ENERGY TRANSITION IN FRANCE : USELESS, COSTLY, UNFAIR

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I - Introduction

The energy landscape did not change much over the course of time before the 19th century. Napoleon and Cesar travelled, dressed, warmed themselves in very similar ways. Since the beginning of the 19th century, however, this landscape has been changing rapidly and drastically. Traditional energies (man, cattle, wind, water) have been practically eliminated, and replaced by new energies (coal, oil, electricity, nuclear). In the area of transportation, for instance, walking, horse-riding, sail boats, have been replaced by railroads, automobiles, planes, and steam boats. Such changes greatly contributed to the extraordinary improvements in living standards registered over the past two centuries in the so-called developed countries; and then, over the past fifty years, in the so-called developing countries.

These changes show that the world of energy has been, and continues to be, constantly *in transition*. Energy transition - or rather transitions - have therefore been a constant of our societies. They have been driven by two forces: technology, and the market. It is technology, based upon science, that created the steam engine, the combustion engine, or nuclear electricity, etc., all the innovations that shaped the changing energy picture. And it is the market, not government intervention, which ensured the implementation of these innovations. In most countries, railways, automobiles, or nuclear electricity became widespread by themselves, with some government regulations, but generally without significant subsidies. None of these "transitions" has been the outcome of a specific public policy.

This is in sharp contrast with what is presently called in France "the energy transition". It essentially relates to the de-carbonization of the economy. The objective is to reduce French CO2 emissions from 340 million tons presently to 170 Mt by 2050, and subsequently to zero. This trajectory, or transition, is not generated by any particular technological innovation. It is entirely politically motivated. Its sponsors justify it by the fear of the consequences that CO2 could have on the global climate.

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This transition can only happen with to a set of taxes, subsidies, prohibitions, requirements, and persuasion. Such political interventions will necessarily be costly in budgetary and economic terms. This makes it completely different from the many other energy transitions experienced in the past.

This by itself does not condemn it necessarily. There are many public policies (such as education, justice, safety, environmental protection) which are highly desirable, and even necessary. But it does not justify it automatically either. There are also many public policies useless and undesirable. It is therefore legitimate to assess the French energy transition. A critical examination suggests that this policy is (i) useless, (ii)costly, and (iii) unfair.

I – A Useless Policy

The Official Theory of Man-made Warming

The French (and European) energy transition policy is largely based on the theory of anthropic warming. This theory maintains that greenhouse gases, mostly CO2[2], emitted by human activity, are the driver of increases in the average of temperatures. This theory is more political than scientific. It was initiated by the UN, which created a new international organization to this effect: the IPCC. The IPCC is explicitly entrusted with the purpose of developing, proving and improving this theory. It does it quite effectively. This activism was honored by a Nobel prize (as members of the IPCC like to remember us). It was a Peace Nobel prize, that is a prize that honors a political activity, not a Science Nobel prize which celebrates a scientific contribution (a detail members of the IPCC do not like to be reminded of). There are reasons to entertain doubts about this intergovernmental theory. Explaining why is not the purpose of this paper. On the contrary, this paper takes the IPCC theory as it is, as if it were empirically validated, and uses it to show that the policies based on it are useless.

The official theory states that the average of world temperatures is a function of the concentration of CO2 in the atmosphere, defined as the mass of CO2 relative to the mass of the atmosphere (presently about 4/10,000). If concentration increases, so do temperatures. By how much? This is measured by means of a somewhat bizarre indicator called “sensibility”: the temperature increase (measured in Celsius degrees) generated by a doubling of CO2 concentration. A sensibility of 1 means that temperatures will increase on average by 1°C. One can distinguish between short-term sensibility and long-term sensibility (one century or more after the concentration increase). We are interested here is the short-term sensibility. It is estimated, in the last IPCC Report, to be “between 1 and 2.5” on the basis of papers

[2] Instead of speaking of « greenhouse gases », measured in « equivalent tons of CO2 », we will refer to CO2 only. The loss in terms of precision is, we believe, outweighted by the gain in terms of simplicity and clarity.

published before 2011; the bracket is rather large; subsequent estimates suggest lower values (Gervais 2018, p. 69). We will use here a sensibility of 1.5.

What matters, in the official theory, is the *stock* of CO2, not the *yearly flow* of CO2 emissions. Obviously, the flow of man-made emissions, which is relatively well known, contributes to the increase of the stock. As a matter of fact, oceans and vegetation absorb about 50% of this yearly flow. In 2017, the stock of CO2 in the atmosphere was estimated to be about 3,200 Gt (billions of tons); yearly world emissions amounted to 33 Gt; in 2018, the stock has become 3,216.5[3] Gt. Equipped with these information, we can estimate the impact on world temperatures of CO2 emissions reductions associated with various policies: rather modest, as we shall see.

