Fossil fuel consumption since 1950: the other side of the extractivist coin

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ABSTRACT

Extractivism is one side of the coin; relentlessly rising consumption of oil, gas and coal is the other side. The level of fossil fuel consumption globally is now roughly five times higher than in the 1950s, and one-and-half times higher than in the 1980s, when the science of global warming was confirmed and governments accepted the need to act on it. This is a central feature of the "great acceleration" of human impacts on the natural world.

What has driven consumption growth? The paper challenges false narratives that isolate consumption from production, and focus one-sidedly on consumption by individuals. It argues that capital accumulation, i.e. the drive of power and wealth that dominates society to renew its dominance, drives economic expansion, and that in turn underpins consumption growth. The paper argues for an approach that analyses consumption by and through technological systems (electricity networks, industrial processes, urban infrastructure, etc), and the social and economic systems in which they are embedded (capitalism, exploitative relations between rich and poor countries, etc).

The paper puts into context the failure of international political action to avert dangerous global warming (the process that started with the Rio summit in 1992), which amounts to a historical political failure of states.

Introduction

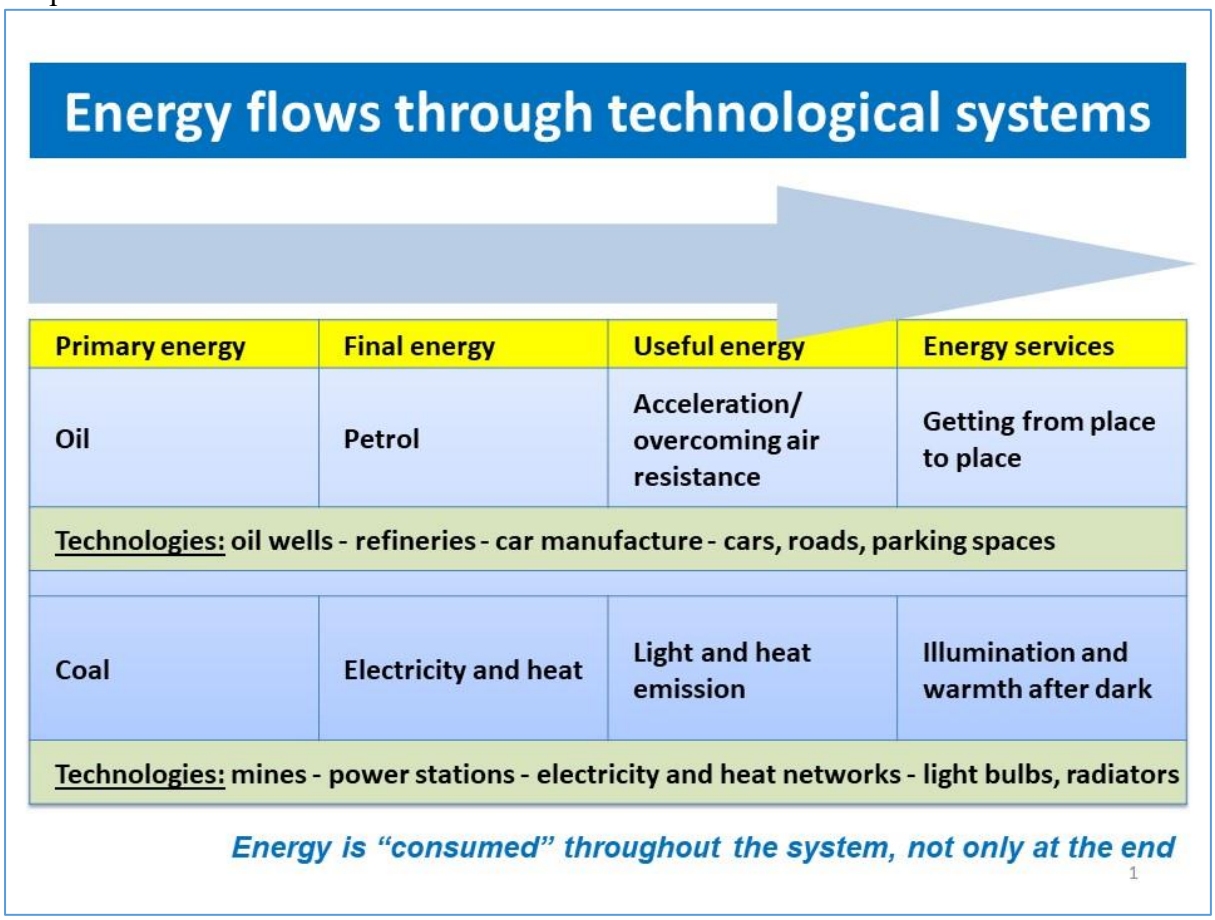
Extractivism has been defined as "a mechanism of colonial and neocolonial plunder and appropriation", that was "forged in the exploitation of the raw materials essential for the industrial development and prosperity of the global North" (Acosta, 2013.) Research has shown how this mechanism sucks natural resources from countries in the global South, to feed a great economic machine based in the global North. I suggest that we can understand some aspects of the sucking mechanism by thinking in particular ways about the great economic machine based in the North, and its development in recent history.

