

The European Energy System in an Age of Globalization

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by

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Part 1: “There is nothing left!”

What I would like to do in my talk here today is to try and place the coal industry and the ongoing changes in European energy today into a broader perspective. I want to zoom out and think through the history of energy in Europe, focusing especially on the connections between what has happened in Europe itself over the years, and what we might call the far reaches of European energy, that is, Europe’s energy links with the non-European world.

Let me start by showing this picture [SLIDE]: it is a painting from the 16th century, depicting a very proud town in southern Germany called Schwäbisch Hall. The name “Hall” comes from a Latin word for salt, and in the 16th century Schwäbisch Hall was a very significant salt-producing town. The salt industry was at this time known as one of the so-called “fire industries”, because boiling of salt water required fire, and to make a fire the salt industrialists used massive amounts of firewood, which at this time was by far the most important energy source throughout continental Europe. The copious use of firewood, however, had by this time given rise to what may be interpreted as a severe crisis in terms of the far-reaching depletion of the locally available fuelwood – as you can see from the painting there is basically no forest at all left in the local surroundings.

The remarkable thing is that the salt industry does not seem to be all that bothered by the disappearance of the forests. They keep on working just like they have always done, and the salt industry continues to flourish. They are able to do so because they have found a way to access very good firewood sources from more distant forests. More precisely, they have forged agreements with upstream localities, from where thousands of logs of excellent wood are transported downstream the small river here, and received in the local harbor of Schwäbisch Hall. The firewood usually arrived in large batches during certain

times of the year, and these days became festive days of town-wide celebrations, everybody was excited and a lot of beer, wine and food was consumed.

This is now almost half a millennium ago, and the world now looks very different. However, the legacy of Schwäbisch Hall's quest for access to firewood is very much alive in our own age. Nowadays, Europe as a whole is precisely in the same situation as Schwäbisch Hall was in the 16th century. Our local energy sources have been – or are about to be – depleted. And just to make sure that you are familiar with the word “depletion”: it means that there is nothing left! Our local fuel resources in Europe have been burnt up, they have been consumed. They are gone. And they are gone forever. Of course not 100% is gone, but what we see now in terms of ongoing fuel extraction is an end-game, we are turning the final pages of Europe's fuel extraction book. All peaks in production are in the past, and everybody who works in non-renewable primary energy production in Europe today works in a declining industry.

Half a century ago a country such as Germany was still able to produce impressive volumes of hard coal and even large volumes of oil and natural gas. Today basically nothing of this remains [**SLIDE German coal production, with peak in 1956**]. Romania was once a world leading oil producer and then a massive producer of natural gas. Today almost nothing remains. Austria was once a major producer of both oil and gas; now there is nothing left. The situation is much the same in Italy, in France, in Spain, well basically everywhere. Even the North Sea's oil is being depleted at a rapid pace, with production now being less than half of what it was 15 or 20 years ago [**SLIDE North Sea oil peak**]. And in the Netherlands, which in 1959 discovered the world's largest natural-gas field, production is now rapidly being phased out due to a tragic course of depletion which has recently given rise to a series of strange earthquakes in the Groningen region. Europe's energy resources have, quite literally, gone up in smoke. They have been squandered, and they will never come back to us. They are gone forever.

The remarkable thing is that Europe's energy users have hardly been affected at all by this radical race to depletion. On the contrary, European energy use today is higher than ever and there has been a tremendous growth during the past 200 years. Just like the salt industry in Schwäbisch Hall in the 16th century, countries such as Germany, and Europe as a whole, have been able to continue burning copious amounts of fuel much like before, and even scale up consumption in ways that few people were able to imagine 60 or 70 years ago. How has this been possible? Well, the explanation is simple: just like Schwäbisch Hall, Europe has managed to successfully tap into fuel reserves located elsewhere – that is, beyond Europe. These non-European energy sources have more than compensated for the depletion of European fuel deposits.

