# Mobile Energy and Obdurate Infrastructure:

# Distant Carbon and the Making of Modern Europe

# Corey Johnson

# Introduction

This chapter considers the oft-used trope of Europe’s “dependence” on Russia for energy, particularly natural gas, in historical and geographical contexts. Rather than focusing on Russia as a supplier, as many analyses do, my entry points are in Europe itself as a massive consumer of hydrocarbon energy. Rather than placing states at the center of the analysis, it considers multiple geographic scales to understand linkages: the household, the urban, the regional, and the planetary. In short, I argue that energy dependence cannot be understood without understanding energy’s mobility, and thus energy and transport—especially, in the case of gas, via pipeline—must be considered in tandem (Seow 2014). Furthermore, Europe’s reliance on distant carbon is part and parcel of planetary urbanization (Merrifield 2013) and an outcome of processes of concentration and extension (Brenner 2013) at multiple temporal and spatial scales. This has many implications. For example, the oft-heard aspiration of turning on a dime—kicking out Russian carbon in favor of better, less politically tainted carbon from Qatar, domestic shale rock, or the US—runs up against the obduracy of the networked infrastructure that constitutes the system. Seeking relief in renewable energy—certainly a worthwhile goal—similarly is only a partial fix in the medium term due to the sheer complexity of an energy system that has developed over centuries.

Curiously, the history and geography of the socio-technical system of natural gas in the US is much better understood than the European (see, e.g., Nye 1998, Herbert 1992, Makholm 2012), in spite of the fact that gas is far more politicized in Europe. The EU is by its own reckoning the “world’s largest energy importer” (European Commission 2015), but discussions of energy dependence in popular media consistently end in hackneyed geopolitical discussions of individual states being reliable or unreliable suppliers, thereby falling into the “territorial trap” (Agnew 1994) that many scholars of the geography of energy have been critiquing in recent years (see, e.g., Bouzarovski, Bradshaw, and Wochnik 2015). In particular, there is a need to consider the imbrication of energy infrastructure in territory and consider the “socio-technical assemblage” that complicates overly simplified “states vs. markets” duality common in discussions of energy governance (ibid.). In that vein, the first half of the chapter covers the energy transitions that eventually led to natural gas—a fuel once considered more or less useless because it was more tethered to geography than other energy sources—becoming now the second most important source of primary energy in the EU, surpassed only by petroleum in importance in the energy mix. The second half of the chapter draws on in geography, urban studies and science and technology studies to argue for how scholars might better conceptualize the material geographies of interdependence that arise out of the development of networked architecture of natural gas that built a virtually uninterrupted conduit from a hot water spigot in Berlin to a well in West Siberia.

# Overcoming energy’s limits

The relationship between European energy consumers and distant carbon was one born of necessity: large scale industrial capitalism, the mass movement of people to dense cities and the energy intensive lifestyles that cities engendered, and internal combustion engines rapidly depleted local energy sources. As Wrigley (2013) has argued, the industrial revolution was in large part an energy transition. Prior dependence on local forests for charcoal and firewood as supplements to animate energy sources (an *organic energy regime*) would have to give way to make possible the concentration and up-scaling of production. This was both a time-scale and geographic-scale problem: reliance on biomass outputs made possible by photosynthesis on a limited area of land over the course of a year simply could not sustain the geographically concentrated, energy-intensive industries and lifestyles that industrial capitalism created (Huber 2009). The *mineral energy regime* that took form in geographically specific contexts, such as the British Midlands and later the Ruhr River region of Germany, freed energy consumers from the temporal limitations of the organic regime because it could depend on millions of years of stored photosynthesis in the form of coal, then later oil and methane (Jones 2014). During the early part of the Industrial Revolution, intensification of production and urbanization made possible by the mineral energy regime were geographically coincident with the sources of energy, such as the coal fields of northern England, the Ruhr basin, or eastern Pennsylvania. Freed from Jevons’ “laborious poverty” of the organic energy regime, productivity shot up, living standards increased, and economic growth could increase vastly because the system was freed, for a time at least, from natural constraints on energy production that yearly cycles of photosynthesis imposed (Wrigley 2013). As the title of historian David Landes’ classic book on the Industrial Revolution suggests, the “unbound Prometheus” radically transformed life in much of Europe (Landes 1969).

