CHAPTER 8

The Challenge of 'Phasing Out' Fossil Fuels: A Climate-Changing Transition

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Introduction

The slow pace of the current energy transition is not surprising; it is indeed expected (Smil, 2013). Fossil fuels[1] are so entrenched in everyday life that it has become hard to imagine a future exempt from their use. In fact, an exercise of this sort would be deemed naïve if it were done without considering the versatile roles fossil fuels-derived products have

[1] Whenever I mention 'fossil fuels' in the plural form I will be generically referring to coal and hydrocarbons (crude oils and natural gas) and not specifically to one or the other. In the same way, whenever I refer to one type of fossil fuel (gasoline, diesel, kerosene, jet fuel, etc.) I will not be using it as a metonym for the whole of 'fossil fuels'. This distinction is essential to analyse the nuances within the worldwide initiatives that aim to—so to say—'phase out' their incessant use. On the importance of acknowledging the plurality and 'considerable heterogeneity' of the substances encompassed in the concept of 'fossil fuels', please see (Smil, 2008). On the use of the expression 'phase out' in relation to fossil fuels, please see this chapter's section "The Fossil Fuels Propelled International Legal Dialectics".

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in the contemporary world, which vary much beyond their large share in the global energy system. That is, to name a few such examples: fuelling mechanized crop harvests; transporting raw materials, goods and people throughout all continents incessantly by land, sea and air; and offering a variety of petrochemicals that go from pesticides and fertilizers to medical drugs, synthetic fibres and plastics.

Against this backdrop, this chapter is set out to identify and discuss the main markers of the entrenchment of fossil fuels within international law. It does so by employing an 'integrative approach' to the legal depictions of energy (Viñuales, 2022), especially through the branches of international environmental and energy law.

The socio-legal analysis here developed briefly illustrates, through sections "Introduction" and "Fossil Fuels' Technical Hegemony", the worldwide hegemony of the fossil fuels-based energy technical system and the impacts it has impinged on the Earth System, with special attention to the second half of the twentieth century. Section "'The Great Acceleration' of Impacts on the Earth System" identifies a long-lasting *ab ovo* structural contradiction at the core of the international legal depictions of energy as a legal object, which prioritize fossil fuels-based 'energy production and use' over 'environmental protection' at the same time while pledging to stop offsetting the balance of the Earth's biosphere and of its ecosystems. The fourth and final section discusses how the ongoing national overarching policies towards low-carbon, clean, energy matrices (labelled generically as 'green deals') are enabling the energy transition—whilst facing demanding challenges stemming from the carbon-intensive international normative frameworks.

Fossil Fuels' Technical Hegemony

The first industrial revolution in the mid-eighteenth century is commonly accepted as the main marker of an exponential boost in coal consumption (Smil, 2010b; Steffen et al., 2007). In the same way, the mid-nineteenth century is referred to as the period in which the intense usage of crude oils began to take form—a happening often labelled as the "second industrial revolution" (E. J. Hobsbawm, 1999; Steffen et al., 2007). This division holds good truth if considered geographically bounded to the western northern hemisphere, while bearing in mind that the fossil fuels perennial dependence they created did not happen immediately.

Global rise in the use of fossil fuels, up to becoming the world's main energy source, was a rather lengthy one. Albeit heavily used already in the late eighteenth century, coal only "began to supply more than 5% of all fuel energy around 1840" and by the brink of the twentieth century it "still supplied only about half of demand" (Smil, 2013).

Coal-based energy supply's rise to 50% took roughly 60 years, though it varied from place to place until its use achieved worldwide hegemony.[2] And so the biggest energy source in the twentieth century "was not oil but indeed coal", which only reached its "highest share of global fuel consumption, at about 55%, during the 1910s" (Smil, 2013). The same lengthy process happened to crude oils, which although already in use by then, only surpassed coal in 1964 (Smil, 2013).

One may therefore understand the so-called first and second industrial revolutions to be fundamentally two energy revolutions, which brought upon new energy (re)sources, new modes of production and new overall uses of energy worldwide. These revolutions—or energy transitions—were what powered the 'industrial' in 'industrial revolutions' and basically rendered possible fundamental aspects of contemporary life: from household electricity and heating systems to plastic gadgets and appliances; an unfathomable amount of medical and chirurgical apparatuses; as well as of the global-wide terrestrial, maritime and air transportation systems, which sustain the contemporary trade of commodities and aggregated value goods.

In this sense, at the present moment, all industries and global value chains are virtually fossil fuels-dependent. Either due to the intensive usage of hydrocarbon-derived materials throughout the production systems or to the fossil fuels-based logistics needed to connect world-spanning supply chains. These examples illustrate how fossil fuels-intensive is the hegemonic technical system[3] presently structuring the world: from what we eat to what we wear, from how we commute and build our homes to how the world's industries operate and national energy systems are powered, or yet, from any gadget's smallest plastic component to the kerosene-fuelled military aircrafts. However, as it is now extensively known, this fossil fuel-based technical system spread throughout the globe at great environmental and climate costs.

[2] For instance, Vaclav Smil (2010a, 2013) shows the tipping point in France occurred around 1875; Japan, 1901; the URSS, 1930; China, 1965; and India, the late 1970s.

[3] For my use of 'technical system' please see (Ellul, 2009; Pratti, 2021).

