8. Beyond the Capitalocene: an ecocentric perspective for the energy transition

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INTRODUCTION

The topic of energy is interwoven with fundamental economic, socio-political and ecological dimensions. While the first two have received considerable attention by energy researchers, the last has been disregarded or considered as a secondary concern. However, in this chapter I aim to show that there are in fact essential links between most energy-related issues on the one hand, and both ecological knowledge and environmental ethics on the other. So, where does this carelessness for the nonhuman world come from? Of course, there could be several root causes, but, ultimately, I propose that it is connected to a tenacious anthropocentrism, the persistent tendency to follow human-centred motives and concerns above all others. Consider for example the following well-known fact: planet Earth is limited in terms of spaces and resources, and humans need to share these with many other species, yet a considerable part of humanity constantly overshoots its environment, consuming way beyond what is regenerated and thus ecologically sustainable. This and similar facts imply that we cannot talk about energy generally – let alone the energy transition from fossil fuels to renewable and sustainable energy sources – without a deeper ecological understanding of the functioning and the well-being of the ecosphere of which we are also a part. Moreover, the fact that humans extract from the environment all kinds of materials and living beings implies a myriad of considerations that pertain to the field of environmental ethics.

For many years now, reports and studies by organizations such as the Intergovernmental Panel on Climate Change (IPCC), the World Bank or the United Nations (UN) have been alerting the public about the dangers of several, interconnected environmental crises. However, more scientific knowledge about the problems facing the planet does not seem effective in eliciting the needed change of trajectory. The question is, besides more

scientific knowledge, what else can help us move further in the direction of strong sustainable societies (Bonnedahl & Heikkurinen, 2018)? I propose that what is needed to achieve a just and ecologically sustainable energy transition, along with more holistic ecological understanding and technoscientific improvements, is a switch of mentality: reimagining the human–energy–nature nexus according to an ecocentric perspective. In short, the radical claim is that ecocentric thinking provides the type of conceptual update the sustainability discourse has been searching for.

The chapter sits at the crossroads of environmental ethics and energy studies. Even though the energy transition is often perceived and framed as a great technoscientific challenge (essentially a conundrum for technoscience and engineering), an increasing body of research suggests that it is actually a complex sociotechnical problem (Büscher et al., 2019; Geels et al., 2017). Understanding that the low-carbon transition is a complex transformation of energy systems (Ghosh & Prelas, 2009, 2011) as well as energy cultures (Pfister et al., 2017; Rüdiger, 2008; Stephenson et al., 2010; Strauss et al., 2013) suggests that it is a dynamic, plural, lengthy work-in-progress intertwined, once again, with economic, gendered, religious, socio-political and ecological dimensions. So, how shall we tackle such a complex low-carbon transition?

Most energy researchers agree that collaborations and open dialogue across the disciplines are not only praiseworthy, but essential for understanding the current situation and moving forward. What is often argued is that energy transition research needs holistic approaches, interdisciplinary and transdisciplinary collaborations among researchers and stakeholders (practitioners, citizens, politicians, policymakers, etc.). This means, for example, that while the work of engineers and natural scientists is fundamental to develop low-carbon technologies and pursue the concrete transformation of complex energy systems, that of social scientists and humanists is needed to understand and inform the parallel evolution of the practices, lifestyles, actions, behaviours and habits of millions of people, or in short their ethics. Moreover, another essential factor that is commonly underlined is the participation of citizens and socio-political organizations (from grassroot movements to institutional powers) in the processes that lead to the implementation of renewable energy projects. The good news is that over the past decade, a significant amount of work in this direction has already been done, especially by social scientists. For example, many researchers stress that the transition ought to be just (Jones et al., 2015; Heffron & McCauley, 2018; Jenkins et al., 2018) with regard to the many different aspects of the notion of 'justice' (distribution, participation, process, retribution, restoration, recognition, etc.). Recognizing the different stakeholders and applying principles of procedural and participative justice seem particularly important for a just energy transition for they would account

for the distribution of benefits and burdens among different actors while engaging stakeholders in participatory and transparent processes. This is also why transdisciplinary approaches are often favoured over disciplinary ones (Pohl et al., 2017; Popa et al., 2015; Thomas et al., 2018).

But what can philosophy, and particularly here the field of (environmental) ethics, tell us about the low-carbon energy transition? The short answer is that, because the debate regarding the energy transition is based on a nuanced ideology (a system of ideas) and is intrinsically linked to how the nonhuman world is conceptualized (environmental ethics), ethical reasoning is very helpful for disentangling and analysing its foundations. For this reason, I claim throughout that there is a set of conceptual assumptions that lie in the background of the discussions shared among researchers, practitioners and stakeholders working in the area of energy transition. Here, my claim is that such a 'conceptual background' – or at the very least some aspects of it – is often taken for granted and overlooked by those who are interested in the more practical, nitty-gritty details. In the core of the chapter, I propose to employ a philosophical perspective to look at these conceptual foundations with the goal of reimagining alternative ways of thinking and acting in relation to energy and nature.

I will use the expression 'human–energy–nature nexus' (or sometimes 'relationship') to describe the complex system of relations between individuals/societies/cultures and both biological and ecosystemic elements. It is worth repeating once again that because all energy (fuels, materials, food, etc.), or to use the language of physicists and engineers, all work, is obtained by some anthropic transformation of nature, it should be conceived not only in technical terms but also as a bio- or eco-cultural construct. The overall goal of this chapter is to suggest a philosophical update of the human–energy–nature nexus that moves beyond anthropocentrism and is attuned to an ecocentric perspective instead.