This energy transition created “landscapes of intensification” – **cities** that were home to factories and populations living ever more modern and consumptive lifestyles; **places of energy and raw material extraction**; and the **infrastructure** (roads, railroads, canals, and later pipelines and electricity lines) that tethered the system together (Jones 2014, Hughes 1983). Importantly, it was this last piece--the transportation networks--that freed the sites of energy consumption from the sites of energy production (mines, wells, etc.). While energy intensity was increasingly dramatically, local sources of carbon energy became ever scarcer, requiring that if growth were to be sustained, energy would need to be brought in from farther away. It was much easier to move energy from source to consumer than it was to move the factories, cities, and labor pool to the sources of energy. This scaling up of the energy catchment area had two consequences. First, it allowed intensive and extensive urbanization to continue *in situ*, in spite of the lack of locally available energy sources. Second, it allowed the industrial and energy revolutions to spread to places that did not have local stocks of coal or oil. While the first places in Europe to develop heavy industries were those close to coal seams and orebodies, eventually nodes of economic intensification could be found farther and farther afield from necessary raw materials.

At this point it is important to note what many scholars of mobile energies and large technological systems have already noted. The energy transitions of the past two hundred years were not simply about technological innovations exploiting natural endowments at the service of economic needs. Rather, these were highly socially mediated transitions (Hughes 1983, Coutard 1999, Graham and Marvin 2001, Bijker, Hughes, and Pinch 1987). Development and innovation, growth and competition, and the momentum of a large system once in place are not the byproducts of self-organization but rather of actor networks and human decision-making that, for a variety of complex reasons, maintain the momentum of a particular system once in place (see chapters by Hughes and Callon in Bijker, Hughes, and Pinch 1987) and lead over time—slowly and with much resistance—to the introduction of new technologies and energy sources. Factors such as vested interests of actors and sunk costs also contribute to momentum (ibid.). The choice of preferred fuel, followed by the investment of large sums of capital in building up that system, create a form of path dependency not entirely unlike what the seemingly arbitrary choice of a railroad gauge created (Puffert 2009). This is certainly the case for natural gas, as will be explored below.

# Urban Lifestyles and Socio-Technical Systems

The massive growth of cities across Europe in the 19th century geographically involved both concentration and extension. In considering networked infrastructure, re-working centuries of built environment in historic city cores around the possibilities of mass transit, mass consumption, and “modern” amenities could only happen incrementally, at great cost, and only by overcoming built-in resistance to changing lifestyles and consumption habits. So it was in the extended city where the earliest and clearest evidence of the energy transition described above is to be found (to accompany this brief summary, see Osterhammel 2014). Streetcars, commuter railways, and, eventually, automobiles substituted for the pedestrian life of the old urban core. Energy intensive iron and brick could be turned into ever larger housing, and larger housing units could be warmed by piped steam from boilers heated by fossil fuels. Water, in turn, could be piped into homes and sewage taken away by a different pipe. Mechanical pumps did much of the work, aided by gravity. Gas lighting, which had first been used to lengthen the work day in textile factories, saw increasing use in street lamps, theaters, and starting in the 1880s in Britain, in home heating, cooking, and lighting (ibid.).

Although natural gas was making inroads into the urban energy system in European cities at the end of the 19th century, it was electricity that would come to dominate household lighting. Early gas was manufactured locally, often from coal, and this manufactured gas, or “light gas” or “town gas,” was costlier than the natural gas from wells that tapped subterranean stores of methane (*Erdgas*, or earth gas, in German) that became predominant in the second half of the twentieth century in Europe. Although electricity was not without its own risks, it came to be viewed as safer than gas for domestic uses such as lighting since gas could explode and poison. Electric lights could be turned on and off in an instant. Many households in cities across Europe came to depend on both electricity and town gas to meet the various household needs of lighting, heating, cooking, etc. (Leuschner 2008). The provision of gas only made economic sense in the eyes of the private gas companies in densely populated cities, since not only did town gas need to be manufactured but it could not be transported (yet) over long distances. Town gas, as the name suggests, was only suitable in urban areas where a profit could be made producing and distributing it, and thus the distinctively urban consumption patterns that developed in northwest Europe in the early twentieth century were at least in part shaped by the energy sources that were available to household consumers.

