and self-government that were sometimes more accountable to their constituents, such as the elected corporate bodies in England that governed universities, towns, companies and societies. By the 1870s, a wave of upheavals in Europe and the Near East – including the unification of Italy and of Germany, the creation of the Third Republic in France, constitutional settlements or liberal revolutions in countries from Spain and Greece to Serbia and Austria-Hungary, and liberal reforms in the Russian and Ottoman Empires – had created varieties of representative government. While continuing to exclude most people from a role in public life, these constitutional arrangements provided in many cases a legal order under which labour unions and popular political parties could emerge. Across the industrialising regions of northern and western Europe in particular, in protest against the exclusion of the majority from public life and against the great inequalities in well-being that industrialisation had brought, mass political movements and organised political parties began to emerge and to create a new form of politics.

The period of transformation that followed, from the 1870s to the First World War, has been called both the age of democratisation and the age of empire. The mobilisation of new, democratising political forces depended upon the concentration of population in cities and in manufacturing, associated with the forms of collective life made possible by organising the flow of unprecedented quantities of non-renewable stores of carbon. At the same time, utilising fossil fuels whose supply increased by as much as 50 per cent each decade required the rapidly expanding control of colonised territories. Those territories were connected to the same assembly of energy flows based on coal and steam power, but were connected in ways that could not easily be used to manufacture effective political claims. To understand why the rise of coal produced democracy at some sites and colonial domination at others, we must look more closely at the way the flow of fossil energy could be employed to organise successful collective demands.

CONTROLLING CARBON CHANNELS

When most energy was derived from widely dispersed renewable sources, a significant part of the population was involved in the work of generating and transporting energy, in small amounts. With the large-scale use of fossil fuels, and especially following the advent of electricity in the 1880s, a large majority of people in industrialised countries became consumers of energy generated by others, and most work involved the handling or supervision of processes that were driven by energy from elsewhere. A much smaller part of the population now handled the production and distribution of energy, and they handled it in huge quantities.

The concentration of energy supplies in large amounts at specific sites led to the creation of an apparatus of energy supply with which the democratic politics of the late nineteenth and early twentieth centuries would be built. Large stores of high-quality coal were discovered and developed in relatively few areas: in central and northern England and south Wales, along the belt running from northern France through Belgium to the Ruhr Valley and Upper Silesia, and in the Appalachian coal belt in North America. Most of the world's industrial regions were assembled above or adjacent to these supplies of coal. The creation of the new energy system, as we saw, resulted not just from the quantity of coal produced but from the mutually reinforcing interactions between coal, steam technology, and iron and steel. The introduction of iron rails, produced in blast furnaces fired by coal using steam-driven bellows, and of iron bridges, allowed the rapid development of railway lines. By the end of the nineteenth century, industrialised regions had built water and rail networks that moved concentrated carbon stores from the underground coalface to the surface, to railways, to ports, to cities and to sites of manufacturing and electrical power generation.

Great volumes of energy now flowed along narrow, purpose-built channels. Specialised bodies of workers were concentrated at the end-points and main junctions of these conduits, operating the cutting equipment, lifting machinery, switches, locomotives and other devices that allowed stores of energy to move along them. Their position and concentration gave them opportunities, at certain moments, to forge a new kind of political power.

The power derived not just from the organisations they formed, the ideas they began to share or the political alliances they built, but from the extraordinary quantities of carbon energy that could be used to assemble political agency, by employing the ability to slow, disrupt or cut off its supply.

Coal miners played a leading role in contesting work regimes and the private powers of employers in the labour activism and political mobilisation of the 1880s and onward. Between 1881 and 1905, coal miners in the United


States went on strike at a rate of about three times the average for workers in all major industries, and at double the rate of the next-highest industry, tobacco manufacturing. Coal-mining strikes also lasted much longer than those in other industries. With the same pattern found in Europe, waves of industrial action swept across the world's coal-mining regions in the later nineteenth and early twentieth centuries, and again after the First World War.  

The militancy of the miners can be attributed in part to the fact that moving carbon stores from the coal seam to the surface created unusually autonomous places and methods of work. The old argument that mining communities enjoyed a special isolation compared with other industrial workers, making their militancy 'a kind of colonial revolt against far-removed authority', misrepresents this autonomy. In his classic study of 1925, *The Miner's Freedom*, Carter Goodrich had argued that autonomy was a product not of the geographical isolation of coal-mining regions from political authority but of 'the very geography of the working places inside a mine'. In the traditional room-and-pillar method, a pair of miners worked a section of the coal seam, leaving pillars or walls of coal in place between their own chamber and adjacent chambers to support the roof. They usually made their own decisions about where to cut and how much rock to leave in place to prevent cave-ins. Before the widespread mechanisation of mining, 'the miner's freedom from supervision is at the opposite extreme from the carefully ordered and regimented work of the modern machine-feeder.' The militancy that formed in these workplaces was typically an effort to defend this autonomy against the threats of mechanisation, or against the pressure to accept more dangerous work practices, longer working hours or lower rates of pay.

The rise of mass democracy is often attributed to the emergence of new forms of political consciousness. The autonomy enjoyed by coal miners lends itself to this kind of explanation. There is no need, however, to detour into questions of a shared culture or collective consciousness to understand the new forms of agency that miners helped assemble. The detour would be misleading, for it would imply that there was some shortage in earlier periods or other places of people demanding a less precarious life.

What was missing was not consciousness, not a repertoire of demands, but an effective way of forcing the powerful to listen to those demands. The flow and concentration of energy made it possible to connect the demands of miners to those of others, and to give their arguments a technical force that could not easily be ignored. Strikes became effective, not because of mining's isolation, but on the contrary because of the flows of coal that connected chambers beneath the ground to every factory, office, home or means of transportation that depended on steam or electric power.