Impact of Potential OECD Policies on Temperatures

The policy scenario tested is the following: between now and 2050, OECD countries (assumed to be the developed countries) reduce their CO2 emissions by 50%; the rest of the world (broadly: the developing countries) do not increase their yearly CO2 emissions. This policy is compared to a reference scenario, without energy transition policies, in which yearly emissions remain what they are in 2017. Both scenarios are plausible, and even optimistic.

The reference scenario is realistic. In the absence of specific policies, it is hard to see why CO2 emissions would decrease in the 33 coming years: over the past 33 years they did increase by 80% (in spite of 23 COPs that pretended to organize their decline). Assuming CO2 emissions stability in the three coming decades is displaying a great confidence in technological progress and its ability to produce energy savings (per capita or per unit of GDP).

The policy scenario tested is also rather ambitious. Over the past 33 years, CO2 emissions of OECD countries increased by 16%. Turning this +16% into a -50% implies a set of costly constraints. Assuming the stability of CO2 emissions in the rest of the world over the same period will also be a challenging achievement: they increased by 290% over the 33 past years.

Table 1 shows the impact of this scenario on world temperatures.

[3] 3200 + 0,5*33 = 3216.5

Table 1 –Impact of an Energy Transition Policy on 2050 Temperatures

	2017	2050 without policy	2050 with policy
CO2 emissions (Gt/an)			
OECD countries	12	12	6
Rest of the world	21	21	21
Total world	33	33	27
Cumulative emissions 2018-50 (Gt)	-	1089	990
Non absorbed cumulative emissions (Gt)	-	545	495
Stock of CO2 (Gt)	3200	3745	3695
Stock variation with/without (Gt)	-	-	50
Idem (en %)	-	-	**-1,3%**
Temperature variation/2017 (°C)	-	**+0,26**	**+0,23**
Temperature variation with/without (°C)	-	-	**-0,03**

Sources : BP. 2018.*Statistical Review* for 2017 emissions.

Notes : The polices examined are: (i) the situation resulting from the continuation of present yearly emissions over the 2017-2050 period (called "without policy", or "without"), and (ii) a diminution of 50% of OECD CO2 emissions and the stagnation of rest of the world emissions over the 2017-50 period (called "with policy", or "with"). The absorption rate of the CO2 emitted is estimated to be 50%. The temperature variation is calculated with a sensitivity of 1.5. It is the variation between 2017 and 2050. Important numbers are in bold case. Gt = Giga tons = Billions of tons.

The outcomes of these simple calculations are the following. In the business-as-usual scenario, that is in the absence of energy transition policies, the average of world temperatures in 2050 would increase - according to the IPCC theory - by 0.26 °C. A strong policy, constraining OECD countries to reduce by half their CO2 emissions, would bring this temperature increase down to 0.23 °C. The difference between these two scenarios, which is a measure of the impact of the strong energy transition policy considered, is 0.03 °C, or 3/100 degree. The impact is not inexistent, but it is very small, in practice negligible.

We equally tested the impact of an even stronger energy transition policy: zero CO2 emissions in 2050 for all OECD countries. Such an extremely costly, and wholly unrealistic, policy would reduce temperatures by 5/100 °C (instead of 3/100 °C). Its impact would remain quite negligible. The conclusion is that OECD energy transition policies are useless.

Impact of French policies on Temperatures

What is true for all OECD countries – that energy transition policies are of no use – is even truer for France alone, for at least two reasons.

The first is that France does not weight much, and less and less so, in the man-made world CO2 emissions: presently 0.3 Gt, or 1% or the total of emissions, which is itself about 1% of the stock of CO2 supposed to be the driver of global warming. If France were to stop overnight (by some sort of miracle) its CO2 emissions, this would

reduce the growth of the stock of CO2 by 1/10,000, and the impact upon global warming would be totally insignificant.

The argument often put forward to justify energy transition in France (and in many other developed countries) is that small streams make great rivers, and that we must give a good example to other countries. The answer is that we already give it, this example, and that is not at all followed. France happens to be one of the countries in the entire world where the ratio of CO2 emissions to GDP is lowest, as suggested by Table 2.

Tableau 2 – CO2 Content of GDP and Electricity, G8 Countries, 2017 & 2013

	GDP (CO2/GDP) 2017	Electricity (CO2/Output) 2013
France	124	68
Germany	208	520
United Kingdom	151	455
Italy	178	384
USA	262	491
Canada	339	158
Russia	965	643
China	761	696
European Union	204	388
World	414	539

Sources : World Bank for GDPs; BP Statistics for global CO2 ; IEA (quoted by the French ministry for Ecology) for electricity-related CO2. *Notes* : The ratio for GDP is expressed in tons of CO2 per million US $ of GDP ; the ratio for electricity in tons of CO2 per million MWh.

