Renew the mix: Carry out the energy transition, at last!

By Aurélien Saussay, Gissela Landa Rivera and Paul Malliet

The five-year presidential term in France will have been marked by the success of COP21, which led to the signing in December 2015 of the Paris Agreement to limit the rise in global temperatures to 2°C by the end of the century. Despite this, climate and energy issues do not seem to be priorities in the upcoming presidential debate.

These issues nevertheless deserve to be dealt with in depth, given that the decisions required entail a long-term commitment by France. In order to meet the goals France has set itself in the Law on the energy transition and green growth (LTECV), it is necessary as soon as possible to undertake the changes required in our energy mix and to improve its efficiency in order to hold down demand from the main energy-consuming sectors, i.e. residential, services, transport and industry.

The recent parliamentary report from the Committee on economic affairs (CAE) and the Commission on sustainable development (CDD) [1] pointedly notes the delay in the implementation of LTECV. In particular, the report highlights the limited progress made in exploiting the main source of energy-savings, the construction sector. It also notes the delay in increasing the share of renewable energies in our energy mix, particularly with regard to the generation of electricity.

To this end, the Multiannual electricity programme (PPE) for the period 2016-2023 does not seem sufficient, in the current situation, to meet the objective set in Article I, Section 3 (L100-4) , Paragraph 5 of the LTECV, which calls for reducing the share of nuclear power to 50% of France's electricity mix by 2025. To achieve this, it will be necessary to revise the PPE at the beginning of the next five-year term.

The main obstacles to the implementation of the ambitious investment plans needed to achieve the law's main objectives – France's transition towards a low-carbon economy – are fear that the economy will become less competitive, particularly energy-intensive industries[2], together with the low acceptability of carbon taxation and the risk that all this will have a recessionary economic impact.

While an analysis of the redistributive impacts of carbon taxation remains a topic for research, work done by the OFCE in partnership with the ADEME has shown that fears of a negative macroeconomic impact are unjustified. Far from weighing on the prospects for an economic recovery, the energy transition could, on the contrary, bring about a resurgence of growth for the French economy over the next thirty years – starting right in the next five-year term.

This result is the macroeconomic translation of the continuous reduction in the cost of the technologies needed for the transition, in all its dimensions: the production of renewable energy, the management of intermittence, and the improvement of energy efficiency. Our analysis shows that changes in the full cost of renewable electricity (i.e. the levelized cost of electricity, LCOE) make a complete change of the energy paradigm possible, without any major additional cost compared to traditional technologies – even in a country with an extensive nuclear power industry like France.

A policy brief recently published by the OFCE, "Changing the mix: the urgency of an energy transition in France, and the opportunities" [in French], presents the main conclusions of this work. First, it demonstrates that achieving an energy transition corresponding to the LTECV would generate about 0.4% additional GDP and more than 180,000 jobs by 2022, at the end of the next five-year term. While this is a modest effect, our projections indicate an expansionary impact of 3% of additional GDP over the longer term up to 2050 – i.e. additional annual growth of 0.1% over the period.

We have also estimated the impact of a more ambitious forward-looking effort to decarbonize the French economy: increasing the share of renewables to up to 100% of the electricity mix by 2050. This scenario presupposes accelerating the construction of the infrastructures generating renewable electricity – mainly onshore and offshore wind along with solar photovoltaic – starting in the next five-year term. This increased effort would result in a larger gain of 1.3% of GDP by 2022, reaching 3.9% by 2050.

This last exercise shows that an energy transition comparable in magnitude to Germany's *EnergieWende* is definitely achievable in France, both technologically and economically.

Accelerating the energy transition in France during the next five-year term would meet a threefold objective: it would give the economy an additional boost to growth; meet the goals for the reduction of CO2 emissions and energy consumption set by the LTECV; and achieve France's contribution to the goal endorsed by COP21 of limiting global warming to a rise of less than 2°C above pre-industrial temperatures.

[1] Joint information mission on the application of the Law of 17 August 2015 on the energy transition for green growth, 26 October 2016.

[2] See on this topic, « L'état du tissu productif français : absence de reprise ou véritable décrochage?» [France's production system: absence of a recovery or a genuine take-off?], OFCE Department of innovation and competition, 2016.

