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The German energy transition: ambitions under the test of reality

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"Politik ist das, was möglich ist"[1]. With this expression, German Chancellor Angela Merkel acknowledged and justified the limited ambition of the "Climate Package" presented on 20 September 2019 by her government after some twenty hours of bitter negotiations between the coalition partners. More generally, she summarized the contradiction experienced by most European countries: on the one hand, to satisfy the expectations of a population increasingly aware of global warming, and on the other hand, to spare the most modest households, as well as the most exposed industrial sectors, the additional costs caused by a rapid transformation in energy systems.

Due to its size, its energy mix and its ability to avoid the deindustrialization that has devastated the territories of its neighbours, Germany is the largest greenhouse gas (GHG) emitting country in Europe (22% of emissions). Nearly 40% of German emissions come from the energy sector, with 25% from coal-fired power plants alone. After having hit the headlines with ambitious targets for 2020 and 2030, Germany is facing the first results as these deadlines approach. The main target of reducing emissions by 40% by 2020 compared to 1990 will not be met - a 33% reduction is now envisaged - and might only be met in 2046, if the pace remains the same as it has been over the past decade. The difficulty in accelerating the decarbonisation of the economy does not detract from the major successes achieved elsewhere, notably in the growth of renewable energies (RE). It does however raise questions in the context of the upwards revision of EU's goals under the "[Green Deal](#)" put forward by the European Commission[2] and growing pressure from social movements such as "Fridays for the Future" or "Extinction/Rebellion".

[1] "Politics is the art of the possible", Frankfurter Allgemeine Zeitung, 20 September 2019.

[2] A Green Deal for Europe, Our Ambition : the to be first neutral continent for the climate, 11 December 2019

[3] Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, Climate Action in Figures, Facts, Trends and Incentives for German Climate Policy, 2019.

[4] The other suppliers of German coal are the USA (18%), Australia (13%), Colombia (11%), Poland and South Africa. Statista, 23 July 2019.

THE CHALLENGE OF THE DOUBLE EXIT (COAL/NUCLEAR)

Contrary to popular belief, it is not the decline of nuclear power which, by requiring increased use of coal, is responsible for keeping emissions high. Although coal's share of the electricity mix increased

in the years following the market exit of 8 of the 16 German reactors (2011), its share has been declining since 2014. In Germany, as in Europe, the main challenge is the transport sector. Compared to 1990, no other sector has seen such a small reduction in CO2 emissions (-0.6%). Between 2012 and 2019, emissions even increased by 6%, since the decrease in emissions per kilometre (-3%) did not compensate for the increase in traffic (+5%)[3].

The decarbonisation of the energy sector is continuing thanks to a profound transformation of the German energy mix. In 2018, coal supplied almost 13% of German electricity production, compared with 25.6% in 1990. The share of lignite was 31.1% in 1990 and 22.5% in 2018. In the west of the country, the last coal mine closed on 21 December 2018, bringing to an end an activity that began more than 200 years ago and which, in the national memory, is regarded as having enabled the *Wirtschaftswunder* (economic miracle) and for having forged the region's working-class culture. Beyond climate arguments, the cost of mining had become excessive due to the geological context and the competitive cost of imported coal. However, the end of the coal era is not close. New power stations are connected and coal is now imported in greater quantities, as is gas, in both cases to the benefit of Russia, which supplies 35% of the coal and 51% of the gas consumed by Germany in increasing volumes as the years go by[4].

Above all, Germany remains the world's largest producer of lignite, ahead of China, Russia and the United States. Emitting more carbon than coal, lignite is also more damaging to the environment since it affects air quality and involves the destruction of dozens of villages. Beyond the attachment of part of the population to this source of energy (concentrated in Lusatia, in the former GDR), operating costs are low and transport costs almost nil, as mines are located next to thermal power stations.

Thought on the future of coal has been given to a Multipartite Commission which delivered its conclusions in February 2019[5], the main one being a end to the use of coal in the energy sector in 2038. The government has decided to follow the Commission's recommendations in part via two laws: the first on the conversion of mining regions, which provides in particular for €30 billion in allocations, and the second setting out the timetable for the closure of power stations and compensation.