The French electricity mix, which is 85% nuclear and hydro, explains this low level of CO2 emissions. Of the five main sources of power, two emit CO2: coal (a lot), and gas (half as much); and three do not: hydro, nuclear and intermittent renewables (wind and solar). Yet, a recent survey shows that 78% of the French believe that nuclear electricity is a major contributor to global warming. This belief owes nothing to their personal experience or real knowledge on the subject; it owes everything to what they have seen or heard in textbooks, newspapers, broadcasts, or TV. This is a measure of the unbelievable magnitude of disinformation on energy issues that predominates in France.

Energy transition is therefore particularly useless in France. The country has already done a lot, more than most, in decarbonation. Rather than claiming that everything should change, French governments would be better inspired to advertise French successes in this area, in the hope that these successes would be emulated.

To conclude on the uselessness of a radical energy transition in France, consider the case of coal power plants in France and China. There are still 4 thermal coal power plants in operation in France (with a capacity of 3 GW, accounting for 1.8% of electricity output). The French government is determined to close them in the

coming four or five years, and attaches a great importance to it; President Macron himself presents it as a major contribution to the energy transition. In the same period, China (for long presented by French ecologists as a model to follow) will open about 560 thermal power plants (with a capacity of 259 GW). A small step forward and a great leap backwards: -4 in France, +560 in China.

III – A Costly Policy

This useless policy is nevertheless very costly. To properly estimate this cost, it would be necessary: (i) to start with the overall objectives (e.g. reduce CO2 by half in 2050), (ii) to deduce the implied sectorial goals (e.g. reduce CO2 emissions in the transport sector by x%, etc.), then (iii) to identify the measures required to reach these goals (e.g. increase fuel taxes by y%, etc.), then (iv) to estimate the direct and indirect consequences of the implementations of these measures (e.g. reduction of mobility by z%, etc.), and finally (v) to evaluate the costs of these consequences for the economy and for the Treasury. This is a massive task that governments, at least in France, do not even attempt to undertake; the issue of the costs of their energy transition policy is apparently not their main concern. Here, we will modestly only try to describe, and when possible put numbers on, what is presently decided or envisaged in France[4].

The starting point of this exercise is the distribution by sectors of CO2 emissions in 2017, and the objectives aimed at for 2050, as presented in Table 3

Tableau 3 – CO2 Emissions, by Sectors, France 2017-2050

	2017 Mt	2017 %	2050 Mt
Energy	47	14	?
Transportation	124	39	?
Residential & tertiary	78	24	?
Manufacturing industry	70	21	?
Other	11	3	?
Total	330	100	165

Source : CITEPA. Note : Other = mostly agriculture.

Four sectors stand out: transportation (mostly road transportation); energy (mostly electricity); the residential and tertiary sector (mostly heating and hot water); and industry. The French case is a-typical. In most countries, the distribution is rather different, with electricity accounting for a much larger share (about 40% on average).

As question marks in Table 3 show, the French energy transition objectives for 2050 are only specified for the total: a 50% cut. We do not know the goals envisaged for the various sectors. All are heavily taxed, regulated, and subsidized. The ministry in

[4] By way of comparison, the reader might keep in mind that the budget of the Justice ministry (which includes jails) amounts to 7 billion euros.

charge is proud to avail itself of at least 36 environmental taxes (ministère de l'Environnement 2017, p. 109 seq.), for an amount of 50 billion euros per year (ministère de la Transition Ecologique, 2018). We shall focus on the two sectors that seem to be the main targets of policies undertaken in the name of energy transition: electricity, and transportation.

Electricity

The emphasis put on electricity by energy transition policies in France is paradoxical. As mentioned above, electricity is the area in which France is doing particularly well in terms of CO2 emissions. Nevertheless, a well identified objective of French transition policy is to reduce nuclear electricity in order to replace it by wind and photovoltaic electricity. The ministry of Energy Transition states it very clearly: "wind electricity will constitute a *pillar* [our emphasis] of the French electricity system". As in most other European countries, the demand for electricity in France has not increased over the past fifteen years; and there are no reasons why it would significantly increase in the next thirty years. In this context, more renewables means less nuclear electricity. This evolution is undertaken *in the name of* energy transition. Here, we no longer face a paradox but a lie. To shut down functioning nuclear plants that do not emit CO2 to replace them by wind turbines that do not emit CO2 either will not reduce at all French CO2 emissions.

As a matter of fact, it might even increase them, for two reasons. The most important one, which is well known, is that wind and solar power are intermittent and random. They function only when the wind blows (about 25% of the time) and/or when the sun shines (12% of the time) – and, this is the important point, not necessarily when electricity is needed. Presently, we do not know how to stockpile electricity in large quantities at reasonable costs. To ensure a demand-responsive supply at every hour of the year, in order to avoid blackouts, one must keep, or build, coal or gas power plants to provide dispatchable electricity available in case of no wind and no sun. Coal and gas power emits CO2. The other reason is that the building of each wind mill implies foundations of 1,500 tons of cement, a high CO2 emissions activity[5]. There may be good reasons to prefer wind power to nuclear power (we do not quite see which ones), but it is not acceptable to do it in the name of the CO2 reducing "energy transition".