'The Great Acceleration' of Impacts on the Earth System

In the late 1990s, historian Eric Hobsbawm defined the three decades that followed the Second World War (WWII) as a 'golden age', on the grounds of finding this 30-year span a time of "extraordinary economic growth and social transformation" that "probably changed human society more profoundly than any other period of comparable brevity" (Hobsbawm, 1995).

This statement acquired new depths of meaning when atmospheric chemist and Nobel Prize laureate Paul J. Crutzen and limnologist Eugene F. Stoermer popularized the 'Anthropocene' concept. The term describes the "human-dominated, geological epoch", in which anthropogenic emissions of carbon dioxide (CO_2) are causing the global climate to "depart significantly from natural behavior" (Crutzen, 2002; Crutzen & Stoermer, 2000). They argued that the beginning of the current geological epoch can be pinned down to "the latter part of the eighteenth century", which "happens to coincide with James Watt's design of the [coal-intensive] steam engine in 1784" (Crutzen, 2002: 23; Crutzen & Stoermer, 2000).[4] The coincidental factor here being the "beginning of growing global concentrations of carbon dioxide and methane" in the atmosphere (Crutzen, 2002; Crutzen & Stoermer, 2000).

Those 'golden years' not only changed human society, but they also radically intensified human impacts on the Earth's biosphere, more profoundly than any other period of comparable brevity so far. These impacts can be mostly traced back to the incessant emissions of CO_2 and other greenhouse gases (GHGs)—the majority of which are due to the overall massive use of fossil fuels and environmental degradation related to it around the world. This golden period also coincides with crude oils' surpassing of coal as the hegemonic fuel throughout the world (Smil, 2013)—the moment in which fossil fuels became the main propellers of global economic development.

Crutzen and Stoermer's proposal inspired a group of scientists to concentrate efforts and build a "systematic picture of the human-driven changes to the Earth System" as a way to "record the trajectory of the 'human enterprise' through a number of indicators" (Steffen et al.,

[4] Watt's steam engine was defined by Alain Pottage, in a hindsight climate-driven analysis, as "an apocalyptic patent" (Pottage, 2020).

2015).[5] The authors came up with 12 graphs that illustrated the human imprint on the Earth System since 1750, encompassing areas such as population growth, fertilizer consumption, transportation, water and energy use, and urbanization. To the surprise of the scientists involved in the said effort, all graphs showed an exponential acceleration from 1950 onwards (Steffen et al., 2015), therefore confirming the worldwide hegemony of the fossil fuels-based technical system.

In the aftermath of their effort, the period Hobsbawm once called 'golden years' was extended and more appropriately relabelled as 'the great acceleration'[6]—which has certainly not yet come to a stop, in spite of a somewhat noticeable reduction in pace regarding its undesired and unintended consequences (Steffen et al., 2015). This greatly accelerated 'carboniferous'[7] period in the post-mid-twentieth century ultimately reveals that the dynamics of our present time are structured upon the consumption of fossil fuels, as well as upon the overall climate and environmental degradation that comes with it.

The 'great acceleration' concept, as thought out by Steffen et al. (2004), alludes to the ever-growing negative outcomes on the Earth System caused by the steep and exponential increase in the use of fossil fuels from 1950 onwards (with climate change being one among many). Such a concept also offers a valuable context to understand the many social consequences stemming from this 'carboniferous' technical system.[8]

Moreover, whether the beginning of the so-called Anthropocene epoch should be considered the late eighteenth century or the end of WWII, or if it should be even considered a proper geological epoch (or nothing of the sort), is a matter for climate scientists and palaeontologists to settle.[9]

[5] This 2015 article is an updated version of their previous publication on the matter dating back to 2004. For the original graphs, please see (Steffen et al., 2004).

[6] For a comprehensive account on this phenomenon and its consequences, please see (McNeill & Engelke, 2014).

[7] The expression was used by Lewis Mumford when referring to the high level of coal consumption in between the nineteenth and twentieth centuries. Please see (Mumford, 1955).

[8] Such as the "shortening of distances", the acceleration of the pace of contemporary life and of the overall worldwide happenings. On these matters, please see (Ferrarese, 2000; Rosa, 2013; Santos, 2001), respectively.

[9] Formal steps were taken towards the formal recognition of the Anthropocene as a geological time unit as the 'Anthropocene Working Group of the Subcommission on Quaternary Stratigraphy' voted the mid-twentieth century as its official start. See (*Crawford Lake, Canada, Chosen as the Primary Marker to Identify the Start of the Anthropocene Epoch*, n.d.; 'Results of Binding Vote by AWG', 2019; Subramanian, 2019). However, it remains to be seen if the concept relates to a geological 'period', an 'epoch' or simply an 'event' (Gibbard et al., 2022; Head et al., 2023).

This chapter takes into consideration both conceptual possibilities in order to investigate some of the branches of international law that blossomed during this period. From the standpoint hereby undertaken, what matters is to investigate the international normative frameworks composing the fossil fuels-based architecture of the contemporary world.

This normative structure seems to be *ab ovo* marked by a tussle between, on the one hand, the need to secure entitlements over energy resources worldwide and the international trade derived from their exploration, and, on the other hand, the necessity of maintaining environmental and climate stability against the backdrop of an ever more disturbed and unbalanced Earth System. The section that follows describes the main legal traits of this carboniferous normative architecture as seen from the entangled perspective of its structuring tussle.