The end of nuclear power is set for 2022. 17 reactors were in operation in 2011 and produced a quarter of the country's electricity. In 2017, 7 reactors produced 12% of the electricity. Around 8,000 direct jobs and 32,000 indirect jobs are involved[6], which will mainly be protected under the dismantling process.

Gas has a number of features (flexibility of use, security of supply enhanced by the multiplication of liquefied natural gas (LNG) terminals in Europe, prices unrelated to those of oil) that suggest its share might increase significantly. Nevertheless, this has stagnated over the last 20 years, with the (slight) increase in imports due primarily to the depletion of German deposits. Its share in the energy mix, however, increased sharply between 2018 and 2019, with the fall in prices occurring at the same time as a sharp rise in the cost of credits on the European carbon market. As a result, coal-fired power plants saw their competitiveness eroded in favour of gas-fired plants. Could the European carbon market ultimately precipitate the end of coal in Germany? If it is confirmed that the implementation of the stability reserve on 1 January 2019 triggered a sustainable

rise in the price of a tonne of carbon in Europe, the hypothesis might become a reality. To date, however, gas has only marginally benefited from the reduction in capacity in the nuclear and coal sectors, with the growth of renewable energies making up for lost capacity.

RENEWABLE ENERGIES UNDER CHALLENGE?

In 1990, coal (including lignite) accounted for 56.7% of electricity generation, nuclear for 27.7% and renewables for 3.6%. In 2017, these figures were 36.6%, 11.7% and 33.3% respectively[7]. The increase in renewable energies has thus made it possible to compensate for both the reduction in the share of nuclear power and the reduction in the share of coal. Thanks to favourable weather conditions, their share in the electricity mix even reached 46% in the second quarter of 2019. The target that the German authorities (35%) had set for 2020 will be exceeded, but reaching the following objectives, in particular 65% in 2030, will not be easy.

With complaints from local residents, concerns expressed by the Army, slow procedures, etc., in 2019, onshore wind energy experienced a crisis that resulted in a collapse in the number of installations connected[8] (82% decrease between the first quarters of 2018 and 2019). Should this continue, the crisis would weaken German ambitions insofar as onshore wind power provides 40% of renewable electricity (solar 20%). Far from following the recommendations of the professionals in the sector, the German government adopted in October 2019 a downward revision of the capacities to be installed.

In addition, the strong growth of wind power, concentrated in the north of the country, has changed the geography of production. As the main consumption centres and four of the seven power stations still in operation are located in the south, interconnections need to be strengthened. However, the vagaries of administrative procedures and the resistance of local residents are holding back the projects. Only 1000 km of the additional 3600 km planned by 2020 had been developed by the first

[5] "Kommission Wachstum, Strukturwandel und Beschäftigung".

[6] DIW Econ, 2015, Die Beschäftigungseffekte der Energiewende. Eine Expertise für den BWE und die Deutsche Messe AG. Berlin, April

[7] Stromerzeugung nach Energieträgern 1990 - 2017, AG Energiebilanz.

[8] Kathrin Witsch, Klaus Stratmann, "Ausbau der Windkraft bricht dramatisch ein", Handelsblatt, 25 July 2019.

quarter of 2019. Security of supply has not, however, been weakened by the transition, 2022 being the last year in which Germany imported more electricity than it exported[9].

THE "CLIMATE PACKAGE", A NEW START FOR THE ENERGY-CLIMATE POLICY?

Against this backdrop, in which Germany's energy transition seems to be hitting a glass ceiling, the "Climate Package" announced on 20 September 2019, has brought little relief from the uncertainties. Above and beyond a greenhouse gas emission reduction target that has been revised upwards (55% compared to 1990), the main decision taken was the introduction of a carbon price for transport and buildings in three stages. The price initially set by the government (€10 per tonne in 2021) was re-evaluated at €25 under pressure from the Green Party. This price will increase by 5€ in 2022 and 2023, then reach 45€ in 2024 and 55€ in 2025. In a second phase, a carbon market will be set up for these sectors with a price of carbon contained between €55 and €65 per tonne before eventually being integrated into the European Emissions Trading Scheme ([EU ETS](#)) which will be called upon to extend to all sectors of the economy.