The COP 21 conference: the necessity of compromise

By Aurélien Saussay

On Tuesday, 6 October 2015, the United Nations Framework Convention on Climate Change (UNFCCC) released a preliminary version of the draft agreement that will form the basis for negotiations at the Paris Conference in December. Six years after the Copenhagen agreement, widely described as a failure, the French Secretariat is making every effort to ensure the success of COP 21 – at the cost of a certain number of compromises. Although the text's ambitiousness has been cut down, the strategy of taking "small steps" is what can make an agreement possible.

The project has renounced a binding approach, where each country's contributions were negotiated simultaneously, and replaced that with a call for voluntary contributions, where each country makes its commitments separately. This step was essential: the Kyoto Protocol, though ambitious, was never ratified by the United States, the world's principal emitter of carbon at the time – and it was the attempt to build a successor on that same model which resulted in the lack of agreement at Copenhagen.

The countries' commitments, called Intended Nationally Determined Contributions (INDC), fall into three broad categories: a reduction in emissions from the level of a given base year – generally used by the developed countries; a reduction in the intensity of emissions relative to GDP (the amount of GHGs emitted per unit of GDP produced); and finally, the relative reduction in emissions compared to a baseline scenario, called “business-as-usual”, which represents the projected trajectory of emissions in the absence of specific measures.

Most emerging countries have chosen to express their targets in terms of intensity (China and India in particular) or relative to a baseline trajectory (Brazil, Mexico and Indonesia). This type of definition has the advantage of not penalizing their economic development – at the price, of course, of uncertainty about the level of the target: if economic growth exceeds the projections used, the target could be met even while the reduction in emissions achieved would be lower than expected. Moreover, part of the target is often indexed on the availability of financing and of technology transfers from developed countries – once again, a perfectly legitimate condition. Due to the contribution that having a plurality of targets makes to a fair distribution of efforts between developed, long-standing emitters and countries that have been developing recently, this represents an essential source of compromise.

With regards to the level of emissions targets set for 2030, while some are trivial – note the case of Australia, which is proposing *to increase* its emissions over 1990 levels – many involve accelerating existing efforts. To meet its commitments, Europe must reduce its emissions twice as rapidly from 2020 to 2030 as it does in the previous decade, and the United States one-and-a-half times; China will need to reduce its carbon intensity three times faster than it has in the last five years, and India two-and-a-half times faster.

As a guide, if the INDCs made public to date were fully realized, then according to the research consortium Climate Action Tracker [1], global temperatures would rise 2.7 °C above pre-industrial levels by the end of the century. This simple calculation must, however, be qualified, since the plan is for commitments to be revised every five years, and they can only be tightened. This system of iterative negotiations should make it possible to move steadily closer to the goal of 2°C that is still being upheld officially.

To be effective, it is necessary to check on whether these commitments are actually met, which requires independent monitoring. In this respect, while guidelines have been highlighted in the current version of the draft agreement, the final negotiations will need to clarify the mechanisms actually used. In the absence of an effective verification procedure, successive revaluations of commitments could turn into a global game of liar’s poker, and ultimately undermine the fight against climate change.

Moreover, the existence of relatively ambitious commitments should certainly not delay the implementation of the necessary adaptation measures, which are at present the subject of a single article in the provisional draft, with no reference to the funding that will be devoted to this. This is one of the project’s main weaknesses, as the question of funding is barely mentioned – the Green Climate Fund, which was to be endowed with 100 billion dollars by 2010, has received only 10.2 billion to date.

In turning the page on Copenhagen, the draft agreement for Paris could constitute a real step forward for climate protection. It is the result of a change in method and a series of compromises which, though scaling down ambitions, are absolutely necessary to the very existence of an agreement. Demanding greater requirements for the proposal’s targets could lead to the failure of the negotiations, which would be far more damaging. In its current version, the draft agreement provides a robust foundation for the future coordination of efforts against climate change.

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[1] The Consortium of the following research organizations: Climate Analytics, Ecofys, NewClimate Institute, and Potsdam

Institute for Climate Impact Research.