The reasoning of the chapter follows the initial steps of a simple problem-solving model.[1] The first task consists in *(1) identifying, diagnosing and describing the problem(s)*. For the case at hand, this means becoming aware of multiple environmental crises, socio-ecological threats and inequalities. Accordingly, the second section illustrates the urgency of a deeper ethical reflection through a summary of descriptive facts that will also serve as general grounding assumptions for the following reasoning. The third section *(2) identifies one of the main root causes* of the environmental crises and the relative slowness of the energy transition in a flawed, short-sighted conceptualization of the human–energy–nature nexus. As anticipated, I propose that a rather specific understanding of this relationship has substantially influenced the way many humans have been thinking and acting towards the environment and its resources. To challenge this prevalent view, I suggest a philosophical critique of the anthropocentric, mechanistic and instrumental traits of the

human–energy–nature relationship along with a careful re-examination of popular long-standing notions such as human exceptionalism and perpetual economic growth. While in the fourth section I engage with, and respond to, the ecomodernist stance, the fifth section presents the constructive part of the chapter: *(3) generating alternative solutions*. So, after the description of the problem *(1)* and the identification of one of its key causes *(2)*, this step suggests a conceptual update and an ethical reorientation of the human–energy–nature relationship. But how do we achieve that? Simply put, through a new type of education at all levels of society that updates the conceptual assumptions of the human–energy–nature nexus in ecocentric terms.

In conclusion, this chapter engages the challenging task of this volume – 'reimagining ethics and politics of space' – by looking at the energy transition through a philosophical lens. On the theoretical side, it contributes to the areas of energy ethics and political ecology. That is, a reflection on the past – or what we can call a 'nafthology' (Salminen & Vadén, 2015) – is accompanied by a vision about possible sustainable energy futures (Burke & Stephens, 2018; Parfit, 2010). On the practical side, some possible consequences of a wider adoption of an ecocentric perspective in energy policy and environmental law are discussed in the last section. This chapter is primarily directed to researchers, practitioners and policymakers who are willing to envision an energy transition that is not only technologically adequate but also ecologically sound and just, and not only for humans.

CURRENT EVIDENCE FOR CONCERN: WHEN DESCRIPTIONS SUGGEST PRESCRIPTIONS

The following list of (rather well-known) descriptive facts will help ground the moral reasoning that will be presented below. First, the human population has increased by almost four times over the past century, reaching in 2020 the staggering number of 7.8 billion people and counting.[2] This growth, along with ever-increasing consumerism, is impacting the Earth's biosphere at an unprecedented rate. Over the past two centuries, but especially after World War II, humans have overexploited the planet: its materials and the existence of millions of nonhuman beings have been used for work, food and various animal products (Price, 1995). Today, most key environmental concerns are clear and, in fact, transboundary: global climate change (IPCC, 2018), irreversible biodiversity loss (Ceballos et al., 2017; IPBES, 2019; Kolbert, 2014; Wilson, 1985; Worm et al., 2006), resource depletion and scarcity along with several types of anthropogenic pollution (atmospheric, surface and ground waters, land and so forth). It goes without saying that these issues are threatening both human and nonhuman lives in alarming ways. It is true, however, that some efforts are leading to partial good news, such as many effective conservation

programmes (e.g. in 2018, Chile established five new national parks) and probable 'greening' of some areas of the planet (increment of net primary production of biomass) due to the increased function of plants as carbon sinks (Barichivich et al., 2013; Sitch et al., 2013).[3] In any case, more holistic assessments are needed to determine the actual state of our ecosystems. And, when taking broader assessments of global ecosystems' health, it seems undoubtable that anthropogenic actions have severe negative effects on many components of the ecosystems beyond vegetation (IPBES, 2019). These alarming facts beg serious questions of *environmental* and specifically *interspecies justice*.

The second relevant fact is more specifically connected to energy production, transformation, consumption and waste. Especially over the last century, many countries developed infrastructural path dependencies based on fossil fuels. These are at the basis of what Ivan Illich called 'high energy societies' (2013), or human assemblages based on a sociotechnical apparatus that is highly *energivorous* (i.e. requires a lot of energy). For example, we can take average annual amounts of energy consumption per capita as a proxy to assess availability and access to power. According to data collected by the World Bank, during 2016 an average inhabitant of China used about 90 GJ/a, one of Germany about 158 GJ/a (whereas the EU average is about 134 GJ/a) and a Northern American around 280–290 GJ/a. To really point out the astonishing level of inequality in energy consumption, these numbers should be compared to the world average of about 85 GJ/a that still includes countries (e.g. Haiti, Yemen, Ethiopia) with values as low as 10–20 GJ/a. Therefore, key issues of distributive *energy justice* need to be urgently addressed (Finley-Brook & Holloman, 2016; Jenkins et al., 2017; Jenkins et al., 2018; McCauley et al., 2013; Sovacool et al., 2016).