The Fossil Fuels-Propelled International Legal Dialectics

A Methodological Caveat

The beginning of the so-called 'great acceleration' also happens to coincide with the ever-increasing rate of worldwide environmental degradation, as well as to the unfolding of different realms of international law. However, before advancing the socio-legal analysis scope of this chapter, a methodological caveat is needed as so to narrow down and better define the phenomenon here contemplated.

According to Jorge Viñuales (2022), 'energy' is a rather difficult object to take hold of from the perspective of law for two main reasons. First, it is a legal object that necessarily crosses borders, due to the "substantial mismatch between the States where energy is produced and the States where energy is consumed". Second, because energy is a multifarious object that can be defined as having at least four facets: that of being a resource, a product, an activity and a technology.[10]

[10] This can be summed up, for instance, by imagining the industrial *activities* comprehended from the exploration of an oil well up to the many uses it provides. Crude oil (*resource*) is obtained through a myriad of technological artefacts used in the fracking and refining processes (*technology*). The outcomes (*products*) of the latter phase—fuels, waxes and petrochemicals—are then traded worldwide on a continuous basis to then sustain an infinite number of other endeavours.

It is important to note that Viñuales was, for the most part, referring to a fossil fuels-related conceptualization of energy, especially in his appraisal of its 'resource' facet. In this sense, the 'substantial mismatch' regarding where energy is produced and consumed alludes to the geographical location where reserves of fossil fuels lie around the globe. Therefore, this approach to energy as a legal object works slightly differently when applied to low-carbon renewable energy (re)sources, which, generally, can be produced and consumed within the same State. These two reasons account for the internationalization of energy transactions and the necessarily multidisciplinary nature of the normative frameworks regarding its fourfold facets.

Based on this innovative understanding, Viñuales (2022) sustains that the field of 'international energy law' should actually be understood as encompassing "the entirety of international law", hence why the Cambridge Professor entitled his book as *The International Law of Energy*.[11] Other than multidisciplinary, such an effort is above all transversal, for it does not allow different areas of international law to be considered as separate but as constitutive of a highly complex and multifaceted study object.

Although agreeing with this "integrative approach" (Viñuales, 2022), this chapter mainly focuses on how the fields of international environmental and energy law depict 'energy' as an object. This narrowing down of the available legal sources is justified because these are the—so to say—'branches' of international law that directly address the most fundamental aspects of the above-mentioned 'resource facet' of energy as a legal object.

This purposeful cutback helps to highlight the previously mentioned *tussle* located at the core of the normative architecture of the worldwide fossil fuels-based energy matrix. That is, the normative tussle—or the somewhat contradiction—between securing intense exploitation of fossil fuels, while trying to maintain the Earth's system climate stability. This inconsistency is observed through the dialectics propelled by the international legal sphere's handling of environmental and development concerns from the mid-twentieth century onwards. And so considerations regarding human rights, trade, foreign investment protection under international law as well as the law of the seas are thus willingly put aside due to

[11] Viñuales justifies doing so when he affirms that "*Energy,* not *international law*, is the pivotal term around which an account of the international law of energy must be organized" (2022: xix).

this chapter's length restrictions and to better focus solely on stressing this most fundamental aspect at the core of the legal depictions of energy as an object.

The Ab Ovo Contradiction in Between International Environmental and Energy Law

As mentioned above, the 'great acceleration' of environmental degradation and climate change-inducing activities also happens to coincide with the outset of the field of international environmental law. The 1972 'Stockholm Conference on the Human Environment' can be considered as its 'foundational moment' (Dupuy & Viñuales, 2018), both because it was the first of many conferences of its kind and due to its outcomes: the Stockholm Declaration on the Human Environment (hereinafter Stockholm Declaration), the establishment of the United Nations Environment Program (UNEP) and the Action Plan for the Human Environment are all milestones of the beginning of the global conversations on the entanglement between environmental protection and development through industrialization (Dupuy & Viñuales, 2018).

The Stockholm Declaration's preamble affirms the "major and undesirable disturbances to the ecological balance of the biosphere" result from harmful activities that should be overcome by building, "in collaboration with nature, a better environment", through "an enthusiastic but calm state of mind and intense but orderly work". Five decades (and many gigatons of CO_2 and other GHG thrown in the atmosphere) later, it is somewhat safe to say that 'calm' was not a very soothing word to choose. And that the 'intensity' of the work was not enough to prevent the worsening of the "undesirable disturbances to the ecological balance of the biosphere".

Throughout the Stockholm Declaration's 26 principles, one finds a variety of ways in which natural resources, ecosystems and the Earth's capacity "to produce vital renewable resources" (principle 3) are referred to and hinted at. While on the Action Plan, one notes the focus to be more on the "environmental aspects of natural resources management" (recommendations 19–69), on the "identification and control of pollutants of international significance" (recommendations 70–94) and on the entanglement between "development and environment" (recommendations 102–109).

On the one hand, the Declaration identified the international sphere's concerns with the overall declining health status of the Earth's biosphere, due to environmentally harmful economic-oriented activities, and highlighted the need to find a solution to this unbalanced equation. Whilst, on the other hand, the Action Plan directly linked these concerns "to the environmental effects of energy use and production" (recommendation 57), and urged for a more "effective development of the world's energy resources, with due regard to the environmental effects of energy production and us" (recommendation 59).