For example, Germany nowadays imports roughly 90% of all the hard coal that it burns. It also imports 90% of its natural gas, 98% of its oil and 100% of its uranium. And the trend is the same in virtually every European country. Britain, for example, closed down its last coal mine a few years ago. In my own country, Sweden, domestic coal production was phased out already in the early twentieth century, and domestic uranium production came to an end in the 1960s. There is no production of fossil fuels in Sweden today. And yet Sweden boasts of a highly competitive steel industry which thrives thanks to imported coal and coke; my country also has millions of car owners and truck drivers who are able to fill up their petrol- and diesel-driven vehicles, and air planes who are able to take off and land in a multitude of Swedish airports thanks to imported jet fuel. Natural gas heats towns and supplies industries with process heat in Sweden's south and southwest, and nuclear power plants produce copious amounts of uranium-based energy for the benefit of Sweden's energy-intensive industries and households.

Most European countries, along with the most advanced nations in East and Southeast Asia are in more or less the same situations. They source their energy from remote locations, and the amounts of imported energy are vast. The only difference really, compared to Schwäbisch Hall in the 16th century, is that the arrival of our much-needed fuel does not inspire any celebrations or festivities. We do not cry out of joy when the gas arrives from Russia [SLIDE Waidhaus gas arrival]; we do not sing the praise of Saudi Arabia's petroleum when the supertanker is sighted at Marseilles; we do not gather to cheerfully watch the arrival of the coal ship from Colombia when it docks in the port of Hamburg [SLIDE Moorburg coal power plant, with coal ship being unloaded]; and there is no street party in La Hague on the French coast when the uranium oxides arrive from the Nigerien uranium mines in the Sahara desert. In fact, few people are aware that these shipments take place at all. And yet they are the very lifeblood of the European economy and of our modern life as we know it.

Before I continue, let me just mention here that there is one very important non-renewable energy source that goes against the overall pattern: namely, lignite, or brown coal. Europe is a great power in lignite, producing over half of all lignite in the whole world. Germany to this day remains the world's largest lignite producer. Russia, Poland, Greece, the Czech Republic, Serbia, Bulgaria, Romania, Albania and Hungary are also massive producers. Europe's lignite resources have not been depleted, and as all other intra-European fossil fuels are depleted, the strategic role of European lignite becomes ever more pronounced. It is an extremely dirty fuel, but it doesn't matter, because historically there have been other factors that have been considered more important. Lignite's key role in most of the countries I mentioned can be traced back to a sinister desire in

these countries for energy autarky, and so governments have championed the expansion of lignite mining at almost all costs. Nowhere would lignite production be able to thrive without heavy government subsidies, because cheaper energy is readily available for pick up in the nearest seaport. Yet in 2018 lignite still remains the backbone of the energy systems in several European nations, and the current trend of nationalism and protectionism will not be very helpful when it comes to changing this disastrous state of affairs. It is not unlikely that many, if not most, of the countries that I mentioned in a couple of decades will feature a bizarre energy mix of heavily polluting lignite combined with wonderfully clean wind and solar energy.

Part 2: Energy colonialism and energy transnationalism

But let me come back to the observation that Europe, with lignite as the main exception, has become almost totally dependent on imported energy. Another way to express this phenomenon is that the European energy system has gone through a radical globalization process. Indeed, it is the globalization of energy that defines the European energy system and its evolution during the past 150 years. Globalization can of course refer to many different things, but let me here discuss two main globalization phenomena: I will refer to these as energy colonialism and energy transnationalism, and I will argue that it is in the interaction between these two historical processes that we may start to discern the underlying dynamics behind the European energy system's long-term evolution.

