

On energy transitions and ecological transitions

How can a young person (especially a young person in a big city) face the deepest problems, the misery of society, without succumbing, at least temporarily, to pessimism? There is no counter-argument here; only conscience can and must help us: however bad the world may be, you were born to put it right. This is not arrogance but only a sense of duty.¹Walter Benjamin (in "Sleeping Beauty", a text from his youth)

*In future earthquakes, I trust that too much bitterness will not extinguish my Virginia cigar.²
Bertolt Brecht (in his BALLAD OF THE POOR BB)*

Jorge Riechmann

The journal Nature editorialises

A notable editorial in Nature, in March 2022, vindicates the 1972 study The Limits to Growth (the first of the reports to the Club of Rome) and notes that "although there is now a consensus on the irreversible effects of human activities on the environment, researchers disagree on solutions, especially if these involve slowing economic growth. This disagreement prevents action. It is time for researchers to put an end to their debate. The world needs them to focus on the larger goals of halting catastrophic environmental destruction and improving well-being".³ The Nature editorial goes on to argue that the debate today, having accepted the existence of biophysical limits to growth, centres on two main positions,

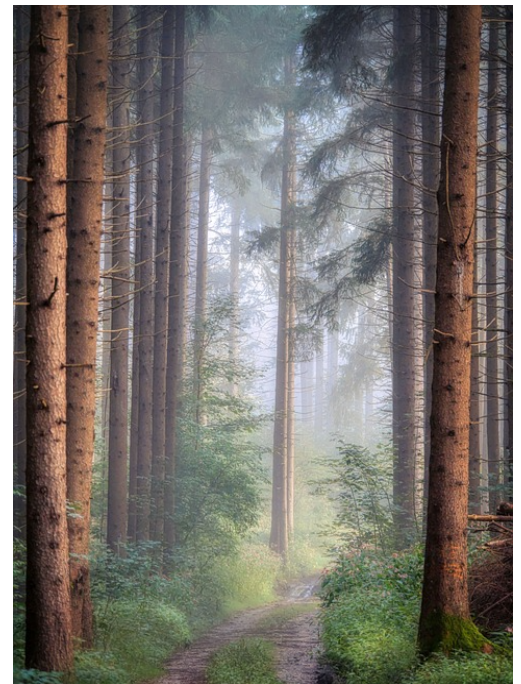


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¹ Walter Benjamin, *Obras*, libro II, volumen 1, Abada eds., Madrid 2016, p. 10.

² Quoted by Paco Fernández Buey in a lecture he gave at the Faculty of Humanities of the UPF, 28 April 1998. Now recovered by Salvador López Arnal in <https://espai-marx.net/?p=12745>

³ Nature editorial: "Are there limits to economic growth? It's time to end a 50-year discussion", translated in South Wind, 18 June 2022; <https://vientosur.info/existen-limites-al-crecimiento-economico-es-hora-de-poner-fin-a-una-discusion-de-50-anos/> . Original text in Nature 603, 361 (2022), 16 March 2022; <https://www.nature.com/articles/d41586-022-00723-1>

green growth versus degrowth, and that they should make an effort to dialogue with each other.⁴

This is a central debate, no doubt, which is modulated and reiterated at different levels. To come closer to home: a friend

The debate on the ecological transition is extraordinarily complicated... "The question is whether we can get to where we want to be (a society that respects biophysical limits) by starting from an industrialised system, modifying it and reducing it, or whether we can do it directly.

(and fellow activist in Ecologistas en Acción) told me in June 2022 that the debate on the ecological transition (and the energy transition in particular) is extraordinarily complicated. It also divides us within the environmental movements themselves. "The question is whether we can get to where we want to be (a society that respects biophysical limits) by starting from an industrialised system, modifying it and

reducing it, or whether we can do it directly. And we do not seem to have much time for either option.⁵ The approach is the same as in the Nature editorial.

I would say that the situation in the third decade of the third millennium is that tragic: we cannot avoid a hellish climate without an emergency economic contraction (in the Global North), rushing out of capitalist relations of production.⁶ And it is doubtful, of course, that such a transformation is on our horizon... But let us take it one step at a time.

What is an ecological transition?

We need an ecological transition as industrial societies are hurtling towards catastrophic scenarios. César Rendueles writes: "We must fight together for a just, planned and public ecological transition. But being clear that a slow and optimal transition is infinitely worse than a fast but less fair one".⁷ Well, let us try to be clear about what an ecological transition is and what — optimal or suboptimal options are available to us.

What is an ecological transition? I would say it is a socio-economic transformation that, starting from the evidence of ecological overshoot, frees up ecological space so that the dignified lives of the currently exploited, marginalised and humiliated are possible; and so that we can live well with the myriad of living beings with whom we share the common home that is the biosphere of Mother Earth. The – basic – idea of meeting fundamental human needs within planetary boundaries continues to be illuminating.

The mere haphazard addition of wind turbines and photovoltaic panels to our electricity system is not a green transition.

The "cotton test", the test to identify a genuinely green transition, is that it would avoid (or at least significantly mitigate) the horizons of ecocide plus genocide towards which we are heading.

⁴ "Researchers such as Johan Rockström of the Potsdam Institute for Climate Impact Research in Germany argue that economies can grow without making the planet uninhabitable. They point to evidence, especially in the Nordic countries, that economies can continue to grow even if carbon emissions start to fall. This shows that much faster technology adoption, such as renewables, is needed. A parallel research movement, known as 'post-growth' or 'degrowth', argues that the world must abandon the idea that economies must continue growing because growth is harmful. Among its advocates is Kate Raworth, an economist at Oxford University (UK) and author of the 2017 book Doughnut Economics, which has inspired its own global movement (...). Both communities need to do more to talk to each other rather than against each other. It will not be easy, but an appreciation of the same literature could be a starting point. After all, limits inspired both the green growth and post-growth communities, and both were equally influenced by the first planetary limits study (J. Rockström et al. Nature 461, 472-475; 2009), which attempted to define the limits of the biophysical processes that determine the Earth's capacity for self-regulation".