Oil: carbon for growth

By Céline Antonin, Bruno Ducoudré, Hervé Péléraux, Christine Rifflart, Aurélien Saussay

This text is based on the special study of the same name [Pétrole : du carbone pour la croissance, *in French*] *that accompanies the OFCE's 2015-2016 Forecast for the euro zone and the rest of the world.*

The 50% fall in the price of Brent between summer 2014 and January 2015 and its continuing low level over the following months is good news for oil-importing economies. In a context of weak growth, this has resulted in a transfer of wealth to the benefit of the net importing countries through the trade balance, which is stimulating growth and fuelling a recovery. Lower oil prices are boosting household purchasing power and driving a rise in consumption and investment in a context where companies' production costs are down. This has stimulated exports, with the additional demand from other oil-importing economies more than offsetting the slowdown seen in the exporting economies.

That said, the fall in oil prices is not neutral for the environment. Indeed, the fall in oil prices is making low-carbon transportation and production systems less attractive and could well hold back the much-needed energy transition and the reduction of greenhouse gas emissions (GHG).

This oil counter-shock will have a favourable impact on growth in the net oil-importing countries only if it is sustained. By 2016, the excess supply in the oil market, which has fuelled by the past development of shale oil production in the United States and OPEC’s laissez-faire policy, will taper off. Unconventional oil production in the United States, whose profitability is uncertain at prices of under 60 dollars per barrel, will have to adjust to lower prices, but the tapering off expected from the second half of 2015 will not be sufficient to bring prices down to their pre-shock level. Brent crude prices could stay at about 55 dollars a barrel before beginning towards end 2015 to rise to 65 dollars a year later. Prices should therefore remain below the levels of 2013 and early 2014, and despite the expected upward trend the short-term impact on growth will remain positive.

To measure the impact of this shock on the French economy, we have used two macroeconometric models, *e-mod.fr* and *ThreeMe*, to carry out a series of simulations. These models also allow us to assess the macroeconomic impact, the transfers in activity from one sector to another, and the environmental impact of the increased consumption of hydrocarbons. The results are presented in detail in the special study. It turns out that for the French economy a 20 dollar fall in oil prices leads to additional growth of 0.2 GDP point in the first year and 0.1 point in the second, but this is accompanied by a significant environmental cost. After five years, the price fall would lead to additional GHG emissions of 2.94 MtCO2, or nearly 1% of France’s total emissions in 2013. This volume for France represents nearly 4% of Europe’s goal of reducing emissions by 20% from 1990 levels.

The simulations using the French *e-mod.fr* model can be extended to the major developed economies (Germany, Italy, Spain, the USA and UK) by adapting it to suit characteristics for the consumption, import and production of oil. With the exception of the United States, the oil counter-shock has a substantial positive impact that is relatively similar for all the countries, with Spain benefitting just a little more because of its higher oil intensity. Ultimately, considering the past and projected changes in oil prices (at constant exchange rates), the additional growth expected on average in the major euro zone countries would be 0.6 GDP point in 2015 and 0.1 point in 2016. In the US, the positive impact would be partially offset by the crisis that is hitting the unconventional oil production business[1]. The impact on GDP would be positive in 2015 (+0.3 point) and negative in 2016 (-0.2 point). While lower oil prices are having a positive impact on global economic growth, this is unfortunately not the case for the environment …

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[1] See the post, The US economy at a standstill in Q1 2015 : the impact of shale oil, by Aurélien Saussay, from 29 April on the OFCE site.

