy consumption. Building on the work done by Khazzoom, Len Brookes (1990) pointed to the fallacies of energy efficiency. For the first time, reflecting rising concern over climate change, the environmental issue replaced the question of energy security in the debate on the real benefits of efficiency. These authors' two-pronged contribution paved the way for what Harry Saunders (1992) termed the Khazzoom-Brookes postulate. A special issue of *Energy Policy* in 2000 opened the floodgates for a new wave of scientific work on the topic, under the new term rebound effect. Today, most of the economic literature refers to the nexus between energy efficiency and increasing energy consumption as the rebound effect (Maxwell et al. 2011). Three main kinds of effects are generally recognized: direct, indirect, and economy-wide (Berkhout et al. 2000; Maxwell et al. 2011). The direct rebound refers to the effect connected to a change in energy service demand by the individual user in response to a more efficient process or technology providing the *same* energy service. The indirect rebound concerns the change in energy demand as a *collective* response to the individual spending of the savings generated by technology that is more efficient. For example, I buy a more efficient car and I use it more: this is a direct rebound effect, and still I save money on fuel. When I eventually use these savings to buy a

new and bigger TV, the additional energy it consumes and the energy needed to produce it constitutes the indirect effect.

The economy-wide rebound effect is much more difficult to define. It generally, and generically, refers to all the adjustments that occur in the economy in the domain of a relevant factors' price as a result of the introduction of more efficient technology. Following the example about cars, cars that are more efficient will increase the general demand for transportation, by lengthening the affordable commuting distance and thereby changing the urban profile of cities (societal effect) or by increasing the demand for this car's production factors and their spatial distribution (production or transformational effect). This latter production side effect does not immediately lead to higher energy consumption, unless the production of the more efficient car is partially outsourced at a greater distance and/or the higher technological content requires more energy-intensive inputs. In this latter case, the greater energy intensity of the inputs would drive greater energy content for each unit of output, regardless of the behavioral aspects concerning the car's use. The economy-wide effect is evidently a *systemic* effect and could possibly account for the majority of the rebound. It is noteworthy, for example, that every process that innovation meant to reduce the contribution of labor to production leads to an accretion of the energy intensity of products by substituting human work (animate power, or endosomatic energy) with mechanical work (inanimate power, or exosomatic energy). The same applies in the social domain when a new device accomplishes some kinds of duties formerly performed by human beings, such as a washing machine or smartphone. Indeed, what made smartphones available and affordable for most of the population was the exponential growth, according to Moore's law of the energy intensity of microchips (Waldrop 2016).

This view of the rebound points to an evolutionary and systemic type of rebound that some scholars have conceptualized as frontier rebound (Saunders and Tsao 2012; Turner 2013) or structural rebound (Galvin 2015). The frontier rebound hints at the expanding frontier of new products and processes that the increasingly higher efficiency in transforming energy renders accessible to the public, whereas the system boundaries in the structural rebound do not change but are the connections and their topology modified by the efficiency of an ongoing process (Ruzzenenti et al. 2015). Either way, if we look at the introduction of a completely new, formerly unavailable product (such as smartphones), or a new structure in the economic system (e.g., telecommuting or working remotely), society and the environment are both

ultimately affected. Although the concepts of structural and frontier rebound might seem separate, because the change occurs in one case at the boundary of the system and in the other within the system, they merge in the concept of complexity change, which incorporates both the introduction of a new, more complex device and a more complex structure of relationships (Ruzzenenti and Basosi 2010).