As regards renewable energies, the next decade should see a near doubling of production capacities (200 GW in 2030 against 118 GW in 2018). Targets have been raised for photovoltaics (98 GW expected in 2030 against 85 GW previously) and lowered for onshore wind power. To promote acceptance, all municipalities are expected to reap the benefits of installing wind turbines within their territory, and a "regional bonus" should allow a more homogenous spatial distribution of equipment.

In terms of mobility, 7 to 10 million electric vehicles are expected by 2030 (1 million charging points should be in service by 2030) and both Länder and municipalities will be allowed to set their own emission standards for buses, taxis and rental cars. Public transport is to receive support of 1 billion € per year from 2021, 2 billion € from 2025 onwards.

86 € billion will be invested between now and 2030 to modernise the rail network and VAT on train tickets will be reduced, while regulatory and fiscal measures will aim to raise the cost of air tickets for short distances. The building sector (14% of the country's emissions) will also be affected, with tax deductions for energy renovation work and the modernisation of heating systems.

Faced with the risk of the spread of protest movements, the German authorities have emphasised the transition's social dimension. The tax paid by electricity consumers to finance support for renewable energies and the contributions made to the financing of the networks are to be reduced, with the shortfall being compensated by carbon taxation. If the carbon tax produces more revenue than expected, the profit would be returned to electricity consumers. Commuters, even motorised commuters, will also benefit from aid until the end of 2026, as will the most vulnerable households.

The "Climate Package", which has been costed by the government at 50 billion €, will not be finalised until it has been adopted by Parliament. 66 legislative texts are needed, according to the Energy Agency[10] one third of which will require the consent of the *Bundesrat*, where the Greens are in a strong position. As it stands, the text reflects the dissensions within the ruling coalition, which have led to a compromise with, admittedly, the establishment of a carbon tax, but at a modest level and with efforts that will essentially focus on the years after 2025. In this context, the added value of the transition in terms of jobs and innovation is a major challenge if the transition is to enjoy broad public support.

ENERGY TRANSITION THAT IS BOTH ECONOMIC AND SOCIAL

Can the job creation resulting from the development of renewable energies in the long term compensate or even exceed the losses due to the concomitant decline of nuclear and coal? In the case of coal (including lignite), most of the restructuring has taken place. The number of direct jobs remaining

[9] [Statista](#).

[10] [DENA](#), *Klimapaket ist große Gestaltungsaufgabe für Gesetzgebung*, 25 September 2019.

(around 20 000) is far lower than the workforce in place until the 1990s. The difficulty lies in the spatial concentration of jobs (particularly in the former GDR where alternatives are scarce) and in the symbolic importance of coal in the mental representations and identity of the regions concerned. Following the submission of the final report by the "Coal Commission", the government undertook to finance conversion projects to the tune of 40 billion € in the mining regions.

Since the 1990s, Germany has pursued a policy of combining support for demand, notably through feed-in tariffs, and the financing of innovation for both photovoltaic and wind energy. The wind energy sector has benefited from the traditional strengths of the German industrial fabric, particularly in the mechanical engineering sector, the dynamism of the national market and the initiatives launched by local and regional players in the coastal regions to overcome the challenges of the conversion of shipyards. The development of the photovoltaic sector might have contributed to the modernisation of regions in crisis, in the south of the former GDR, where the sector has gained momentum thanks to public support and local industrial traditions. However, the strong growth of the sector in the 1990s and 2000s was hampered by the means used by Chinese competitors to industrialise the large-scale production of solar panels and thus reduce costs. As a result, the sector comprised 35,000 jobs in 2019 compared to 140,000 in 2011. Nevertheless, the introduction of complex devices combining renewable energies, intelligent systems management and storage solutions seems to be a promising way for Germany and Europe to position themselves in the most innovative segments of the value chain.

