Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 115 (2017) 1–5

Energy Procedia

www.elsevier.com/locate/procedia

International Conference – Alternative and Renewable Energy Quest, AREQ 2017, 1-3 February 2017, Spain

The NOW dilemma in Energy. The possibilities for Architecture and Urbanism

Adolf Sotoca, Phd*

Professor Serra Hunter, Universitat Politècnica de Catalunya. Barcelona, 08028. Spain

Abstract

Energy efficiency has found its place at the very core of the discussion in Architecture and Urban Planning. Research & Development, Political Agendas and Education Curriculums are increasingly driven by the need to reach a fair balance between the way we inhabit the world and the energy we require for it. After many decades neglecting this discussion a growing awareness about the carrying capacity of our environment is being brought to actual policies on the built environment. The dominant tendency today privileges economic growth, thus being the maximization of performed labor per energy unit its ultimate goal. Renewal energy sources and energy efficiency are means for, on the one hand, an alternative to finite fossil fuel sources and, on the other hand, the optimization in the use of energy. Very little attention has been paid, however, to a more profound paradigm shift in economy. Some authors, however, have also claimed replacing the myth of economic growth by a more steady-state development as a solution for the current sustainability conundrum. The question is whether withholding the use of energy might be an alternative to its hi-tech optimization. Some of the contemporary authors who have discussed the issue in recent energy crisis are recounted here for a wider and holistic understanding of the problem.

Peer-review under responsibility of the organizing committee of AREQ 2017.

Keywords: Energy Efficiency, Steady-State Economy, Urban Planning, Architecture.

* Corresponding author. Tel.: +34 605 390 933
E-mail address: adolf.sotoca@upc.edu

1876-6102
Peer-review under responsibility of the organizing committee of AREQ 2017.
10.1016/j.egypro.2017.05.001

1. Energy, Efficiency & Equality.

At the time the oil crisis of the 1970s stroke the global economy, a barely spread manifesto called “Energy and Equality” posed a critical theme for discussion: How energy efficiency is related to social equality and, ultimately, to a sustainable relationship with the environment that humankind lives in?. Author Ivan Illich delved into the theme and concluded that the energy policies adopted for the aftermath of the 70’ crisis “will determine the range of social relationships a society will be able to enjoy by the year 2000” [1]. For him, the key question was whether or not increasing technology optimization was the right path to follow.

By the time “Energy and Equality” was published, the English economist Len Brookes argued that an economy responsive to increasing energy costs, thus based on fuel optimization, would merely accommodate the new prices, causing energy consumption to be higher than it would have been if no effort to increase efficiency had been made. This effect, which could be devised as Jevons’ paradox in context of the 70` oil-crisis [2], has been referred to as “rebound” in many scientific studies since then. One of the most celebrated was the special issue of Energy Policy Journal published in 2010 [3]. A reading of the many articles contained in the issue concludes that the rebound effect on a certain sector very much depends on the cost share of energy in such economic sector. To put it simple, in processes, products, and activities where energy is a very high part of the cost the rebound effect may be remarkable, whereas in activities where energy plays a secondary role in costs, the rebound can be considered as neglectable. Assuming such conclusions, we may ask ourselves about the share of energy-costs in our societies, since the large-scale rebound is escalating up as investment in energy efficiency keeps growing in developed countries. Rebound increase might be seen, therefore, as the symptom of an energy-junkie society, being much of our economic processing greatly dependent on energy consumption -and the efficiency of its cycle-. So, rather than rapidly assuming energy efficiency as the ultimate goal for a more sustainable society, it seems worthy to stop for a moment and ask ourselves whether sustainability might rely in other approaches other than mere efficiency. Suffice is to say that once such debate transcends the pure monetary focus and, instead, considers a widest environmental and ethical scope, alternate views to efficiency gain ground in the discussion. As the oil crisis of the 1970s paved the way for this critical debate, several -and quite divergent- approaches were devised.

2. The NOW dilemma. Three attitudes towards the environment.

“Energy and Equality” advocates for a low-consumption energy policy as a mean for a wide choice of life styles and cultures. He envisioned three diverse attitudes when it comes to link human development and energy usage. For him wellbeing can be identified with high amounts of per capita energy use, with high efficiency of energy transformation or with the least possible use of mechanical energy.