1. The case of oil

The modern petroleum industry was spearheaded by American entrepreneurs in the 1850s and 1860s, and pretty soon American kerosene, which was used for lighting, started to appear in European markets for lighting oils. However, a number of European entrepreneurs early on set out to challenge the Americans. They did so by turning to oil resources in European colonies, especially Russia's recently colonized Transcaucasian lands, later on also in the Dutch and British East Indies and in the impoverished Ottoman Empire and the Middle East. Then in the 1910s oil started to be regarded as a strategically important energy source, mainly due to its role in propelling warships [SLIDE WWI warships], tanks and airplanes, and as a result oil imports were increasingly identified as an issue for state agencies to look into. European governments decided that they wanted control over both oil imports and domestic distribution. And so they set out to acquire their own oil fields in distant parts of the world. The result was a new, aggressive form of European oil colonialism. Britain with its BP company led the way here, but France and other European nations were not far behind. After World War II this trend continued at an accelerated pace, with for example Italy

becoming very active from around 1954 in regions such as Egypt and Iran, and Spain, which in cooperation with the larger international oil companies tried but failed to find oil in the Spanish Sahara. In the 1960s Germany entered the game (DEMINEX), and more surprisingly even smaller nations including my own country, Sweden, tried to find oil in foreign territories. Most amazingly, even countries behind the Iron Curtain emerged as oil colonialists, and I am here thinking not so much about the far-reaching involvement of the Soviet Union in third-world oil exploration projects, but also of countries such as Bulgaria, which thanks to the friendship between its dictator Todor Zhivkov and his counterparts in Libya, Muammar al-Gadafi [SLIDE], was able to tap into Libyan oil.

So oil colonialism is definitely a major trait of both nineteenth- and twentieth-century European oil history. But acquiring crude oil was only one of many challenges in putting the European oil supply system to work. There was also a need for refining, storing, and distributing oil and oil products. And those activities did not come about in any automatic way. In terms of refineries, European governments strongly advocated that the oil must be refined domestically, not abroad. Some countries also created state-owned refining companies, which were then typically integrated with those companies that were looking for oil in colonial regions. Economists refer to this as “vertical integration”. Italy’s ENI is a case in point here, Spain’s CAMPSA, a state import monopoly founded in 1927, is another. In any case oil refining became very much a national affair, and essentially what Europeans did was to construct a chain of oil refineries along the coasts. [SLIDE refinery map] At these locations imported crude oil from colonial regions was refined and then shipped to industrial users, filling stations, airports and so on by way of tanker, rail or truck.

Subsequently refineries were also built in a number of landlocked locations in continental Europe. Let us look a little bit at these landlocked locations. Here initially the idea was that colonial crude oil could be unloaded in one or the other seaport and then transported by rail into Europe’s interior regions. But when oil use started to grow exponentially in the 1950s, this soon turned out to be totally unfeasible, because it put an enormous stress on the European railway network. Instead, oil companies along with other actors such as petrochemical companies, industrial groups and regional governments joined forces in constructing very large and above all very long oil pipelines from the seaports to major industrial centers in continental Europe [SLIDE oil pipeline map 1960], such as Ludwigshafen and Ingolstadt in Germany and Schwechat in Vienna’s outskirts in Austria. The most important oil pipelines in Western Europe were the ones from Marseilles to Baden-Württemberg, from Rotterdam to the Ruhr, from Genoa to Ingolstadt and from Trieste to Ingolstadt and Vienna. Here is an

image showing the emerging European oil pipeline grid that took form as a result of these ambitions.