Third, consider the point already sketched above about the ecological footprint. According to the Global Footprint Network, the Earth Overshoot Day (EOD) for 2019 was 29 July. This represents the date on which humanity's resource consumption for the year 2019 exceeded Earth's biocapacity to regenerate those resources that same year, or precisely when human population overshoots its environment.[4] Why is this relevant for the topic of energy? Different levels of resources exploitation can be illustrated in terms of average country-based ecological footprint, or 'how much stuff' (i.e. how many global hectares per year, or gha) is required to sustain the standard of living of a particular nation. The results are impressive and show great social, economic and ecosystemic disparities.[5] For example, even if we leave aside fossil fuels guzzlers such as the United States, Saudi Arabia or the United Arab Emirates (all in great biocapacity deficit with values > -4.8 gha), it is troubling to consider that during the period between 1965 and 2014 the average annual ecological footprint of the official 28 members of the European Union increased from 3.4 to 4.5 gha per person whereas the region's biocapacity only rose from 2.1 to

2.2 gha per capita. In short, this means that the standards of living of the EU28 – we may add, one of the geographical areas where sustainability it taken more seriously – requires around 2.79 Earths to be sustained.[6] Compare this to the values for individual ecological footprint, biocapacity and 'Earths needed' of countries such as fast-growing Brazil (footprint of 3.08 gha, biocapacity of 8.9 gha, 1.83 Earths) or the Central African Republic (footprint 1.2 gha, biocapacity of 7.4 gha and only 0.67 Earths) and the picture becomes clearer. Morally speaking, the conclusion seems clear: people who reside in countries that are consuming resources well beyond what is ecologically sustainable bear more responsibility for the current biospheric conditions. Consequently, and even though the conversation about sustainability concerns everyone, the debate about reducing levels of consumption should begin within more unsustainable nations.

A fourth way of looking at these problems is to consider human impact over time (Wilkinson, 2005).[7] In the last two decades, there has been a rich intellectual debate concerning how to name the period of greatest human impact on planet Earth. The nomenclature abounds, with neologisms such as Anthropocene (Crutzen, 2002; Crutzen & Stoermer, 2000), Capitalocene (Moore, 2016), Plantationocene, Gynocene, Chthulucene (Demos, 2016; Haraway, 2015, 2016), Anthrobscene (Parikka, 2014), Anthropo-obScene (Swyngedouw & Ernstson, 2018), Econocene (Norgaard, 2013), Technocene (Hornborg, 2015), Misanthropocene (Patel, 2013), Manthropocene (Raworth, 2014), the Great Acceleration (Steffen et al., 2015) and others. This 'naming debate' should not be considered trivial intellectualism or a mere bio-geological reflection. Semantics is important, and carefully considering how to distinguish and designate this period is crucial to better understand the types and degrees of impacts as well as the different levels of responsibility. Without diminishing the merits of the other formulations, let me briefly consider here two of the most popular notions: Anthropocene and Capitalocene. The first term was initially proposed by atmospheric chemist Paul Crutzen and biologist Eugene Stoermer almost 20 years ago (2000). Their reasoning was straightforward: because human activity – mankind as a 'major geological force' – has been fundamentally transforming the biosphere, a new conceptualization of geological time is needed. Since the term was introduced, much of the debate has been focused on when such great impact started. On this, I tend to agree with other scholars in identifying the dawn of the Anthropocene in the late 19th century, when the population started growing at unprecedented rates and Western industrialism bloomed. The second notion, Capitalocene, was coined around 2011 by Swedish author Andreas Malm and then adopted by others (Malm & Hornborg, 2014). In his introduction to the edited volume *Anthropocene or Capitalocene?*, sociologist Jason W. Moore (2016) suggests that the notion of Capitalocene is endowed with more explanatory power than

the 'vaguer' Anthropocene: 'Capitalocene does not stand for capitalism as an economic and social system. … Rather, the Capitalocene signifies capitalism as a way of organizing nature – as a multispecies, situated, capitalist world-ecology' (p. 6). There is no doubt that capitalism has not been the only economic ideology that has been detrimental to the environment (Dominick, 1998; Mazurski, 1991). But Moore (2016) explains that the term is more appropriate and contextual because it 'captures the basic historical modern pattern of world history as the "Age of Capital" – and the era of capitalism as a world-ecology of power, capital, and nature' (p. 6).

Finally, let me conclude with a point about the urgency to address the key issue connected to the energy transition: global climate change. At the end of 2018, hundreds of grassroot organizations along with a new IPPC report (IPCC, 2018) and the latest Conference of the Parties (COP24 in Katowice, Poland) alerted people once again about unavoidable climate change as well as many other critical environmental issues. It is in plain sight that, despite these warnings, the systemic reshaping of public policies, governmental decision-making and lifestyles moves too slowly. Many countries simply lag behind in terms of both awareness and proactivity towards achievable targets such as the Sustainable Development Goals (SDGs). As writer Roy Scranton (2015) remarks, the issue has become one of adaptation rather than mitigation so that 'the concern is not whether global warming exists or how we might prevent it, but how we are going to adapt to life in the hot, volatile world we've created' (p. 12). Despite the ongoing energy transition and numerous improvements, changes in lifestyles and sustainability-oriented programmes implemented all over the world, individual and local actions are probably limited when it comes to achieving the SDGs within the expected timeframe, let alone more ambitious projects of strong sustainability (Neumayer, 2013; Pelenc & Ballet, 2015). No matter how tragic the situation and apocalyptic the future may be, adding more scientific knowledge in merely incremental ways seems insufficient to really solve the problems.