As mentioned in the previous section, the contextual backdrop of the 1972 Stockholm Conference is that of Hobsbawm's 'golden age', which can also be referred to as "the great acceleration" of the "human imprint" on the Earth System (Steffen et al., 2015). Or, to put it bluntly, that of the global consumption of crude oil overcoming that of coal (Smil, 2013), therefore firmly establishing fossil fuels as the primary source of energy worldwide. Thus, the Stockholm Action Plan's statement regarding energy resources is to be understood as referring mostly to fossil fuels.

As a matter of fact, this interpretation is strengthened by the Stockholm Declaration's differentiation between, on the one hand, "vital renewable resources" produced by the Earth, which "must be maintained, and, wherever practicable, restored or improved" (principle 3); and, on the other hand, the "non-renewable resources of the earth", which "must be employed in such a way as to guard against the danger of their future exhaustion" (principle 5).

The Stockholm Declaration's references to ecosystems and the "earth's capacity to produce vital renewable resources" implicitly contain the idea of cycles: a series of events that, when completed, return to the initial phase to then repeat themselves on and on, indefinitely. These references contain the assumption of reversibility of the damages caused to the biosphere and ecosystems—possibilities that are fading away with every new Intergovernmental Panel on Climate Change's (IPCC) assessment report.

The 'foundational moment' of the field acknowledges the link between 'energy production and use' and the 'disturbances to the ecological balance of the biosphere', whilst pleading to find harmony between both. Therefore, pleading to accommodate what is irreconcilable and to find a form of equilibrium between an environmental-harmful energy system and the worldwide environment damaged by it. Or, in other words, a system that privileges the exploitation of 'non-renewable resources', even

though these are deleterious to the preservation of the 'vital renewable resources' produced by the Earth.

Precisely because this contradiction is constitutive of this so-called foundational moment of international environmental law, it is also present in the developments that followed the Stockholm Conference. And given that 'energy' as a legal object is multifaceted and necessarily transversal, this tussle to accommodate the irreconcilable is structural to the way in which the international legal sphere addresses it in its 'resource facet'.

Moreover, the 1982 World Charter for Nature (WCN), the 1992 Rio Declaration and the 1992 United Nations Framework Convention on Climate Change (UNFCCC) further developed the ways in which natural resources, ecosystems and the Earth's system are referred to and hinted at, reinforcing the idea of reliance on recurring natural cycles. However, while all three instruments link the exploitation of natural resources to the deterioration of the environment and natural systems, only the WCN and the UNFCCC relate the latter to the overall use of non-renewable resources, therefore depicting the dark side of the 'resource facet' of fossil fuels-based energy.

The WCN's preamble states that "life depends on the uninterrupted functioning of natural systems which ensure the supply of energy and nutrients". This means the uninterrupted recurrence of natural cycles. In this sense, the mentioned 'supply of energy' seems to be a reference to the within-nature energies (Pratti et al., 2022), responsible for the cyclic continuance of ecosystemic services, which are at the basis of renewable energy systems such as bioenergy and hydroelectric power.

As a matter of fact, recital ten of the WCN firmly differentiates natural resources as soils, living resources, renewables (including water) and non-renewable resources ("which are consumed as they are used"). Furthermore, it warned that the latter's conversion for consumption should be balanced with their abundance and compatibility with the "functioning of natural systems".

Similarly to (although less assertive than) the WCN, the UNFCCC also relates fossil fuels-based energy to environmental—and, more precisely, climate—degradation. For instance, article 4(10) recognizes that "measures to respond to climate change" are more difficult to implement for the countries whose economies are highly dependent on "fossil fuels and associated energy-intensive products".

The main legal instruments of international energy law 'branch' frame this tussle between the fossil fuels-based energy system and the Earth's environmental and climate stability in a whole different manner.

The preamble to the 1991 European Energy Charter highlights that "efficient energy systems" are of essential importance for environmental protection. It is rather interesting to note that environmental protection is solely mentioned in the context of energy efficiency (as one sees throughout titles I and II of the Charter).

The 1994 Energy Charter Treaty (ECT), designed to fulfil the guidelines of the 'European Energy Charter', is a great example of Viñuales' (2022) "integrative approach" to energy as a legal object. It encompasses a wide range of provisions that go from defining the economic activities of the energy sector and determining investment mechanisms (financing and access to capital, as well as investor protection procedures), to establishing questions of intellectual property and transfer of technology, and offering guidance on international trade and environmental protection. Given this chapter's purposes, however, only the ECT's insufficient handling of environmental protection is under scrutiny at the moment.

In its article 19, entitled "Environmental Aspects", the ECT states that all Parties shall strive to minimize the harmful environmental impacts within the energy cycle in an economically cost-effective manner.[12] Similar wording was already present in the European Energy Charter (Title II, n 7), but the ECT further expanded this strictly economic-oriented conception of environmental protection—and its binding force outweighs the more symbolic aspect of the 1991 instrument.

The 2015 International Energy Charter, a declaration of political intention that updates and expands the European Energy Charter, is in line with this apposing of energy production and environmental protection. Indeed, it recognizes in its preamble the existence of a "trilemma between energy security, economic development and environmental protection".[13]

[12] The Treaty defines 'energy cycle' as "the entire energy chain", including "exploration, production, conversion, storage, transport, distribution and consumption of the various forms of energy".

[13] The World Energy Council has established a 'World Energy Trilemma' in 2010—an index report prepared annually to rank countries energy performances on these three indicators. Please see: *World Energy Trilemma Index* (n.d.).