In his book *Cities of Light and Heat*, historian Mark Rose chronicles the adoption of gas and electricity in Denver and Kansas City during the late 19th and early 20th century (Rose 1995). He calls the boosters of technologies that used electricity and gas “agents of diffusion”; these agents, who included power company owners, appliance salespersons, real estate developers, and others, were instrumental in making certain types of consumption indispensable to the urban household. Highly gendered marketing campaigns implored housewives to “cook with gas!” while others attempted to alleviate commonly held fears about electric clothes irons by proclaiming that a new iron would “remove the feeling which tangles nerves and tires bodies” (Rose 1995: 86). These agents of diffusion made the non-vital seem essential: instant hot water at the turn of a knob, uniform heat that did not require constant attention, irons, automatic washing machines, “ice boxes” that did not require delivered ice. Without these conveniences, modern life was not possible. Similar marketing was happening in European cities, as electric and gas companies competed for customers in an environment in which the entire pie of energy consumption was growing, meaning that a transition from gas lighting to incandescent lightbulbs only meant that consumers would need to be persuaded that everyone needed a home hot water heater that burned gas.

By the early 20th century, gas was firmly woven into the urban metabolism of most northern European cities. At the household scale, piped town gas that had once provided light was increasingly used for heating and cooking. At the urban scale, an extensive and expensive infrastructure of gas plants, gasometers for storage and pressure maintenance, and a pipeline network to move it to consumers was now largely in place. As cities continued to grow, there was little question that new homes would be connected to gas and electricity service because that is what it meant to be urban. At some point, however, the costs of locally manufactured gas would become too high, just as the requirements of firewood and charcoal to sustain urban growth had been outstripped in the late 18th century (Kim and Barles 2012). The sheer size and consumptive appetite of the modern European city met the natural limits imposed by a highly localized or regionalized regime of energy provision.

It was actually France, not typically thought of as a gas innovator, where long distance transport of gas first entered the picture in Europe. In the 1950s, a 312-km long pipeline, the so-called “eastern artery,” was constructed to supply the Paris region with gas manufactured in the coking plants of industrial Lorraine (Beltran 1992). Attention then turned to the Lacq region in southwest France, where oil exploration had yielded the discovery of a large deposit of natural gas. For France, the construction of new pipelines to move natural gas to markets in Paris, Lyon, and Nantes marked an important milestone in several respects. First, this was the first time France had essentially a national network of gas distribution, instead of the polycentric town gas model. Here “national” must be qualified, since the provision of gas was still focused on larger cities. Second, it marked the transition away from manufactured gas to natural gas (ibid.). This required household energy transitions as well, since natural gas had different properties to the then customary town gas, including approximately double the heat content (Heymann 2012). Appliances would need to be replaced to accommodate the more potent fuel. But gas was by now a widely accepted energy source, and households were more than willing to assume the expense of transition given the benefits of gas over other energy sources in household applications. Households and industry together were the largest consumers, but the French electricity monopoly burned around one-third of the gas in generating plants. By late 1960s France still had no nuclear generating capacity.

While not matching the sheer profligacy of American energy consumption, post-World War II’s growth in Europe was fed by energy: OECD-Europe’s energy consumption as measured in metric tonnes of oil equivalent (mtoe) roughly doubled from 1960 to 1973 (Clark 1991). As for natural gas as an important part of the energy mix, the discovery of the supergiant gas field near Groningen, Netherlands, in the early 1960s and the increasing appreciation of gas as a clean, efficient source of energy set into motion events that would create an increasingly cross-border, Europe-wide transmission system (Bouzarovski, Bradshaw, and Wochnik 2015). These dynamics would also fairly quickly necessitate looking beyond domestic sources to meet increasing demand as the following section explores.