⁵ I replied: or if it cannot be done either way, dear friend - which is, I am afraid, our real situation. But let that aporetic reflection be sketched out and put aside for a better occasion.

⁶ For this see for example Petrocalipsis by Antonio Turiel. (ed. Alfabeto, Madrid 2020), p. 117-123.

⁷ <https://twitter.com/crendueles/status/1625856680612495363>

The mere haphazard addition of wind turbines and photovoltaic panels to our electricity system is not a green transition. And we should start by pointing out that carbon tunnel vision is a kind of reductionism we cannot afford.⁸ But the absence of a systemic approach means that in discussions on green transitions, the ecological-social problem is always reduced to climate change, the energy problem to electricity generation, and the destruction of the web of life to nothing (because we usually ignore it: we prefer to look the other way). The height of reductionism is reached when we try to limit criticism of the current model of hyper-technological renewables deployment to a matter of landscape protection!⁹

What we are facing is not just a climate crisis that can be solved by technological transformations driven by "green capitalism" - if only that were the case; we would have much more room for manoeuvre! But our real situation is much more dire. It is a crisis of civilisation: a systemic and global crisis whose basic authorship lies in a capitalism that generates immense external costs for which it takes no responsibility,¹⁰ and whose self-expanding dynamic aims to grow the mercantile economy indefinitely without taking into account the planetary biophysical limits. As long as this does not change, as long as we are not capable of systemic change, it will not matter how many short-term technological patches we apply.¹¹

A few years ago, in my book Barefoot Ecosocialism, I suggested an image that seems to capture our situation well. In their flight forward, industrial societies resemble a runner in a steeplechase, but with hurdles getting closer and higher (diminishing returns conditioned by the second law of thermodynamics!)... and the runner relies on his magic shoes, which the multinationals in the industry are already about to build for him – they assure him.¹² One hurdle is peak oil, but just beyond it is the even more frightening hurdle of the combined "peak" of all non-renewable forms of energy. Close behind is the depletion of phosphates (with devastating consequences for the dominant model of industrial agriculture; this is an issue of transcendental importance almost entirely absent from public debate). And further on, the depletion of aquifers and the world's fisheries. And nearby, too, are the "peaks" of metals and minerals essential to industrial economies, from neodymium to lithium via tantalum and tellurium. And also the many hurdles linked to the degradation of ecosystems and the Sixth Great Extinction of living species... And the terrible hurdles of global warming,

⁸ "What is carbon tunnelling? It is looking at reality solely through carbon emissions. To consider a product or service (an apple, a jacket or the electricity supply in our home) solely in terms of how many grams of carbon dioxide it has generated by the act of producing it. In the particular case of solar plants, this tunnel vision is leading to very serious dysfunctions in spatial planning. The ecological transition, even if some people are constraining it out of interest or ignorance, goes far beyond the energy transition, and this in turn goes beyond the simple fact of changing the fossil plug for a renewable one. Where is the energy produced? What is the opportunity cost for the territory? Who benefits from it? How is it distributed? What decision-making power do the inhabitants have? Does it boost or correct territorial imbalances? Where is biodiversity, where is agriculture, where are the landscapes? To what extent do cities participate in this effort? Will we condition demand or will we only bet on increasing supply?" Andreu Escrivà, "Un deslumbrante túnel de carbono", El País/ Comunidad Valenciana, 1 October 2022; <https://elpais.com/espana/comunidad-valenciana/2022-10-01/un-deslumbrante-tunel-de-carbono.html>

⁹ Alejandro Tena, "El despliegue de renovables abre un cisma en la lucha climática: ¿cómo acelerar la transición energética y proteger el paisaje?", Público, 17 de diciembre de 2022; <https://www.publico.es/sociedad/despliegue-renovables-abre-cisma-lucha-climatica-acelerar-transicion-energetica-protger-paisaje.html>

¹⁰ As Nate Hagens has pointed out on more than one occasion, "no industry in the world would be profitable if the full cost of all externalised costs were included (for example, a full \$0.38 cost of the harmful impacts of the kWh obtained by burning coal, rather than \$0.04)" (Hagens, "Where are we going? The forty kinds of grey", digital magazine 15-15-15, 13 July 2018; <https://www.15-15-15.org/webzine/2018/07/13/a-donde-vamos-los-cuarenta-tipos-de-gris/>). It is impressive today to reread texts such as those of the institutionalist Karl William Kapp, a German economist who went into exile and worked in the USA, who in 1950 published the first edition of The Social Costs of Private Enterprise (published in the collection CLÁSICOS DEL PENSAMIENTO CRÍTICO of Los Libros de la Catarata, Madrid, 2006). More than seven decades ago, Kapp, in that book, wrote about the ubiquity and enormous magnitude of "externalities", about the socio-ecological destructiveness of capitalism and sustainability: not in the language we are speaking now, but with enormous lucidity about these questions that now seem "new" to many.

¹¹ We are talking about ecological overreach, energy crisis, tearing apart the web of life, loss of biodiversity, extractivism (with intensive exploitation of renewable and non-renewable resources), overfishing, deforestation, destruction of fertile soil, desertification, scarcity of fresh water, global warming, alteration of major biogeochemical cycles (such as those of nitrogen and phosphorus), persistent chemical pollution, food dependence on finite resources, increase of diseases of zoonotic origin, increase of bacterial resistance...