THE FLAWS IN THE OLD HUMAN RELATION TO ENERGY AND NATURE

Three interwoven arguments will clarify the claim that the current understanding of the human–energy–nature nexus is conceptually flawed. First, it is important to understand that the notions of energy and nature that are commonly used and taken for granted were born in a specific context. Drawing from similar analysis started in environmental ethics (Moncrief, 1970; White, 1967), I suggest that it is especially since the scientific and then industrial revolutions that the powers and capacities of technoscience allowed the gradual emergence of the idea that human beings can dominate nature. During the

modern period, reverential, fear-based, animistic and vitalistic views of nature are being progressively replaced by the idea that the biosphere is nothing more than an inanimate reservoir of resources at human disposal. As I have already shown elsewhere (Frigo, 2017), the modern, Western conceptualization of energy depends on the scientific, quantitative and mechanistic approach of the natural sciences and engineering which partially operated at the service of the economic and socio-cultural forces characteristic of that period. The result is that an *anthropocentric philosophy of energy and nature* became culturally dominant, reinforcing the ontological equivalence between matters useful to produce power and nature-energy itself (it should now be clearer in which sense I employ the expression 'human–energy–nature nexus/relationship'). Despite its modern, industrial and European origins, this paradigmatic way of understanding nature-energy has been very influential, for good and bad, at a planetary level. Even though this claim can be viewed as a rough generalization, for the purpose of the present cultural critique it is useful to identify such 'mentality' as a sort of organic ideology, an offshoot of the modern European-Western worldview grounded in technoscience, industrialization and belief in progress.

Second, and related, some humans started to perceive and theorize nature as something distinct from humanity. To some extent, it is understandable that people had to learn how to neatly separate what is wild, untamed and uncertain from what is proper, civil and readily available for the sake of their emancipation and survivorship. What is surprising, however, is that some human groups developed strong desires to dominate nature, extend their sovereignty over the entire planet by cherishing human exceptionalism and swiftly conceptualizing many natural entities and beings as 'resources' intended predominantly for human benefit. But the issue here goes beyond survivorship so that what emerges is a dangerous estrangement from natural environments paired, at the same time, with arrogance and greed towards them. The issue of being 'separated from nature' is especially paradoxical in the case of people that are living energivorous and commodious lifestyles (Borgmann, 1984). Because their standards of living require a lot of 'nature-energy', they are the creatures that most depend on the nonhuman world but are also the most removed from it. These problematic notions of human autonomy, independence from nature and exceptionalism are commonly thought of as positive human traits and are often coupled with a rhetoric based on the values of individualism, competitiveness and security. In other terms, the theoretical basis of the Capitalocene – capitalist and (neo)liberal ideologies (Monbiot, 2016) – becomes visible in the case of the anthropocentric commodification of the nonhuman world. In the capitalist market of nature, biological and ecological functions are considered valuable if they can be monetized as 'goods and services' for exclusive human benefit (this is the leitmotif of most current policies).

These, among others, are the main reasons why the traditional human–energy–nature relationship is fundamentally flawed. What should appear as extremely surprising is that not only the Capitalocene and its traditional *petrocultures* (Petrocultures Research Group, 2016) but also the current transition to renewables remain grounded on a similar reductive understanding. In fact, neither energy policy generally, nor the two most promising avenues of socio-political research – energy justice and energy democracy – have been able to consider biocentrism or ecocentrism as serious starting points for reimagining the human relation to energy and nature.

ETHICS AND POLITICS OF SPACE: THE CHALLENGE OF ECOMODERNISM

But before moving on with my theoretical proposal, we shall address ecomodernism (Asafu-Adjaye et al., 2015). This is a quite recent and influential techno-fix perspective that directly challenges the content and aims of this chapter. Essentially, ecomodernists argue that humans can protect nature and grow economically and demographically by using technology to 'decouple' them from the ecological footprint. Although there are some merits to such a ecomodernist view, such as the stress on achieving higher efficiencies and implementing more sustainable engineering design, other arguments are problematic. For instance, ecomodernists linked to the Oakland-based Breakthrough Institute claim that humans can bring about a 'great Anthropocene' or that the Earth is necessarily going to become 'our [i.e. humans'] high-energy planet' (Caine et al., 2014). The pulp of this philosophy can be found in the pamphlet entitled *An Ecomodernist Manifesto* (Asafu-Adjaye et al., 2015) where a group of notable scholars clarify their scepticism regarding 'extreme' environmental catastrophism and advocate for an optimistic reliance on technoscience:

> As scholars, scientists, campaigners, and citizens, we write with the conviction that knowledge and technology, applied with wisdom, might allow for a good, or even great, Anthropocene. A good Anthropocene demands that humans use their growing social, economic, and technological powers to make life better for people, stabilize the climate, and protect the natural world. In this, we affirm one long-standing environmental ideal, that humanity must shrink its impacts on the environment to make more room for nature, while we reject another, that human societies must harmonize with nature to avoid economic and ecological collapse. (p. 6)

As the last sentence underlines, for ecomodernists an ecocentric turn in the human–energy–nature relationship would be superfluous if not even counterproductive. Their argument is intelligently ambivalent: on the one hand, they acknowledge that humans are the main cause of the countless environmental issues facing planet Earth. On the other hand, they problematically rely on

the assumption that humans will use their growing social, economic and technological powers to solve all problems. Ecomodernists do not think that we need to change our mindset, but rather become better techno-fixers, greener architects and smarter climate stabilizers.