Before turning to Russia’s role in the European energy system, it may be useful here to provide a bit of a conceptual mop-up. The exponential growth of energy demand in European cities encompassed nearly all aspects of urban life: brick and steel for buildings, concrete and asphalt for roadways, lights, elevators, refrigerators, space heating, factories—all of these were energy intensive, and none of them was considered optional. Despite economic analysis that treats some modern energy uses as intensive and others as not, when compared to the organic energy regime *all* modern energy uses are intensive, relying on million-year time scale processes of subterranean carbon concentration and storage to power consumptive lifestyles. Part of the “landscapes of intensification” in urbanized Europe was an increasingly complex set of infrastructures at the household, urban, regional, and increasingly supra-regional and planetary scales, that moved hydrocarbons from source to flame. Importantly, as the scale of energy provision increased, more and more capital was sunk in long distance infrastructure to move those carbon molecules over longer distances meaning that “distant carbon,” as I have called it here, resulted in a form of path dependency in the system and the *obduracy* of the system made wholesale shifts in energy provision more and more difficult (Johnson 2014, Hommels 2005).

This “background of technology” (Verbeek 2005) is not completely invisible, and the 20th century consumer recognized that the massive, unsightly gasometer was related to her having a warm living room. But the background of technology certainly became taken-for-granted, which in itself acts as a form of obduracy in the system. The modern energy regime requires little or no labor for the consumer, is seldom interrupted, and costs a small fraction of the middle class household’s income to operate. With practically no one taking note, the supply area of natural gas for European cities grew and grew. Pipelines were built over the 20th century that extended the network over an ever larger territorial extent, precisely to maintain that dependability and low cost at the core of what it means to be urban, Western, cosmopolitan, etc. As energy systems extended, inevitably they would—and did—run up against geopolitical realities, whether the fraught politics of the Mideast or the Iron Curtain.

# Carbon Mobility and the Role of Russian gas

Part of the common narrative that I want to disrupt with this work is that “country A is dependent on country B.” The point of departure of neatly contained territorial units is alluring, since political decisions that impact energy use often do happen in state institutions and much of the data available is aggregated at the level of the state. As I hope the first part of this chapter has shown, though, energy systems operate at multiple scales, and the “territorial trap” (Agnew 1994) and accompanying state fetish impoverishes our ability to constructively engage with the topic of our dependency on distant carbon.

In this section I cull liberally from the excellent work of the Swedish historian of technology Per Högselius, whose book *Red Gas* has greatly enriched our understanding of the development of energy infrastructures in Eurasia (Högselius 2013). He upends the metaphor of a politically motivated “energy weapon” being wielded against innocent, helpless Europeans by chronicling the “hidden integration” of Europe that was occurring during the height of the cold war through networks of natural gas infrastructure. For the purposes of this chapter, the essential point is that the nature of postwar European economic systems—on both sides of the Iron Curtain, but especially in the West—required the scaling up of energy provision that resulted in the current system of long-distance carbon mobility.

The 1960s were a key decade for what I am going to refer to as the *natural gas transition* in Central Europe. Most of West Germany depended on coal, petroleum, and town gas for home heating and industrial applications. Coal was abundant in the industrial northwest of the Federal Republic of Germany (FRG), but the coal industry was suffering from competition from imported petroleum, while areas without coal but with growing political and economic weight—mainly Bavaria and Baden-Württemberg in the south—were loath to depend on “imported” coal from northwest Germany to fuel their growth. At the household level, consumers in the coal-rich industrial region around the Ruhr River were already well accustomed to gas, which was supplied to them by coal syndicates. In a sense, coking plants contributed to the demise of the residential market for coal by building the infrastructure to find a market for methane, which was a byproduct of the coking process that turned mined anthracite coal into a product more usable in the steel industry (Leuschner 2008). Ruhrgas, founded in 1926 by coking conglomerates and now part of the energy company E.ON, was a pioneer in bringing the urban gas infrastructure to households. That company, headquartered amidst the most productive coal-producing region in Europe, also eventually became the largest purchaser of Russian natural gas.