¹² In 2016, Adidas and Nike promised long-distance runners to build "magic shoes" to enable marathon world records under the two-hour barrier (the record stood at 2 hours, 2 minutes and 57 seconds in 2016-17). Nike seems to have gone further down the road with its Vaporfly Elite model (no less!), which would reduce the energy expenditure needed to run by 4%. See C. Arribas: "La polémica está en la mediasuela", El País, 20 de marzo de 2017; http://deportes.elpais.com/deportes/2017/03/19/actualidad/1489949905_491011.html

of course, with its many consequences (including the acidification of the oceans). A horizon which, according to optimistic forecasts, will become apocalyptic in the second half of the 21st century, and according to pessimistic forecasts, before then (in decades, not decades).

Unjustified energy pessimism?

But might it not be true that we have more room for manoeuvre than the pessimists perceive? Throughout 2022, in Spain, an intellectual controversy took place in the form of an attack on the hetero-designated "collapsist" positions that insisted on supposed weaknesses in the analysis of researchers such as Antonio Turiel or Luis González Reyes.¹³ Among these weaknesses would be an unjustified energy pessimism, meaning that ecosocial collapses are less likely and the timescales of the ecosocial crisis longer than the so-called "collapsists" estimate.

It is true, however, that the short-term energy shortages anticipated by peak oil scholars and activists in the early 2000s

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have not occurred on a global scale. The extraction and processing of unconventional hydrocarbons (especially thanks to fracking or hydrofracturing techniques in the US) have bought us some time: to continue the forward flight of the system's core societies for a few more years. The lower ERR (energy rate of return) of these oil-like liquids and gases is diluted in the global energy mix and, according to Juan

Carlos Barba, "can ensure several decades of energy viability for the current economic model".¹⁴

This is also the result suggested by Jorgen Randers' foresight studies in the 2010s.¹⁵

Is this really good news? The least that can be expressed is a feeling of bittersweet unease. For this possible increased viability of fossil capitalism (for a limited time) increases the likelihood of a much worse collapse by degrading the biosphere to the point of an uninhabitable Earth (for beings like us). It increases, in particular, the danger that increased GHG emissions will tip us into runaway climate change and, with this rapid and uncontrolled warming, lead to unspeakable devastation of the biosphere. The collapse would be postponed at the cost of aggravating it.

It almost goes without saying that the war in Ukraine and the "return of militaristic geopolitics" (which had never really gone away) means that fossil fuels will continue to be used until their complete economic exhaustion (since nothing can replace them to move the heavy machinery of armies and societies that want to be superpowers); and that nuclear energy will continue its way, but not because it is advantageous for producing electricity (it is ruinous in that sense), but because of its intimate association with the manufacture of atomic bombs.¹⁶

¹³ See, among other texts, Emilio Santiago Muño, Jaime Vindel y César Rendueles: "Colapsismo. La cancelación ecologista del futuro", *Corriente cálida*, 14 de noviembre de 2022; <https://corrientecalida.com/colapsismo/>

¹⁴ An intervention at the Instituto de Transición Romper el Círculo, Móstoles, 11 de noviembre de 2018.

¹⁵ Jorgen Randers, 2052 – A Global Forecast for the Next Forty Years, Chelsea Green Publishing 2012.

¹⁶ José María Lasalle writes: "Security has crept into the European unconscious through the back door of fear. This changes continental solidarity from a North-South to an East-West axis of consensus. It changes the design from a green economy to an armament and geopolitical one" ('Mackinder, China y el imperio gambero', *El País*, 16 de marzo 2022). Cecilia Carballo writes: "We run the risk of missing the train of the ecological transition because of the security crisis derived from the invasion of Ukraine. What the pandemic put on the agenda and accelerated could now be pushed back and postponed as a consequence of the military and security crisis. Despite decades of talk of energy transition, fossil fuels still account for 80 per cent of primary energy and unfortunately, the deployment of renewables has only served to meet an ever-increasing additional demand". ("Si Europa quiere, puede", *El País*, 22 de marzo de 2022).

Addition rather than replacement

The long phase of energetic decline in which we are already at the beginning will lead us, by hook or crook, to energetically and materially more austere societies.¹⁷ But for the time being, we are still trying to grow by all means.

The fact that the share of fossil fuels in the energy mix has fallen by only 7% in 20 years does not mean that we consume less fossil fuels today than we did then; on the contrary, our current consumption is 40% higher than it was then... We never replaced one source with another but instead added new sources to the old ones.

Richard Heinberg has aptly summed up our situation: renewable energies are not replacing fossil fuel energy but adding to it.¹⁸ As Jean-Baptiste Fressoz has been pointing out for years, and Jaume Franquesa now reiterates, strictly speaking, the energy transition does not exist: we are not replacing sources, but adding new energy capacity from new sources, while global energy

use continues to grow.¹⁹ And despite all the investments and installations of renewable energy, global GHG emissions continue to rise.²⁰

This is largely due to economic growth: while renewable energy supplies have expanded in recent years, global energy use has soared even more, with fossil fuels providing the difference. The more the global economy grows, the more difficult it is for renewable energy additions to turn the tide by replacing fossil fuel energy rather than simply adding to it.

In 2000, global dependence on fossil fuels was around 90%; twenty years later, this has only fallen to 83%. The fact that the share of fossil fuels in the energy mix has fallen by only 7% in 20 years does not mean that we consume less fossil fuels today than we did then; on the contrary, our current consumption is 40% higher than it was then. This shows another characteristic of the history of energy transitions so far: we never replaced one source with another but instead added new sources to the old ones. The history of energy transitions has been a history of additions.²¹

There will be no true energy transition without a horizon of strong decrease (in the use of energy and materials) that our societies are not even considering at the moment. And on the other hand, continuing to add electricity generation with

¹⁷ Two dense and brief books to explain this perspective: Alice J. Friedemann's *Life After Fossil Fuels* and Antonio Turiel's *Petrocalipsis* (ed. Alfabeto, Madrid 2020). See also Megan Seibert and William E. Rees, "Through the Eye of a Needle. An eco-heterodox perspective on the transition to renewables", 15-15-15 magazine, 11 December 2021; <https://www.15-15-15.org/webzine/2021/12/11/por-el-ojo-de-la-aguja-una-perspectiva-eco-heterodoxa-sobre-la-transicion-a-las-energias-renovables/>. As well as issue 156 (monograph on the energy crisis). de *Papeles de Relaciones Ecosociales y Cambio Global*, Madrid, invierno 2021-22.