This policy has a cost, or rather a surcost, relative to what would be the cost of electricity in the absence of intermittent renewables. This cost is both direct and indirect (Prud'homme 2017).

Direct surcosts – The direct production cost of wind and photovoltaic electricity (what is paid by producers) has traditionally been higher than the production cost of

[5] The construction of a nuclear power plant also requires cement : 18 times less than the building of wind mills, per kWh produced.

conventional electricity. Consequently, developers asked for, and obtained, subsidies. No subsidies, no wind or solar energy, in France as elsewhere. When Spain stopped granting such subsidies, investments in renewables stopped immediately. These subsidies have taken the form of compulsory purchases, at government-decided high prices. EDF, the main (government-owned) utility must buy all the renewable electricity produced, whether it needs it or not, for a period of about 15 years (the assumed length of life of the intermittent electricity investment). For a producer, this is a dream: a guaranteed market, at a generous price. A special Fund then reimburses EDF of the difference between the price it paid, and the "normal" cost of electricity.

This difference is a measure of the direct surcost of renewable electricity. It is well known, and official, because the energy regulator (CRE) figures it out every year, to determine the amount of the reimbursement check. It is presently about 5 billion euros, and increases regularly. The regulator calculated that the cumulative amount will be, with very prudent hypothesis, 57 billion over the period 2014-25.

Who foots the bill ? Electricity consumers, by means of a tax based on electricity consumption, called CSPE. Its rate increases regularly every year. Il can be found on everybody's electricity invoices, albeit in very small print. In addition, the Treasury imposes a 20% value-added tax on it (many people think that the value-added dimension of the CSPE is not obvious). The cost to consumers of the direct surcost is therefore not 5 billion, but 6 billion.

Indirect surcosts – This direct surcost, which is well-identified and measured, is only one part of the renewables surcost. Saying that it is the emerged part of the cost iceberg would be an exaggeration, but the metaphor would capture part of the reality. Wind and solar power impose other, and indirect, costs upon society. A brief list is as follows:

- Wind turbines, taller than all gothic cathedrals, destroy centuries-old landscapes. They lower the market value of nearby buildings. The loss of value caused by existing wind turbines to real estate has been valued at 20 billion euros (in total, not per year).

- Wind turbines kill birds, particularly migratory protected species, and above all bats, at a difficult to estimate but significant environmental cost.

- The spatial distribution of wind or sun "farms" (the word conveys a bucolic image that has not much to do with the industrial reality it pretends to describe) leads to a significant increase in electricity transport networks. There were about 200 electricity production points in France; there are now nearly 10,000. The additional transport cost amount to about one billion euro per year.

- Their random intermittence implies costly safety nets in the form of redundant thermal power plants, or of equally costly "interruptible contracts" (giving the distributor the right to stop supplying power to some big consumers). Stockpiling, if it existed, or when it will exist, will also be costly.

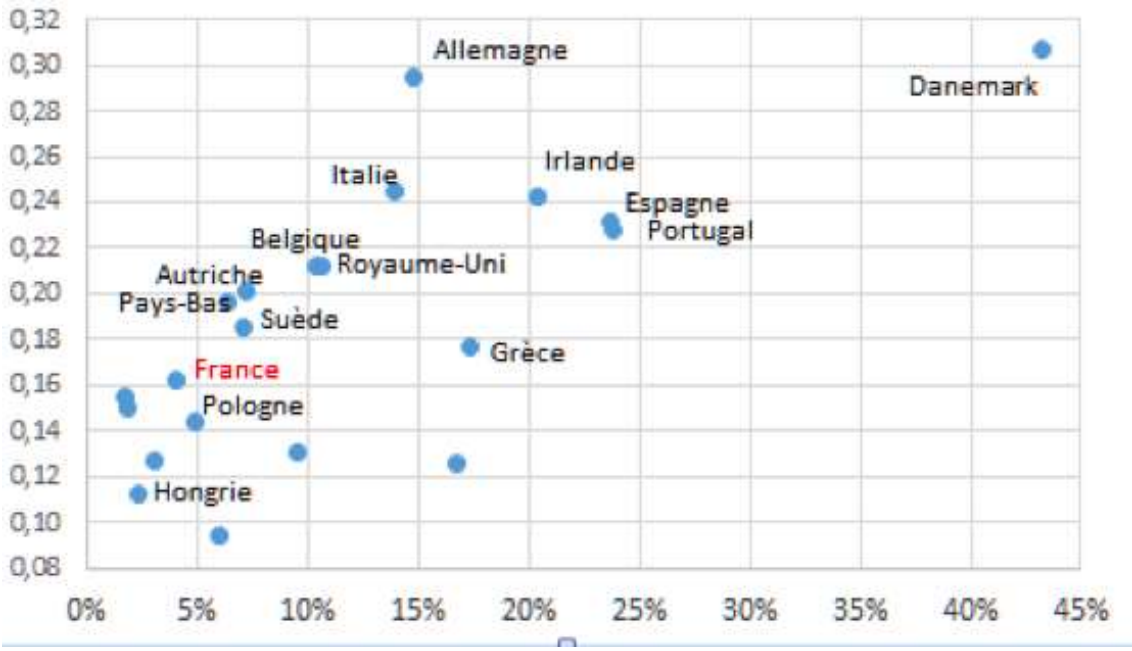
- The worst is probably the so-called “eviction effect”. Renewable electricity has priority access to the grid system. Whenever wind or sun electricity increase, traditional power plants must reduce their output. They amortize their fixed costs on a lower output, thereby increasing their unit costs of production, a form of wastage which is necessarily reflected in higher system costs.