The scaling up of gas provision in the 1960s involved political and economic decisions at several levels. With the discovery of giant natural gas fields in the Netherlands (Slochteren) and Algeria (Hassi R’Mel), politicians and business executives were actively toying with the idea of how to move gas over long distances. This was not just a political or economic question but also a technological one: gas under pressure required strong steel pipes that did not leak and technologically sophisticated pumps to maintain pressure along the route of the pipe. As the decade progressed, sustained post-war economic growth continued while events such as the 6 Days War in the Middle East called into question the reliability of oil supplies from there. The Soviet Union, meanwhile, had discovered that it sat on huge reserves of natural gas; in fact, they were the largest reserves in the world. Despite early skepticism among Soviet leadership of building out a large scale gas network, and owing largely to the boisterous promoting of gas by Alexei Kortunov, director of the USSR’s gas directorate Glavgaz, the Soviet’s committed to a strategy of gas exports (Högselius 2013). From the very early stages, Soviets set their sights not only on their allies in the Warsaw Pact as the primary export markets, but also western European countries. Not only would capitalist countries provide much needed sources of hard currency, but also access to the steel pipe technology that would be required for long distance, high pressure movement of natural gas (ibid.).

Growing interest in natural gas was not just about political decisions being made by national governments in the context of cold war geopolitics. In the Netherlands, for example, the discovery of vast quantities of natural gas near Groningen in 1959, caused the two main shareholders in the exploration company, Exxon and Shell, to have internal discussions about how best to “create” a market for this newfound natural wealth. While Shell was primarily interested in supplying large-scale users, such as electricity generators and industry, Exxon argued for a strategy that would reshape the household market by convincing users to use gas as their *primary* primary energy source, instead of a mix of town gas, heating oil, and coal, which was then customary (Correljé, van der Linde, and Westerwoudt 2003). This involved some risk, since large scale investments in infrastructure would need to be made *and* consumers would need to be persuaded of the need to buy expensive new household appliances or retrofit their existing ones. But that is precisely what happened (ibid.). A high-pressure network was constructed, with the help of US engineering firm Bechtel (the US had long since made the conversion to natural gas, and most of the world’s expertise was thus in American companies). Conversion workshops were set up in municipal gas plants, where existing stoves and cooktops were tweaked to allow the burning of natural gas with its higher heat content than the coal-derived town gas. Marketing campaigns touted the clean, efficient, and space-saving advantages of natural gas heat over coal and heating oil. By the end of the 1960s, 80% of Dutch households had gas service and 60% were heating with it, a dramatic change in less than a decade (ibid.). Similar sorts of transitions were happening in Germany even without the large domestic supply enjoyed by the Netherlands.

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1968 was an important year in Central Europe: the Prague Spring was brutally crushed by Soviet tanks in August, and a mere ten days after tanks rolled into Czechoslovakia, the Austrian minister of transport and the Soviet gas minister stood atop a pipe in Baumgarten and ceremoniously cranked open the valve that allowed the first “red gas” to enter Austria from Czechoslovakia (Högselius 2013). Baumgarten is still among Europe’s most important physical gas hubs, and it is a key node in the Central European Gas Hub, through which much of the gas in Central Europe is traded (Heather 2012). (Incidentally, the ceremonious valve opening or button pushing has been repeated in various locations since, such as in 1973 when German and Soviet authorities pushed the “red button” starting gas shipments and most recently in 2011 when Angela Merkel and Dmitry Medvedev, along with the prime ministers of the Netherlands and France, were on hand to open the Nord Stream pipeline by spinning a wheel).