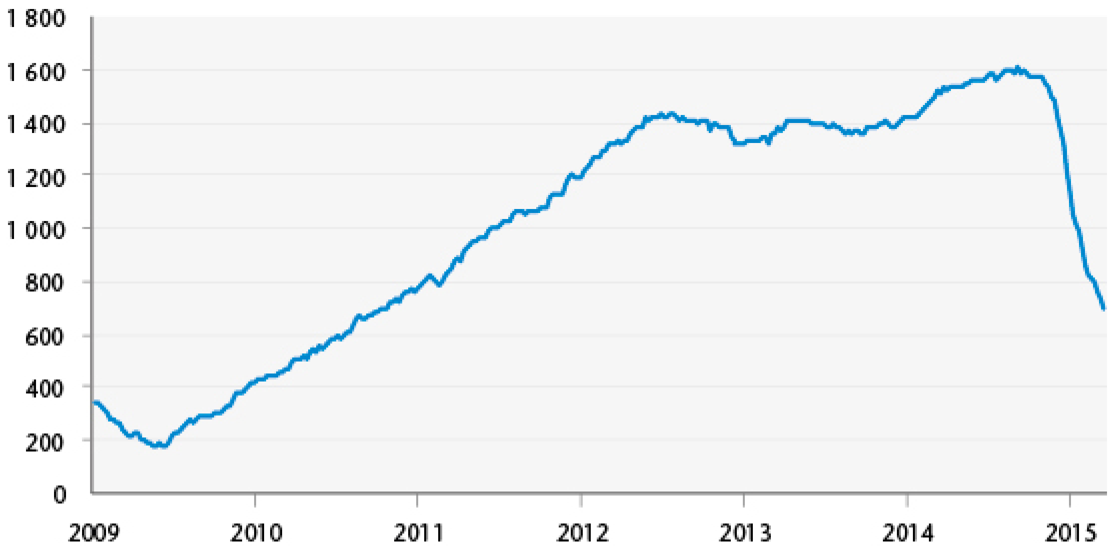
The US economy at a standstill in Q1 2015: the impact of shale oil

By Aurélien Saussay (@aureliensaussay)

The US Bureau of Economic Analysis has just released its estimate of US growth in the first quarter of 2015: at an annual pace of 0.2%, the figure is well below the consensus of the leading American institutes, who had agreed on a forecast of just above 1% – well below the 3% hoped for in early March.

While it is still too early to know the exact reasons for this setback, one factor seems to be emerging: in the United States, the shale oil “revolution” seems to be on the verge of imploding. The sharp fall in crude prices in the second half of 2014 caused a collapse in mining activity: the number of oil rigs operating in the US fell by 56% from November 2014 to April 2015, returning to the level of October 2010 (see chart). The speed of this downturn underscores the fragility of the shale oil boom and its dependence on high oil prices.

Figure. Oil drilling rig count in the continental US



Source : Baker Hughes.

Given the very short lifetime of shale oil wells, *i.e.* less than 2 years, the sharp decline in the pace of drilling should result in an equally rapid decline in production in the coming months: in fact, for the month of May the US Energy Information Agency (US EIA) has forecast that shale oil production will fall for the first time since the start-up of operations in 2010.

This rapid contraction of the shale oil industry could have significant consequences for the US economy. There are two main components to the macroeconomic impact this will have:

the business of drilling and completing wells, and the gains in the trade balance from substituting domestic production for imported oil.

In 2013, the hydrocarbons mining industry and mining-related services accounted for 2.1% of the US economy, up from 1.6% four years earlier. At a first order, a decline in the drilling rate could therefore cut US growth by 0.3 GDP point. The Fed's manufacturing indicator already shows just such a decline: American industrial output is down by 1% on an annual basis in first quarter 2015, a first since the second quarter of 2009. The mining sector seems to be the leading contributor to this decline, with activity falling off by 4% during the quarter.

However, this figure neglects the ripple effect from the sector onto the rest of the economy – which goes beyond the impact simply on upstream industries: for example, in the regions affected, shale oil operations were accompanied by a real estate boom generated by the influx of workers into the shale fields. Texas and North Dakota, for example, which concentrate 90% of the total production of shale oil, contributed over 23% of US growth from 2010 to 2013, whereas they accounted for only 8% of the economy in 2010. The negative impact of the collapse of the oil industry could thus be more important than the size of the oil sector alone might suggest.

The rise in US production of over 4 million barrels per day in 2014 also led to an improvement in the trade balance, contributing an additional 0.7 GDP point to growth. If the reduction in the number of wells is followed by an equivalent decrease in production starting in the second half-year, and oil prices stay at around USD 60, US domestic production would now contribute only about 0.2 GDP point, half a percentage point less than in 2014.

Finally, the rapid exploitation of shale oil deposits was mainly due to the so-called independent producers who specialized in this activity, and who are therefore particularly vulnerable to the volatility in international prices. This is a very capital-intensive activity: the independents made use of bonded debt to finance their operations – for a total of USD 285 billion as of 1 March 2015, including USD 119 billion in high-yield bonds[1]. The impact of the fall in oil prices has been particularly important for this last segment: the share of "junk bonds" rose from 1.6% in March 2014 to 42% in March 2015[2], *i.e.* 50 billion dollars. It should be noted that this increase has resulted mainly from the deterioration of existing bonds, even though new bond issues have also contributed. If this trend continues, it could lead to a crisis in the high-yield segment of the US bond market, which would hurt US corporate financing conditions this year at a time when the Fed wishes to begin to tighten monetary policy.