Strikes were also common among coal workers outside Europe and North America. The workers of the Zonguldak coalfield on the Black Sea coast of Turkey organised repeated strike actions, and a strike in April 1882 by the coal heavers at Port Said, the world's largest coal loading station, is recorded as the first collective action by an emergent Egyptian workers' movement. However, without the linkages that connected coal to large centres of industrial production within the country, these actions could not have paralysed local energy systems and gained the political force they enjoyed in northern Europe and the United States.

Sabotage:

The power of the miner-led strikes appeared unprecedented. In Germany, a wave of coal-mining strikes in 1889 shocked the new kaiser, Wilhelm II, into abandoning Bismarck's hard-line social policy and supporting a programme...
of labour reforms. The kaiser convened an international conference in March 1890 that called for international standards to govern labour in coal mining, together with limits on the employment of women and children. By a 'curious and significant coincidence', as the New York Times reported, on the same day that the conference opened in Berlin, 'by far the biggest strike in the history of organized labor' was launched by the coal miners of England and Wales. The number of men, women and children on strike reached 'the bewildering figure of 260,000'. With the great manufacturing enterprises of the north of England about to run out of coal, a correspondent reported 'the possibilities of a gigantic and ruinous labor conflict open before us'.

The strike was not the only method of disrupting the flow of energy and the critical functions it supplied. In 1889, striking dockworkers in Glasgow were forced back to work after their employers hired groups of strike-breakers. The dockers decided to work as slowly and clumsily as the unskilled men brought in to replace them. After three days they won their demand for increased wages. The newly formed National Union of Dock Labourers publicised the success of this method of disruption, and it was emulated in France and formally adopted by dockers in 1909 Émile Pouget published the book that popularised the method's name, Le Sabotage. Within a year the new word 'sabotage' had been adopted in English, initially to describe an industrial action by French railwaymen, but then to refer to the slow-down, the work-to-rule and other means of interrupting the normal functioning of a critical process.

Foot-dragging and other forms of worker protest were nothing new. But the term 'sabotage' reflected the discovery that a relatively minor malfunction, mistiming or interruption, introduced at the right place and moment, could now have widespread effects. 'With two pennies-worth of a certain substance, used in the right way', explained the leader of the French railwaymen's union in 1895, 'we can make a locomotive unable to work.' A coal-fired steam locomotive could deliver three megawatts of power (about 4,000 horsepower), or thirty times the motive power of the first reciprocating steam engines of a century or so earlier. The new effectiveness of sabotage derived from this, vast concentration of kinetic energy in a mechanism that a single operator could disable.

By the turn of the twentieth century, the vulnerability of these mechanisms and the concentrated flows of energy on which they depended had given workers a greatly increased political power. Large coal strikes could trigger wider mobilisations, as happened with the violent strike that followed the 1906 Courrières colliery disaster in north-eastern France, which helped provoke a general strike that paralysed Paris. The most common pattern, however, was for strikes to spread through the interconnected industries of coal mining, railways, dockings and shipping. In Britain, the miners, railwaymen and transport workers organised three great national strikes in 1911–12, formalising their relationship in the Triple Alliance created on the eve of the First World War. The coordination of strikes, slow-downs and other forms of sabotage enabled the construction, at certain moments, of a new political instrument: the general strike. 'A new force has arisen in trades unionism,' warned Winston Churchill, who as home secretary in Britain confronted this novel threat. 'Shipping, coal, railways, dockers etc. etc. are all uniting and breaking out at once. The general strike 'policy' is a factor which must be dealt with.'

A generation earlier, in 1873, Friedrich Engels had rejected the idea of using a general strike as a political instrument, likening it to ineffectual plans for the 'holy month' – a nationwide suspension of work that the Chartist movement had advocated in England in the 1840s. The idea reflected an anarchist belief in locally based, spontaneous rebellion, Engels argued, whereas in practice workers lacked the resources and organisation to make a general strike effective. Were they to acquire such resources and powers of organisation, he said, they...
would already be powerful enough to overthrow the state, so the general strike would be an unnecessary detour.\textsuperscript{33}

Thirty years later the general strike still appeared to many on the European left as an anarchist tactic that should not take the place of organised political action. The Belgian general strike of 1902, led by the coal miners in an effort to win universal suffrage, reopened the debate about the tactics of social democracy in Europe – although even supporters like Rosa Luxemburg argued that the efficacy of the general strike in Belgium's case rested on the geographical concentration of the country's industry and could not be replicated in larger countries.\textsuperscript{34} Three years later, she changed her mind. After witnessing the wave of strikes that paralysed Russia in the 1905 Revolution, she argued in The Mass Strike that workers could now organise a social revolution without a unified political movement, because isolated economic struggles were somehow connected into a single political force. This force, she wrote, 'flows now like a broad billow over the whole kingdom, and now divides into a gigantic network of narrow streams'.\textsuperscript{35} Luxemburg's language tried to capture the dispersed yet interconnected power that workers had somehow acquired. But her fluvial metaphor missed the fact that it was not streams and tides that brought workers together into a novel political force but railways, rivers and canals and the concentrated stocks of energy they carried.

During the First World War, US and British coalfields and railways were placed under the direction of government administrators, and coal and rail workers were in some cases exempted from conscription and integrated into the war effort industrially. The number of strikes was reduced, but the critical role of these energy networks became more visible. In Germany, compulsory works councils were set up in major industries, and in France the government banned strikes in industries related to the war and took a direct role in setting wages and working conditions.\textsuperscript{36} The war's duration and destructiveness, to which the energy from coal contributed, undermined political orders everywhere, in many cases bringing the new populist forces to power. In central and eastern Europe these forces overthrew the old order; in western and northern Europe and the US they were accommodated within it. From the West Virginia coal strikes of 1919 to the German general strike of 1920 and the British general strike of 1926, the coordination of industrial action by mine workers, dockers and railwaymen reaffirmed their new power to shut down energy nodes. The dispersed energy systems of solar radiation had never allowed groups of workers to assemble a political capability of this sort.