This directly contradicts the ecocentric argument supported here. Because I identify in anthropocentrism, mechanization and instrumentality of nature the major flaws of the Anthropocene/Capitalocene, I argue that a change of mentality is not only needed, but also valuable and actually possible through a widespread ecocentric education and a renovated attention to some of the voices (e.g. indigenous, ecofeminist) that have been ignored in the energy debate so far. For example, these are the alternative narratives of the peoples who have been living in a more sustainable and/or less destructive way, caring differently and thinking about the human–energy–nature relationship ecocentrically. But these are also the voices of the nonhuman beings (animals, plants, ecosystems) that cannot communicate their concerns in human language but nonetheless possess interests and are capable of displaying them, if and when human actions improve or worsen their conditions and well-being. This change of approach requires, of course, the acknowledgement that animals have interests in surviving and flourishing too, a premise that some researchers dismiss or do not fully consider related to energy issues. The possibility for such expansion of the circle of moral considerability has been extensively examined through a sensiocentric animal ethics such as that of Peter Singer (2015) or Tom Regan's notion of animals as 'subjects of a life' (Regan, 1987). Furthermore, defending the idea that non-sentient entities such as plants, rivers and the like (those that do not possess the ability to perceive suffering, i.e. nervous system) also deserve moral considerability – let alone that they should also possess interests and be attributed rights – requires another, even more radical philosophical leap. To do that we need to embrace a biocentric or ecocentric outlook supported, in any case, by the findings of the ecological sciences. A cultural shift can occur, and humans could abandon the hubris of controlling nature and embrace instead a different environmental ethics. Unsurprisingly, this can be done in collaboration with an updated version of technoscience that understands and respects ecological boundaries. This would be a more adequate way to become the ecological companions of other beings, their stewards (Chapin et al., 2011; Rozzi et al., 2012; Welchman, 2012) and tutors (Frigo, 2016) rather than their guardians, controllers or dominators (Bourdeau, 2004).

In conclusion, since research, public discourse and the work of energy practitioners have been monopolized by the language of engineers and economists, taking ecocentrism seriously into account demands constructively criticizing the modern Western worldview and agreeing to a philosophical paradigm shift. Embracing an ecocentric perspective requires a recognition that other species

(plants, animals, etc.) and ecological entities (waters, soils, etc.) possess intrinsic worth, 'interests' of their own, and thus require space and resources too. In the following section, I will concentrate on the main features of an ecocentric philosophy of energy for the reshaping of the human–energy–nature relationship.

THE THEORETICAL FOUNDATIONS OF AN ECOCENTRIC PHILOSOPHY OF ENERGY

We have seen above that the predominant understanding of energy depends on broader economic, socio-cultural and philosophical assumptions which are often overlooked by energy and policy practitioners. I argued that the modern conceptualization of energy is intimately linked to the progressive devaluation of nature. The following are four possible theoretical foundations of an ecocentric version of the human–energy–nature nexus.

First, following the Gaia hypothesis developed by James Lovelock (2000, 2007, 2009), an ecocentric position may support the ontological and normative idea that the Earth should be understood as a complex living organism. Although resilient and capable of self-regulatory functions, Gaia is finite and currently threatened by human exploitation and hubris. The approach of the Capitalocene does not work because we reached a point of irreversible damage such as in the case of biodiversity loss and ecosystems' degradation.

Second, although the philosophical position defended criticizes the Capitalocene, it is not necessarily in contrast with the approach of natural scientists and engineers. My proposal is, rather, integrative: the limitless consumption of nature made possible undisputable achievements, granting modern humans plenty of conveniences and commodities, countless inventions and groundbreaking improvements in health, transportation, electrification, intellectual and fine arts, and general material conditions. However, technoscience can be separated from the ideologies of the Capitalocene and integrated with ecological understanding and thus contribute to an ecocentric philosophy of energy.

Third, systemic and infrastructural energy and environmental challenges are complex and require innovative reflections on ontological, moral, religious, gendered, socio-economic and political dimensions. For example, the location, size and functioning of a coal mine in China (Andrews-Speed & Ma, 2008; Smil, 2004), a wind farm in the Netherlands (Rasch & Köhne, 2017) or Texas (Swofford & Slattery, 2010), or a biofuel industry in Brazil (La Rovere et al., 2011; Wilkinson & Herrera, 2010) may impact the lives of both people and nonhuman beings very differently. Even in the apparently non-problematic case of renewable energy projects such as wind or solar farms, issues concerning their social acceptance (Bauwens & Devine-Wright, 2018; Wüstenhagen

et al., 2007), economic feasibility and ecological impact may constitute constraining factors. Therefore, I support the argument (developed in the area of philosophy of technology) that sociotechnical systems and artefacts incorporate social values and preferences (Verbeek, 2011). It follows that an adequate energy transition should account for such values and integrate ecocentric concerns into the design of artefacts and policies while expounding those that are incompatible with an ecocentric outlook.

The fourth possible foundation of this updated philosophy of energy concerns ethical praxis. I maintain that the way specific actors think about something, such as energy and nature, is likely (but not necessarily) to become visible in their concrete actions. For instance, if I think about the forest near my town solely as a wild place where I can drive my rugged SUV and not instead as the home of countless other species, it is rather likely that, if I do go to that forest, I will use it for my own driving enjoyment rather than recognizing the intrinsic well-being, aims and purposes of the ecosystem. I must acknowledge, however, that this assumption remains weak unless it is understood within a virtue ethics perspective. In fact, one might argue that there are many cases in which humans do not act according to the best or most preferable choice even though they *know* what it is. For instance, even though many humans know what healthy nutritional habits are, some do not act accordingly and prefer to consume junk food. So, how can we prove that because people will *know* what is right – an ecocentric perspective is conceptually more adequate – they will then also *act* according to it? In all honesty, such a claim cannot be made. The only acceptable version of this assumption posits that there should be a causal connection between moral virtues (knowing what is good) and action (doing what is good) precisely because the goal of the moral praxis is indeed to become a virtuous person. Virtue ethics does not ask 'What is the right thing to do in situation "x"?' but rather 'What kind of person should I become so that my action will be good?' Therefore, the milder version of this fourth point becomes: people who think in ecocentric terms are also more likely to act ecocentrically.

