Sebastian Kopacz

Professor Redman

History 397ST

10 May 2018

How IG Farben Made World War II Possible

Though World War II is popularly studied for its military history by the masses, relatively little attention is paid to how fuel affected Germany's preparation for the conflict. The problem of fuel is mentioned in many WWII narratives, but the specific role of synthetic fuel in all of this is particularly worth attention. The history touches on multiple subjects, including the rise of the German dye industry in the 19th and 20th centuries, the development of the Bergius process for synthesizing fuel (among others), and Germany's coal problems in World War I. All of these narratives relate to the rise of IG Farben, Germany's largest chemical company at the time, and how the cartel became intertwined with Nazi politics before the war. The result of these developments all lead to one crucial point: without synthetic fuel and IG Farben's ability to mass produce the product, Germany could not have started World War II, or would have done so aware of their inability to adequately fuel their machinery for any sustained amount of time. Throughout the conflict a number of factors led to Germany's defeat, not least the fuel shortage the Nazis believed they could avoid, but it was the work of Friedrich Bergius and the leaders of IG Farben that made World War II a logistical possibility in the first place.

The history of synthetic fuel's role in Nazi Germany starts with the background for why the Nazis saw the importance of the industry, and this is best done by looking at fuel's role in the first World War. In terms of fuel resources, Germany and Austria-Hungary had the largest

reserves of coal in Europe, though they drastically lacked an adequate amount of oil; conversely, the Allied Powers had relatively large access to oil, though only a fraction of the coal supplies available to the Central Powers (Jensen 539). This meant that a significant part of Germany's war machines used coal, which established a precarious dependence on the fuel that would soon prove fatal to their army. Near the beginning of the conflict, all seemed well as German forces swept into France and seized three fifths of her coal mines, depriving the country of about 75 percent of its prior coal output (540). This placed the Central Powers in a advantageous position in terms of fuel, but any optimism would be short lived as the conflict drew on, as a number of problems would cause massive headaches for the German forces.

For one, local needs of occupied territories drained a significant part of coal supplies, and "in the case of the French mines, the miners were simply not there to work them" (541). This was compounded by aggressive Allied blockades of coal supplies, namely from Britain. The blockades had such an effect that German coal exports dropped from 44 million tons in 1913 down to only 16 million by the end of the war (541-42). Another factor was Germany's overall strategy in the war. While movement was relatively stagnant in France after the first year of conflict, Germany kept advancing well into Russian territory (a result of the Russian army fighting with what might as well have been potatoes). This meant an enormous strain on supplies as well as Germany's available railway network, which sent upwards of 50 trains to the East and 162 to the West each day, eventually causing a major railway shutdown (541). For the Allied Powers, the United States was able to provide a near endless supply of oil to its allies (543). In a pattern that would be repeated by Germany in the next World War, a crippling shortage of coal and Allied developments in technology essentially eliminated the mechanical advantage with

which Germany had so confidently entered the war (542). By the beginning of 1918, German coal reserves were desperately low, and this played an essential part in Germany's decision to call for an armistice to end the Great War. This crippling fuel shortage inspired the Nazis to try eliminating foreign dependence on oil when it would come to be their turn to wage war.

It was not long after the end of World War I that industry leaders in Germany saw an opportunity to take advantage of producing synthetic oil, and this would include Carl Bosch, head of BASF and eventually IG Farben itself. He would come recognize the potential of the Bergius process once it could be applied on an industrial scale, and invest in the process so that it could be worked out at IG Farben's plant in Luena. Before this, however, lied decades worth of work in chemistry that laid the ground for Friedrich Bergius and allowed him to develop the process so crucial for the Nazi Party, years later.

The Bergius process is the high pressure catalytic hydrogenation of coal. Essentially, the process causes "the coal to react with hydrogen gas at high pressure and high temperature," converting it into a substance that could be distilled into a variety of petroleum products (Stranges 644). For this to have been possible, a number of advancements and discoveries had been made in the century before Bergius had begun working on his experiments. It starts with the first instance of hydrogenating coal. French scientist Marcelin Berthelot achieved this in 1869, by treating coal with hydroiodic acid in a glass tube, and subjecting it to high temperatures for several hours (644). Hydrogenation using metallic catalysts would be discovered by Berthelot's former assistant, Paul Sabatier, when he established catalytic hydrogenation as a legitimate method in 1900, winning him a Nobel Prize in chemistry twelve years later (645). Then came advancement in high pressure techniques relevant to Bergius' future work. High pressure

hydrogenation would first be achieved by Russian scientist Vladimir Ipatiev in the early 20th century; Walther Nernst would use high pressure hydrogenation to synthesize ammonia in 1908; lastly, Fritz Haber would develop a method to synthesize ammonia of his own with similar techniques, and Carl Bosch would advance the method to a commercial scale through BASF during World War I (645-47).