The power of the general strike put large industrial employers on the defensive. In 1918, the Rockefeller Foundation in New York issued a report explaining the vulnerability:

If the recent past has revealed the frightful consequences of industrial strife, do not present developments all over the world afford indications of possibilities infinitely worse? Syndicalism aims at the destruction by force of existing organization, and the transfer of industrial capital from present possessors to syndicates or revolutionary trades unions. This it seeks to accomplish by the 'general strike'. What might not happen, in America or in England, if upon a few days or a few weeks' notice, the coal mines were suddenly to shut down, and the railways to stop running! ... Here is power which, once exercised, would paralyze the ... nation more effectively than any blockade in time of war.\textsuperscript{37}

The Rockefeller family had commissioned the report following the Ludlow Massacre of 1914. The killing of striking coal miners by the Colorado National Guard - armed with machine guns and brought in to defeat the attempt by the United Mine Workers to unionise a Rockefeller-owned mine in the Great Coalfield War of 1913-14 - had caused a national political crisis that threatened the 'present possessors' of large industrial capital.\textsuperscript{38} The Rockefellers hired

\textsuperscript{33} Friedrich Engels, 'The Bakunists at Work', in Karl Marx and Friedrich Engels, Revolution in Spain, London: Lawrence & Wishart, 1939, first published in Der Volksstaat, 31 October, and 2 and 5 November 1873; see also Adrian Shubert, The Road to Revolution in Spain: The Coal Miners of Asturias 1860-1914, Urbana: University of Illinois Press, 1987. The rejection of the general strike was part of Marx and Engels's battle with the anarchists, led by Bakunin - a fight that led to the breakup of the First International. The anarchists advocated locally based, widespread rebellion, epitomised by the general strike. Marx and Engels argued for the steady organisation of the working class in order to win the political reforms that would enable them to conquer the power of the state at the national level. In their view the role of trade unions, beyond gaining economic improvements within the workplace, was to promote the political education of the working class so that they would act increasingly in their own collective interests. See Paul Thomas, Karl Marx and the Anarchists, London: Routledge & Kegan Paul, 1980: 249-340.


William Lyon Mackenzie King, who had helped resolve more than forty coal, railway, shipping and other strikes as minister of labour in Canada, devised a less violent method of defeating the mine workers. The Rockefeller Plan, widely copied in the interwar period, created company unions that allowed workers to negotiate over pay and working conditions while preventing them from joining independent unions.39

Large American firms portrayed the new company unions and other forms of worker representation as 'industrial democracy', and compared them to the 'self-government' that the United States championed in the Middle East and other regions in the same period.40 The firms compared the difference between the old industrial relations and the new to 'the difference between a feudalistic state – the government of which, however enlightened, contains nothing of the consent of the governed – and a democracy,' explaining that, 'if people have a voice in the making of the regulations which affect them, they are more able to understand and accept law.41

Labour movements in the US and other countries fought against the paternalism of welfare industrialism, and later managed to have company-controlled unions made illegal; but industrialists continued to promote corporate benevolence and welfare as a method of weakening union power. They supported broader welfare measures where they promised to weaken organised labour. After working as an industrial relations consultant to Rockefeller and other firms, Mackenzie King returned to politics in Canada, where he served as prime minister for twenty-two years, opposed attempts to introduce New Deal–style protections for workers, and became the architect of the country's welfare state.42 As workers in industrialised regions fought for a more egalitarian life, the democracy they began to achieve was always liable to slip from providing a means of making effective egalitarian claims to offering a means of regulating populations through the provision of their welfare.

Between the 1880s and the interwar decades, workers in the industrialised countries of Europe and North America used their new powers over energy flows to acquire or extend the right to vote and, more importantly, the right to form labour unions, to create political organisations, and to take collective action including strikes. In most cases, these changes enabled mass-based parties to win power for the first time. Workers also acquired the right to an eight-hour day and to social insurance programmes, including provisions against industrial accidents, sickness and unemployment, as well as to public pensions in retirement.43 The emergent women's movements fought against the exclusion of women from public political life, sometimes with the support of socialist parties, and gradually forced the granting of voting rights to women. Large industrialists often came to support limited versions of these reforms, since improving workers' well-being would increase their stamina and discipline and reduce industrial protest, while welfare measures that strengthened domestic hierarchies could reinforce the maternal roles that women had begun to escape during wartime mobilisation.44 Labour organisations sometimes opposed proposals for social insurance as partial measures that would undermine their efforts to achieve a more effective change in the ownership of wealth. Where more radical change was threatened, as in interwar Germany and Austria, industrialists supported the destruction of the parliamentary system.

Despite such limits and setbacks, working people in the industrialised West acquired a power that would have seemed impossible before the late nineteenth century. The rise of large industry had exposed populations to extraordinary forms of social insecurity, physical risk, overwork and destitution. But the concentration and movement of coal required to drive those industrial processes had created a vulnerability. Workers were gradually connected together not so much by the weak ties of a class culture, collective ideology or political organisation, but by the increasing and highly concentrated quantities of carbon energy they mined, loaded, carried, stoked and put to work. The coordinated acts of interrupting, slowing down or diverting its movement created a decisive political machinery, a new form of collective capability built out of coalmines, railways, power stations, and their operators. More than a mere social movement, this socio-technical agency was put to work for a series of democratic claims whose gradual implementation radically reduced the precariousness of life in industrial societies.