PROPOSING AN ALTERNATIVE: TOWARDS AN ECOCENTRIC OUTLOOK

The following section sketches the contours of an ecocentric philosophy of energy that extends beyond anthropocentrism to include the nonhuman world. I will limit my discussion to three traits of an ecocentric human–energy–nature relationship which mirror the critique presented above in the third section: (1) ecocentrism as opposed to anthropocentrism, (2) a broader recognition of intrinsic values in the nonhuman world as opposed to the monopoly of

instrumental concerns, and finally (3) a holistic, ecologically oriented view in contrast to a mechanistic one.

Anthropocentrism, Ecology and Ecocentrism

In their collection of studies, Donato Bergandi et al. have convincingly shown that there are structural links between ecology, evolution and ethics (Bergandi, 2013). Similarly, here I argue that there are fundamental links between human life, energy and the nonhuman world. As discussed earlier, energy in nature can be understood in a materialistic and mechanistic way and ecological sciences already account for it. But ecology and ecocentrism are two different things. A brief clarification of how ecology has been studying energy may be helpful to fully grasp the importance of an ecocentric outlook. The study of philosophy of ecology indicates that the approach of ecological sciences has drawn largely from physics in terms of its conceptualization of energy (Chapman et al., 2015). The representation created by ecologists typically portrays the different species as members of a 'pyramid of life' or the elements of a 'food web'. These are structured according to different levels of biological organization: simpler elements (subatomic particles, atoms, molecules, organelles) provide the basis for life (cells, tissues, organs, organ systems). Then, at the individual level, we find all the different organisms classified according to taxonomy. Assemblages of different species constitute populations, communities and hence biomes (a large naturally occurring community of flora and fauna). Finally, biomes and the so-called inanimate components of the ecosystem (waters, minerals, soils, airs) are part of the broadest system that can be conceived on a planetary basis, that is the biosphere, or ecosphere (Mader, 2010). An important point is that all living and non-living beings share throughout the system an abundant, although limited, flow of energy as nutrients. Many ecologists still understand and study energy in ecosystems mainly as a 'flux of matter' between different trophic levels measured, for instance, through the calculation of the primary (gross and net) productivity of biomass. But because this approach is also grounded in the old paradigm, it ignores other philosophical implications of an ecological understanding (Callicott, 1986). Nonetheless, there are examples of moral thinking connected to energy via an ecological understanding. One exemplar case is that of American environmentalist and conservation manager Aldo Leopold. In his famous essay *The Land Ethic*, he writes:

> Land, then, is not merely soil; it is a fountain of energy flowing through circuit of soils, plants, and animals. Food chains are the living channels which conduct energy upward; death and decay return it to the soil. … It is a sustained circuit, like a slowly augmented revolving fund of life. (Leopold, 1949, pp. 182–183)

From the recognition of the role of energy within the structural complexity of the land, Leopold (1949) derives a moral principle: 'A thing is right if it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong if it tends otherwise' (p. 189). The derivation of this moral principle from the ecological understanding demonstrates that it is possible to infer moral guidance – practical moral consequences – from descriptive facts.[8] For Leopold, human beings need to step down from the self-constructed pedestal at the top of the chain of being to embrace their role as part of the biotic community. If we follow a perspective such as the land ethic, and accordingly we understand the fluxes of energy throughout the ecosphere in this more interdependent and relational way, then ecocentrism may take root and bloom.

Generally speaking, and at least in the Western world, the environmental movement began in the 1960s in parallel with the so-called second wave of feminism and the civil rights movement. While the latter two focused on the oppression experienced by women and minorities respectively, environmental activism and scholarship were initially aimed at changing and moving beyond cultural narratives which have been supporting the oppression of nature. The emergence of environmental philosophy can thus be seen as one of the most successful academic responses to the impending environmental crises. Since the 1970s, for example, several environmental ethicists developed complex analyses of the possible ethical positions one can follow in relation to nature. Strong anthropocentrism, weak anthropocentrism, sensiocentrism, biocentrism and ecocentrism are some of the most recognizable of such perspectives (Pojman & Pojman, 2012).

In the Western academic world, different ecocentric positions were developed by environmental thinkers such as Aldo Leopold, Arne Naess, Val Plumwood, Holmes Rolston III, J. Baird Callicott and Karen Warren. A common trait among ecocentrists is the attempt to derive the most radical philosophical implications from the findings of ecological sciences and environmental studies (and sometimes also address the situation of oppressed groups of humans such as in the case of ecofeminism). Ecocentrism 'is based on an ecologically informed philosophy of *internal relatedness*, according to which all organisms are not simply interrelated with their environment but also *constituted* by those very environmental interrelationships' (Eckersley 1992, p. 49, emphasis in original). Ecocentrism borrows from ecology the notion that, in each ecosystem, there is a myriad of different beings (animals, plants, decomposers or detritivores, minerals, soils, waters, airs[9]) *who* are constantly born or formed, live, die, decay and are cyclically transformed as part of the biosphere functioning. Ecocentrist thinkers typically pose a great ontological and metaphysical challenge: rather than considering mankind at the top of ontological and ecological hierarchies, they propose to redefine and reposition human beings and their role within ecosystemic functioning (Callicott, 1986).