Bavaria and its political leader Otto Schedl played a particularly interesting role here, actively pursuing a strategy that aimed to make Bavaria independent not from foreign countries, but from other German regions and especially from the coal regions of the Ruhr, which he really hated and blamed for Bavaria's economic backwardness. Imported oil from North Africa and the Middle East became his tool in his struggle for Bavarian coal independence. However, in order to access foreign oil without becoming dependent on northern Germany, he needed to forge cooperation not only with exporters of crude oil, but also with actors in Italy, Austria and Switzerland, which emerged as transit countries. The construction of oil pipelines from Italian seaports to Bavaria, taking the route across the Alps, must be regarded as one of the most impressive feats in European oil history. But there are several other examples of landlocked regions that followed the same strategy, with actors forging cooperation with neighboring European countries so as to enable imports of crude oil from faraway. Ludwigshafen, as we see here, accessed Middle Eastern oil by way of Rotterdam or Hamburg, but rather through a cooperative venture with France. In Eastern Europe Czechoslovakia, Hungary, Poland and East Germany forged similar cooperation, albeit under a totally different political regime, with the Soviet Union, whose immense colonial oil riches they accessed through the famous Druzhba pipeline system. The point here is that oil pipeline construction in both Western and Eastern Europe became the basis for cooperation between different European countries. Or, somewhat differently expressed, oil pipeline construction became the basis for a far-reaching European oil transnationalism. This transnationalism was dynamically co-produced with rapidly growing and ever more aggressive extractive activities in Europe's colonial or quasi-colonial peripheries.

2. The case of natural gas

Now, moving from oil to natural gas, the interaction between energy colonialism and energy transnationalism becomes more complex. It took much longer for natural gas to become a globalized fuel, mainly because it is so much more difficult to transport gas over long distances as compared to transporting coal or oil. Even today, there is no truly globalized market for natural gas. The breakthrough for natural gas as a fuel in Europe is, ironically as it may seem these days, directly linked to attempts to strengthen European energy independence. Natural gas was spearheaded in Europe by a number of countries and regions that did not possess any large domestic coal deposits, especially France, Italy, Austria and also Bavaria. All of these countries very actively promoted natural gas as a way to overcome coal import dependence. Their

enthusiasm for natural gas was initially linked to some quite substantial domestic finds of gas deposits. But when they with great enthusiasm set out to exploit these deposits, natural gas soon became so popular among users that overall demand very quickly outpaced anything that the local sources were able to meet. In this situation the gas companies faced a delicate and very strategic choice: either they would have to disappoint their gas users and say that unfortunately there is no gas left, so you have to switch to coal or oil. Or, they would have to try and meet growing demand by seeking access to foreign supplies. All gas companies in Europe opted for the second alternative.

But from where should the gas be sourced? Who could possibly supply Europe with more natural gas to compensate for depleted local supplies? The first large-scale project to be seriously discussed here aimed at moving gas from the European colonial periphery in North Africa across the Mediterranean into continental Europe. This possibility became immensely popular not only in France, which had discovered a vast natural gas field in the Saharan desert in Algeria, but also in for example Bavaria as well as in Italy, Spain, Austria and even Britain. This map [SLIDE Bavarian-European gas map] here is from the early 1960s and it shows how gas companies believed that colonial natural gas from Algeria could be brought into Italy, Spain, France, Belgium and even Britain. It is a vision of European energy colonialism. But it is also a vision of European energy transnationalism, in the sense that it envisaged a far-reaching cooperation between a number of European countries to make this energy system come about.

Precisely at this time, however, further very important natural gas discoveries were made in Europe itself: in the Netherlands. The Groningen natural gas field there turned out to be so immense that it seemed impossible for the Netherlands itself to make use of all the gas. For this reason the Netherlands concluded agreements with Belgium, France and Germany for large-scale gas exports. This cooperation became a cornerstone of European gas transnationalism.

But further and even more significant gas fields were being discovered in the Russian colonial periphery: in Northwestern Siberia. This is a distinctly colonial region, home to indigenous peoples such as the Nenets. The gas discoveries in Siberia in the early 1960s made headlines in Western media, and several West European gas companies started to consider the possibility of importing Soviet natural gas. And so by the early 1970s Western Europe was sourcing most of their gas from two colonial peripheries: Algeria and Western Siberia. Together with the gas from the Netherlands, these colonial gas streams made the European gas market very competitive. In spite of the fact that Europe had very little indigenous gas, save the Groningen field and the smaller French field at Lacq, this competitive situation meant that the gas importers were able to source

colonial gas at a very good price. Moreover, the gas transnationalism that was becoming evident already in the early Algerian and Dutch visions became increasingly pronounced because long-distance pipelines from Siberia, from the Sahara and later on from other gas exporting countries as well forced whole groups of Western European countries and regions to cooperate with each other in the construction of these huge pipeline systems. Here is another image [SLIDE map of European gas grid as of 1980, Erdgasverbund] showing, in this case, how the construction of gas pipelines from the Siberia to Western Europe contributed to a process of European integration in natural gas.