This 2015 Paris Agreement, designed to enhance the implementation of the UNFCCC and "strengthen the global response to the threat of climate change" (Article 2), did not address this trilemma, nor the energy sector's share of responsibility for the ongoing climate crisis and its dependence on the exploration and use of non-renewable resources. As a matter of fact, the Agreement did not even mention fossil fuels.

Nonetheless, the wording of its article 2(a) states the goal of holding the increase in the global average temperature to well below 2 °C (whilst pursuing efforts to limit it to 1.5 °C) above pre-industrial levels. The mention of 'pre-industrial levels' is a subtle, though evident, reference to the mid-eighteenth-century industrial revolution, which "happens to coincide" (Crutzen, 2002: 23) with the ever-increasing anthropogenic emissions of CO_2 and other GHGs due to the consumption of coal.

In the same way, by establishing the necessity to reach the peak in GHG emissions (article 4), the agreement seemingly hints at the end of the hegemonic era of the fossil fuels-based technical system. However, in spite of the many reasons to celebrate the Paris Agreement as a successful achievement of the international legal sphere, the failure in properly addressing the twenty-first century's structural trilemma is to be acknowledged at least as a missed opportunity—at the very least, from a symbolic perspective.[14]

This was somehow redressed on the Conference of the Parties to the UNFCCC in 2023, during the so-called COP 28, which happened in Dubai, in the United Arab Emirates, and also held the first Global stocktake under the Paris Agreement. Regarding the latter, its final text is characterized by a strong worded phrasing in reference to fossil fuels. More specifically, its recital 28, which mentions the need to accelerate the "phase down of unabated coal power", recognizes the need of "transitioning away from fossil fuels" in energy systems, as so to achieve net zero by

[14] I by no means intend to diminish the astonishing importance of the Paris Agreement. I fully agree with Professor Lavanya Rajamani (2016) when she firmly notes that "the Paris Agreement represents the most ambitious outcome possible in a deeply discordant political context".

2050, and calls for the "phasing out of inefficient fossil fuels subsidies that do not address energy poverty or just transitions as soon as possible".[15]

The (Un)balance Between Environmental Protection and the Energy Cycle

An unsettling problem has been present throughout the major developments of the international environmental and energy law fields in the past 80 years. At their intersection, a contradictory structural trait may as well be defined as the main distinctive legal marker of the so-called great acceleration: that of the relation between 'energy production and use' and overall environmental consequences.

On the one hand, from its foundational moment onwards, international environmental law acknowledges the link between 'energy production and use' and the 'ecological disturbances to the balance of the biosphere'. The solutions hinted at, however, urge for the harmonization of both, given that worldwide ecological balance is widely important, among other reasons, for the maintenance of ecosystemic services and the sustenance of 'energy supply'.

On their part, the WCN and the UNFCCC both narrowed down the negative outcomes of this link to the usage of 'non-renewable' energy resources, with the latter directly addressing fossil fuels. Therefore, indicating the way out of this negative-sum game of 'more energy production' equalling 'more biosphere degradation' to be a shift towards renewable energy sources. While, as previously highlighted, the 2015 Paris Agreement

[15] Although the direct references to 'fossil fuels' is a paradigmatic happening and should be celebrated as a victory, one must acknowledge it was—to some extent—a 'Pyrrhic victory'. The expression "phase down of unabated coal power" is an urge to diminish what should be urgently abandoned; "transitioning away from fossil fuels" in energy systems, is a reference to energy matrices and not to the GHG-intensive infrastructures of global logistics and of urban mobility; lastly, the "phasing out of inefficient fossil fuels subsidies that do not address energy poverty or just transitions" is simply a too narrow, sector-specific call to action. This being so, although the direct references to fossil fuels are a great symbolic victory, one can say that from a practical perspective the word 'victory' does not apply—given that the range of impacts has been narrowed down rather significantly. In this sense, the Paris Agreement—that does not even mention fossil fuels but put in place important mechanisms directed at facing climate change—can be even further appreciated. On the Paris Agreement's mechanisms, see section "The Fossil Fuels Propelled International Legal Dialectics". For the full text of the global stocktake, see (UNFCCC, 2023).

did not straightforwardly mention, this entanglement between fossil fuels and the degradation of the biosphere.

On the other hand, although the field of international law of energy[16] also recognizes the unsurmountable relation between the energy field and the environment—as well as with many other areas of international, regional and domestic law—it does so in an insufficient and one-sided manner. This is so because environmental protection is seen as a matter of the efficiency of the energy cycle, understood in cost-effective terms throughout the whole energy chain. That is, environmental protection is something to be done *through* and *for* the benefit of the energy production cycle, and not to prevent or redress the many different forms of ecological impact the activities from 'well to wheels' generate. This ignores the fact that the 'energy cycle' of renewable energy (re)sources, such as hydropower and biofuels, is largely dependent on the ecosystemic services disturbed by the use of fossil fuels.

Oddly enough, the international legal sphere's overall approach to the 'resource facet' of energy as a legal object seems to have a tendency to prioritize 'energy production and use' over its manifold environmental consequences—hence, rendering the protection of the ecological balance of the biosphere almost as an afterthought, when it comes to the securing of the fourfold facets of the fossil fuels-based energy matrix.

All things considered, given the current health status of the planet and the dire and ever-worsening consequences of global warming and climate change, this multidisciplinary and transversal socio-legal interpretation of the entanglement between energy production and environmental protection does not seem to be too far off.