In a broader sense, we can view the expanding frontier as the growing interface (the contact surface) between human beings and technology, which is a pendant in the expanding frontier between the economic system and the environment. On the one hand, there is the energy and the matter, or the "pleroma," in the words of Carl Jung, which feed the system; on the other, there is the complexity of the economic system and society, the *creatura*, which nurtures human beings. It is notable that this frontier, the one with human beings, has a surface of contact that can expand along two main paths, insofar as a surface is a two-dimensional space: the number of individuals or the number of functions, individual or collective, superseded or hybridized by an economic system. An economy can grow along these two lines, but, interestingly, the *creatura* only along the second line (or the complexity increases). It is not difficult to imagine that energy efficiency plays a fundamental role in enabling the expansion of this frontier in both cases, either because the system can reach more individuals or because the system can transform endosomatic energy into exosomatic energy (replacing humans with machines). However, even today, many scholars and scientists in this field perceive economic growth and the rebound effect as two disjointed phenomena, if and when they acknowledge the existence of the rebound effect at all.

In our opinion, the immanent, post-hegemonic discourse on energy aimed at presenting energy efficiency as a solution to energy or environmental security prevents the broad recognition of the rebound effect and its consequences in terms of practices, polices, and visions of the future of economic growth.

The Loch Ness Monster of Energy Efficiency

The existence of the rebound effect has always been fiercely debated, as has its relevance for the energy conservation policy. Khazzoom's 1980 article sparked a volley of criticism, albeit still confined to the academic milieu. During a meeting of the International Association for Energy Economics in 1986, Amory Lovins, a champion of energy efficiency

renowned for his book *Factor Four*, clashed with Khazzoom himself (Schipper 2000). In the early 1990s, Michael Grubb (1990) contested Brookes's views, in a series of articles and letters in *Energy Policy*, over its magnificently therapeutic qualities for one side and its detrimental effects for the other. The debate spread in the late 1990s from "the pages of obscure energy-economics journals," in the words of Horace Herring (1999), to popular newspapers such as *The New York Times*. In a 1998 *New Scientist* article, Fred Pearce (1998) maintained outright that "increased energy efficiency leads to more energy use," causing turmoil at the International Energy Agency (IEA). In response, IEA members, namely the United States and the Netherlands, commissioned papers on the topic, and a session on the subject was held at the Annual Meeting of the International Association for Energy Economics in Quebec City in May 1998, resulting in the aforementioned special issue of *Energy Policy* (Schipper 2000).

We wonder whether the alarm raised was similar to that experienced by some of the major oil companies when the well-known article by Marion Hubbert (1956) on peak oil was published. Indeed, like the peak oil debate, the issue of the rebound effect is a leitmotif in the field of energy studies that periodically arises with every new generation of scholars, new studies, and new polemical energy, followed by a new wave of recommendations, warnings, or rebuttals. As Lee Schipper (2000) brilliantly expressed it, the rebound effect is the Loch Ness Monster of energy efficiency. The head of Nessie surfaced again in recent decades in articles in *The Guardian* (Rowley 2011), *The Huffington Post* (Chameides 2011), *The New York Times* (Tierney 2011), and *Scientific American* (Biello 2013), attracting widespread attention in the Anglo-Saxon world. Curiosity was sparked by a report from the Breakthrough Institute, a think tank in Oakland, California, which raised alarm again about the consequences of energy efficiency mandates, claiming that "extensive evidence and a strong expert consensus that a large amount of the energy savings from below-cost energy efficiency are eroded by demand 'rebound effects'" (Nordhaus et al. 2011). This report revived the debate and received the attention of leading scientific journals such as *Nature* (Tollefson 2011).

At present, even among the most convinced apostles of energy efficiency, there is a consensus about the existence of the rebound effect, but its effect is negligible, it is said. Among the most prominent figures representing moderate skepticism, or mild enthusiasm for efficiency, is Lee Schipper from Stanford University. Interviewed by David Owen (2010) for *The New Yorker*, Schipper claimed that "rebounds are

significant but do not threaten to rob society of most of the benefits of energy efficiency improvements." Skip Laitner, director of economic and social analysis at the American Council for an Energy-Efficient Economy in Washington, DC, claims, "If the United States were using 1970s technology in today's economy, for instance, energy use would be roughly double what it is now" (Tollefson 2011). David Goldstein, of the Natural Resources Defense Council's energy program, and Robin Roy, a former project director at the US Congress's Office of Technology Assessment, report their ultimate evidence of the inconsistency of the rebound effect (Goldstein et al. 2011). Their main arguments against rebound effect are (1) California, through a strong environmental policy, has kept per capita electricity consumption at the same levels for the past 30 years compared to the other 49 states where consumption increased, and (2) the decoupling of energy consumption and energy intensity (GDP per unit of primary energy) occurred in the United States in the mid-1970s. Michael Levi of the Council on Foreign Relations[3] suggests that the money saved through efficiency does not lead to a significant rebound because it will not be spent entirely on the energy bill.