These developments gave Bergius the proper circumstances for his work. After receiving a Ph.D. in chemistry at the University of Leipzig, Friedrich Bergius worked for a total of 18 months with both Nernst and Haber (though at separate times), and his time with them gave him experience using high pressure equipment, and the inspiration to explore further into the possibilities that these techniques could afford (649). By 1910, Bergius had a private laboratory in Hanover where he and fellow colleagues would perform experiments with high pressure technology. Soon enough he began to study the composition of artificial coal, finding that hydrogenating the substance would give it a molecular structure similar to heavy oils (652-53). By 1913, the German scientist had essentially found the golden ticket to success, and it became all but within his grasp. That year, Bergius had simultaneously begun experimentation with hydrogenating heavy oils, artificial coal, and natural coal, the successes of both experiments causing Bergius to file for patents the same year (656). Bergius and his partners wanted to see the effects of hydrogenating coal artificially produced in their laboratory, and had discovered that the method produced medium to low weight hydrocarbons (657). Bergius' success encouraged him to try the experiment on natural coal, and after processing the coal in an autoclave at 150 atmospheres of pressure and at over 400 degrees celsius, he found essentially the same success (657). Bergius then spent the next decade further developing his process, attempting to make it

suitable for an industrial scale, which included changing the batch process into a continuous flow operation. However, it would not be until Carl Bosch's BASF invested and took over the process in 1925 that these problems would be fixed (664). After Bergius had agreed to end his work on the research, BASF scientists in Luena took only a few years to make the Bergius process efficient, and by 1927 the plant was producing 300,000 metric tons of synthetic fuel annually (665-66).

In an almost perfect sequence of events, the end of World War I was followed by the finalization of what would become Germany's primary method of production for synthetic fuel, and the method was bought by the ideal company for its success. Soon after its investment into the Bergius process, BASF would merge with other companies into a major conglomerate of industrial businesses known as IG Farben, which would play its cards (somewhat) wisely during the rise of Nazism to secure state investment in its synthetic oil production. But IG Farben did not just appear out of nowhere, it rose from a history of the chemical industry in Germany, which started when a British chemistry student unintentionally made dye in a test tube.

William Henry Perkin was a student of chemistry at London's Royal College when his academic prowess attracted the attention of the school's director, the German August Wilhelm von Hofmann (Jeffreys 12). Over an Easter Break, Hoffman had tasked the young Perkin with trying to create a synthetic version of quinine, a popular treatment for malarial fever, by using coal tar. After oxidizing and distilling multiple derivatives, Perkin had found that the experiments did not produce quinine, but instead he found his test tubes covered with a "black sludge" that would then turn into a "striking purple color when he tried to wash them in water" (13). After testing the sludge on silk and finding the color to be remarkably fast, Perkin soon

began to advertise his discovery in hopes of financial backing for a business. Up until this point in time, only natural dyes had been available, and it could often be prohibitively expensive. Thus, when news of Perkin's discovery reached out, German businesses, among others, leapt at the opportunity. Entrepreneurs simply waited for German chemists to return to the nation with an understanding of dye making, and by 1876 Germany had seventeen large dye manufacturers, many located along the Rhine river system for practical reasons (19).