The early years of gas deliveries were not without difficulty, but it was not because of politically motivated supply shutoffs. Rather, the Soviets were unable to deliver promised quantities of gas due to technical snafus and the fact that much of the gas in the first years was coming not from Siberia or the Caspian, but rather from Ukraine. Knowing that being seen as undependable would put at risk the prospects of the USSR making further inroads into western European markets, the Soviets instead cut deliveries in Ukraine by approximately the same volume of gas that had promised to Austria and Czechoslovakia (ibid., 100-101). Ukraine was therefore subjected to rationing of Ukrainian-produced gas (from Galicia) in the late 1960s and early 70s so that Soviet contracts with Austria could be more or less fulfilled.

These early delivery problems were short lived. Long distance pipelines from West Siberia fed copious quantities of gas into the system, while in Galicia, on Ukraine’s border with Poland and Czechoslovakia, new storage capacity came online (the largest gas storage facilities in Europe, in fact, are in western Ukraine). As a result, the Soviet Union turned into what Russia continues to be to this day, at least to its west European customers: a very reliable supplier of large quantities of natural gas. By the mid-1970s, in addition to the Warsaw Pact countries, West Germany, Finland, France, and Italy were receiving natural gas from the USSR. Turbulence in global oil markets as a result of oil embargoes further solidified the role of “blue gold” in the European energy system, and an ever larger share was coming from the large fields of the North Sea, North Africa, and the Soviet Union. Large-scale pipelines were under construction or planned, nearly all using German-built steel pipe, to transport gas from increasingly remote areas of Eurasia to consumers in urban Europe.

# Linking scales: toward a Planetary Urban Europe?

Only by challenging the state-centric understandings of energy provision and consumption can we adequately come to terms with the role infrastructure plays in shaping modern life—and contemporary politics—in Europe and Russia. To tie together the histories and geographies of the *natural gas transition* and scaling up of energy provision with relevant geopolitical questions, I turn here to and emerging body of work that challenges the tidy conceptual lines between urban geography on the one hand, and increasingly global processes of resources, markets, and mobilities on the other. There is growing interest among historians of technology and some geographers in networked infrastructure in Europe, particularly in light of the six-decade European integration project. Much of this work points to increasingly transnational, long distance material infrastructures that constitute an important, if largely “hidden,” form of territorial integration (Badenoch and Fickers 2010, Misa and Schot 2005). This line of inquiry is welcome development, because it explicitly asks us to think outside of the territorial boxes when considering European integration (statist, territorial-entrapped analysis). This growing body of work at the intersection of science and technology studies, geography, and history has indeed largely informed this chapter. However, I wish to push the scalar imaginaries beyond just thinking about how “Europe”—as messy that term is—is integrated in ways that push the borders of territorial Europe as well as the borders of what integration means.

In the previous sections, I provided an examination of Europe’s natural gas transition: how the requirements of industrializing, urbanizing Europe resulted over time in the creation of a geographically expanding network of infrastructure to provide especially urban spaces with energy, and how natural gas became a key constituent part of the energy equation as the spatial scale of energy provision increased. In this section I provide a charcoal sketch of how we might conceptualize the linkages between scales, drawing in particular on recent work under the broad rubric of *planetary urbanization*. This emerging set of interventions in urban theory seeks to destabilize the category of analysis and practice “urban” by suggesting that the distinction does not capture how in fact urbanization works, namely as a process and set of interactions between economy, nature, politics, and social life that transcends purported boundaries between, for example, cities and countryside (Brenner 2014). This work builds on Henri Lefebvre’s argument that society had become thoroughly urbanized (Lefebvre 1970), and that capitalist urbanization is characterized by a dialectic of implosions and explosions (concentration and extension) that draw not just surrounding hinterlands into capital accumulation and the spatial division of labor, but rather every corner of the planet.

It is in this vein that planetary urbanization offers a window into relating the seemingly mundane act of hooking a new home in Leipzig, Lille, or Sofia up with gas service to the exhumation of Mesozoic-era hydrocarbon molecules in West Siberia. Brenner and Schmid remark:

This situation of *planetary urbanization* means, paradoxically, that even spaces that lie well beyond the traditional city cores and suburban peripheries—from transoceanic shipping lanes, transcontinental highways and railway networks, and worldwide communications networks infrastructures to alpine and coastal tourist enclaves, “nature” parks, offshore financial centers, agro-industrial catchment zones and erstwhile “natural” spaces such as the world’s oceans, deserts, jungles, mountain ranges and atmosphere—have become integral parts of the worldwide urban fabric (Brenner 2014: 162).