David Biello (2013), though pessimistic about the efficacy of efficiency in the long run, has stressed: "But efficiency measures do save some energy. California has kept per capita electricity use the same for the last 30 years, despite the proliferation of gadgets, heated swimming pools and air conditioners, among other modern conveniences." In an article published in *Nature*, some scholars from Yale University and the University of California, providing a review of the existing literature of the various kinds of rebound effect and prefacing with caution that these different types of effects "cannot simply be added together to give the combined effect," nonetheless conclude that "rebound effects are small and are therefore no excuse for inaction. People may drive fuel-efficient cars more and they may buy other goods, but on balance more-efficient cars will save energy" (Gillingham et al. 2013). Recently, Danny Cullenward and Jonathan Koomey, from the University of California, Berkeley, and Stanford University, respectively, set out their critique of a model of the direct rebound effect in the US industrial sector presented by Saunders in a paper pivotal to the Breakthrough Institute's report on rebound effect. Cullenward and Koomey claim that this model is flawed because it uses average prices rather than marginal prices to address further the critical view of efficiency required by rebound effect, suggesting that "policymakers and journalists need to react with more caution to subsequent assessments of the rebound effect. Future work in this field might someday alter the consensus

view that energy efficiency technologies and policies actually reduce energy consumption; after all, the nature of the scientific method is to question established conclusions and, occasionally, to upend the dominant worldview" (2016: 8). They continue along this line by entreating future nonspecialist reviewers to be "cautious when reviewing papers that reach strong conclusions on the effectiveness of energy efficiency policy, particularly if those conclusions are based solely on theoretical models of consumer and institutional behaviour in the real world" (9). Disbelievers in energy efficiency are warned that energy efficiency must be preserved as a fundamental tool for the incumbent, positivist narratives on energy and climate change.

Energy Efficiency as the Legitimization of the Current System and the Difficult Path to our Reconciliation with Reality

As we have seen so far, the attitude toward the rebound effect of the "evangelists for energy efficiency" (Owen 2010) ranges from mild minimization to harsh dismissal. On closer consideration, the foundations of their critiques are based either on methodological aspects or empirical manipulations of the data. Some claim that the models are flawed and suggest that the phenomenon does not exist. In the same manner, environmental negationists argue that climate change does not exist because climate models are neither reliable nor testable. Others limit the focus of the analysis to particular cases—countries or sectors—or limit the chronology to prove that efficiency has led to lower energy consumption. Yet this result is attained only by the ad hoc selection of case studies, as the broader picture confirms that economy, at a global level and in the long run, always tends to increase energy consumption amid an increase in energy efficiency (Ruzzenenti and Bertoldi 2017). Jeffrey Dahmus (2014) developed a groundbreaking, long-term historical analysis of 10 economic sectors in the global economy, going back as far as the eighteenth century, to show that energy consumption has always increased with energy efficiency. Economic growth, energy consumption, and efficiency have always been deeply intertwined. The rebound effect and the Jevons paradox are intrinsic to economic growth, and energy efficiency has led to reduction in energy consumption only during limited periods or for specific sectors or economies. This is an energy imperative, although difficult to accept and complex to understand, that we must acknowledge when developing our energy policy.