The first approach keeps on using increasing shares of energy and stresses tight management of scarce and destructive fuels for the sake of endless industrial growth, thus neglecting sustainability as a critical component for human development. The second approach fosters, as Illich would say, the retooling of industry of thermodynamic thrift. The third option is, on the contrary, based on the responsible and conscious use of power as the foundation for a more equally, fair and sustainable society. While the first attitude Neglects the problem and the second tackles it by Optimizing the use of energy, the third option proposes a Withhold of energy activity. More than 40 years after Illich analysed them, these three attitudes are currently standing as the alternatives for energy policy worldwide, thus defining what we might identify as “the NOW dilemma” –standing N for neglect, O for optimization and W for withhold).

The first two attitudes imply huge public expenditure and increased social, technological and geopolitical control; both rationalize the emergence of highly technology dependant societies and both are present and widely discussed. However, Neglecting skips the fundamental discussion that we face today, either from the economic standpoint as, more importantly, from the environmental perspective. This attitude is very much discredited in developed societies and, although it is still the leading trend in some contexts, its prospect run is very much limited in the future. Optimization enjoys, on the contrary, an incredibly favourable acceptance in diverse forums aiming to maintain the rate of economic growth by making the most out of available resources. Withholding, on the other

hand, is increasingly gaining a voice among academics and representative who envision a more ambitious structural change. What it is at stake here is a brink between the on-going economic system based on growth, to which Neglecting or Optimizing are inclined to, and a shift towards a steady-state economic system where, rather than growth, Withholding will yield to a human development based society. While Neglecting seems an exhausted path, both Optimization and Withholding, despite having grounded their roots more than forty years ago, are currently under intense debate and development.

3. Distributive Optimization. Efficiency beyond production and consumption.

Energy efficiency stands at the moment very high on the scientific and political agendas worldwide. Traditionally productivity has been measured by two factors: machine capital and labour performance. But when Nobel Prize recipient Robert Solow analysed the history of industrialization, he found out that both factors together accounted only for a 12,5 percentage of all economic growth, thus posing the focus on the 87,5 leftover. Since then a commendable effort had been put at work in identifying where such an important share of economic growth relies on. Physicist such Reiner Kümmel and economist Rober Ayres have been analysing the economic growth all along the industrial period through the study of machine capital, labour performance and thermodynamic efficiency of energy use. They found that “the increasing thermodynamic efficiency with which energy and raw materials are converted in useful work” accounts for the rest of the gains in productivity and growth in industrial economies. This line of reasoning has been fundamental in standing for energy efficiency as the main driver for economic growth, as broadly explains by economist and social theorist Jeremy Rifkin in a recent address in Barcelona [4].

In “The zero marginal cost society: the internet of things, the collaborative commons and the Eclipse of capitalism”, Jeremy Rifkin envisions a scenario where the up-front costs of establishing an Energy Internet are significant, but the marginal cost of producing each unit of solar and wind power is nearly zero. In short, renewable energy might be, quoting Rifkin, “nearly free after accounting for the fixed costs of research, development, and deployment.” [5]. According to Rifkin, the change of energy paradigm when it comes to optimization goes beyond the mere shift from fossil fuels to renewable sources. No doubt that renewable energy stands as the fundamental pillar when it comes to energy efficiency. It is calculated that sun beams 470 exajoules of energy to Earth every 88 minutes, equalling the energy needed by humankind in a year. As for wind energy, a recent report from Standford University concludes that if only the 20% of the world’s available wind was harvested, it would generate seven times more electricity than we currently use to run the entire global economy[4]. Therefore, it seems that there is a long way to run in efficient renewable energy harvesting. However, the critical characteristic of renewable energy is that it is distributive and non-centralized. Renewable energies, and more particularly solar and wind energy, are ubiquitous. In such change of paradigm, the Internet of Things (IoT) will allow for a decentralized system of production, distribution and consumption where every building will become a power plant, thus changing the way power is generated and distributed in society.