THE BATTLE FOR COAL

After the Second World War, the leading industrialised countries began to reorganise the relations between labour forces and energy flows. In the United States, the change began in response to a strike by oil workers. In September 1945, workers at a Standard Oil refinery in Michigan organised a strike that spread to Texas and California and became the first nation-wide oil strike, closing down

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40 A comparison I will explore further in Chapter 3, where I examine Britain's adoption of the policy of 'self-determination' as a mode of governing the oil regions of the Arab world.
43 Despite the vast increase in the production of wealth in the nineteenth century, measures of human welfare even in industrialised countries did not begin to improve until the twentieth century. John Coatsworth, 'Welfare,' American Historical Review 101: 1, 1996.
a majority of the country's refineries. *Time* described the oil workers' union as 'the world's . . . most recalcitrant labor union.' It was the oil companies, however, that rejected government arbitration. In response, the government used the War Powers Act to place the refineries under military control. Strikes spread to coal mining, electrical power, iron and steel, railroads, and automobile manufacture, producing the most concentrated period of industrial conflict in American history. To end the oil strike, the government forced the Standard Oil companies and other large refiners to concede the right of national unions to represent a collective workforce, while limiting their role to bargaining over remuneration and working conditions.45 The settlement provided a new model of labor relations, which replaced the company unions pioneered by Rockefeller in coal mining and the oil industry, and was also adopted in automobile manufacturing and other large industries. The concession defeated more far-reaching postwar proposals for industrial democracy, in which workers would play a role in managing an enterprise and earn shares in its profits. Instead, government and industry promoted the new science of industrial management, which focused on methods of increasing 'productivity.' Improvements in pay and terms of employment would depend on workers' accepting speedups, closer supervision, the elimination of jobs, and increased physical exhaustion, rather than any more radical redistribution of shares of the nation's wealth.46

The American model of industrial relations was exported to postwar Europe, along with a decisive switch in sources of energy. In France, Germany and Britain, the 'battle for coal' of the late 1940s shaped postwar politics, as coal miners led campaigns not just for improved pay and working conditions but for more extensive changes to the way prosperity and well-being were distributed. Following the nationalisation of the French coal industry in 1944, the Communist-led union movement turned coal mining into a showcase of increased productivity, in exchange not only for improved wages but for a direct role in the management of industry. Three years later, however, after rapid inflation caused real wages to collapse, coal miners joined a series of strikes demanding that the government increase pay levels or extend food rations.47 Rather than yield to these claims, France and other European governments turned to the United States. Keen to promote their new corporate management model abroad (and to have Washington subsidise their exports), American industrialists used a fear of the popularity of Communist parties in Western Europe to win support for postwar aid to Europe. 'The Communists are rendering us a great service,' commented the future French prime minister Pierre Mendès-France. 'Because we have a "Communist danger" the Americans are making a tremendous effort to help us. We must keep up this indispensable Communist scare.'48

The European Recovery Program (ERP), popularly known as the Marshall Plan, sought to engineer a political order in Europe built on a new relationship between organised labour and large industrial enterprises, similar to the order America was pioneering at home.

There were three elements to the American-funded reorganisation of the power of labour. First, the Marshall Plan promoted US-style industrial management. The Labour Division of the ERP became a laboratory for developing and testing the new American methods of managing manpower and machines. The doctrine of productivity justified increased supervision of labour, and paying wages that failed to keep pace with rising prices. 'The only answer to Britain's difficulties', the American ambassador to London reported to the secretary of state, George Marshall, 'is to work harder and, I fear, for less.' Studies showed, however, that most of the difference between American and European productivity could be explained not by Americans working harder but by America's abundant supplies of coal and oil, which allowed its industry to use between two and three times as much electrical power per worker.49

Second, the recovery programme as a whole was made conditional on the acceptance by European governments of plans for economic integration, which began with the integration of Western Europe's coal industry. The European Coal and Steel Community, established as a first step towards the political union of Europe, reduced competition in the coal industry and supported the mechanisation of production, with funds provided to alleviate the effects of the resulting pit closures and unemployment. The United States helped finance the programme, which reduced the ability of coal miners to carry out effective strikes by rapidly reducing their numbers and facilitating the supply of coal across national borders.

The third element was the most extensive. The US funded initiatives to convert Europe's energy system from one based largely on coal to one increasingly dependent on oil. An important goal of the conversion to oil was to permanently weaken the coal miners, whose ability to interrupt the flow of energy had given organised labour the power to demand the improvements to collective life that had democratised Europe.

The corporatised democracy of postwar Western Europe was to be built on this reorganisation of energy flows. ERP funds helped pay for building oil refineries and installing oil-fired industrial boilers, putting in place the infrastructure needed to convert from coal to oil. The US encouraged the building of roads, gave ERP countries $432.5 million to purchase American vehicles, and subsidised Italian and French car manufacturers. Western Europe had no significant oilfields, so the additional oil would come from the Middle East, in particular from the new fields in Saudi Arabia, where American companies and the US government were keen to increase production to provide funds to support the insecure oligarchy of Ibn Saud.

Scarce supplies of steel and construction equipment were shipped from the United States to the Persian Gulf, to build a pipeline from eastern Saudi Arabia to the Mediterranean, enabling a rapid increase in oil supplies to Europe. At the same time, Marshall Plan administrators devised a global pricing plan for oil. Oil was cheaper to produce in the Middle East and cheaper to transport from there to Europe, in comparison to the equivalent costs for US oil, the price of which was protected by government production quotas. Under the pricing plan, rather than allow Europe to benefit from cheaper oil, supplies from the Middle East were sold to Europe at the much higher price of imports from the US. The plan protected oil producers in America and the monopoly profits of the international oil companies, but would have made it difficult to switch Europe from coal, especially as the US companies supplying Middle Eastern oil would accept payment only in dollars. So ERP dollar funds were also used to pay for the European purchases of oil – an arrangement that secured the role of the dollar as the basis of the global financial system, built on the need to use dollars to acquire oil. Over 10 per cent of ERP funds were used to procure oil, representing the largest single use of Marshall Plan money. The ERP financed more than half the oil supplied to Marshall Plan countries by US companies during the period of the Plan (April 1948 to December 1951), making the oil companies among the largest beneficiaries of Marshall Plan aid.

Spurred by these American subsidies, oil increased its share of Western Europe's energy consumption from 10 per cent in 1948 to almost one-third by 1960. The diversion of steel to build pipelines and of Marshall Plan funds for this purpose was justified in part by the need to undermine the political power of Europe's coal miners.