These (and other) indirect surcosts are not very well known and measured, but available information suggests that their importance might be comparable to that of the direct cost. Who will bear them? Consumers, again, in the form of higher electricity prices.

What is the evolution of direct and indirect unit surcosts (per kWh) over the course of time, when the share of renewables in the electric mix increases ? Direct costs tend to decline, mostly because the cost and/or price of imported components (wind turbines, solar panels) diminishes. But indirect costs increase.

Increased prices – Direct and indirect surcosts are obviously reflected in higher prices paid by consumers. In Europe, this price is a function of the renewables penetration rates in the electricity mix, as shown in the following figure.

Figure 1 – Electricity Prices as a Function of the Share of Wind and Solar Power in the Electricity Mix, 2015



When the share of intermittent renewables (wind plus solar) is low, prices are low. When this share is high, so are prices. German households pay their electricity

twice as much as French households[6]. The development programmed in the French "energy transition" implies a doubling of electricity prices.

Transportation

In France, the transport sector is by far the most important sector in terms of CO2 emissions. These emissions are overwhelmingly caused by road transport, of both people and goods. For many years, governments have attempted to reduce the importance of road transport, as a means to reduce its emissions. Policies to that effect have been many, costly, and inefficient.

Numerous attempts - The anti-car arsenal has been manifold. Let us briefly mention eight instruments utilized:

- Replace trucks by trains;
- Replace cars by trains for long distance rides;
- Facilitate car-sharing;
- Favor public transport in cities;
- Lower speeds on roads;
- Develop bicycle use in cities;
- Replace diesel oil by gasoline;
- Replace fuel cars by electric cars.

Costly attempts – To reach these goals, governments did not spare their efforts. They taxed heavily automobile transportation, and subsidized heavily non-automotive modes.

Specific taxes on road transport, that is taxes that do not apply to other goods and services, amount to 45 billion euros in 2017. This is nearly as much as corporate income tax (57 G€), and 60% of the personal income tax (77 G€). This is three times as much as what public administrations, including subnational governments, spend on road investment and operation. The most important of these taxes is the TICPE, a fuel tax; its amount is 36 G€ in 2017[7]. Road fuel is, after tobacco, and by far, the most taxed good in France.

The government intended to increase further this taxation by increasing an existing carbon tax. This perspective infuriated many road users, and led to the Yellow Vests movement

. The government postponed (temporarily ?) this increase. If a massive reduction of CO2 emissions were necessary (an hypothesis we rejected), a carbon tax is not absurd,

[6] The difference is not as large for industrial prices: Germany allocates surcosts disproportionately on households, in order not to overcharge industry.

[7] This amount does not include the VAT that fuels pay like any other good, but it includes the VAT collected on the fuel tax, which is an extension of the fuel tax itself.

in principle. If CO2 is a bad, to tax it in general, in all its forms, is desirable. It will exert a pressure on carbonated goods consumers, and therefore CO2 producers, to reduce their usage and the associated emissions, in hundreds of different fashions that we need not know and even imagine. The higher the tax, the lower will be CO2 emissions. A good carbon tax could thus replace all anti-carbon policies, and ensure by itself the desired energy transition.

It is the implementation of this elegant principle that raises difficulties. It assumes the absolute efficiency of market mechanisms. Let us mention two problems, amongst many. Because the CO2 illness is global, the remedy must be applied globally, in all world countries; its implementation in just one country would only displace activities – and CO2 emissions – out of that country. Unfortunately, a single world carbon tax is but a dream. It is socially and politically unthinkable.

Second, a carbon tax is hegemonic in nature, and its implementation assumes the elimination of all existing taxes and regulations on carbonated goods. In reality, the carbon tax in France (and in many other countries) is introduced as an addition, not as a substitution. This is well illustrated by the debate on the French carbon tax. One argument put forward was: France can afford a 45 euros carbon tax because Sweden has a 120 euros carbon tax, and fares well with it. This argument ignored (by malice or ignorance) the fact that the TIPCE, which has been in place for many decades, functions exactly like a carbon tax. As a matter of fact, presently, fuels taxes are (slightly) higher in France than in Sweden.