To this nearly all-encompassing list, I would only add pipelines (and maybe other forms of energy movers) as well as subterranean carbon sinks.

Thinking through this temporally as well as spatially, a conceptual thread can be pulled from the diminishing returns of Britain’s forests in the lead up to the Industrial Revolution, to the shift from local coal to gas, nuclear, oil, and renewables (with their longer supply chains) well over a century later. At each stage in the energy transitions, the spatial ambit of the energy source grew. In a lengthier exploration of this topic, here might be a good point to turn to the field of Urban Political Ecology and consider the ecological footprints of urban metabolisms (see, e.g., Luke 2003). For now I would simply like to suggest that planetary urbanization offers some possibilities for thinking through how the political geography of energy networks has been formed over time through the outcome of processes happening at multiple spatial scales, mediated by consumption habits, political decisions, and nature’s possibilities, and that there is considerable momentum built into the energy system once in place.

Thinking about the issues presented in terms of the planetary urban is also useful because it helps us to conceptualize the transitions of energy systems and infrastructure. For example, oil and coal can be readily be put on a ship and transported around the world; as a consequence, more or less global markets have emerged for those commodities. Natural gas, by contrast, is still mostly transported by pipeline and therefore is largely traded in regional markets by contractual relationships rather than spot markets (Freifeld 2009). Liquefied natural gas (LNG) transported by ship is growing in importance but is still very expensive when compared to, for example, conventional piped gas from Russia. Three developments are moving gas towards a more globalized commodity: consumption of energy increasing rapidly in areas outside of the traditional big markets in North America and Europe, the diminishing returns in conventional sources of gas (North Sea, Russia, Netherlands), and the development of new, more challenging hydrocarbon sinks, such as tight gas, oil sands, shale oil, etc. (Johnson and Boersma 2015). As a more globalized market for gas emerges, a more variegated and global network of energy provision to Europe will likely also emerge.

# Conclusion

Even though 2014 and 2015 saw less of Russia’s gas transiting Ukraine, much of the difference was simply made up by increased volumes in the new Nord Stream pipeline that links Russia and its largest EU consumer, Germany, under the Baltic Sea. The Nord Stream was completed long before Russia’s annexation of Crimea and the ongoing hostilities in eastern Ukraine, but the project was explicitly about avoiding transit risks (including price disputes, conflict, theft, politically motivated shutoffs, etc.) that could interrupt smooth deliveries of hydrocarbons that have flowed practically without interruption between Russian gas fields and homes and companies in Central Europe since the 1960s (Johnson and Derrick 2012). The political elite in Russia understand that becoming unreliable to “*dickes Deutschland*” (“fat Germany,” as a very senior German diplomat told me in an interview several years ago) is in no one’s best interest, in spite of the ethno-nationalist war of aggression being waged by Russia in Ukraine. As many observers have noted, the EU’s rather feckless response to Russia’s involvement in the Ukraine crisis can be tied to Europe’s dependence on Russia’s natural resources. I would frame it somewhat differently: it is tied to the political calculus of how European voters would react if the heating bill for the flat in Munich suddenly doubled or tripled.

It is interesting to witness the growing calls for an Energy Union for Europe then, in a sense an attempt to reterritorialize energy markets and networks at the scale of the EU. An Energy Union has been proposed many times, and in some ways is foundational to the entire European integration project since the Coal and Steel Community is commonly thought of as the precursor to the EU. A common energy policy is still elusive, but may come to pass given recent events in eastern Europe. What it will not change, however, is the underlying networked infrastructure that transcends, even spites, political boundaries as it continues to grow in extent. Nor will it change the lifestyles and livelihoods of modern, urbanized Europe that create appetites for distant carbon at practically any cost.

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