¹⁸ This leading US researcher shows that high-tech renewables cannot be considered the ultimate solution to our climate and ecosocial crisis (but neither are they a lost cause). He argues that we need to develop a realistic plan for energy descent rather than insisting on delusional dreams of eternal consumer abundance by means other than fossil fuels. After the feverish fossil fuel phase is over, Heinberg points out, we will return to renewable energy, one way or another. It would be preferable to make a partial transition to renewables that would allow us to retain some of the best we have achieved in the last decades of intensive energy use: but this is not a matter of wishful thinking but of realistically assessing possibilities. And unfortunately, such a preservation of socio-technical achievements will be impossible without functioning electricity grids, which are difficult to maintain. Using hydro, solar, wind and geothermal power to feed small, local, low-voltage grids would greatly facilitate the transition from fossil fuels... The author develops this line of reasoning in Richard Heinberg, "A realistic 'energy transition' is to get better at using less of it", *Resilience*, 17 February 2023; <https://www.resilience.org/stories/2023-02-17/a-realistic-energy-transition-is-to-get-better-at-using-less-of-it/>. His conclusion is that "at present, the political insistence on maintaining economic growth is discouraging the search for truth and serious planning about how to live well with fewer resources".

¹⁹ Jean-Baptiste Fressoz, "Pour une histoire désorientée de l'énergie", *Entropia. Revue d'étude théorique et politique de la décroissance* 15 Autumn 2013. In an interview, Franquesa explains: "The concept of energy transition refers us to a history of substitutions, or presumed substitutions, of energy sources. We would have a kind of sequence where we would have gone from one source to another. But if we look at the history of consumption, and I am talking about the global level, but we could also look at the national or continental level, this substitution does not exist. In other words, when oil overtakes coal as the world's leading energy source, coal consumption continues to rise. Right now, what we have is an addition, an addition. Even if we think in terms of renewables, the reduction in fossil fuel consumption in recent years has been minimal and is taking place in the context of decreasing energy consumption worldwide. So what we have is that the new sources that are being used are just adding to what we already had to meet growing demand. So the energy transition does not exist...". Jaume Franquesa, "La transición energética no existe" (interview), *El Salto*, 12 February 2023; <https://www.elsaltodiario.com/energias-renovables/jaume-franquesa-transicion-energetica-no-existe>. The author is presenting the thesis of his book *Molinos y gigantes: la lucha por la dignidad, la soberanía energética y la transición ecológica*. (Errata Naturae, 2023).

²⁰ In 2022, after the economic slowdown induced by the response to covid-19 in 2020, the record high of CO2 emissions from fossil fuels was reached: 37.5 billion tonnes, 48% higher than in 2000 (and rising). Data from <https://www.globalcarbonproject.org/>

²¹ Delfina Godfried y Juan Ignacio Arroyo: *Elefantes en la transición energética*, CEPE Di Tella, octubre de 2022; https://www.utdt.edu/ver_novedad.php?id_novedad=5152&id_item_menu=25201

renewables without touching the other elements of the system will plunge us even more strongly into corporate control over energy (and through this, into control over society as a whole)²² and into the dynamics of colonial/neo-colonial extractivism that are already very powerful today.²³

They call it transition and it is not

Xan López, a proponent of the Green New Deal from the Madrid-based collective *Contra el Diluvio*, suggests that we should call climate hold-upism “the position that denies the need for urgent or aggressive action to mitigate or adapt to the effects of climate change” (a position that, of course, places such hold-upism in the realm of irrationality from the outset, and places the bulk of the environmental movement outside any accusation of hold-upism) and points out that a myriad of concerns, many of them not only legitimate but also easy to understand and support, can converge in hold-upism. I am thinking of concerns about the environmental impact, the deepening of territorial inequality, mistrust of energy companies, the state, and in general, the interference in our localities or regions by outside powers; others may have less appeal but are capable of mobilising a significant number of people, such as the impact on particular business interests, or the simple desire to reject the costs of an energy transition without rejecting its benefits.²⁴

Significantly, among the “legitimate concerns” identified, the most important of the reasons that can lead to the slogan “renewables yes, but not like this” is missing: what is presented as an energy transition (the mere addition of solar photovoltaic modules and windmills) is not an energy transition. That any so-called energy transition that does not aim, first and foremost, in the Global North, towards a good way of life with a sharp decrease in energy and material consumption, is not an ecological transition.