**Oil in the Age of Coal**

If coal played a crucial role in forging democracy, what difference did it make to replace coal with oil? Like coal, oil sometimes enabled workers to assemble themselves into new social forces. Although the refinery strike of 1945–46 was the first nation-wide oil strike in the United States, in California, the country's leading oil-producing region for the first third of the twentieth century, petroleum workers had led the struggles during and after the First World War not only for better pay and conditions, but also for a broader social transformation. They fought for the public ownership of the oil industry as the basis of 'a true democracy' in which 'government shall be so formed as to benefit the great mass of the common people ... against the material interests of the remaining few.' They failed to have the industry placed under public control, but they forged a new kind of community-based labour movement deeply involved in local and state politics, and better able than unions in other industries to survive the political repression that followed.

The political strength that oil workers could acquire depended on the ways in which oil was used and the vulnerabilities its use created. Before the twentieth century, the main use for petroleum was to provide artificial lighting, in the form of kerosene (also known as paraffin) for oil lamps, and to supply lubricants for machinery. It was widely distributed, mostly in small amounts, and supplied in reusable metal cans to individual consumers. With the exception of Russia, no country in the nineteenth century converted oil into a significant source of mechanical power to drive industry and transportation. Unlike coal, therefore, oil was not concentrated into vital channels on

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50 Raymond G. Stokes, *Opting for Oil: The Political Economy of Technical Change in the West German Industry, 1945–1961*, Cambridge, UK: CUP, 1994: 96. The European Cooperation Administration (the agency responsible for administering the ERP) spent 824 million on increasing refinery construction; and dollars freed by ECA funds from other expenses, such as oil purchases, were switched to refinery construction, along with ECA counterpart funds. David S. Painter, 'The Marshall Plan and Oil', *Cold War History* 9: 2, May 2009: 168. Building oil refineries represented an important means of reducing the severe shortage of dollars among European countries, as the ECA director Paul Hoffman reported to Congress, because it enabled them to import crude oil rather than more expensive refined products. Although an ostensible aim of the ERP was to address the dollar shortage, US oil companies successfully fought to limit the use of ERP funds to construct oil refineries. US Congress, House of Representatives, Committee on Interstate and Foreign Commerce, Petroleum Study, Progress Report, 15 May 1956. 81st Congress, 2nd Session.


54 Quam-Wickham, 'Petrolecots and Proletarians.'
which other processes depended, and oil regions did not become industrial centres. The places where oil was produced were often remote from large markets, most of which were found in the regions that had industrialised using coal. Even there, lamp oil was increasingly a product for rural areas rather than towns and cities, which were illuminated with coal gas and, by the end of the nineteenth century, with electricity. The weakness of these linkages and the limited role of oil as a concentrated source of mechanical energy restricted the potential political force of those who produced the oil – except, as we will see, in Russia.

These weaknesses can be seen in the largest oil-producing region outside America and Russia before the First World War – the Austrian province of Galicia, part of modern Poland and Ukraine. The Galician oil wells extended eastwards from Cracow in a 300-mile arc towards the border of Romania. By the 1890s steam-powered percussion drills had replaced the hand-digging of wells, accessing deeper layers of oil-bearing rock and causing a surge in production in the following decade. The increased supply threatened the large firms that controlled the European kerosene market, the Standard Oil Company and its main European rival, Deutsche Bank in Germany. However, Galicia lacked a network of navigable waterways or railways for transporting its oil to Germany and other important markets, an isolation that the large companies could use to weaken both local Galician oil firms and the workforce. Starting in 1904, oil workers organised a series of strikes over conditions of work and collective rights, including the demand for an eight-hour day. The local firms were vulnerable to the strike and willing to negotiate, but the large foreign operators refused to deal with the strikers. When the workers responded by sabotaging the oilfields, disabling the pumps that moved oil to storage reservoirs and allowing it to flow into local streams, the Austrian government sent seven infantry battalions to protect the pumps and pipelines. By refusing to negotiate and prolonging the strike, the large firms were able both to defeat the workers and to put the smaller producers out of business. In fact, rumours circulated that Standard Oil had financed the 1904 strike with this dual aim.\footnote{55 Alison Fleig Frank, Oil Empire: Visions of Prosperity in Austrian Galicia, Cambridge, MA: Harvard University Press, 2007: 140–72.}

In the twentieth century, as the spread of electric lighting began to limit the growth in demand for kerosene in industrialised countries, oil companies were forced to look for new uses for their product. The solution was to convert the oil from a means of illumination into a source of mechanical power. At first it was used in boilers as a direct substitute for coal to drive reciprocating steam engines, in the form of fuel oil. The development of the internal combustion engine, which spread rapidly after 1900, gave oil a use for which it had no readily available substitute, both in the lightweight gasoline engine and the more powerful diesel engine.\footnote{56 The first oceangoing ship to be equipped with a diesel engine was an oil tanker, the 

In the Russian-controlled Caucasus, oil workers were already able to benefit from this development. The oilfields of Baku, in modern Azerbaijan, concentrated around the city and occupying an area of no more than 12 square miles, produced more than half the world's petroleum for a brief period at the start of the twentieth century. Linked by a rail line and pipeline to the Black Sea port of Batumi and by waterways and railways to the rest of Russia, the oil industry launched the protests that culminated in the Revolution of 1905. Labour unrest in the south Caucasus began in 1901–02 with strikes and demonstrations led by the pipeline, refinery and port workers of Batumi, culminating in a large strike by oil workers at the Rothschild plant in which 14 protesters were killed. The labour organisers, including the young Joseph Stalin, stayed in touch with allies in Baku.\footnote{57 Ronald Grigor Suny, \textit{The Making of the Georgian Nation}, 2nd edn, Bloomington: Indiana University Press, 1994: 163–4; Robert Service, \textit{Stalin: A Biography}, Cambridge, MA: Belknap Press of Harvard University Press, 2005: 48–50.} The wider Revolution began with a strike of Baku oil workers in July 1903, which spread along the railway line to the marshalling yards and workshops at Tiflis (now Tbilisi), the midpoint of the Transcaucasian Railway, then to Batumi, and then 'like a brushfire across southern Russia'.\footnote{58 Robert W. Tolf, \textit{The Russian Rockefellers: The Saga of the Nobel Family and the Russian Oil Industry}, Stanford, CA: Hoover Institution Press, Stanford University, 1976: 156.} It was the country's first general strike, which, as we have seen, led Rosa Luxemburg to recognise the new power of workers connected, as she put it, by individual 'economic' grievances rather than 'political' organisation.\footnote{59 Luxemburg, \textit{Mass Strike}: 44.} In December 1904 the Baku oil workers announced a second general strike, from which the 1905 Revolution was launched.