Non-automobile transport modes, by contrast, are heavily subsidized in France (as much, and probably even more, than in many other countries). SNCF, the quasi rail monopoly, tries to hide it, with the help of the media. In reality, the difference between its expenditures and its commercial income amounts to about 14 billion euros per year, as has been known by all specialists for years, and recently recognized in an official report (Spinetta 2018). This difference, a deficit in plain English, is compensated by all sorts of subsidies and by yearly increases in debt (which is itself eliminated from time to time by an *ad hoc* subsidy). The rail reform introduced in 2018 will not change this situation.

The case of local urban public transport is even worse. Their deficit (investment an operating expenditures minus commercial income) amounts to about 9 billions euros. It is covered by a tax allocated to local government for that purpose, called Versement Transport (Transport Contribution), which is a wage tax, levied on the wages paid in each local government by enterprises. The total amount of subsidies to public transportation is therefore about 23 billion. It has been about constant over the past decades.

Other forms of subsidies to reduce CO2 transport emissions are relatively modest. The exception could be the development of electric vehicles. The subsidy is presently 6,000 euros per vehicle purchased. If the number of vehicles concerned reached one million per year, as aimed at by the government in the name of energy

transition (a very unlikely prospect), the taxpayer bill would increase to 6 billion euros per year.

Inefficient attempts – For the most part, all these costly efforts to reduce transport-related CO2 emissions have not achieved much. Cars and trucks continue to supply most of people and goods transportation in France. Not because of pro-road policies, but in spite of anti-road policies.

This is obvious for freight. Notwithstanding a dozen "freight plans" aiming at doubling, or even tripling, the share of rail, and costing billions of euros, the share of subsidized rail has stagnated or diminished, whereas that of overtaxed trucks has increased. In ton*km, rail freight represents now about 10% of total freight. In terms of users expenditures, which is much more meaningful economically, it represents less than 2% of the total.

For daily transportation, including journeys to work, car represents 89% of passengers*km. This is not true for Paris and the Paris region, where an excellent network of subways, local trains, and RER (high capacity rail lines) reduces this share significantly. But Paris, contrary to what Paris-living elites think, is not France. In transport matters, Paris and France are two distinct countries.

For passenger transport at large, motor vehicles (cars, two wheelers, buses) account for 87% of traffic, in passengers*km. Bicycles account for 0.5%. To inflate this number, bike-lovers measure its share in terms of trips, as if a one-km bicycle trip could be compared to a 50 km car ride; and they limit themselves to urban trips, which are the only trips that can be undertaken with a bicycle.

Transport in France is therefore predominantly road transport. Some might deplore it. But all should recognize it. This is explained by the higher performance of this mode for most – though not all – trips, in terms of speed, cost, comfort, versatility. The massive hyper-taxation of the automobile, and the equally massive hyper subsidization of alternative modes, do not suffice to change this situation.

This is why CO2 emissions of the transport sector do not decline much. They did diminish somewhat over the past decades. Not because road transportation diminished, to the benefit of other modes; on the contrary it increased slightly. Rather because CO2 emissions per vehicle*km declined, thanks to progress in vehicle technology.

It also means that putting the brake on road transport means putting the brake on transport at large. The weight of road transport is so large, and substitution possibilities so few, that additional taxes and constraints on road transport necessarily produce higher transport costs in general, and reduce mobility. In agglomerations, lower mobility reduces the effective size of labor markets, and hence their efficiency. Less mobility means workers who do not access the jobs they want, and enterprises who do not access the workers they need: it means a lower productivity, and even

greater unemployment. In the country as a whole, lower mobility reduces trade between regions, and the gains that come with it. The positive role of transport infrastructure in the attractiveness and prosperity of a country or zone is well established. Improving transport infrastructure while at the same time increasing transport costs is no improvement at all.

In passing, let us mention the much too frequent use of the argument: "it will decrease CO2 emissions" to justify any transport project or decision. One cannot seriously defend the (indefensible) 30 billion euros Lyon-Torino high speed rail link by saying that this project will save a few million tons of CO2. Such a statement is a pretext, not an argument.

Even more shocking is the statement to be found on the official site of the French Road Safety Agency: "*Driving at 80 km/h instead of 90 km/h, 30% less of CO2 emissions*". This is publicity for lowering the maximum authorized speed from 90 km/h to 80 km/h on secondary roads, a controversial measure. It will reduce average speed by 2-5 km/h, fuel consumption by 1 or 2% (according to French official formulas), and CO2 by a similar percentage. Transforming 1 or 2% into 30% is a huge piece of disinformation. CO2, so many lies are committed in thy name!

IV – An Unfair Policy

The so-called "energy transition" policies are not only useless and costly, they are also regressive. They weigh more on the poor than on the rich, relative to income, and occasionally even in the absolute. On poor households, on poor regions, and on poor countries.