A civilisational trap

We are decades – if not more than a century – behind schedule. “Ethanol was first used in combustion engines in 1826. Rudolf Diesel invented the diesel engine in 1890 to run it on biological fuel. The first practical battery, the Daniell cell, was invented in 1836. The first hydrogen fuel cell was invented in 1839. The energy crisis of the 1970s led to the establishment of the US Department of Energy in 1977, and since then, billions of dollars have funded energy research at universities and National Laboratories. The basic, unsolved problem is that alternative energy sources require fossil fuels for every step of their life cycle.”²⁵

²² See in this respect Álvaro Campos-Celador: “15 tesis para el debate sobre la transición energética”, *eldiario.es*, 4 de febrero de 2023; https://www.eldiario.es/ultima-llamada/15-tesis-debate-transicion-energetica_132_9910433.html

²³ On this point I already argued in my extensive article “El descenso energético (y la necesidad de decrecimiento): implicaciones para las transiciones ecosociales”, web de *Contra el Diluvio*, el 7 de noviembre de 2022; <https://contraeldiluvio.es/el-descenso-energetico-y-la-necesidad-de-decrecimiento-implicaciones-para-las-transiciones-ecosociales-continuacion-del-debate-con-emilio-santiago-muino/>. See also “Manifiesto for an ecosocial energy transition from the peoples of the south”, 9 February 2023; <https://fpif.org/manifiesto-for-an-ecosocial-energy-transition-from-the-peoples-of-the-south/>. Where we read: “What is new at the moment is the North's ‘clean energy transitions’, which have put even more pressure on the global South to cede cobalt and lithium for the production of high-tech batteries, balsa wood for wind turbines, land for large solar panels and new infrastructure for hydrogen mega-projects. This market-based, export-oriented decarbonisation of the rich depends on a new phase of environmental plunder of the Global South that affects the lives of millions of women, men and children, not to mention non-human life. Women, especially those in agrarian societies, are among the most affected. Thus, the Global South has once again become a sacrifice zone, a basket of supposedly inexhaustible resources for the countries of the North...”. There is a Spanish version: “Manifiesto de los pueblos del Sur -por una transición energética justa y popular”; <https://pactoecosocialdelsur.com/manifiesto-de-los-pueblos-del-sur-por-una-transicion-energetica-justa-y-popular-2/>

²⁴ Xan López, “El retardismo climático y un Green New Deal para una época escéptica”, *eldiario.es*, 20 de febrero de 2023; https://www.eldiario.es/opinion/tribuna-abierta/retardismo-climatico-green-new-deal-epoca-esceptica_129_9965268.html. Xan suggests (I don't know if with some kind of slip of the tongue) that what is at stake in hold-upism are identity issues: “The strength of retardism, condensed in the renewable slogan yes, but not like this, is that it can unite these two opposing forces, simplifying an almost impossible debate into a seemingly simple request: ‘yes, the first problem is serious; no, I will not ignore all the issues that define me, even if that means delaying any kind of energy transition’”. The issues that define me: identity politics.

²⁵ Friedemann, *Life After Fossil Fuels*, op. cit., p. 190.

For example, producing polysilicon is a highly electricity-intensive process. German analyst Johannes Bernreuter points out that three-quarters of existing polysilicon, an essential component for constructing photovoltaic cells, comes from Chinese factories... whose electricity is mostly from coal.²⁶ Now that the demand for photovoltaic cells to drive a “green energy transition” is rising sharply, a concomitant explosion in the use of coal is to be expected.²⁷ In fact, in 2022, China authorised two new coal plants every week (106 GW of new projects authorised in one year).²⁸ This is how we deceive ourselves, pretending that the displacement of impacts is an actual reduction in impacts...

The dependence of our high-tech renewables on fossil fuels is a central issue.²⁹ "Investment in renewables is itself very energy intensive. So, in the short term, we're going to need more oil (...) John Hess, head of the US independent oil producer that bears his name, predicts that the projected 16 trillion in green investments will 'turbocharge' oil demand in the near future".³⁰ Or, as Antonio Turiel explains it:

To date, no one has been able to build a hydroelectric dam, a wind turbine or a photovoltaic panel in such a way that the manufacturing, installation, maintenance and eventual decommissioning process does not use fossil fuels. No one has achieved this with renewable energy alone because it is not evident that it can be done. Maybe it could be done in a technical feat, but we would probably use more energy than the system would give back to us, so we would have an energy sink and not an energy source. On the other hand, we do not realise that materials we take for granted, such as cement and steel, are critically dependent on the existence of fossil fuels. No one addresses this problem seriously because it is an insurmountable point. There is absolutely no evidence that these systems can be made without fossil fuels. In fact, some authors say that today's renewable systems, the electric ones, are just extensions of fossil fuels. Obviously they have less carbon footprint, they emit less CO₂ per unit of energy produced, but without fossil CO₂ they cannot be run.³¹

And going a little deeper into the matter: as Óscar Carpintero and Jaime Nieto explain, the construction of these high-tech renewable devices implies being able to reach high temperatures in the industry: between 1480°C and 1980°C for the photovoltaic panels; between 980°C and 1700°C for the cement and steel of the wind turbines.³² On a large scale, this requires the use of high-density fuels such as oil, coal or gas. For the vast majority of, renewable technologies can

²⁶ Matthew Dalton, “Behind the rise of U.S. solar power, a mountain of chinese coal”, *The Wall Street Journal*, 31 de julio de 2021; <https://www.wsj.com/articles/behind-the-rise-of-u-s-solar-power-a-mountain-of-chinese-coal-11627734770>

²⁷ This is being observed in 2021, although more factors than the one mentioned above are involved in this "coal explosion". "Despite all the progress made by renewables and electric mobility, 2021 sees a big rebound in coal and oil use. Largely for this reason, we also see the second-largest annual increase in CO₂ emissions in history," explains Fatih Birol, director general of the International Energy Agency (IEA), in the agency's latest energy outlook report... Víctor Martínez, “La resurrección del carbón provoca el segundo mayor aumento de CO₂ de la historia en plena carrera ecológica”, *El Mundo*, 14 de octubre de 2021; <https://www.elmundo.es/ciencia-y-salud/medio-ambiente/2021/10/14/6166c8ffdddfa8978b45a9.html>

²⁸ Javier Leal, “China crea dos nuevas centrales de carbón por semana”, *The Objective*, 5 de marzo de 2023; <https://theobjective.com/economia/2023-03-05/china-centrales-carbon-eeuu-consumo-verde/>. At the same time, China continues to install a lot of solar and wind capacity: 125 GW by 2022.