Prosumers, citizens that besides being consumers are also empowered to produce, will be entitled to harvest their own renewable energy in their homes, offices, and factories and share green electricity with each other on an Energy Internet. Every prosumer will become a source of power. The creation of a renewable-energy regime, loaded by buildings, partially stored in the form of hydrogen, distributed via a green electricity Internet, and connected to plug-in, zero-emission transport, will allow billions of people to share energy at near zero marginal cost in an IoT world. What basically this standpoint advocates for is that energy efficiency in economy will be based in distribution and management rather than on production. The IoT will foster the shift from a conventional economy made of consumers and producers, to an innovative society of prosumers that will harvest and distribute their own renewable energy at very low marginal cost, sharing their surplus with others on a smart energy internet that is beginning to stretch across national and continental entities. A recurrent example of such strategy is found in Europe. The Work Program 2016-2017 (WP) of Horizon 2020 defines the topic “Secure, Clean and Efficient Energy” as one of the main targets for Research and Development within the European Union [6]. The WP puts particular emphasis on enabling the participation of consumers in the energy transition and improving the efficiency of the efficiency of the energy system, especially as regards to building stock retrofitting, energy storage and, specially, energy distribution. A reading of the relevant topics identified in the WP frames the areas of R&D that the European Union is willing to

finance in the coming years. Besides the obvious research on renewable energy technology, a strong focus on consumers and network performance characterizes the Program's goal.

The set of policies, strategies and actions aligned with Optimization sums up for a top-down economic growth policy. However, the actual scenario in Europe is also built upon an alternative view of energy and human development promoted from a bottom-up perspective. Both academy and local policy, scholars as well as many municipalities across the continent, are raising their voice in favour of a renewed understanding of the role that energy might play in a steady-state oriented society.

4. Withholding, an alternative efficient way.

Withholding, however ingenuous and utopian might seem, is increasingly permeating the debate on energy policy. Limitation on power use -and growth in general- is being present since long in academic forums and discussions, as well as, more recently, on actual and fully enforced political agendas worldwide. As for the former, the pioneering contributions of Nicholas Georgescu-Roegen are particularly noteworthy. In his "The Entropy Law and the Economic Process" [7], the Romanian author dissects the economic process from a strictly scientific analysis of embodied energy. Though the lenses of the second law of entropy, Georgescu-Roegen builts on the reasoning that the economic process only transforms natural resources (low entropy in the shape of free/available energy) into waste (high entropy in bound/unavailable energy). So for him, the debate on sustainability is not as much tied to energy itself -a problem ultimately to be solve by the smart harvesting of solar energy- as with waste, being pollution the embodiment of high entropy matter unlikely to be reused without an additional surplus of energy. Although there is no denial that mankind can recycle the waste left behind by economic processes, "it isn't less true that in order to do that, it must use an additional amount of low entropy much greater than the decrease of entropy of what is recycled" [7]. So, to put it in short, any activity aiming for entropy increase, namely any human activity, will fatally result in deficit of free energy. Therefore, following up on his own reasoning, Georgescu-Roegen concludes that despite growth through the so called efficiency may be justified in the short run, it is definitely unsustainable for the long run. He advocates instead for the limitation of growth, thus decreasing the demand of energy as far as that's the only compatible way with its dowry of low entropy. Georgescu-Roegen's ideas were shared by many of his contemporaries among which we may only mention here the wide work of Ivan Illich on convivial technology [8] or the widely praised "Limits to Growth" drafted by the Club of Rome in 1972. However, advocacy for limited usage of resources has been scarcely successful in energy policies worldwide. It is only recently that the more recent financial crisis of 2008 and its consequent de-growth renaissance have brought back the discussion both into the political agenda [9] and the applied research field [10] in Architecture and Urbanism. Regarding the earlier, the thesis posed by Serge Latouche in "Farewell to Growth" have been widely acknowledged and incorporated in many of the recently defined municipal agendas across Europe. Newly social-based political movements, very much influenced by de-growth and steady-state theories, are having a remarkable impact in local agendas [11]. The energy issue is paid great attention in the most recent policies of urban recycling in major European cities, being energy poverty and energy efficiency one of the mainstream mottos for the new political agenda across Europe.