Interpersonal Regressivity

Electricity, road transport, and housing are the sectors which contribute most to CO2 emissions. CO2 reduction policies will mostly target these sectors, and increase their costs. Unfortunately, in these three sectors, consumption increases more slowly than income. For each of them, the share of expenditures is larger in poor households than in rich households. To tax these expenditures, or to increase their cost, will hit poor households more than rich households. One number sums up this reality: the income-elasticity[8] of the demand for these goods. Calculations based on the households expenditures survey (for 2011, the most recent survey available) produce income-elasticities of 0.5 for electricity and 0.8 for fuel. Such numbers overestimate income-elasticities, because they are calculated relative to households expenditures, not households incomes.

[8] The income-elasticity of the demand for a given good tells us by how much demand increases when income increases by 10%. If demand increases by 10%, income-elasticity is 1 ; if demand increases by 5%, income-elasticity is 0.5 ; if demand increases by 20%, income elasticity is 2.

It has been known for a long time that environmental taxes hit the poor more than the rich. Governments are well aware of it. To limit the ensuing social damages, they introduce various subsidies for poor households, for instance energy vouchers, or subsidies for the purchase of newer, less CO2 intensive, automobiles. On the one hand, governments increase the price of power or of fuel; on the other hand, it subsidizes poor households for the consumption of these goods. But such exonerations or subsidies, which are always administratively costly and complicated, are generally far from eliminating the basically regressive dimension of the price increases generated for (or in the name of) the "energy transition".

There are even cases of regressive subsidies. Consider the example of electric vehicles, the purchase of which is subsidized to the tune of about 6,000 euros. Even with this aid, their price remains much beyond the means of a poor household. In practice, this subsidy benefits mostly rich households, usually for the purchase of a second (or third) automobile.

This leads to the development of energy poverty. A growing number of households no longer have enough income to heat their homes or to travel to work. The phenomenon has been analyzed by INSEE, the National Statistics Agency, (Cochez *et al*, 2015) under the name of "energy vulnerability", defined as the situation of a household spending more than 8% of its income on home heating and/or more than 4.5% on its daily trips. 22% of households are in a situation of energy vulnerability for housing, or mobility or both. This vulnerability is particularly prevalent for older, and for younger (less than 30 years), citizens. The study simulated the impact of high increases in energy prices, of magnitudes in line with energy transition policies. A 40% increase in heating costs would increase the heating vulnerability from 15% to 27% of households, a doubling. A 30% increase in car fuels would increase the mobility vulnerability from 10% to 17%. This energy poverty is not specific to France. It is also a reality in the United Kingdom, or in Germany. Energy transition policies are not the only cause of it, but they do play an important role in it.

Inter-regional Regressivity

Inter-regional regressivity, that is the fact that poorer regions are more hit than others by energy transition policies, is less known, but no less important. This reality is illustrated on the case of France in the following Table 4.

Tableau 4 – Households Expenditures on Electricity and Fuel, by Geographic Zones, 2011

	Electricity		Car fuels	
	€/yr	Index	€/yr	index
Paris agglomeration	527	100	841	100
Large cities	630	120	1083	129
Medium sized cities	555	105	1196	142
Small cities	698	132	1462	174
Rural areas	850	160	1769	210

Source : INSEE, Survey of households expenditures 2011
Note : Numbers in euros did age, but the hierarchy remains significant ; this is why index numbers are more meaningful that numbers in euros.

Table 4 is striking. As electricity and fuels prices are identical over the territory, differences in expenditures reflect differences in consumption. They are wide. A rural household consumes 60% more electricity than a Paris agglomeration household, and 110% more in car fuels. Relative to income (which is obviously higher in the Paris agglomeration and in larger cities), differences in expenditures would be even more marked. Increases in power and fuel prices caused by energy transition policies are therefore much more painful for rural areas and small cities: about twice as much in absolute numbers, and three times as much in relative (to income) numbers. They deepen seriously the already serious territorial breakdown in France. Looking at Table 4, one gets a better understanding of the geography of the Yellow Vests movement.

A number of other energy transition policies have similar effects. The location of wind farms, for instance, is heavily concentrated in the poorest regions or areas. No wind farms in the fashionable Ile de Ré or Lubéron; and practically none either in the rich Ile-de-France region. The damages they cause, such as the loss of property value, are therefore concentrated in poorer areas. The same can be said of the loss of time implied by the change in maximum speed authorized from 90 km/h to 80 km/h on secondary roads. Parisians are entirely unconcerned by this loss: their daily trips are undertaken at 50 km/h; and their week-end or vacation trips are undertaken on highways at 130 km/h. By contrast, inhabitants of Creuse (in Central France) only drive on the secondary roads affected by this policy measure.

International Regressivity

The worst unfairness concerns most probably the distribution of the energy transition costs between rich and poor countries. In absolute terms, in US dollars, the surcost of a given reduction in CO2 emission (for instance by the substitution of wind farms to a coal power plant) is the same in India and in Germany. Let us assume it is 200 US$. One must realize that 200 dollars means more, much more, in India than in Germany. It corresponds to 200 hours of work in India, and to 2 hours and a half in Germany. Poor countries simply cannot afford our energy transition.