The focus of the paper is on fossil fuels (oil, gas and coal) rather than other natural resources, and on the way that the sucking mechanism, and the great economic machine, have worked since the mid twentieth century. The paper is about research approaches. It does not present new factual information about subjects that are well known; rather, it offers three suggestions, arising from work on a recently completed book (Pirani 2018), about how to interpret these processes. 1. To consider fossil fuel consumption by and through technological systems, and the ways these are embedded in social and economic systems. 2. To consider that ways of measuring actual quantities of fossil fuels are highly contested: statistics are a site of struggle. 3. To consider what the failure to reverse the growth of fossil fuel consumption tells us about political processes.

Technology and society

Out of the total quantity of fossil fuels consumed each year, a small proportion are consumed directly by households, e.g. coal burned by people at home for heating. But most are consumed by, and through, large technological systems, e.g. transport systems, industrial systems, electricity networks and urban infrastructure systems. (See graphic 1.) Oil and gas consumption is concentrated through technological systems to an even greater extent than coal consumption. And oil is the extractivist fuel par excellence: about 60% of the global total is traded across national borders before being used. So is about 30% of gas – but only about 14% of coal.

Graphic 1



The expansion of extractivism during the twentieth century has been driven by the rapid expansion of demand for fossil fuels in the global North. This demand has in turn been driven by the development of technological systems. The ways they have developed have not been predetermined or inevitable, but have been shaped by social relations under capitalism. The technological systems of the nineteenth century industrial revolution were fuelled first by water and wind, and then by coal, mostly domestically produced (mechanised textile production); or they were fuelled from the start by coal (the steam engine and iron and steel making). The technological systems of the second industrial revolution of the late nineteenth and early twentieth century were, typically, either fuelled by coal initially, but then increasingly by oil and gas (electricity generation), or were fuelled by oil from the start (the internal combustion engine and transport systems based on it, and chemical fertilisers for agriculture). The demand for this oil and gas gave impetus to extractivism.

The point about the relationship of technological, social and economic systems may be illustrated with the examples of transport, and electricity generation, which together today account for more than half of all fossil fuel consumption.

Transport. The manufacture of cars with internal combustion engines, predominantly in the USA, started before the first world war. It was given impetus by the installation of the first automated production lines in Detroit in 1910-14, and by the war itself, during which motor transport was developed for military purposes. In the inter-war period, in the USA, car transport became a mass phenomenon. The industry was consolidated, into three huge corporations and a few slightly smaller ones; it pioneered sales techniques such as planned obsolescence, and political lobbying techniques that were used to support road infrastructure construction and to undermine alternative forms of transport (specifically, public transit in cities and railways between them). The latter campaign reached its apex after the second world war, when the US state's direct cash support for highway construction was more than four times as great as the entire Marshall Plan (US aid to post-war reconstruction in Europe). From the 1950s, the US system of car-based transport was copied in Europe, and from the 1980s efforts were made to export it to parts of the global south.

Car-based cities, where historically most car journeys have been made, were not inevitable, efficient, or the natural outcome of technological development: they developed in line with the profit-centred expansion of American capitalism. And were then copied elsewhere. Cars and urban infrastructure were important causes of oil consumption growth during the post-war boom.