They maintain that modern humans, despite their technoscientific powers, are still fundamentally dependent on the ecosystems of which they are part and, paradoxically, still know so little about. An ecocentric perspective challenges the idea that the Earth is necessarily destined to become a 'human planet' as the ecomodernists propose. Instead, humans are considered 'special animals' in the sense that their ability to develop effective extrasomatic adaptations made them capable of changing the natural environment. In this way, human power is acknowledged upfront and, because of it, humans are envisioned as ecological companions, as co-inhabitants rather than managerial guardians or mere conquerors or exploiters of nature (de Groot et al., 2011). Because it decentres humans and repositions them within an ecological understanding, it can be said that ecocentrism represents, conceptually, a paradigm shift similar to that which occurred in the 16th century from a geocentric model to a heliocentric one. It goes without saying that, if taken seriously, the consequences of this change of perspective could be groundbreaking.

The Necessary Balance between Instrumental and Intrinsic Values

The second characteristic of an ecocentric philosophy of energy and nature is the radical expansion of moral considerability to include the nonhuman world, namely the increased recognition of its intrinsic value for other beings and entities (Callicott, 1984; McShane, 2007a, 2007b). Although it is a philosophical position, the ecocentric argument is in agreement with the scientific findings of both ecological and thermodynamic sciences. These latter acknowledge that there are thresholds and limitations inherent to the functioning of the ecosphere as well as the technosphere (e.g. space is limited and all machines have efficiency limits). These limitations eventually affect both humans and nonhuman life. All beings share a finite amount of space and resources, that is, the ecosystemic energy either coming into the system as solar radiation or already converted solar radiation (e.g. fossil fuels). Of course, some reasonable use of nature for human ends is inevitable, but the new mentality advocated here implies a completely different degree of attention and care towards the nonhuman world.

A Holistic View of Energy

Contrary to the mechanistic view of energy promoted by the old human–energy–nature relationship, an ecocentric philosophy of energy is built on a more holistic approach. Energy has been understood in multifaceted ways: in its most material form as fuels and geo-chemical compounds, bio-chemically as the flux of nutrients within organic and inorganic life, metabolically as the transformation of food into movement and heat. However, an ecocentric view

suggests that there may exist immaterial, spiritual or relational ways of experiencing and understand energy which fall through the cracks of the old paradigm. This is because they are not epistemologically relevant or objectively measurable; in other words, they are non-quantitative and non-mathematizable. These are other types of non-quantitative accounts of energy that people (and perhaps also other beings) can experience. Isn't it true that we often speak about a particularly energetic atmosphere in a room, of a special energy in a relationship, or the energy that one can perceive while meditating alone in the middle of a forest? The neuroscientist may still attempt to reduce these phenomena to 'states of the mind' related to specific chemicals and electric impulses in the brain, but that explanation could be argued to be, again, a form of reductionism dependent on a mechanistic and quantitative view.

Since these and other similar phenomena are not completely reducible to a quantitative/measurable form, scientific studies have disregarded or simply ignored them. However, other areas of human knowledge such as philosophy, ethics (Frigo, 2018b), literature or poetry are sometimes capable of intercepting these phenomena (Frigo, 2018a). The key point is that these and other more qualitative dimensions of the human–energy–nature relationship are somehow empirical and relevant so that they should become part of the current debate about energy transition along with quantitative and statistical research. For instance, we can find examples of this kind of work in the emerging field of energy humanities (Boyer & Szeman, 2014; Diamanti & Bellamy, 2016; Moezzi et al., 2017; Szeman & Boyer, 2017), but also in the work of naturalistic poets such as Ralph Waldo Emerson and Henry David Thoreau. Consider for instance Thoreau's poem *Nature* and notice how it merges the theme of intimate connection with the environment with a call for human humility:

O Nature! I do not aspire
To be the highest in thy choir, –
To be a meteor in thy sky,
Or comet that may range on high;
Only a zephyr that may blow
Among the reeds by the river low;
Give me thy most privy place
Where to run my airy race.
In some withdrawn, unpublic mead
Let me sigh upon a reed,
Or in the woods, with leafy din,
Whisper the still evening in:
Some still work give me to do, –
Only – be it near to you!

For I'd rather be thy child
And pupil, in the forest wild,
Than be the king of men elsewhere,
And most sovereign slave of care;
To have one moment of thy dawn,
Than share the city's year forlorn.

Borrowing again Leopold's (1949) ecocentric perspective, it can be said that an ecocentric philosophy of energy 'enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land' (p. 173). At the same time it decentres human beings and 'charges' them with the responsibility of acting as co-inhabitants, companions and tutors of the nonhuman world.

CONCLUSION: PRACTICAL IMPLICATIONS OF AN ECOCENTRIC HUMAN–ENERGY–NATURE RELATIONSHIP

In energy policy, the use of a precautionary principle of non-action should be privileged whenever the consequences are unclear or possibly dangerous (COMEST, 2005; Cooney 2004; deFur & Kaszuba, 2002; Kriebel et al., 2001; Sandin, 2004). This does not mean embracing technological conservatism, but rather considering more radically the interests and well-being of humans as well as those of other ecosystemic entities and beings to avoid further biodiversity loss and ecological destruction. As I claimed repeatedly, nature-energy should not be merely conceptualized as means to be exploited. The recognition of intrinsic value of the nonhuman sphere becomes a priority, leading to concrete actions aimed at its protection. This would imply, and thus prescribe, that ideals of equality and justice will be implemented by treating nonhuman needs as being as important as those of humans. However, it seems reasonable to assume that in exceptional and seemingly extremely rare cases (when one absolutely excludes the other), human needs should be privileged over those of the nonhuman world.