Nevertheless, the assessment that can be made in terms of jobs from Germany's energy transition in 2019 is nuanced. Between 2010 and 2016, employment in the energy sector increased slightly[11], a trend that reflects both a sharp fall in the photovoltaic sector over the past decade, a decline in conventional energies and a sharp rise in the wind and distribution sectors. In the end, the

energy sector accounted for 700,000 jobs in 2018, almost half of which are in renewable energies. In 2018, the wind energy sector employed five times as many people as the mining sector, compared to three times fewer in 2000. In 2018, Germany had as many jobs (160,000) in this sector as the ten other European countries with the highest number of employees in the sector[12].

With the progress of digital technology and most renewable energies, the industrial fabric is also being enriched by new players, particularly start-ups[13]. However, further job losses, in addition to those foreseeable in the coal sector, cannot be ruled out. Energy companies that have been slow to grasp the challenges of the transition have not yet completed their transformation. In 2018 E.ON and RWE broke with the model of vertical integration adopted since the post-war period by most European industry players. By means of asset swaps worth more than 40 billion €[14], E.ON has refocused on network and distribution activities, RWE on generation, both conventional and renewable. As a result, E.ON has announced a 7% reduction in its overall workforce[15]. The decarbonisation of the transport sector also means an increase in the use of electric vehicles, a turning point which is both a necessity for German industry, particularly to secure a place in the Chinese market, and a risk. The first projects for the Airbus battery project were launched in 2019 (a battery factory has been set up in Salzgitter), but the fate of the 600,000 jobs in the sector does not appear to be guaranteed, if only because there are fewer employees and fewer parts needed to build an electric vehicle than for one with a combustion engine.

Germany has embarked on a bold energy transition designed both as a follow-up from the Fukushima nuclear accident and in response to global warming. The decision to move simultaneously out of nuclear and coal has raised the stakes in terms of the capacities to be replaced, the networks to be strengthened and the jobs to be created. Although

[11] O'Sullivan Marlene, Edler Dietmar, Lehr Ulrike, 2018, *Ökonomische Indikatoren des Energiesystems; Methode, Abgrenzung und Ergebnisse für den Zeitraum 2000 – 2016*, GWS research report, 2018/01

[12] Ulrich Philip, Lehr Ulrike, 2018, *Erneuerbar beschäftigt in den Bundesländern; Bericht zur aktualisierten Abschätzung der Bruttobeschäftigung 2016 in den Bundesländern*, GWS research Report 2018 / 02, March

[13] The Borderstep Institute and the University of Oldenburg estimate that 81% of the 170 000 start-ups connected the green economy created between 2008 and 2013 developed activities in the renewable energies sector. *Energy efficiency or the fight to counter global warming* (Trautwein, C., Fichter, K. & Bergset, L., 2018, *Green Economy Start-up Monitor 2017*, Institut Borderstep Institute and the University of Oldenburg).

[14] Arash Massoudi, Tobias Buck, "Eon to acquire Innogy in €43bn deal with RWE", *Financial Times*, 10 March 2018.

[15] Tobias Buck, "Eon to cut 5,000 jobs after Innogy takeover", *Financial Times*, 13 March 2018.

in 2019 any assessment can only be provisional and partial, the strong growth of renewable energies has been the *Energiewende's* main success. To date, this has made up for the loss of capacity in the nuclear and coal sectors.

As far as greenhouse gas emissions are concerned, the picture is more mixed. The share of coal in electricity production is slowly declining, while the decarbonisation of the transport sector is experiencing the same difficulties as in the European Union as a whole. In this context, the German government has resigned itself to a carbon tax, a move the impact of which is expected to remain modest compared to the levels projected by the "Climate Package". The latter appears all the more daring since, after several years of negotiation, the European Commission has made climate policy one of its priorities, with targets raised only a few months after the adoption of the Energy-Climate framework agreed for 2030.

Hence, a German transition is taking place, which, after having struck a chord with the public due to its boldness, now needs to change scale otherwise it might fall short of expectations. Moreover, the political context is not the most favourable. The three regional elections held in 2019^[16] witnessed the decline of the major coalition parties, with the Greens making modest progress, while the AfD, hostile to wind turbines as well as to the end of coal, won a quarter of the votes cast, with gains of more than 10% in the three Länder compared to the previous elections.

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