²⁹ “As Smil has shown for wind turbines and Stormvan Leeuwen for nuclear power, the production, installation and maintenance of any technological infrastructure remains critically dependent on fossil energy. Of course, it is easy to retort that until the transition has been made, solar panels will have to be produced by burning fossil fuels. But even if 100% of our electricity were renewable, it would not be able to power global transport or cover the production of steel and cement for urban-industrial infrastructure. And given the fact that the cheapening of solar panels in recent years is largely the result of the manufacturing shift to Asia, we must ask ourselves whether European and US efforts to be sustainable should really be based on the global exploitation of cheap labour, scarce resources and destroyed landscapes elsewhere? Alf Hornborg, “Un futuro globalizado con energía solar es completamente irreal, y nuestra economía es la razón”, *El Salto*, 27 de septiembre de 2019; <https://www.elsaltodiario.com/energia/futuro-globalizado-energia-solar-completamente-irreal>. See also Thomas A. Troszak, “The hidden costs of solar photovoltaic power”, NATO ENSEC COE, abril de 2021; <https://enseccoe.org/data/public/uploads/2021/04/nato-ensec-coe-the-hidden-costs-of-solar-photovoltaic-power-thomas-a.troszak.pdf>

³⁰ Reuters Breakingviews: “Volverse verde es de todo menos fácil, diga lo que diga Boris Johnson”, *Cinco Días*, 16 de octubre de 2021; https://cincodias.elpais.com/cincodias/2021/10/15/opinion/1634295943_026846.html

³¹ Antonio Turiel, “La escasez de materiales es una estaca en el corazón de la transición energética”, *CSIC cultura científica*, 29 de noviembre de 2021; <https://www.csic.es/es/actualidad-del-csic/antonio-turiel-la-escasez-de-materiales-es-una-estaca-en-el-corazon-de-la>

³² Datos procedentes de la US Environmental Agency: <https://www.epa.gov/rhc/renewable-industrial-process-heat>

only achieve temperatures for industrial processes in the low range: less than 400°C. “Unfortunately, renewables do not have the autonomy that would make them independent of fossil fuels.”³³

A massive renewable electrification of these processes (apart from the reduction in the Energy Rate of Return it would entail) would also require the replacement of large amounts of industrial equipment and machinery used for these heating processes (furnaces, etc.), which now run largely on coal and fossil fuels. As the US Environment Agency report concludes: “Often, the most valuable role renewable heating technologies can play in industrial applications is to provide 'preheating' before an existing conventional energy source is used.”³⁴

Feasible recipes versus viable technologies

Now, assuming that alternative energy sources require fossil fuels for every step of their life cycle, let us assume for the sake of the argument – it is a huge assumption – that a transition to “100% renewable” (conventionally understood) could be achieved within the strict timeframe imposed by the climate tragedy, two or three decades (in reality, the urgency imposed by the ongoing climate tragedy is greater, and the energy transitions of industrial society have operated with much longer timeframes).³⁵ During this transition period, GHG emissions would hardly decrease or could even increase (due to the aforementioned dependence on fossil fuels and the drive for economic growth that is still being sought). This is what UPM professor Mariano Vázquez Espí (member of the Architecture, Urbanism and Sustainability Research Group) has proposed (only half-jokingly) to call the “Carpenter's paradox” (after the ecological economist Óscar Carpintero, professor at the University of Valladolid), following in the wake of Jevons' paradox (which said that the increased efficiency of steam engines, far from reducing coal consumption, on the whole increased it). Vázquez Espí says, “I will state it in my own way, without the author's permission: in the current situation, building everything necessary for a transition to all renewable energy by 2050 or so, far from reducing GHG emissions, will increase them.”³⁶

The service life of wind turbines and photovoltaic cells is at most two to three decades, so as soon as the first generation of machines has been installed, they would have to be replaced. So as soon as the first generation of machines has been installed, they will have to be replaced, but how can this be done if we do not have high-tech systems for capturing renewable energy that can reproduce themselves? And do not think that we have suddenly encountered this problem: half a century ago, Nicholas Georgescu-Roegen formulated it in these terms.

Viable technologies based on solar radiation or nuclear reactions require, to shape them, an immense amount of materials - in the former case, to concentrate their low density; in the latter, to restrict their high density. Only fossil fuels

³³ Óscar Carpintero y Jaime Nieto, “Reflexiones generales sobre la transición energética: una perspectiva post-crecimiento”, *Gaceta Sindical* 37, octubre de 2021, p. 191. Véase otra versión (digitalizada) en https://www.fuhem.es/papeles_articulo/transicion-energetica-y-escenarios-postcrecimiento/

³⁴ Óscar Carpintero y Jaime Nieto, “Energy transition and post-growth scenarios”, *Resilience*, 6 de octubre de 2022; <https://www.resilience.org/stories/2022-10-06/energy-transition-and-post-growth-scenarios/>

³⁵ Vaclav Smil often insists on this. “Energy transitions go very slowly. When the tractor appeared at the end of the 19th century, horses were still used in the countryside for generations. (...) The transition to fossil fuels began in England in the 18th century, but did not reach Asia until 1950 (and this transition is precisely the cause of global warming). (...) In 1800 we burned wood. And today it still accounts for 10 per cent of our energy. This means that in two centuries, the world did not complete the transition from wood to coal...”. Vaclav Smil, “Vivimos en un sistema irracional y la Tierra no puede soportarlo” (entrevista), *XL Semanal*, 8 de junio de 2021; <https://www.xlsemanal.com/personajes/20210608/cambio-climatico-energias-renovables-transicion-energetica-vaclav-smil.html>