In this regard, it is possible to say, paraphrasing Viñuales (2013), that *environmental protection* is seen as an 'immigrant' in the land of *energy* law and as such, it would only have the scope of action that is consistent with *energy production*. If e*nvironmental protection* was to collide with *energy cycle* considerations, the latter would likely prevail,[17] especially so in regard to the fossil fuels-based energy cycle.

[16] On the meaning of the expression 'international law of energy', please see note 11 above.

[17] In the original, Viñuales was analysing the relationship between 'environmental protection' and 'development/growth', respectively. I replaced the latter by 'energy'.

The Present Energy Transition: A Race to the Top on Climate Actions?

The Worldwide Quest towards Renewable Energy Sources

As previously stated, there are many reasons to celebrate the 2015 Paris Agreement. Among these, two particularly stand out—considering the multidisciplinary and transversal perspective taken in this chapter.

First, the agreement can be considered as a hard-fought landmark in the UN climate negotiations, for it managed to establish ambitious and aspirational goals, extensive binding obligations of conduct, alongside rigorous oversight mechanisms (Rajamani, 2016) on matters relating to the global efforts against climate change.

As a matter of fact, the mechanisms contained in articles 3, 4 and 14 institute a due diligence-based standard of care (Voigt & Ferreira, 2016), requiring States' efforts to achieve the goal set on article 2 to progress over time, with the newest efforts necessarily going beyond the previous ones. According to Cristina Voigt and Felipe Ferreira (2016), these mechanisms have "the potential to function as a catalyst for a race to the top on climate action".

Second, by defining that the international community's response to climate change must aim at the goal of holding "the increase in the global average temperature to well below 2°C above pre-industrial levels", whilst "pursuing efforts to limit the temperature increase to 1.5°C", the Paris Agreement did more than initially meets the eye. It bluntly introduced a temporal frame of reference and a temperature rise threshold that shall not be exceeded, in contrast to which the efforts to stop offsetting the equilibrium of the Earth's biosphere can be measured against. In other words, it embedded the climate emergence, heir of the great acceleration, in the realm of international law.

The 1.5 °C mark was not merely symbolic nor arbitrarily chosen. It indicates a tipping point for the Earth's climate system that will, in case it is exceeded, set in motion irreversible systemic damages to the Earth's ecosystems, as the IPCC climate models show (Hoegh-Guldberg et al., 2018). Needless to say, if the 2 °C threshold is reached or overshot, the consequences will worsen catastrophically.

Among the many after-Paris efforts to adapt and mitigate climate change, the so-called green deals seem to be the most paradigmatic

initiatives.[18] These are overarching national policy programmes (except in the case of the European Union's, which is not strictly 'national') with their own schedules regarding the peak and subsequent reduction of CO_2 and other GHG emissions, therefore moving their energy matrices away from fossil fuels.

Examples of the many worldwide comprehensive initiatives currently taking form are, for instance, the European Union's 2019 *Green Deal,* China's 2020 *Action Plan for Carbon Dioxide Peaking Before 2030*, South Korea's 2021 *New Deal*, as well as the recently announced US *Inflation Reduction Act* (IRA)[19] and Japan's *Green Transformation* programme, both in 2022.

The differences within these initiatives provide guidance concerning the social transformation their respective countries aim to achieve. On the one hand, the transversal goals of the ecological and just transitions pervading all policy areas of the European Green Deal exemplify the weight environmental and social matters have acquired within the EU.[20] On the other hand, the market-oriented and pro-competition perspective of the US IRA shows the primacy given to large-scale implementation of clean technologies over underlying social matters.

However, among the myriad of regulatory and financing policies these national initiatives institute, they all share the 'net zero goal' as the main, across-the-board, objective. China's plan to peak and then start reducing its carbon footprint from 2030 onwards, as well as the US and the EU's respective plans to become carbon neutral by 2050 are the most important examples of this common objective. That is, reducing CO_2 and other GHG emissions to as close as possible to zero, in such a way that the remaining emissions shall be absorbed from the atmosphere by, for instance, oceans and forests (United Nations, 2022). In other words, 'net zero' means 'carbon neutrality', which necessarily implies moving away from fossil fuels.

[18] Formally, only the European Union's initiative is called 'Green Deal'. However, given the similar goal the worldwide policies have—that of the net zero and the phasing out of fossil fuels—I have been generally referring to all as 'green deals'. For more on my use of the expression and analysis on what these initiatives entail to the realm of the law, please see (Pratti, 2021).

[19] The IRA can be understood as complementing and strengthening the United States officially rejoining the Paris Agreement.

[20] On how the EU has been handling its 'ecological transition', please see (Chiti, 2022).

Achieving the net zero goal means putting a stop to the rise of the global average temperature, stabilizing and establishing the conditions for the reduction of the overall concentration of atmospheric GHG. However, as indicated by the 2022 IPCC sixth assessment report (Pathak et al., 2022: 58), the global temperature is set to reach the 1.5 °C mark by the end of the next couple of decades.