Electricity production and distribution. This technology consumes more fossil fuels than any other: globally, in the mid twentieth century it used about one-tenth of the supply; now it uses more than one third. Electricity networks have become regarded as basic infrastructure for modern industrial society, providing energy in a flexible form for light, heat, motive power and to operate increasingly sophisticated machines and appliances in industry and people's homes. By the 1920s, many European governments had ensured electricity provision to almost all urban residents and most people in the countryside. But the USA, which was so far ahead of other rich countries in its development of mass car ownership, was way behind them on electricity. Private companies had electrified towns before the first world war, but most of the countryside was electrified only under the 1930s "new deal". This reflected a contrast that endured throughout the history of electricity between the (socialist or welfare-state-ist) view of it as a public service, and the view of it as a business.

Electricity became central to development ideologies, from the Soviet Union in the 1920s to much of the global south after the second world war. Here, too, public service ideals clashed with profiteering principles, a tension that came to a head in the 1990s, with the international financial institutions seeking to introduce, or impose, neoliberal principles of market reform into electricity sectors in the global south where electrification was far from complete. The inequalities always reflected in electricity provision have since then grown significantly wider. Electricity is today not available to more than a billion people, is intermittent and partial for a billion and a half, and in permanently short supply to hundreds of millions more.

Against the background of these social and economic dynamics, electricity technologies have developed in a one-sided way. Centralised systems, ideal for the fossil fuel and nuclear power stations that were dominant after the second world war, have persisted, decades after technologies have become available to hasten decentralised networks and more generation from renewable sources. Corporate and state control blocks and frustrates technologies that can enhance social justice and reduce ecological damage.

Conclusion. The point is not to propose techno-fixes, but to underline that the history of fossil fuel use is the history of technological systems that have developed in particular directions because of the social and economic conditions. To these examples, electricity networks and cars, one could add a range of twentieth-century technologies that spread across the global North, especially, in the post-war period: military equipment and aviation, petrochemicals and plastics, chemical fertilisers for agriculture, household electrical appliances, and so on. All of these are implicit in each one of the billions of drops of oil that have poisoned the water in the Niger Delta, and other social and ecological impacts of extractivism.

Ways of measuring

To understand the history of fossil fuel consumption, and to consider a future transition away from fossil fuels, quantities matter. It matters that, in 2011, for example, Nigeria's crude oil exports were 123.9 million tonnes of oil equivalent (mtoe), its crude oil supply for its own economy was 6 mtoe, and that the main fuel for that economy was 102.8 mtoe of renewables, more than 99% of which were biofuels, mostly collected by women and children in rural families, walking many kilometres per day. These quantities reflect modern (economic) imperialism: oil is exported for the commodified energy economy, while most Nigerians live outside that economy. It matters that, in another recent year, the US Department of Defense consumed 13.4 mtoe of commercial energy products, more than Nigeria's total. Even that figure excludes some US military activities. (IEA, 2011; Karbuz 2007.) It matters that most countries give no information at all to international agencies about military consumption of fossil fuels. It matters that, thanks to the expansion of the (extractivist) oil industry, global plastics production has grown from 6 million tonnes (mt) in 1960 to 311 mt in 2014. (Smil 2014, 40-42 and 62-63.)

Systematic statistical measurement of the amounts of fossil fuels consumed, and attempts to measure the ecological impacts of fuel use, essentially date from the 1970s. In the state and the academic mainstream in rich countries, the oil price shocks produced the realisation that fossil fuels would not always be cheap or limitless. The UN had compiled statistics before then, but now the International Energy Agency began to compile sectoral breakdowns of fuel consumption.

At the same time, the growth of environmentalism inspired discussions in academia about how the ecological impact of fuel use, and other types of economic activity, could be measured. In 1970, Paul Ehrlich, the biologist and neo-malthusian, set out his IPAT formula (impact = population x affluence x technology) for measuring such impacts, in a polemic with Barry Commoner, the socialist and plant physiologist. Commoner's critique, that the formula over-emphasised the role of population and under-emphasised the role of technology, foreshadowed polemics on these issues ever since. In the discipline of structural human ecology, researchers concerned with quantitative measurements of ecological impacts developed a detailed critique of the IPAT formula. Nevertheless, the Kaya identity, an equation based on IPAT, became accepted as the primary means of measuring impacts of fossil fuel consumption in research that has fed into the Intergovernmental Panel on Climate Change (IPCC) reports. (Ehrlich et al 1972; Pirani 2018, 201-205.)