As for the later, Canadian researcher and policy-maker William Rees highlights the "Energy Issue" when considering steady-state economy policies that had been previously formulated by Herman Daly at a broader scope [12]. At urban scale, Rees proposed in "Our Ecological Footprint" ambitious land-use legislation and zoning by-laws plans need to consolidate and densify existing built-up areas to capitalize on the economies of scale and agglomeration available to compact communities [13]. More recently, in "The ecological crisis and self-delusion: implications for the building sector", he proposes a series of principles to be implemented at building scale [10]. Authorities should, on the one hand, promote passive systems for energy saving in developing countries where there is still an unavoidable demand for new buildings. On the other hand, policies should also emphasize renovation and replacement in developed countries where growth has slowed-down. None of the principles proposed by Rees, however, insists on the term "efficiency" as main strategy for a more sustainable environmental policy. According to him, LEED and "green building" protocols may have been a necessary first step but "fall fart short of both the necessary and the possible. Of contemporary approaches to both new construction and major renovation, the

German PassivHaus standard brings us the closest to the necessary mark in stringent performance standards". So, rather the seeking for optimization of the already on-going energy system, Rees calls for a more profound reformulation of our mind-set: rather than techno-based radical development, Rees advocates for the withholding of needed resources.

For him most mainstream approaches to sustainability do nothing but reproduce the status quo by other means, rather than address the fundamental problem. Consistent with the prevailing cultural illusion, today's global society essentially equates sustainability with maintaining growth through technological innovation and greater material and economic efficiency. The general problem is that, even though LEED and its counterparts elsewhere acknowledge the built environments' share on over-consumption, they still remain weeded to the techno-industrial paradigm. In short, LEED appears as a reform at the margin that delivers a more energy and material efficient version of the otherwise status quo. And, as proven by the second law of thermodynamics, our relation with the environment is not only about how efficiently we extract and make use of natural resources, but also about what are the outcomes of the economic process in which such resources are involved. Under such perspective, Withholding the use of energy appears to be the only really efficient way to a sustainable take on development.

5. Alternative and Renewable Energy Quest in Architecture and Urbanism. An addenda.

Beginning the 1990`, far earlier we could imagine the Internet of Things and even before that the debate on sustainability gained its current momentum, the Business Council for Sustainable Development stated that "industrialized world reductions in material consumption, energy use and environmental degradation of over 90% will be required by 2040 to meet the needs of a growing world population fairly within the planets ecological means". Coming for an institution not suspicious of any naivety, such statement deserves special consideration. A sustainable approach demands for a new cultural paradigm that integrates both the biophysical reality and socio-political necessity on a finite planet. As very vocally advocated by Rees, "growth must give way to the 'steady-state'; competition yield to cooperation; selfishness bow to generosity in sharing resources". Undertaking such mission requires ambitious decision in urban form, land-use zoning, urban transportation and building technology. The building sector may decisively acts in favour of today's ecological reality, thus paving the way for other critical sectors of economy to follow the lead. Urbanism and Architecture, might act in such conditions as tractors for a renewed culture of the environment. Indeed, no industrial sector has greater material leverage and none is better positioned to lead the quest for global sustainability. If we architects and planners, as main actors on the built environment transformation, were committed with such task the rest of society would surely follow.

References

[1] Illich, *Energy and Equity*. London: Calder & Boyars, 1974.

[2] D. Owen, "The Efficiency Dilemma," *The New Yorker*, New York, 2010.

[3] AA.VV, *On the Rebound: The interaction of Energy Efficiency, Energy Use and Economic Activity*, vol. 28, no. 6–7. 2000.

[4] J. Rifkin, "Smart Regions Smart Cities: A digitally interconnected and ecologically sustainable revolution across the European Union," Sant Cugat del Vallès, 2016.

[5] J. Rifkin, *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*. New York: Palgrave Macmillan, 2014.

[6] EU, "Horizon 2020 Work Programme 2016 - 2017 'Secure, Clean and Efficient Energy,'" 2016.

[7] N. Georgescu-Roegen, *The Entropy Law and the Economic Process*. Cambridge, US: Harvard University Press, 1971.

I. Illich, *Tools for Conviviality*. New York: Harper & Row, 1973.

[8] S. Latouche, *Farewell to Growth*. Cambridge, UK: Polity Press, 2009.

[9] W. E. Rees, "The ecological crisis and self-delusion: implications for the building sector," *Build. Res. Inf.*, vol. 37, no. 3, pp. 300–311, 2009.

[10] AA.VV, *Energy Policy Making in the EU: Building the Agenda*. Springer, 2015.

[11] H. Daly, *Steady-State Economics*, 2nd ed. Washington DC: Island Press, 1991.

[12] W. Rees and M. Wackernagel, *Our Ecological Footprint*. Gabriola Island, B.C., Canada: New Society Publishers, 1996.