The global drivers of fossil fuel consumption: is the IPCC looking at them the right way?

By Simon Pirani (simonpirani@gmail.com). Presentation for seminar on "How fossil fuel consumption shapes the lives communities lead", Thursday 1 October.

Introduction

I am working on a research project about the global history of fossil fuel consumption since 1950. The presentation is part of that. The basic premises are:

■ The future of fossil fuel consumption will, hopefully, be decided upon more and more by the actions of communities and social movements, and less and less by governments and inter-governmental negotiations.

■ Such a view is justified by the striking failure over the last 25 years of international political negotiations aimed at reducing greenhouse gas emissions. The Paris talks in December will compound this failure, as all the main participants have acknowledged that there will be no binding targets for emissions reductions.

■ The history of government efforts to regulate fossil fuel consumption is also largely a history of failure. Think about Volkswagen.

■ To understand this failure, to understand what is driving this juggernaut that governments seem unable to stop, we need an all sided view of the drivers of fossil fuel consumption.

The presentation will (1) explain briefly what I mean by an all-sided view and (2) raise questions about the approach taken to fossil fuel consumption by the Intergovernmental Panel on Climate Change (IPCC) and researchers on whose work its reports are based.

What an all-rounded view means

(This is a very quick overview, based on a presentation I did at a conference in the USA that I circulated before, and copies of which are available.)

It is generally taken as a starting point, including by the IPCC, that economic growth and population growth are the main drivers of fossil fuel consumption and of GHG emissions.[1] My research on the history of consumption seeks to question that starting point, and to develop an approach that brings together a wider range of issues. I will talk about five of the most important.

1. Urbanisation and industrialisation.

Generally speaking, rich countries that reached a high level of urbanisation and industrialisation in the mid twentieth century have a high level of fossil fuel consumption, due to factors including industrial activity and relatively high living standards. The sharp

[1] IPCC, Climate Change 2014. Mitigation of Climate Change (Working Group 3 contribution to the Fifth Assessment Report), p. 47.

increases in consumption levels in the last 20 years are associated with urbanisation and industrialisation in other countries.

In China and India, the increases in consumption are concentrated in expanding cities and expanding industry, while consumption levels in the countryside remain extremely low. So in China, while consumption is high on the urbanised east coast, especially in industry, in the countryside there are 450 million people who cook without modern fuels, mostly using primitive coal stoves. On a world scale, the 40%+ of the population that lives in the countryside in developing countries accounts for a negligible proportion of fossil fuel consumption.

A focus on industrialisation also highlights that production, transportation and distribution of manufactured goods is a key driver of fossil fuel consumption. Analytically, production and consumption can not so easily be separated.

2. Big systems, especially electricity systems

The history of fossil fuel consumption is largely the history of big systems – transport systems, industrial systems and electricity systems.

There is a great deal of research on infrastructure lock-in, i.e. the idea that once these systems are in place, a set of economic and social relations, as well as technological relations, take shape around them, making it all the more difficult to shift to another system.

Some points about electricity. Urbanisation and industrialisation has not only increased energy consumption, it has also tended to increase the proportion of energy delivered in the form of electricity. In the past ten years, most of the increase in fossil fuel consumption has been coal consumption, and much of that coal went into power stations in China and other developing countries.

Of course, electricity has huge advantages over other forms of energy because of its flexibility. But it also takes a great deal of energy to produce. On a world scale, 46.5% of the total primary energy supply goes into power stations, heat plants, blast furnaces etc, to be turned into another type of energy. Of this 46.5%, 32.3% is used in the process and 14.2% is delivered as electricity and heat to final users.

So, quite apart from finding ways of generating electricity from non-fossil-fuel sources, mountains of fossil fuels can be saved (a) by engineering improvements that can make power stations more efficient, (b) by finding ways to restrict electricity to those uses for which it is really advantageous, and (c) by decentralised systems that reduce losses in transport and distribution. This was a key argument made by Amory Lovins, a pioneer of energy conservation in the 1970s, and was taken very seriously by the political establishment. One of my questions is: why did the political establishment lose interest in this?

The way that industrial processes use fossil fuels is also a key part of the story. Process analysis shows that industrial consumption of fossil fuels has huge inefficiencies, often for economic reasons. Engineers at Cambridge university who research potential energy efficiency savings [e.g. in production of steel, aluminium and products made from them] and

have concluded that "we have engineering options to reduce current energy demand by 73%".[2]

3. Excessive consumption in rich countries, and deprivation elsewhere

I think everyone here is aware of the vast gap between levels of consumption in rich countries and in poor countries. Two points:

a. These should be treated as two sides of the same coin. The economic system in which inequalities persist and grow is bound to reproduce these inequalities in the sphere of energy as well as everywhere else.

b. Individual consumption, whether in rich countries where it is highest, or elsewhere, goes on through social and economic systems. Take an example of obviously egregious consumption, by car drivers in the USA. However privileged they may be compared to billions of people with no cars and no electricity, they are also trapped in a system. There are millions of homes in the USA from which the only way to the shops, or the children's school, or work, is to drive. My conclusion is that much writing about the history of individual consumption as a social phenomenon suffers from a lack of connection with the economic and technological contexts.