As the Revolution unfolded, local observers reported that 'labour troubles have been felt in Baku more severely, perhaps, then in any other part of Russia'.\footnote{60 Report from Mr Vice-Consul Urquhart, Baku, appended to Mr Consul Stevens, 'Report for the Year 1905 on the Trade and Commerce of Batoum and District', 26 March 1906: 13, in United Kingdom Parliamentary Papers, House of Commons, vol. cxxxvii, Command Paper 2682, no. 1366 Annual Series, Diplomatic and Consular Reports. Russia, 1906.} Stalin later claimed that the advanced organising skills of the oil workers of Baku and the intensity of their conflict with the oil industrialists gave him an experience that qualified him as 'a journeyman for the revolution'.\footnote{61 Stalin's words, from a 1926 speech to railway workers, are cited in Ronald Grigor Suny, \textit{A Journeyman for the Revolution: Stalin and the Labour Movement in Baku, June 1907–May 1908}, \textit{Soviet Studies} 23: 3, 1972: 373.} In fact, however, the leaders of the striking oil workers broke with the local Bolsheviks...
launched the 1905 Revolution were able to paralyse transportation networks and industrial activity across the Empire, much as coal strikes could in north-western Europe.

Unlike north-western Europe, Russia was a multi-ethnic empire. Its ethnic divisions were reflected and employed in the organisation of the Baku oil industry – and in the defeat of the 1905 Revolution. Unskilled labour in the industry was carried out partly by local Azeris and partly by migrant workers from Iran, from both Persian- and Azeri-speaking communities. The skilled workforce was chiefly Russian and Armenian. The managers and local owners of oil businesses and other commercial enterprises were mostly Armenians, many of whom had prospered in the oil boom. A local British observer described Baku as 'commercially and ethnologically the Johannesburg of Russia', comparing it to the gold-mining boomtown of the Transvaal. The South Africa war had recently consolidated a system of imperial self-government based on a racialised labour regime, developed in the mining industry, from which Britain would derive ideas for 'self-determination' in the oil-producing regions of the Arab world (see Chapter 2).

The Russian imperial government responded to the revolutionary strikes by unleashing the Black Hundreds, ultranationalist counter-revolutionary forces whose principal weapon was the pogrom – the organised use of mob violence against ethnic minorities. The first round of ethnic violence in Baku, in January 1905, was unsuccessful and 'gave renewed impetus to the labour movement. The following September, however, the Black Hundreds stormed the city, set fire to the oilfields, and stirred up and armed the Muslim Azeris against the Christian Armenians. Thousands were killed, the oil industry was crippled and the workers' revolutionary demands were defeated.

Despite the signs that oil might be turned into an instrument for building political freedoms, the patterns of labour mobilisation, transportation and energy use found in Baku at the turn of the twentieth century proved to be an exception. The use of ethnic divisions to organise oil production proved more common, and would later be employed throughout the Middle East. The ability to weaken the labour force by dividing it into separate racial groups, with managers, skilled workers and unskilled workers housed and treated separately, reflected the different distribution of oil production across the world compared

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to coal, and its development after rather than before the rise of modern industry. Oil production often grew rapidly, in regions remote from large populations, to serve distant users in places already industrialised with coal – a fact that encouraged the producers to import workers from different places and then perpetuate the forms of ethnic division. This difference, however, was only one of several factors that made oil production increasingly unlike the production of coal. Oil was produced using distinctive methods, and transported over longer and often more flexible routes, for reasons connected in part to the different physical and chemical form of the carbon it contains. To understand further why the politics of oil differed from those of coal, we must turn to these factors.

**OIL FLOWS**

Since oil comes to the surface driven by underground pressure, either from water trapped beneath it or from gas trapped above, sometimes assisted by the action of pumps, its production required a smaller workforce than coal in relation to the quantity of energy produced. Workers remained above ground, closer to the supervision of managers. As the carbon occurs in liquid form, the work of transporting energy could be done with less human labour. Pumping stations and pipelines could replace railways as means of transporting energy from the site of production to the places where it was used or shipped abroad. These methods of transport did not require teams of humans to accompany the fuel on its journey, to load and unload it at each junction, or to continuously operate engines, switches and signals. In fact, oil pipelines were invented as a means of reducing the ability of humans to interrupt the flow of energy. They were introduced in Pennsylvania in the 1860s to circumvent the wage demands of the teamsters who transported barrels of oil to the rail depot in horse-drawn wagons. Baku borrowed the innovation in the following decade from the American oil drillers, for the same reason. Pipelines were vulnerable to sabotage. During the 1905 Revolution in Russia, for example, the British consul in Batumi reported that 'a considerable number of pipes have been holed by the revolutionaries and have thereby been rendered useless'. But they were more difficult to incapacitate than the railways that carried coal, and could be quickly patched up. The damage, the consul reported, 'will not take long to repair and the line will in all probability be at work shortly'.

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68 As oil is extracted the pressure in the reservoir drops. Pumps may then be used to bring more oil to the surface, or to increase the reservoir pressure by driving water or gas into secondary wells.