The implosion of the shale oil industry will test the strength of the recovery in the US: if it turns out to be weaker than expected, the shock of the sharp slowdown in the production of shale oil could be enough to bring the American economy to near stagnation in 2015.

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[1] Yozzo & Carroll, 2015, "The New Energy Crisis: Too Much of a Good Thing (Debt, That Is)", *American Bankruptcy Institute Journal.*

[2] Source: Standard & Poor's.

Shale gas: recovering a mirage?

By Aurélien Saussay

A report posted online on April 7 by *Le Figaro* assesses the gains that could be expected from the exploitation of shale gas in France: the report concludes that this is an opportunity to revive the French economy and cut France's energy costs by substituting domestic production for our imports of gas. It estimates that the macroeconomic impact would be substantial: in the "likely" scenario, more than 200,000 jobs would be created, with an additional 1.7 points of GDP on average over a 30-year period.

The magnitude of these figures stems directly from the assumptions used in the report, especially in terms of geology. The production costs for a shale gas field and the volumes that could be extracted depend on the field's physical characteristics (depth, permeability, ductility of the rock, etc.). However, without carrying out any experimental fracking, it is very difficult to make a future estimate of all of these parameters, and hence of the final production cost.

It is nevertheless possible to see how these parameters are distributed in the only territory that has extensively exploited shale gas up to now: the United States. By reviewing the production data for the US deposits accumulated over more than ten years, a realistic distribution of production costs can be modelled. This is the approach adopted to develop the SHERPA model, which is described in an OFCE working paper published today, *Can the U.S. shale revolution be duplicated in Europe?*

More than 60 shale gas deposits have been explored in the

United States since it first began to be exploited in the early 2000s. But only 30 have been put into commercial production, and six of these account for over 90% of the total US output of shale gas. Based on the geological assumptions corresponding to the median of the six best deposits, the Net Present Value (NPV) of France's gas resources comes to 15 billion euros – 15 times less than the 224 billion estimated in the aforementioned report. To reach this latter figure, it must be assumed both that the cost of drilling and well completion will be similar in France and the United States, and that the French deposits are comparable to the best American field, around Haynesville, Louisiana … but the characteristics of that field are exceptional: the average output of its gas wells is nearly four times the average of the five other main deposits. While it is of course impossible *a priori* to exclude that this latter assumption would hold, it is very unlikely.

This uncertainty emphasizes the need to carry out experimental drilling to guard against overly optimistic scenarios. The case of Poland is instructive: the projections of the US Energy Information Agency (EIA) pointed to very large shale gas reserves in a country that is heavily dependent on imports of Russian gas. The Polish government, keen to strengthen its energy independence, decided to try to speed up domestic production, offering up to a third of its territory for operating concessions. The first wells were disappointing: it turned out that the rocks in the Polish deposit contained too much clay, making them too ductile and impeding good fracturing of the rock – an essential step for exploiting shale gas, regardless of which technology is used. After the trials, Poland's substantial reserves, touted as the largest in Europe, proved to be unworkable.

This kind of evaluation should be made in a way that is public and transparent. Professional prospectors, whose main activity is to assess the geological reality of a hydrocarbon deposit previously estimated on paper, in fact have an interest in overestimating the pre-drilling assessments in order to sell their services. An example from abroad once again shows the extent of the problem: in May 2014, the US EIA reported that the estimate of the exploitable volume of shale oil in the US Monterey deposit, hitherto regarded as one of the most promising, was being slashed by 96%. After a review, it was clear that the first estimate, made two years earlier, had been based entirely on the calculations of private independent prospectors, without the intervention of the governmental services of the US Geological Survey.

To ensure a realistic assessment of France’s resources of shale gas, experimental drilling needs to be entrusted to a public body, with fully transparent results and methodology. Only an approach like this can ensure that future scenarios are objective and not unduly optimistic.