3. Uranium

Now, similar stories could be told in the cases of other prominent energy sources such as uranium, biofuels, electricity, and of course also coal.

Uranium is the most internationalized energy source in the European fuel economy. 99% of the uranium that nuclear operators use is imported from non-European uranium mines, mainly from Russia's colonial peripheries, from the steppe lands of Central Asia, from first nations' territories in Canada, from former French and British colonies in Africa and from Australia. However, nuclear power plants can do little with the uranium extracted from these places. The uranium needs to go through various refinement processes, of which the most controversial is uranium enrichment. These refinement processes are strongly internationalized, and nuclear companies are often at pains trying to navigate the nuclear fuel system. [SLIDE Nuclear fuel cycle]

For example, the Finnish nuclear operator TVO in the late 1970s purchased uranium from Canada, which was then shipped across the Atlantic to Le Havre on the French coast for conversion – in the same facilities that processed France's African uranium – into uranium hexafluoride. After that, the fuel embarked on another lengthy voyage, heading for the port of Riga in Soviet Latvia, where it was reloaded onto railway cars for transport to the Mayak nuclear complex in the eastern Urals. Enriched in the Soviet Union, the fuel reappeared a few weeks later in Leningrad. Next, it floated across the Baltic to the fuel element factory at Västerås, Sweden, after which it could eventually be transported, in its final form, to TVO's nuclear power plant at Olkiluoto on the Finnish coast. For each step in the supply chain, TVO concluded a detailed contract with the respective supplier.

An interesting side-effect of this fuel supply complexity is that it has stimulated European integration in the nuclear field, or what we may also call European nuclear transnationalism. I'm not thinking here so much about the EURATOM cooperation, but more about for example joint attempts by several countries to

construct uranium enrichment facilities and also the emergence of the French, British and Russian reprocessing plants as hubs for European spent fuel management.

4. Coal

Now, what about coal? How has Europe's coal import dependence played out in the global arena, and how has the globalization of European coal interacted with European coal transnationalism? Well, coal is unique in European energy history because it's the only fuel in which a really dynamic European market emerged long before coal was globalized. Especially Britain early on emerged as a coal exporter of great significance for almost all other European countries; British coal was used in industrial steam engines, in locomotives, in town gas works and so on in such diverse places as St. Petersburg and Stockholm, Milan and Athens. Later on Germany also became a significant coal exporter and subsequently also Poland. In many places, such as the Netherlands and also in northern Germany, there was a healthy competition between British coal and coal from here in the Ruhr area, and European coal was so abundant and prices so low that coal from elsewhere in the world was not at all able to compete on the European market before 1914. But around that same time British coal production peaked and started to decline [SLIDE British coal production, with peak in 1913], and in the Interwar years several coal-producing countries started to realize that their coal deposits were being depleted at an alarming rate. This was so for example in France, and after World War II France, facing depletion, desperately sought access to German coal, and this became a major motivation for creating the European Coal and Steel Community in 1950. But then in 1956 German coal production also peaked, and unsurprisingly coal started to become more and more expensive all over Europe.