Consider the following possible effects in environmental law. One consequence could be an extension of legal consideration beyond humans through the language of rights and moral agency (as is already happening in many legal systems worldwide). Second, sanctions towards people who harm the nonhuman world (with the due exceptions such as cases of self-defence) might become more severe. Third, forms of temporary and permanent tutorship of nonhuman interests could be established. Fourth, anti-natalist policies might be enacted on a voluntaristic basis or through policies of incentives/sanctions (i.e. more than two children would imply higher costs, the contrary more sub-

sidies). That would resemble the opposite of what happens in many countries today. Undoubtedly, this remains a very controversial subject that would require extensive discussion. However, it remains true that human population is one of the main factors of ecological impact and a serious debate about population policy is needed. Here, it suffices to say that limiting such growth represents one of the possible implications of an ecocentric outlook. Of course, this is not an exhaustive list. It only provides some conclusive examples that follow from the attempt to reimagine the human–energy–nature nexus in non-anthropocentric terms for the sake of diminishing the exploitation of the nonhuman world.

To avoid the bleak future forecasted by doomsayers (Heinberg, 2003; Scranton, 2015), but without embracing doomslayers' optimism (Lomborg, 2001, 2007; Regis, 2016), let me conclude by quoting the suggestion of French philosopher-engineer Jean-Pierre Dupuy (2014):

> Our responsibility is all the more enormous as we are the sole cause of what will happen to us. And yet there is a danger that our sense of our own responsibility will increase, rather than diminish, the very arrogance that gave rise to it. Once we have persuaded ourselves that the salvation of the world is in our hands, there is a risk we will throw ourselves with renewed energy into a headlong rush toward the abyss – that fatal impulse compounded of pride and panic, which with every passing day comes nearer to being the outstanding emblems of our age. (p. 7)

Hopefully the teachings of ecocentrism can provide a renewed impulse to reimagine our responsibility and move beyond the Capitalocene.

NOTES

1. Here, I follow a standard six-steps problem-solving model: (1) identify, diagnose and describe the problem; (2) determine the root cause(s) of the problem; (3) generate alternative solutions (4) evaluate and then select the option(s); (5) implement the solution(s) and (6) follow up with monitoring and further evaluations of the outcome. In this chapter I will discuss only steps 1–3, namely the part of the process that begins with the diagnosis of the problem and ends with the development of alternatives. My role and expertise do not allow me to move further.
2. More precisely: 1 billion in 1804, 2 in 1927, 3 in 1960, 4 in 1974, 5 in 1987, 6 in 1999 and 7 in October 2011. Interestingly, it took 123 years to move from 1 billion (1804) to 2 billion people (1927) but only 12 years to move from 6 (1999) to 7 (2011). Source: United Nations Secretariat, Department of Economic and Social Affairs.
3. For instance, bio-geoscientific studies by Sitch et al. (2013) using Dynamic Global Vegetation Models (DGVMs) show that there is a trend in the land sink of CO2 driven by increasing net primary production (NPP) from natural ecosystems in the tropics. Similarly, Barichivich et al. (2013) have discovered that a 'lengthening and intensification of the photosynthetic growing season, manifested principally over Eurasia rather than North America, is associated with a long-term increase

(22.2% since 1972, P < 0.01) in the amplitude of the CO2 annual cycle at northern latitudes.' Yet, this supposed 'greening' was proposed with caution and could actually be misleading because it is an indirect effect of higher CO2 accumulation rather than a significant improvement of ecosystemic conditions. That is, you could have more canopy but 'emptier' ecosystems because of the loss of animals.

4. You can calculate your personal overshoot day at http://www.footprintcalculator.org/.
5. It is widely known that, as the United Nations Development Programme stated again and again, a minority of the world's population (around 17 per cent) consume most of the world's resources (80 per cent), leaving the rest with the remaining 20 per cent. Even though there has been marked progress on reducing poverty over the past decades, more than 4 billion people are still struggling to survive, on the threshold of poverty and deprivation, living without the very basic necessities of life – food, water, housing and sanitation. Currently, about 8 per cent of world population, or half a billion people, still live in extreme poverty.
6. For the sake of comparison as well as for the following discussion, it can be useful to note that according to the Global Footprint Network, in 2014 the United States had an ecological footprint of 8.4 gha/person against a biocapacity of 3.76 gha/person, thus 1.8 times more impact but only 1.7 times more biocapacity than average EU-28 countries. Simply put, if everyone on the planet in 2014 had the same ecological footprint as the average resident of the United States or Europe, we would need respectively 4.97 and 2.79 Earths to support our demands on nature. See: http://data.footprintnetwork.org.
7. Periodization is the attempt to categorize the past into discrete, quantified blocks of time that are named according to specific events or characteristics. It is based on the possibility to find relatively stable features/traits within periods of time whose beginning and end are often arbitrary or up for debate. Following the work of geologists and historians, we have become acquainted with terms such as Holocene, Jurassic, or Enlightenment and Modernity respectively.
8. Here I will not delve into the problematic issue of deriving prescriptions from descriptions. I refer the reader interested in that debate to (Callicott, 1982; Callicott, 2013, pp. 70–78).
9. To stress the variety and plurality of existences, I intentionally borrow from Leopold the use of plurals.

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