70 Mr Consul Stevens, 'Report for the Year 1905': 8.

In addition, diesel oil and petrol are lighter than coal and vaporise more easily, and their combustion leaves little residue compared with the burning of coal. For these reasons, as Lewis Mumford noted in 1934, they could be stowed away easily, in odds and ends of space where coal could not be placed or reached: being fed by gravity or pressure the engine had no need for a stoker. The effect of introducing liquid fuel and of mechanical stokers for coal, in electric steam plants, and on steamships, was to emancipate a race of galley slaves, the stokers.71

The fluidity and relative lightness of oil made it feasible to ship it in large quantities across oceans. In contrast, very little coal had historically crossed oceans.72 In 1912, Britain exported one-third of its coal and was responsible for two-thirds of the world's seaborne exported coal; but almost 90 per cent of its exports went to the adjacent regions of Europe and the Mediterranean.73 Over the course of the twentieth century, the proportion of coal exported internationally stabilised at about 15 per cent. By contrast, following the development of the oil tanker in the late nineteenth century, oil could be moved cheaply between continents. From the 1920s onwards, about 60 to 80 per cent of world oil production was exported. So much oil was moved across oceans that, by 1970, oil accounted for 60 per cent of seaborne cargo worldwide.74

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72 The main exception was high-quality steam coal from South Wales, essential for the navy and fast liners, which was shipped to British overseas coal stations (H. Stanley Jevons, *The British Coal Trade*, London: E. P. Dutton, 1915: 684). In fact, half the coal Britain shipped outside Europe in the decades 1903–13 went to just two places – Rio de la Plata in South America and the Suez Canal (Rainer Frendling, *Anglo-German Rivalry in Coal Markets in France, the Netherlands and Germany, 1850–1913*, *Journal of European Economic History* 25: 3, 1996: Table 2). Historically, long-distance coal shipments from Britain could be used as ballast or make-weight, and benefited from low rates for back-carriage (William Stanley Jevons, *The Coal Question*, London: Macmillan, 1865: 227).

73 H. S. Jevons, *British Coal Trade: 676–84*. The economic historian Charles Kindleberger, an architect of the Marshall Plan who had headed a section on military supplies in the Office of Strategic Services in 1942–44, recalled that, at the outbreak of the Second World War, coal was regarded as something that didn't move across big bodies of water. It was shipped to British coal stations but you wouldn't expect international transoceanic trade as we started a regular thing. And yet when the war came along, and we needed to get coal to Europe we started to move coal out... They were loading it in clam shell buckets on to barges in Puget Sound to go to Europe, a landing in Texas, Portland, Maine, everywhere.


Compared to carrying coal by rail, moving oil by sea eliminated the labour of coal heavers and stokers, and thus the power of organised workers to withdraw their labour from a critical point in the energy system. Transoceanic shipping operated beyond the territorial spaces governed by the labour regulations and other democratic rights won in the era of widespread coal and railway strikes. In fact shipping companies could escape the regulation of labour laws altogether— as well as the payment of taxes— by registering their vessels in Panama or under other ‘flags of convenience’, removing whatever limited powers of labour organising might have remained. (When oil production later moved offshore, in places like the Gulf of Mexico, the rigs were treated as vessels and also registered under flags of convenience, enabling even the production site to operate free of local taxes and labour laws.)

Unlike railways, ocean shipping was not constrained by the need to run on a network of purpose-built tracks of a certain capacity, layout and gauge. Oil tankers frequently left port without knowing their final destination. They would steam to a waypoint, then receive a destination determined by the level of demand in different regions. This flexibility carried risks: in March 1967 it was one of the causes of the world’s first giant oil spill, the Torrey Canyon disaster off the coast of Cornwall, which helped trigger the emergence of the environmental movement, a later threat to the carbon-fuel industry. But the flexibility further weakened the powers of local forces that tried to control sites of energy production. If a labour strike, for example, or the nationalisation of an industry affected one production site, oil tankers could be quickly rerouted to supply oil from alternative sites.

In other words, whereas the movement of coal tended to follow dendritic networks, with branches at each end but a single main channel, creating potential choke points at several junctures, oil flowed along networks that often had the properties of a grid, like an electricity network, where there is more than one possible path and the flow of energy can switch to avoid blockages or overcome breakdowns.

These changes in the way forms of fossil energy were extracted, transported and used made energy networks less vulnerable to the political claims of those whose labour kept them running. Unlike the movement of coal, the flow of oil could not readily be assembled into a machine that enabled large numbers of people to exercise novel forms of political power.

**Producing Scarcity**

There was another set of ways in which the different properties of oil compared to coal affected its democratic potential. The fluidity of oil and its relative ease of distribution presented those who controlled oil resources and their distribution networks with a new problem. In both the coal and the oil industries, producers always sought to avoid competition. Competing with rival firms over prices or market share destroyed profits and threatened a company with ruin. In the case of coal, the high cost of transporting supplies across oceans ensured that producers faced competition only within their own region. They avoided competition either by forming cartels, as in France, Germany and the United States, or by creating organisations to regulate prices and production, such as the postwar European Coal and Steel Community. In Britain, producers were ruined by competition, and in 1942 were taken over by the state.

Oil companies faced a much larger difficulty in avoiding competition. With the advent of the bulk oil tanker in the 1890s, it was no longer enough to control production and distribution within only one region. Since oil could travel easily between continents, petroleum companies were always vulnerable to the arrival of cheaper oil from elsewhere. This vulnerability, seldom recognised in accounts of the oil industry, created another set of limits to the democratising potential of petroleum.