Rich countries try to persuade them of the contrary, with two equally weak arguments. The first is that reducing their CO2 emissions is in their own interest, in

that it will save them the costs of excessive warming. But these costs are costs for tomorrow, for the end of our century; and they are the costs forecasted by questionable models. Today, such costs do not exist. Contrary to what is repeated again and again in rich countries, the number and the intensity of hurricanes do not increase, nor does rainfall or drought, nor does sea level increases (about 2 mm/year), nor do illnesses (infant mortality and duration of life improve everywhere), nor do famines, which have completely disappeared from countries not in war. Agricultural output, far from declining, increases nearly everywhere, faster than population – in part because the amount of CO2, which is the natural food of plants, has increased.

The second argument is that rich countries promised poor countries that they would give them 100 billion of dollars per year if they accepted to play our game. That was in Copenhagen, in 2009, at COP 15. A considerable amount, and a tempting offer. But a virtual one. Nine COPs later, no progress has been made. There is absolutely no agreement as to who exactly will pay what, to whom, according to what criteria, and with what controls.

These arguments, unsurprisingly, failed to convince poor countries, and in particular China and India. There priority is economic and social development, not at all energy transition. They have always said so clearly (and honestly), in particular at the Paris COP, and did not take any concrete commitment to reduce their CO2 emissions. Whenever there is a contradiction between these two objectives, they chose economic development.

Rich countries have made a different choice, not only for themselves, but also for others. Between energy transition and the economic development *of poor countries*, rich countries have chosen energy transition. This choice, which has been perceived as "climate imperialism", has been particularly clear in the area of electricity. Poor countries, particularly in Africa, but also in India or Pakistan, want coal-fired power plants, which produce at a lower cost the electricity they desperately need. Rich countries, their aid agencies, and the development banks they control (including the World Bank), have decided not to finance any coal power plant, even under the form of reimbursable loans. In addition, environmental NGOs have successfully pressured private banks in rich countries to adopt the same policy. In practice, the consequences of this shameful refusal have been limited. China stepped in. It finances (at interest rates higher than World Bank rates, and with less environmental constraints) the coal power plants poor countries consider necessary for their economic development. This refusal, however, will leave socio-political scars.

V – Conclusion

The author is not a foe of the environment, nor systematically opposed to public intervention, much to the contrary. We have been, for many decades (Prud'homme 1980), very much aware of the damages that man's activities can cause to nature and to our environment: pollutions of all kinds, excessive consumption of

natural resources, threats to biodiversity, destruction of our natural and cultural heritage, etc. We know that the fight against these damages, potentially great and at times irreversible, must be constant, and that it necessarily implies appropriate government interventions.

We have had the pleasure to see that, in the course of past decades, this fight has generally been a success. At least in the developed countries, for tens of pollutants, pollution levels are now much below what they were forty years ago, and *a fortiori* what they were in the 19th century (Gerondeau 2018). The disappearance of natural resources like iron ore, copper, or oil, widely presented in the 1970's as imminent and catastrophic, simply did not happen. The dramatic damages that environmental degradation was predicted to cause to health and longevity did not materialize, much to the contrary. For sure, not everything is perfect in and for the environment, and much remains to be done. However the combination of scientific progress, political intervention, and market forces did yield beautiful fruits, and completely invalidated most of the catastrophic forecasts proclaimed by environmental activists.

Yet, over the past two decades, the fear of global warming replaced the fear of environmental degradation. The fight against CO2 pushed aside the fight against pollutions. This uphill combat against CO2, under the name of energy transition, invades minds and institutions. Symbolically, at least in France, the ministry of Environment eliminated the word "environment" from its title, to become the "ministry of Ecological Transition and Solidarity".

Whenever there is as conflict between the defense of the environment and the promotion of "ecological industries", the ministry of Transition becomes an enemy of the environment. Wind turbines destroy landscapes (including landscapes classified as World Heritage by UNESCO), massacre bats by the thousands, pour millions of tons of cement in the countryside, etc. In a surprising turn, the ministry of Transition sides with the wind power businessmen against environment lovers. It exonerates the former from the traditional building permits, ignores the negative advices of the managers of concerned natural parks, and does its best to prevent impacted residents from bringing lawsuits.

It is this new religious-like dogma based upon fear and punishment, together with our care for the environment, that induced us to look more closely at the "energy transition". With numbers and not merely with slogans. What is it exactly? What are its objectives? At what costs can they be achieved? With what economic and social consequences? This effort has led us to conclude that this "transition" is neither ecological, nor solidary, even less economic. It is beyond the realm of rationality, in a world of fantasy. As Goya puts it in one of his drawings: "the sleep of reason produces monsters".


El sueño
de la razon
produce
monstruos

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