At the same time transportation costs, thanks to new oil-propelled ships, declined rapidly. The combined effect of this was that coal from very far away started to become competitive in Europe. As a matter of fact, it became so cheap that all the state subsidies that European governments poured into their coal industries were more or less without effect. And so at one point steelworks, cement producers and power plants found themselves negotiating about coal imports with producers in distant countries such as Colombia, South Africa, Australia and the United States. Note here that the list includes several high-income coal exporting countries, so it's not simply a matter of poor developing countries exploiting low labor costs to make their coal exports competitive. Australian coal, for example, is competitive in Europe basically because Australia has so much more coal than Europe; its coal fields are much richer, whereas Europe's coal fields are poor, there is almost nothing left, and if you want to access what's still there it's difficult and expensive and you have to

invest a lot of money. So it's the depletion of Europe's own coal deposits that makes overseas coal competitive!

Now, finally: what about lignite? Is there a role for lignite in a globalized European energy system? Lignite is the only fuel that Europe does not import these days from faraway regions. There is no European lignite colonialism, apart from perhaps the tragic story of forgotten indigenous peoples in Europe such as the Sorbs in Eastern Germany and their becoming victims to the advancing lignite mining frontier. In fact there is not even any intra-European circulation of lignite. And yet we do not know if there will perhaps in the future emerge a long-distance trade in lignite! There is nothing inherent in lignite that prevents this. The standard economic argument is that lignite is too poor a fuel for being moved over long distances, transportation is too expensive and so it doesn't become competitive if it's exported. And anyway it doesn't make sense, because you can just as well set up a power plant next to the lignite mine and export lignite electricity instead. It's cheaper. But, what will happen when Europe runs out of lignite? Is it impossible that we will turn to imports? Probably yes, but this "yes" doesn't follow from any natural state of affairs in physics or geology – because the lack of competition from overseas lignite is in reality merely a result of other fuels so far having been much cheaper. Lignite from South Africa, for example, cannot compete with hard coal from South Africa.

Part 3: In the age of renewables

What will happen if and when Europe seriously makes a transition to renewable energy sources? Will the trend towards ever growing import dependence be reversed? Will Europe once again be able to produce most of its own energy? Or will we see new, unexpected patterns of globalization?

One thing is clear: the electricity system will play an ever more central role, because of growing volumes of wind and solar energy. The growing importance of electricity is very interesting from an international relations perspective, because there is no energy system in Europe which today is more nationally defined than the electricity system. The European electricity system is mainly a set of national and subnational grids that have been linked to each other on the margin. This makes it very different from oil, gas, uranium and coal. Only something like 5-10% of all electricity in Europe is traded across borders.

However, it could have been different. If we look into history we will actually find visions of European colonialism and European transnationalism very similar to the ones we see in oil, natural gas, uranium and coal: European electricity system-builders have always dreamed about accessing electricity from faraway regions, notably the colonial lands of northern Scandinavia,

Russia and Africa, and to combine access to this energy with intra-European transnationalism. In particular, there have been intense attempts to construct what we would now call a European “supergrid”. Especially in the years around 1929-1930, such visions were widely spread in Europe. [SLIDE Atlantropa, with hydropower dam across the Strait of Gibraltar]

Nothing came of this at that time. Since the 1990s, however, the old visions have been revived, partly in the context of changing political landscapes in Europe and the world, and partly because of technological change in wind and solar energy. On the one hand, there are now far-reaching visions in Europe of accessing massive volumes of solar energy from North Africa and the Middle East, most famously through what used to be call the Desertec project. [SLIDE Desertec] As you can see here such a project would preferably be combined with the massive wind energy supplies from the North Sea and elsewhere, and this is now already happening. But such a transition to intermittent sources of electricity poses a huge challenge to the transmission grid. In this context a number of grand visions are now taking form, visions that center on the construction of a European supergrid – that is, a grid that spans all of Europe and which doesn’t necessarily care about national borders. The EU Commission, in particular, is very eager to see such visions materialize, because just like Hermann Sörgel in the 1930s they think that greater European integration in electricity will also strengthen the political cohesion of Europe. And so electricity and the transition to renewable energy may actually become a way for Europe to overcome current separatist and protectionist trends in European and international politics. European transnationalism in electricity may become a way for Europe to find its way in *this* age of globalization.