From this point, it was a race to see which nation (and which companies within that nation) would gain a lead in this new and increasingly popular market, and Germany certainly played to win. Many times, success on a grand scale depended on discovering new colors for artificial dyes, as was the case with BASF and their nearly accidental discovery of "alizarin red" (20). Within decades, Germany had become an industrial powerhouse as a result of these dye companies, and this was aided by the expansion of scope for many of these businesses. An excellent example is the case of Friedrich Carl Duisberg, a humble chemist who was hired to Friedrich Bayer & co. the *second* time he begged them for a job, and would quickly rise to become the company's head executive. After being given an underpaid job to work on dyes for Bayer, Duisberg quickly demonstrated that, on top of his scientific abilities, he had the necessary business skills to thrive in the cutthroat environment of German industry. His first success came in finding a method to produce Congo red in a manner distinct enough to prevent a patent infringement lawsuit from the company that originally created the artificial dye(27). After the company began to sue, Duisberg convinced them instead to join Bayer in monopolizing the production of Congo red, a swift move that landed Duisberg at the head of his company's research department (27). From then, he moved to expand his company and begin

pharmaceutical production; he found quick success when the company began producing Phenacetin, a fever producer, which owed much of its popularity due to the nascent trend of giving new drugs catchy names and then trademarking the name itself (30).

Bayer & co., like all of the businesses that would form IG Farben in 1925, found great success in the years before the outbreak of World War I. They continued to turn Germany into an absolute powerhouse of industry, and it was during this period that Carl Duisberg, inspired by the power of American corporations, first started to suggest the benefits of joining businesses together (45). He found partial success in forming the "Triple Association" in 1904, consisting of Bayer, BASF, and Agfa (46). The constituent businesses still had autonomy, but they now worked with some coordination that would ideally benefit all of the companies. Unfortunately for Duisberg, this was as far as he could unite companies for the time being.

When World War I broke out, a major shift occurred for the German chemical industry. One shift was the germinating dependence of the industry on the state. After realizing how desperately low Germany was on supplies after the first year of conflict, the military requested help from industry leaders such as Fritz Haber and Carl Bosch, who at that point had developed the impressive Haber-Bosch method of synthesizing ammonia (66). They were asked to find a way of synthesizing nitric acid to help the war effort, and in return Germany would fund the necessary plants (66). After much frustration and effort, Bosch was able to successfully synthesize the substance by May of 1915, giving Germany a desperately needed boost; on top of that, Haber had begun to implement the use of chemical weapons for the German forces, and these two developments had placed "the German chemical industry right into a mutually

dependent relationship with the state," as the military became the industry's biggest customer (74).

After the war, it took less than a decade for IG Farben to be formed. In 1924, discussions for merging began in earnest. The push for amalgamation was, ironically, opposed by 60 year old Carl Duisberg himself, who could have had a number of possible motivations at that point in his life (119). Carl Bosch, then the head of BASF, was the strongest advocate for merging, partly due to his new personal dream of seeing synthetic fuel production become a major industry. Eventually the pro-merge camp won out, and IG Farben became an official company in December of 1925 (121).

The next several years saw IG Farben succeeding in business but still struggling in terms of organizing the large web of companies, dealing with the Great Depression, and creating a market for synthetic fuel. Then, when Adolf Hitler and his Nazi party rose to power in 1930's, the company was soon swallowed up into its politics. During a meeting between Nazi officials and German industry leaders in 1932, the Nazis had essentially given the companies an ultimatum: fund the party in its rise to power, or struggle with the complications of an otherwise inevitable civil war (170). When Bosch received word of this, he paid the Nazis RM 400,000, the largest donation of any company present at the meeting (170). This was part of a series of efforts made by IG to "butter up" the Nazis, and it would be successful when, in 1933, the Nazi party agreed to buy any synthetic fuel that IG could not sell, in exchange for a promised increase in oil production (193). The plan that offered Hitler a convenient way to fuel his illegally built airforce had now completed the personal mission that Carl Bosch had been pursuing for years.

From there, the Nazis continued to build their independence of foreign oil. For one, Germany placed a harsh tariff on imported gasoline in an attempt to encourage domestic production of fuel (Krammer 400). The Nazis also coerced many companies into making sacrifices for the state. In 1934, the government forced "all major brown-coal interests" into a combine that would produce synthetic fuel plants, all at the cost of the combine itself (401). Finally, all of these efforts culminated in one large attempt at fuel independence, when Hermann Goering, newly designated as "fuel commissar," implemented his "Four Year Plan" to produce enough fuel for Germany's war machine (402). It was mainly dependent on synthetic fuel, namely fuel from hydrogenation. Another alternative method was available, the Fischer-Tropsch process, but it was cast aside due to its poor quality that "could not compete" with Bergius fuel, despite the former's "good ignition and sulfur-free quality" (Leckel 2343). At this point, it was clear that Germany could not have waged war without synthetic fuel. The Four Year Plan before and after its revision called for the production of fuel to be dominated by the synthetic industry, and whatever fuel was made by the plan was considered to be enough for waging war (Jensen 548). The Nazis, aware that a majority of its fuel was imported, intended for the gap "to be filled by the production of synthetic fuel from coal (the Bergius process)." (548). Now confident that *lebensraum* could be gained with a short war consisting of several quick but deadly offensives, Hitler sent his troops to invade Poland in 1939.