The problem was, and is, one of ideology. Consumption of fossil fuels is conceived among political and corporate elites, in the media, in international institutions and sections of academia, as being essentially an act by individual humans. This is an abstraction that normalises, and excludes from critique, the technological systems on which those individual humans are dependent, and the social and economic control of those systems. In the

international climate negotiations since the Rio summit in 1992, governments from the global South have used consumption-per-head statistics to emphasise the gulf between their citizens' consumption and that of citizens in the North (e.g. in 2011 per capita energy consumption in the USA was 34 times the level in Bangladesh). For this narrow purpose of indicating the difference between nations, these comparisons are of course useful. But these rows of figures do not capture differences within nations; they do not capture the realities of unequal economic relationships; they do not even capture the fact that most of the energy attributed to individuals is consumed indirectly, i.e. in infrastructure, industrial processes and other uses with which they have no personal connection. (World Bank 2017; Pirani 2018, 47-52.)

Researchers have addressed some of these shortcomings e.g. with consumption-based accounting, that tries to attribute the fuel use involved in producing exported products (e.g. steel bars made in China and exported to the USA) to the consuming nation rather than the producing nation. (Davis and Caldeira, 2010.) But like all statistics, these numbers show some parts of the picture and not others. They capture the fuel consumption in the steel mill and transportation, but not, for example, the fuel consumption implicit in China's unprecedented urbanisation in recent years. Nor do they capture the waste implicit in steelmaking, the waste that might be expected if the steel is used e.g. in the building industry when it reaches the USA. And so on. It is not that academics working in engineering disciplines have not, since the 1970s, devised and improved ways of measuring the flows of fossil-fuel-produced energy through systems (i.e. net energy analysis, energy flow analysis etc). They have. And methods have also been developed to distinguish discriminatory and non-discriminatory consumption. (Spreng 1988; Goldblatt 2005.) But this research is downplayed by dominant ideologies.

Conclusion. (Or at least, one conclusion.) Researchers need to combat these ideological biases and work to overcome the divisions between disciplines, e.g. bringing together ecologists' and engineers' work with that of historians, sociologists, etc.

Transition

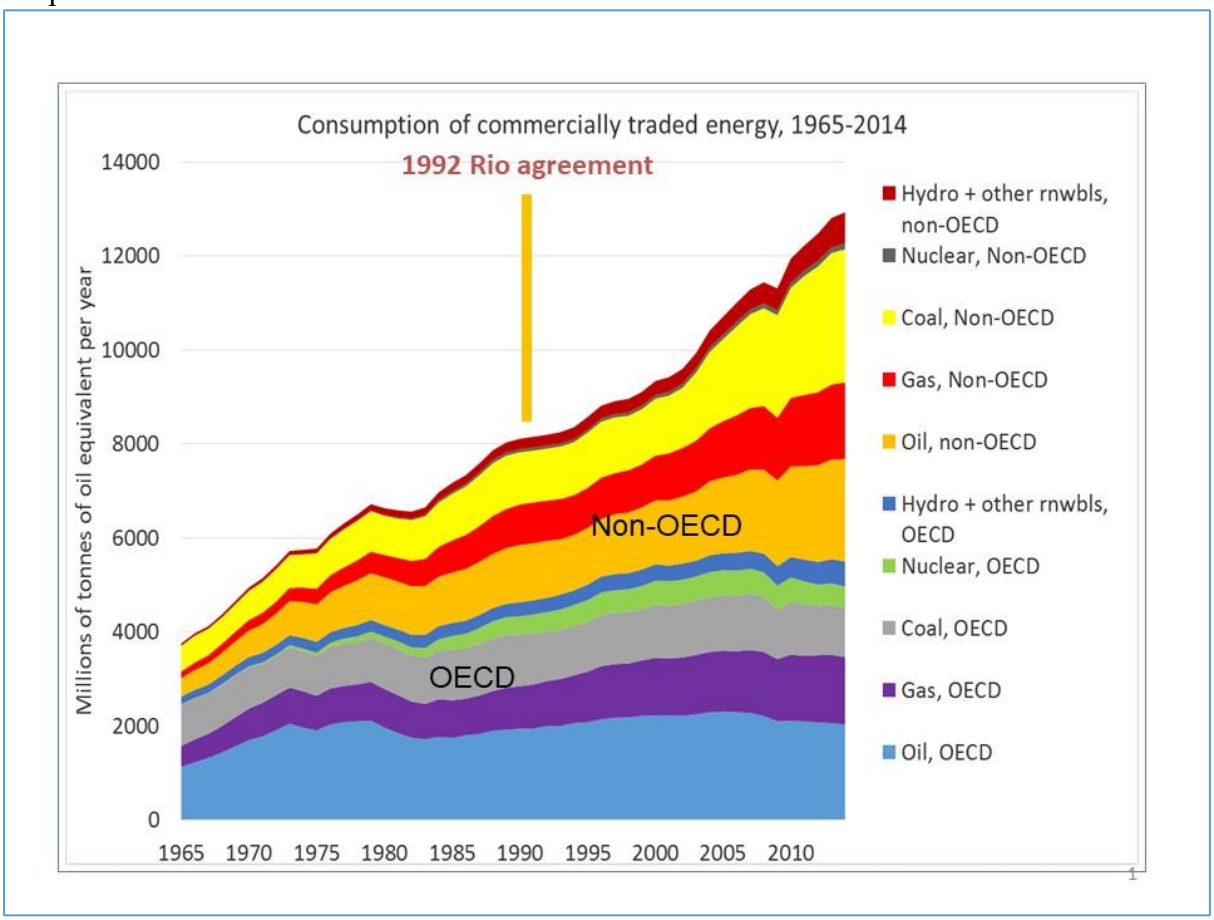
The transition away from fossil fuels, as a political question, was materially changed by the discovery of the global warming effect in the 1980s, a significant achievement of "big science" that mobilised late-20th-century technologies (paleoclimatology, oceanography, etc) under state control.