4. The marginalisation of conservation initiatives and alternative technologies.

Throughout the history of attempts to move away from fossil fuels, markets have almost always proved stronger than government regulation. So progress made by the solar industry in the late 1970s was wiped out in the 1980s by low oil prices.

5. The history of climate policy and the international negotiations.

The failure of the international negotiations, the fact that fossil fuel consumption has risen so rapidly since the late 1980s when it was acknowledged as the key driver of climate change, it itself a central part of this history, an extraordinary phenomenon that needs explaining.

Conclusion to this part:

The challenge is to work out an approach that integrates these different aspects of the problem. A unifying theme is that fossil fuels are consumed by people not so much individually as via sets of social, economic, political and technological relationships.

The IPCC's methodology

My question about methodology concerns only one part of the IPCC's work: how greenhouse gas emissions, and such drivers of emissions as fossil fuel consumption, are counted. Two things to think about (see handout):

(a). Emissions per capita (typically in a particular country), a figure often used by researchers.

[2] Jonathan Cullen, Julian Allwood and Edward Borgstein, "Reducing Energy Demand: what are the practical limits?", *Environmental Science and Technology* 2011 (45), pp. 1711-1718.

(b). The Kaya identity, an analytical tool named after Yoichi Kaya, an energy economist at Tokyo university who worked it out.

emissions = population x (GDP/pop'n) x (energy/GDP) x (emissions/energy)

Four problems.

1. The Kaya identity has a heavy ideological underpinning

The Kaya identity is based on the IPAT formula (impact = population x affluence x technology), which assumes *a priori* that population is a key driver of resource depletion. IPAT is highly ideological. It was developed by Paul Ehrlich, the standard-bearer of neo-Malthusianism and population control in the 1970s, during a polemic with the socialist environmentalist Barry Commoner.

Commoner argued that Ehrlich was stuffing all the really important issues – including those I have referred to as social, economic and technological systems – under the heading "technology", and that the emphasis Ehrlich placed on population was not proven and not justified. I think these arguments need to be developed for the present day.

Today, crude arguments for population control are rarely heard at the international political level. But when discussion of emissions-per-capita gets into the media and wider forums, it is often used to turn attention towards personal consumption, and away from the social, economic and political systems through which the vast bulk of fossil fuels are consumed.

2. Emissions per capita figures show some things but conceal others

The emissions per capita figures, which are of course very high for rich countries and low for poor countries, are important for developing countries in the long-running political argument about who should fund climate policies.

In the most recent IPCC report, these figures are supplemented by research on consumption-based emissions accounting, that is, work by researchers who have shown in the case of e.g. consumer goods made in China and exported to the USA, how to add the emissions caused by production processes to the USA's account instead of China's.

But there are many things that the emissions-per-capita figures obscure. They do not distinguish between different people in the country (e.g. the rural poor and urban population in India or China, discussed above), and they do not distinguish between direct consumption (i.e. fuels or electricity that people use themselves) and indirect consumption (fuels used in industry and the economy generally). These issues are addressed by research based on "bottom up" data rather than top-down statistics.
So for example a recent paper on electrification in India[3] showed that, over the last 30 years, the proportion of households with electricity access has grown from around 20% to around 70%, which meant that 650 million more people gained access to electricity.

[3] Shonali Pachauri et al, "Household electricity access a trivial contributor to CO2 emissions growth in India", *Nature Climate Change*, October 2014

The paper showed that that improvement accounted for 3-4% of India's emissions growth, and that the total direct and indirect use of electricity by those 650 million people accounted for 11-25% of emissions growth. The vast majority of emissions growth was due mainly to urban populations and industry.

To my mind, such research should place a huge question mark over the assumption that population growth can be treated as a residual explanation for increases in consumption.

3. The two factors in the Kaya identity that refer to economic and technological systems – energy per unit of GDP, and emissions per unit of energy – also have important limitations.

Energy per unit of GDP expresses the energy efficiency of a whole economy, and a time series can indicate whether it's improving. But it says nothing about the drivers of efficiency, or inefficiency, about the processes by which various economic sectors consume energy.

[The insights of process analysis and engineers are reflected in the chapters of the IPCC reports, but not so much in the summaries for policymakers.]

4. There is an assumption throughout that GDP growth can be identified with human progress.

Again, this is highly ideological and highly contested.

Conclusions

-- The way that fossil fuel consumption, and its environmental impact, is measured, is underpinned by ideological assumptions. The IPAT formula is a key here. So is the identification of GDP growth with progress.

-- Not only should society at large have access to the results of research, but it is also important that social movements and communities on one hand, and academic researchers on the other, together develop approaches to the subject and together question prevailing ideological assumptions. The assumption that consumption can be understood largely as consumption by individuals is one example.

-- In my view, approaches need to be developed that put fossil fuel consumption in the context of social, economic and technological systems, and in the context of production.

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