³⁶ [36] Mariano Vázquez Espí, personal communication, 23 November 2021. Information here: <http://habitat.aq.upm.es/gi/mve/>. In the words of Carpintero and Nieto: “Today's civilisation is facing what has been called the energy trap. That is: the deployment of renewable sources and infrastructures requires a massive use of fossil fuels (the faster the transition process is planned, the greater it will be) and, at the same time, this will mean, during the first years, higher GHG emissions that will aggravate the problem of climate change in a scenario where time is also scarce and where, in addition, with useful lives of 20-30 years, in three decades we would be doomed to renewal processes of a similar energy intensity (and for which it would be difficult to find available fossil resources)”. Óscar Carpintero and Jaime Nieto, “Reflexiones generales sobre la transición energética: una perspectiva post-crecimiento”, op. cit., p. 191.

can be used with smaller facilities [because of their high energy density] and in some cases, virtually without any facilities. (...) The matter is as crucial [and restrictive] a technological factor as energy.³⁷

As Ernest Garcia has recalled on numerous occasions,³⁸ Nicholas Georgescu-Roegen formulated a distinction between feasible recipes (things we know how to do) and viable technologies (sets of feasible recipes self-sustained by a basic feeding process). One could also speak of self-reproducing socio-technical systems or durable technical matrices. Viable technologies must be self-reproducing.

Georgescu-Roegen said that there had been only two viable technologies throughout human history: fire control - pre-industrial societies, Prometheus I - and the steam engine - industrial societies, Prometheus II. Now that the fossil energy model is coming to an end, what will be the third viable technology - if ever (Prometheus III)?³⁹

As Art Berman explains, "a 100% renewable economy is a correct concept only if we are willing to accept a lower standard of living and a much smaller population than today. Humans have never moved from a higher-density energy

It does not seem easy to mobilise society in pursuit of climate and ecological goals that go hand in hand with some impoverishment.

source to a lower-density one. A renewable energy world would have a smaller and less productive economy due to the lower energy density of its primary sources. I am an advocate of solar and wind energy, and I take climate change very seriously.

However, it is essential that people know the truth: the world will be a much poorer place when fossil energy is abandoned.⁴⁰

If we fail to grasp the deep dependence of industrial societies on fossil fuels, we underestimate the difficulties of any

The keyword for any ecological transition is less (degrowth), but we insist on using more.

serious post-capitalist ecosocial transition. And if we open our eyes to the deep fossilist character of capitalism, a phenomenal strategic difficulty appears: decarbonising means impoverishing

ourselves,⁴¹ and it does not seem easy to mobilise society in pursuit of climate and ecological goals that go hand in hand with some impoverishment. (And then, of course, we can and should nuance what are poverty and wealth, scarcity and abundance, and how good lives for everyone are thinkable with much less energy and materials).⁴²

Letting go

The keyword for any ecological transition is less (degrowth), but we insist on using more. "If there are no photovoltaic panels", we are told, "there will be coal, gas and oil". What is excluded from the debate in advance is the only thing that would really get us off the path of ecocide plus genocide: using (much) less energy... Merely adding (electricity

³⁷ Nicholas Georgescu-Roegen, *Ensayos bioeconómicos* (ed. de Óscar Carpintero), Los Libros de la Catarata, Madrid 2007, p. 91.

³⁸ Ernest Garcia, "Del pico del petróleo a las visiones de una sociedad post-fosilista" en Joaquim Sempere y Enric Tello (eds.), *El final de la era del petróleo barato*, Icaria, Barcelona 2008, p. 28.

³⁹ Nicholas Georgescu-Roegen, *Ensayos bioeconómicos* (ed. de Óscar Carpintero), Los Libros de la Catarata, Madrid 2007, p. 90-94.

⁴⁰ Art Berman, "¿Por qué el cohete de las renovables no ha podido despegar?", revista 15/15/15, 3 de agosto de 2020; <https://www.15-15-15.org/webzine/2020/08/03/por-que-el-cohete-de-las-renovables-no-ha-podido-despegar/>. To better understand all this (and a few other things): Nate Hagens, "Economics for the future –beyond the Superorganism", *Ecological Economics*, 20 de noviembre de 2019; <https://www.sciencedirect.com/science/article/pii/S0921800919310067>. There is a translation into Spanish: "Una economía para el futuro: más allá del superorganismo", *PAPELES de relaciones ecosociales y cambio global* 151, 2020.

⁴¹ *Impoverishing* ourselves means slowing down, doing less, using less energy and materials, travelling and commuting less, producing and consuming fewer goods, and substituting private forms of activity with communal and collective ones: it does not necessarily mean living worse. But it does mean living differently - radically. The steak/plate of peas debate clearly puts this issue on the table.

⁴² See for example Jefim Vogel et al, "Socio-economic conditions for satisfying human needs at low energy use: An international analysis of social provisioning", *Global Environmental Change* vol. 69, julio de 2021; <https://www.sciencedirect.com/science/article/pii/S0959378021000662>

generation capacity with renewables) is not making any transition. It is also necessary to let go, detach, and know how to let go. This is almost always very difficult for us in our personal lives and also in our collective lives.

Another way of stating the keyword for a real ecological transition, if we are talking in the Global North, would be renunciation (or asceticism, if you prefer it in Greek). Renunciation of segments of human domination: the appropriation of ecological space; the colonial exploitation that has become neocolonial; the patriarchal abuse of women; the entertainment that robs us of our conscience and attention; the comfort that covers up the structures of crime.

I know that renunciation is not a popular idea. But what will happen when, despite the penetration of wind and photovoltaics in some countries' electricity systems, GHG emissions continue to rise on a planetary scale – as they are doing now? What will happen when more and more countries in the periphery collapse? What will happen if we enter the runaway climate change phase and almost everything is written off?