These overarching national policy programmes currently being shaped worldwide are, at their core, the transition of their respective energy matrices from fossil fuels to low-carbon renewable (re)sources. In this sense, they represent the many different national journeys towards the fulfilment of the Paris Agreement's article 2 goal. Ultimately, they represent the transition of the global energy system. And given the advantages being a forerunner on new and clean technologies brings (Pratti, 2021), these initiatives seem to be competing with each other, which seems to be giving form to a 'race to the top' on the establishing of normative frameworks regarding the energy transition.[21]

This worldwide quest towards renewable energy sources faces multiple challenges and requires distinct areas of expertise to be tackled. One may say that the feasibility of timely large-scale implementation of carbon neutral technologies, the financing mechanisms to do so and the legal adaptations these require from all levels of law are the most pressing ones. However, from the socio-legal perspective of this chapter, a multifaceted and transversal challenge deserves special attention. In particular, because possible solutions necessarily evoke the entirety of international law and concern the legal architecture the present energy transition is arising in and struggling against.

'Phasing Out' Fossil Fuels: What Does It Legally Entail?

As seen throughout sections "Introduction", "Fossil Fuels' Technical Hegemony", and "'The Great Acceleration' of Impacts on the Earth System", from the mid-eighteenth century's rise of massive use of coal to the present non-stop drilling, refining, international trading and transporting of crude oils and their derived products, a fossil fuels-based

[21] There is, of course, a geopolitical dimension inherent to these initiatives, especially so regarding the access to the 'mineral foundation' of the energy transition, as well as to be the establish who will be the forerunners on the deployment of low-carbon, clean technologies and on the establishing of legal performance standards for these. On the matter, please see (Siddi, 2023a, 2023b).

socio-technical system of worldwide reach emerged—and brought about with it an international normative architecture consistent to it.

As a matter of fact, fossil fuels are so entrenched in the contemporary world that one is able to trace them throughout "the entirety of international law" (Viñuales, 2022). Be that in the international normative frameworks aiming at granting access to energy resources, investment in their exploration and securing their trade, or in the ones conforming the international community's actions against environmental and climate negative consequences caused by their consumption.

Evidently, the same happens with the overarching policies currently being shaped around the world to meet the Paris Agreement's temperature goal. Unlike the structural tussle at the core of the international legal depictions of energy as an object, however, these national policies seem to have a tendency to prioritize environmental and climate protection over 'energy production and use', especially so if the latter is based on non-renewable (re)sources.

Here, it becomes possible to highlight two fundamental facts regarding the present energy transition. First, it is giving rise to a multitude of new normative frameworks within national legal spheres. This is so because the so-called green deals must necessarily pervade all areas of contemporary life, given that fossil fuels are somehow virtually embedded in everything. For instance, from a non-exhausting bird's eye view and solely focused on the European experience, the legal areas currently being substantially modified or restructured anew are: regulations on access to resources and secondary raw materials; on waste management and recycling; on the efficiency, adaptation, and transitioning of the energy matrix towards renewable sources; on public and private financing and investment mechanisms in regard to intensive CO_2 and other GHG emitting activities; on carbon pricing, emissions trading system (ETS) and carbon border adjustment mechanisms (CBAM); on emission performance standards and discontinuation programmes for vehicles based on their polluting capacities; and on the vast field of agriculture, forestry and other land use (AFOLU).[22]

[22] For instance, ever since the Green Deal Communication in 2019 (European Commission, 2019), the EU has had an impressive normative output on key areas of the energy transition without falling short with its environmental and social ambitions. This has been the case, for instance, with the 'Fit for 55 legislative package', the Clean Hydrogen Alliance (European Commission, 2022b), the Battery Alliance (European Commission, 2022a), the Climate Law (Reg 2021/1119, 2021), the RePower EU strategy (European Commission, 2022c), the Biodiversity Strategy (European Commission, 2020), and the CBAM (Regulation (EU) 2023/956, 2023), the amendment of its ETS (Directive (EU) 2023/959, 2023).

With overarching objectives like this having multifarious impacts on all areas of the EU polity—other than its energy matrix and its ecology—the EU, its "regulatory space", and its administrative system are expected to undergo a remarkable transformation process (Giorgi, 2023). At the same time, each of these normative frameworks pushes forward the global objective of disentangling, of eviscerating, fossil fuels from the structural core of daily life. Of course, doing so will neither be easy nor fast and this "is expected" (Smil, 2013). However, it will probably still not mean zero fossil fuels consumption, especially given the infinity of uses petrochemicals have. Moreover, this interpretation is in line with the previously mentioned outcome of the UNFCCC's COP 28, which called for "transitioning away" from fossil fuels *in energy systems*—as opposed to a fully fledged abandonment of it.[23]

Regarding these points, the European Green Deal (European Commission, 2019) offers a primary example through the way it articulates the 'net zero' and the 'phasing out fossil fuels' goals: the former is to be achieved by 2050,[24] whereas to the latter no specific time frame was established. This possibly indicates that the energy transition may not mean the absolute end of fossil fuels (especially of crude oils) but most likely the emancipation of the world from its dependence on them.

Second, there is an apparent conflict emerging between national policies that prioritize environmental protection and climate stability over fossil fuels-based 'energy production and use' and the depiction of energy as a legal object by international law—which has been seemingly doing the opposite, as discussed in section "'The Great Acceleration' of Impacts on the Earth System". Duly noted, this aspect is connected to the tussle between the many normative frameworks currently being designed, as well as the 'carboniferous' international normative architecture in place.

In this regard, the energy-oriented international normative framework in place may represent an obstacle to the energy transition. On the one hand, the original intent of securing investments and access to natural resources—at the roots of the internationalization of energy transactions (Viñuales, 2022)—may actually hamper national initiatives to move away

[23] On this matter, please see note 15 above.