From the perspective of coal and fuel in Germany, World War II was essentially an amplified form of what had occurred in World War I. Being "entirely cut off from adequate supplies of oil," Germany had looked to synthetic fuel for help (546). However, the Four Year Plan was nowhere close to as successful as it intended to be, partially due to the inefficiency of

synthetic fuel processes, which consumed ridiculously high amounts of coal for synthesis (549). Thus Germany was dependent on coal once again, but at a much larger scale than it had experienced in the first World War. After Germany's early successes had stunned the world, Hitler once again recognized the need for fuel, and this was a major reason for his invasion of Russia in 1941 (547). However, Hitler would never succeed in controlling Rumanian oil fields in Soviet possession, and by 1942, the Nazis faced a coal shortage (549). The reasons for this shortage echoed World War I, as major factors were domestic needs and the support of allies (Benito Mussolini had demanded an absurd amount of supplies from Hitler, among them was fuel). Additionally, Hitler himself played a major role in the coal shortage. For example, when skilled coal miners were drafted for combat (a bad decision on the Fuhrer's part in the first place), Hitler refused to allow women to work in the mines, and instead used ineffective and already emaciated concentration camp prisoners (550). This sharply cut the coal mine's productivity, producing yet more headaches for the Nazi regime.

By 1943, despite the shortage in coal, the Nazis had planned to rely entirely on synthetic fuel production for the war effort (553). This plan kept Germany fighting for a while longer, and thankfully for the Nazis, Allied forces had not considered bombing the synthetic fuel plants until the following year. But when they did start bombing, it was essentially game over. After the numerous strategic blunders Hitler had committed throughout a war that had prolonged far longer than he had expected, the Allied bombing of synthetic fuel plants placed the final nail in the coffin for any hopes of a Nazi victory. The situation was so desperate that "when the Western allies temporarily halted their advance [into Europe] in October I944 they saved Germany for the time being ... because of her absolute lack of fuel" (554). By 1945, the Nazis had been enclosed

by the Soviets from the East and the remaining Allied forces from the West. Finally, on the 7th of May in 1945, the Germans had officially surrendered, and the war had ended in the European theater.

Though synthetic petroleum was not sufficient enough to provide adequate fuel for the Third Reich's plans of *Lebensraum*, Nazi officials and Hitler would not have been convinced that they were ready for war without it. The advent of synthetic fuel that had coincided with the rise of the Nazis was intricately intertwined with much of Germany's history, from their experience in World War I, the development of the Bergius process in the early 20th century, and the creation of the massive IG Farben as a result of the German dye industry. This was not the only technological advancement that increased the Third Reich's ability to nearly conquer all of Europe, but it was among the most important, if not *the* most crucial factor. The technology was promising, and if managed correctly the Nazis could have succeeded in their effort. Thankfully, for the sake of democracy and humanity itself, factors such as Hitler's massive incompetence (and/or insanity) led to an Allied victory.

Works Cited

Jeffreys, Diarmuid. *Hell's Cartel: IG Farben and the Making of Hitler's War Machine*. Metropolitan Books, 2008.

Jensen, W. G. "VIII. The Importance of Energy in the First and Second World Wars." *The Historical Journal*, vol. 11, no. 03, 1968, p. 538., doi:10.1017/s0018246x00001680.

Krammer, Arnold. "Fueling the Third Reich." *Technology and Culture*, vol. 19, no. 3, 1978, p. 394., doi:10.2307/3103372.

Leckel, Dieter. "Diesel Production from Fischer−Tropsch: The Past, the Present, and New Concepts." *Energy & Fuels*, vol. 23, no. 5, 2009, pp. 2342–2358., doi:10.1021/ef900064c.

Stranges, Anthony N. "Friedrich Bergius and the Rise of the German Synthetic Fuel Industry." *Isis*, vol. 75, no. 4, 1984, pp. 643–667., doi:10.1086/353647.