The solutions that oil companies developed to this problem might be called a method of sabotage. In the coal age, workers had discovered the power that could be built from the ability to interrupt, restrict or slow down the supply of energy. The challenge facing large oil companies was to do something similar: to introduce small delays, interruptions and controls that, by limiting the flow of energy, would enhance their control. Émile Pouget's pamphlet of 1909 on sabotage had concluded by suggesting that the capitalist class were perhaps the real saboteurs. A decade later, following the publication of an English translation of the pamphlet in Chicago, the American economist Thorstein Veblen developed this idea. Large business corporations, Veblen wrote, depended for their profits on a form of sabotage. Their goal was not to maximise production, but to raise prices by restricting output to ensure a shortage. The 'pettifogging

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75 The Torrey Canyon, an oil tanker owned by a Bermuda-based subsidiary of the Union Oil Company of California, registered in Liberia, chartered to BP, built in 1959 and rebuilt in 1966 in a Japanese shipyard to increase her size from 66,000 to 119,000 deadweight tons, ran aground off the coast of Cornwall, England, in March 1967. The tanker had set sail without knowing its final destination, and lacked detailed navigation charts for the coast of southwest England. The damage to the coastline and to wildlife was exacerbated by the lack of methods to handle large oil spills. The British government tried to set fire to the oil by having air defence forces bomb it with napalm, creating further damage and inadvertently revealing both their possession of the controversial weapon and the inaccuracy of the bombs (more than a quarter of the bombs missed their target).


The second method of preventing energy organized around the consumption construction of the United States organized around 1948. James F. Farber, president of the Soverign National Security Act, discussed with the Exon.Master plan, how we had recently appointed as the country's first czar of defense under the new National Security Act, presented this plan.

Vacuum, we had to design a four-cylinder motorcar and replace the standard six-cylinder engines with the new V-8 as the dream of every American car engine within less than a decade. While Farber spoke, the Morris Motor Volkswagen Beetle was preparing to break into the successful four-cylinder market. With the introduction of the two-cylinder Morris Minor, the United States managed to compete with the two-cylinder vehicles.

Critical items of US international oil policy tend to accept national security as the leading policy goal, with which we may frame the cost of oil, expressing its true value. In terms of security, the concept of capital export expansion concerns an inevitable scarcity of resources, as in Michael Kline, Power, Power Politics: The New Great Game, New Edition, New York, Metropolitan Books, 2009, or in Simon Donnelly, American Hegemony, Oxford University Press, 2005. Explaining the logic of capital export expansion leads us to see how oil, which is the singular nature of the world, helps to maintain the logic of capital by controlling the ability of the US oil major to influence their programs in national security, and the production of this perspective is framed within the historical context of American hegemony.

The two world wars of the twentieth century helped to restrict the supply and movement of oil, but the supply of R&D in the United States was truly enormous. The researchers developed policies to control international trade and marketing of oil, and national agencies agreed to block the development of new oil discoveries in the Middle East and elsewhere. The controls on the country's own oil production, quotas, and price controls in the United States, and control of oil companies, were put in place to maintain limits on the supply of oil. These controls were also coordinated with the development of what has been called a "technological" zone, a set of coordinated but widely dispersed regulations, infrastructure, and technical procedures that render certain objects or workflows governable.

The following chapters explore how this was done, beginning with the efforts of oil companies to control the Middle East and the political and regulatory mechanisms that made this possible. After the Second World War, as oil companies continued to develop, two further techniques emerged for transforming production of oil in the Middle East: the introduction of the "calculated arrangements," or workflows, and the more "flexible" arrangements.
2CV, and the German engine maker BMW with its first postwar passenger car, the one-cylinder Isetta 250. The European vehicles outsold and outlasted the badly engineered American cars, but the latter helped engineer something larger. They manufactured the carbon-heavy forms of middle-class American life that, combined with new political arrangements in the Middle East, would help the oil companies keep oil scarce enough to allow their profits to thrive.

The ability of organised workers to assemble a political machine out of the networks and nodal points of a coal-based energy system had shaped the kinds of mass politics that emerged, or threatened to emerge, in the first half of the twentieth century. The rise of oil reorganised fossil-fuel networks in ways that were to alter the mechanics of democracy. The possibilities for making democratic claims were altered in both the countries that depended on the production of petroleum and those that most depended on its use.

Much more could be said about the role of the major oil companies and car manufacturers in helping to produce and popularise ways of living based on very high levels of energy consumption. This is a question not of balancing the history of oil production and distribution with an analysis of its consumption, so much as understanding that production involved producing both energy and the forms of life that were increasingly dependent on that energy.

The Prize from Fairyland

The story of oil in the Middle East usually begins in the wrong place: with the discovery of oil at Masjid-i-Suleiman in 1908. After seven years of unsuccessful exploration, lugging their heavy equipment on wagons and mules across harsh and inhospitable terrain, a small team of drillers working for a maverick British investor on the desert plateau of south-west Persia struck a large source of oil. The discovery led to the creation of one of the world's largest oil companies, later known as BP, and launched the development of a modern petroleum industry in the world's richest oil region. This tale of heroic explorers discovering unimagined wealth in a desolate territory overlooks the fact that oil was already known to exist in more convenient places in the Middle East, and that a principal reason for searching in the barren hills of Persia was not to launch the region's oil industry, but to delay its development.

The main feature of Middle Eastern oil throughout the twentieth century was that there was always too much of it. To be more precise, there was too much of it in too few locations. To have plentiful supplies of a source of energy is not necessarily a problem. Where there is abundant water, timber, solar energy or grassland, widely distributed across space, collective life can thrive. Those who harness and supply the energy can earn a living and perhaps a profit from doing so. With energy from fossil fuels, as we saw in the case of coal, the quantity of energy available can increase exponentially. For geological reasons, however, the sites at which these large volumes are available happen to be relatively few. This combination of extraordinary abundance and limited locations gave rise to the problem.

Firms that organised the supply of fossil fuels could frequently collaborate to restrict their availability. With coal, as we have seen, for several decades they were forced to share this ability to sabotage the flow of energy with those who mined and transported it, enabling coal workers and their allies to assemble an unusual political power. In the case of oil, the capacity to slow down or interrupt the supply of energy on a large scale was much harder to organise. Oil workers found it difficult to carry out a successful sabotage-a difficulty that would impede their efforts to build with oil an enduring mechanism for advancing democratic political claims.

The companies that managed the production and distribution of oil also faced greater challenges than coal companies in restricting the flow of energy. However, in the Middle East and other regions they could benefit from the relative dearth and isolation of sites initially known to produce oil, take advantage of the distance that separated these places from those countries (already