As one researcher and populariser pointed out on Twitter, high-tech renewables are admirable devices that cannot sustain this civilisational model or help with the ecological overshoot. *"The main focus should be on how we reduce and simplify our civilisation to live within planetary ecological limits while meeting the basic needs of the entire population. This and no other is the great challenge of the decade. Within this real ecological transition (a sharp reduction in production and consumption), renewables have a role to play..."*⁴³

Let us conclude. By trying to maintain our levels of energy overconsumption in a world that is on a path of energy decline, we will throw more and more external costs on the peripheral peoples and countries (in a neo-colonially structured world system) and nature (with ever larger sacrifice zones, and consummating an ecocide that is also a

⁴³ <https://twitter.com/limites1972/status/1622964309050421257>

In another Twitter thread, the same author stated: "To understand the scale and implications of the civilisational crisis we are in, we need a broad, systemic approach that allows us to understand how different parts of the system relate to each other. Today, technical over-specialisation is encouraged (and professionally rewarded). The brightest minds tend to know a great deal about a particular subject but little or nothing about those areas that are not their speciality. (...) Many of the proposed analyses and possible 'solutions' to the eco-social crisis are flawed because they are biased by this super-specialist tunnel vision and simply do not take into account the systemic and global dimension of the problem. Moreover, these failed 'solutions' are often the consequence of a faulty diagnosis that is limited to one part of the system (e.g. 'the climate crisis' or 'electricity generation'), or to the immediate future (e.g. this year or this winter), or the local (e.g. Spain). And so it happens, for example, that the pro-renewable BAU reduces the eco-social crisis to the climate crisis or the energy issue to the electricity issue... They do not have a systemic view and therefore do not see that climate change and the increase in CO2 emissions are just one of the many symptoms of ecological overshoot and the Great Acceleration caused by exponential economic growth. They do not have a systemic view and therefore do not consider the physical limits to using minerals and rare earths to manage the energy transition. They do not consider that modern mining is totally dependent on fossil fuels and diesel. They do not take into account that the progressive - non-linear - decline in the grade of the ore deposits needed for this energy transition will increase the reliance on diesel and reduce recoverable reserves over time. They do not take into account the peak production of fossil fuels (oil, gas and coal) and their declining net energy yield and impact on economic and industrial activity. Nor their impact on geopolitics. Nor their impact on a supply chain that is highly dependent on cheap shipping and cooperation between states. Nor do they consider their impact on finance and the availability of finance (i.e. energy and resources) to undertake all these mammoth projects on a large scale. And they do not take into account the physical limits of science, its diminishing returns, and how it will find it increasingly difficult - for lack of resources - to provide the technologies (fusion, carbon capture, etc.) that renewable energy systems require and that do not exist TODAY. And they do not consider how less developed countries WILL NOT stand by while we plunder their resources for our energy transition, while they have to deal with toxic waste, environmental impacts and other externalities. And they do not take into account how states and powers (India, Brazil, Russia, China...) will at some point have to prioritise the welfare of their populations and some degree of internal social stability, and how this will affect our consumption of their resources and the products they produce for the US. And they do not consider how all the environmental crises (climate change, biodiversity loss, chemical pollution...) resulting from ecological overshoot will impact people's daily lives and the increasing energy and resource effort required to mitigate them. And they do not take into account the time horizon and the economic (energy) effort and financing required to completely replace an industrial and intercontinental transport system developed on the basis of (and around) coal, oil and diesel. And they do not take into account, or care, that after the first wave of macro-renewables, on which we will spend almost all the earth's mineral capital, these will have to be replaced in 20 or 30 years. And what will we do then? Where are we going to get the minerals for the second wave? Nobody takes into account that minerals are integrated (diluted) in circuits and alloys and that it will not be energetically (economically) viable to recycle them. And that the renewables being installed today are not designed to be recycled. None of this is taken into account by these super-specialists when they project into the future; they simply consider the 'normality' of the last 75 years - i.e. cheap energy, an abundance of resources, high scientific output, international cooperation, global supply chains, outsourcing of waste and resource extraction to poor countries, access to finance.... - All of these, we say, simply assume that they will be there for as long as it takes to make this transition. For this reason, and for all that we are leaving behind (food production, plastics production?), our political, economic and scientific leaders should have a systemic perspective with a broad global and temporal vision. Today, the best approach to understanding the world is still the system dynamics approach used more than fifty years ago by MIT scientists when they published *The Limits to Growth*". <https://twitter.com/limites1972/status/1617614173147652096>

crime against ourselves). There will be a relevant change in electricity generation in countries like Spain (it is underway), and they will call it an "ecological transition". But it will be a play on words because, unfortunately, it will not pass the test of practice: avoiding the ecocide plus genocide towards which we are moving. And we will be self-deluded (we are at it) like the drunk looking for the keys under the lamppost.⁴⁴

The critical question of the ecological transition is not how many MW of wind and solar PV we will be able to plug into the grid but: what unprecedented levels of love, justice and rationality we will be able to deploy. And so far, we are not answering this question well...

*The initial version of this text was prepared for a conference at the Ateneo Guipuzcoano in Donostia/San Sebastián on 27 February 2023.

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⁴⁴ This drunkard is looking for his house key (which he lost a while ago) under a street lamp, although he has dropped it in a dark place twenty metres further on because there is more light under the lamp. This little story or joke comes from Carl Améry (in one of the texts of *Bileams Esel*, List Verlag, München 1991).

❖ **About Jus Semper:** The Jus Semper Global Alliance aims to contribute to achieving a sustainable ethos of social justice in the world, where all communities live in truly democratic environments that provide full enjoyment of human rights and sustainable living standards in accordance with human dignity. To accomplish this, it contributes to the liberalisation of the democratic institutions of society that have been captured by the owners of the market. With that purpose, it is devoted to research and analysis to provoke the awareness and critical thinking to generate ideas for a transformative vision to materialise the truly democratic and sustainable paradigm of People and Planet and NOT of the market.

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