[24] The European Union established the carbon-neutrality goal to be achieve by 2050 and set an intermediate target of reducing 55% of its emissions already by 2030 with its climate law (European Climate Law (Reg 2021/1119), 2021). However, as this chapter is being written, there is no 2040 goal set yet (Keating, 2023).

from the exploration of fossil fuels. The 20-year sunset clause of the ECT's article 47 is a primary example of such, as its entrenchment effect and "limits imposed on the agenda of policymakers" are unparalleled (Kouroutakis et al., 2022).[25]

On the other hand, because this framework has been designed while having as a main concern the geographical mismatch of where energy is produced and consumed, as well as the fourfold facets of fossil fuels-energy, it may not apply as intended to the critical minerals, rare earths and overall raw materials that are fundamental to the energy transition.

The main fact that stands out in this regard is that there is not a fully fledged overarching international normative architecture when it comes to mining activities—neither an UN-led international organization[26] nor even an international treaty similar to the ECT—which may become a problem in the future, given the worldwide consumption of raw materials is increasing ever faster. Although already having an impact on a variety of supply chains around the world, the "mineral foundation" (Bazilian, 2018) of the present energy transition is yet to fully develop its more disruptive consequences.

Nonetheless, it remains to be seen what impacts the rather different dynamics of the 'geographical mismatch' of non-renewable energy (re) sources will have on the national, regional and international normative frameworks of the energy sector. Not due to matters concerning availability and access to solar, wind or geothermal energy power though, but because the technologies to explore these energy sources are themselves subject to a rather different and multifaceted 'geographical mismatch'. The same applies to the core technologies at the basis of electric vehicles.

These are all fundamentally dependent on critical raw materials, which are largely concentrated in a few countries. And, on top of that, the capacity to refine and process these elements is largely dominated by even fewer countries—mostly not those in which such resources are found, with the exception of China.

[25] As a possible answer to this problem, the European Commission proposed a planned, joint withdrawal from the ECT. Please see (Bektasheva, 2023; European Commission, 2023).

[26] In this regard, however, there is the International Seabed Authority, established under the 1982 United Nations Convention on the Law of the Sea (UNCLOS), who is expected to decide by 2025 about the possibility of deep sea mining on areas beyond national jurisdictions.

Be that as it may, the indispensable mineral-based materials and technologies of the ongoing energy transition must be transported many times throughout the world before reaching their final clean low-carbon uses. And this will certainly be done by fossil fuels-intensive means of transportation for the foreseeable future, until these are finally disentangled from the structure of contemporary life and the global value chains underlying it.

By shedding light on these two fundamental facts regarding the ongoing energy transition and on the inescapable challenges they impose, it is possible to infer that prior to being a scientific or a technological matter, the ongoing energy transition's goal of 'phasing out' fossil fuels is a legal challenge. As such, it has the potential of reshaping some deeply rooted structures of international law while pushing forward the redesigning of national normative frameworks around the world. In sum, we seem to be witnessing the beginning of a new and hopefully more sustainable dimension of the transformative, form-giving function of the realm of the law (Kjaer, 2022). In the meantime, we ought to bear with the climate-changing consequences of the presently enduring carboniferous socio-technical system.

Conclusion

The previous energy transitions saw the emergence of fossil fuels-based energy resources and it gave rise to a world-spanning carboniferous socio-technical system, which is reflected within the core structures of "the social practice we call international law" (Viñuales, 2022). By delving into this structure whilst having the 'resource facet of energy' as a legal object, this chapter identified the unsettling, and somewhat contradictory, privilege that both international environmental and energy law have been assigning to fossil fuels-based 'energy production and use' over 'environmental protection' matters.

This problematic and structural mishandling of the inseparable link between energy and the environment poses a fundamental challenge to the efforts of phasing out fossil fuels. On the one hand, as seen through the example of the ECT's article 47, this international normative architecture may bluntly hamper national initiatives towards the hegemonization of renewable energy (re)sources. On the other hand, the lack of fully

fledged international normative frameworks to secure investment and access to the 'mineral foundations' of the ongoing energy transition, alongside the geographical mismatches of the countries in which these are located and refined before their final use, are still to present problems whose complete extensions and solutions remain to be seen.

The most immediate and promising answers to these challenges are stemming from the so-called green deals, which are redesigning innumerous national normative frameworks to eviscerate their dependences on fossil fuels and lay down the regulatory pathway for the implementation of low-carbon, renewables-based energy matrices. These national overarching normative frameworks are rebalancing the scale, which has been prioritizing 'energy production and use' from non-renewable sources, in favour of environmental and climate protection and renewables. These are to be watched closely for they seem capable of having a spillover effect on the legal spheres beyond the State—transnational, international and global law—rendering these more consistent with the needs of the times. It remains to be seen how the *ab ovo* contradiction this chapter identified will be dealt with as these likely developments unfold.

This is not the first—and most likely will not be the last—energy transition. But it certainly is the most important one up until now. Through the legal dialectics currently brewing, the realm of the law—in all of its spheres (national, regional, international and global)—seems to be going through a watershed happening regarding the enabling of its form-giving, transformative functions. May it thus not lose sight of this energy transition's *raison d'être*: to maintain a human-favourable balance of the Earth's biosphere and of its ecosystems, so as to ultimately avoid the climate catastrophe that awaits by the end of this century. To this end, one can only hope the law will have the significant role it is expected of it (Pratti, 2021).

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