If the causal nexus between energy efficiency, complexity, and growth is a far-reaching problem, if there is overwhelming economic and historical evidence pointing to efficiency as a cause of growth, why is it so difficult for scholars and politicians to accept the rebound effect? A possible explanation is that the goal of lowering energy use and lessening environmental pressure while maintaining levels of consumption and wealth is one of the most enduring energy myths—a myth very similar, in its nature and purposes, to that of perpetual motion. "Energy efficiency is a strategy that allows people a higher standard of living, with increased energy services, while decreasing their energy consumption," stated emphatically by a group of important economists and engineers close to the political milieu in the US (Goldstein et al. 2011). Indeed, it is difficult to be forced by the reality of numbers to dismiss such a promising and appealing predicate. Energy efficiency is not only a long-lasting myth, but also ubiquitous. He dwells in many disciplines behind the promise of a bright future to be achieved only with the eternal and liberating power of technological progress. This myth lies at the heart of today's post-hegemonic discourse on energy and its undisclosed, principal goal of saving economic growth from environmental crisis.

Conclusions

Economic growth and the kind of affluence we have experienced in the past century were the result of fossil fuels, prominently hydrocarbons. This is a widespread perspective, deeply rooted in our imaginations and perceptions. Liberal democracy supports the current economic structure and is pivotal to its ideology on growth. Moreover, the story of the liberal economy has been profoundly intertwined with that of fossil fuels since the dawn of the industrial revolution, when, with the Enclosure Acts, capital accumulation became a fundamental condition for the development of industries and, subsequently, the same paradigm was applied to underground energy resources. Energy efficiency in this sense, serves not only to subtract growth from the discussion over the fate of the economy and society (futurization) but also to postpone indefinitely the transition to renewable energy or an even more alarming steady-state economy (defuturization). The following, from Richard Ottinger's article published in *Strategic Planning for Energy and the Environment* (2010: 21–22), illustrates the common way of thinking about energy efficiency as the best and most ready-to-use solution for

the present, in order to sustain development of economy (i.e. growth) and secure the world as we know it, based on fossil fuels:

> Since potential energy crises are imminent, it behooves the world to act immediately and vigorously to promote energy efficiency—by far the fastest, most affordable, safest and cleanest of technologies. This is necessary to alleviate the immediate threats we face, in order to give the world time to develop economic, safe, and clean alternative energy technologies.

This illustrates how future orientation serves to the reduce the tension of the present. The system perspective we refer to in the proposed interpretation of role and significance of the notion of energy efficiency for modern societies does not exhaust the explanation of neglecting or at least ignoring the rebound effect and the Jevons paradox in the public discourse. However, the explanation of the structural tension caused by contradictory expectations of economy and ecology, predictions and actions, enables us to illustrate how the unintended is exported beyond the borders of the system.

In its first inception, the rebound effect was inspired by this paradoxical verve that the current positivistic approach occulted into a mechanistic formulation. Within the concept of the rebound effect, there is a hint toward resolving an unintended effect into a mechanical phenomenon. But the phantom of Jevons is revived in the Loch Ness Monster, and, if reduced to gears and levers, the blatant displacement of intention exhibited by its phenomenology still persists. This is why the rebound effect is frightening and intrinsically irreducible for the post-hegemonic discourse on energy. It separates the future from the hegemony of energy efficiency as it inoculates the germ of unpredictability and that of an unintentional course of actions, opening new avenues for an altogether different future based on renewable energy or an economy freed from the growth paradigm.

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Notes

1. Luhmann did not use the notion of the discourse itself, but we can observe various discourses through the lens of his notion of system semantics—for example the discourse of the economic subsystem could treat energy as a commodity; in politics, energy means a tool of power; in science it is a quantitative property; in moral codes it can be good or bad and this code could be added to any other. Moreover, within any given subsystem we can also distinguish different discourses as consistent with particular semantics but generated around different phenomena, as in the politics discourse of energy or securitization, and in economics discourses of fossil fuels or renewable energy sources.

2. Luhmann follows here an understanding of communication as the basic operation in a social system.

3. The Council of Foreign Relations has been for decades one of the major think tanks in the United States and numbers among its members 12 secretaries of state, as well as various CIA directors, bankers, lawyers, professors, and senior media figures.

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