The point is *not* that the broader rift that has opened up between humanity and nature, under capitalism, was unknown beforehand. Fossil fuels have played a central part in the way that capital exploited labour since the industrial revolution of the 18th century, and in the imperialist expansion of capitalism. There is a long history of the price paid by labour (in terms of mining deaths and subordination to the technological systems controlled by capital), the cost to human health in urban development (air pollution), and the hugely damaging ecological impacts. All this was part of that rift.

Christophe Bonneuil and Jean-Baptiste Fressoz have argued against "grand narratives of awakening, revelation or arousal of consciousness" in the 1980s about the damage done by society-nature interactions. (Bonneuil and Fressoz 2016, 72-79.) Nevertheless, the discovery of global warming made precise the character of a particular danger – which is global, rather than local – that had hitherto been unclear. By the end of the 1980s, political leaders accepted the need for a coordinated international response. The result was the Rio convention of 1992 and all the international climate negotiations that have followed. Since the convention was

signed, fossil fuel consumption growth and greenhouse gas emissions have accelerated; the negotiations have failed on their own and any other meaningful terms. (See graphic 2.)

Graphic 2



I suggest that the failure must not be normalised, and that the causes of this catastrophic collective failure of the world's leading states poses research questions that need to be answered. Here are some points:

First, the ideological attachment to market mechanisms for reducing greenhouse gas emissions (codified in the Kyoto Protocol of 1997), and to "economic growth", has guided the whole climate talks process. This ideology was the other side of the coin of the USA's opposition to binding emissions reduction targets. In 1997, prior to Kyoto, climate-science-denying Republicans and market-oriented Democrats united in the US Senate to re-confirm the opposition to binding targets by 96 to zero.

Second, while climate science denial remains ideologically very strong, it was not dominant in the rich-country political elites who oversaw the failure of the Rio process. The US Democrats and most European governments acknowledged the results of climate science and the dangers of global warming. By the late 1990s most (although not all) of the international oil companies had stopped funding climate science denial, and switched their efforts to "greenwashing". The advocates of voluntary targets, market mechanisms and "green growth" have done much more to ensure the continued expansion of fossil fuel consumption than climate science deniers.

Third, a function of the Rio process was to create a discourse, legitimising the course of action taken. Global warming would be dealt with by market instruments, calibrated on the

basis of climate science and supervised by the intergovernmental agreements; society would be represented at these negotiations by the interaction of governments and NGOs. Ideas that global warming required the transformation of the economy or of society were marginalised.

Conclusion. Taking these issues out of the ideological straitjacket imposed by the Rio process is a starting-point for countering global warming and moving away from fossil fuels. It is necessary to find ways to make these issues for society as a whole, and to make society as a whole the actor that deals with them. While that is obviously a very general-sounding statement, it is better to acknowledge this than to get drawn into "political" arguments within the Rio framework that avoid the real problems.

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