

Black gold – the history of the energy sector

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Abstract: The history of oil production, processing and use is centuries old. Of course, the kerosene lamp, fractional distillation yielding kerosene of unprecedented purity, industrial extraction of oil, including from beneath the seabed, purification, and pipeline transmission of natural gas, led to the explosion (sic!) of the oil industry, transportation energy, chemistry, pharmaceuticals, and many other fields.

Keywords: Crude oil, kerosene, bitumen, mine, natural gas, Ignacy Łukasiewicz

Introduction

The light of an oil lamp in a Lviv hospital operating room was a symbol of the beginning of a new era. The lamp, equipped with a modified unique combustion system for the gases produced during the combustion of kerosene purified in an unprecedented way in the process of fractional distillation, opened up enormous possibilities for the industrial use of oil and its processed products. Know-how met industrialist and landowner in Bóbrka, the development of chemistry and engineering brought development, progress and economic growth to the whole world. The oil industry forced the cooperation of entrepreneurs with the world of science, the unemployed became labourers, workers became engineers, poverty and illiteracy irrevocably gave way to affluence and education. Ignacy Łukasiewicz, who was born 200 years ago, in order to commemorate his memory at the request of an MP from Krosno – the cradle of the oil industry – was declared the patron of the year 2022 by the Sejm of the Republic of Poland.

The centuries-long history of human interest in the extraction, processing and use of oil, kerosene, tar, and natural gas has been known and described by travelers, medics, and scientists alike. The fascination with fire from the earth, burning water, heat and light are not only worth recalling, but they are also worth preserving in memory and passing on to those who associate light and heat only with a keystone.

The purpose of this article is to recall and introduce the history of the geology, extraction, processing and use of oil and kerosene in the period before 1853, as well as an incidental mention of the successors of Ignacy Łukasiewicz, the fathers

of the extraction of oil from under the sea floor and the industrial use of natural gas transmitted through pipelines.

History of oil use

The history of oil use and processing is many centuries old. The Sumerians used the compacted products of the natural evaporation of rock oil (bitumen, asphalt) from the earth's surface, mainly as a building material. Added to the mixture of clay, sand and gravel used to make high-strength bricks, it was used to fix stone walls (bituminous glue), cover roads (in fact, they were the first asphalt roads in human history), reinforce the banks of artificial reservoirs, and cover the bottoms of boats, thus making them waterproof. Liquid oil (as lamp fuel) was widely used for interior lighting. The people of Mesopotamia considered oil medicinal – they treated boils and scabies with bitumen ointments, and tried to ease joint pain by bathing in oil fountains. Petroleum products tarred Noah's ark and Moses' basket, the recipe for distilling *oleum incendiarum* was closely guarded in Byzantium, and Marco Polo saw kerosene lamp fires burning in Baku in 1272 (Polo 1975: 78).

Over the past 170 years, oil and the petrochemical industry have changed the world, and have been an engine of progress. North of the Carpathian Mountains, between the Vistula and the San, there are many towns with peculiar names: Ropa, Ropki, Ropianka (near Krosno), Ropienka (near Ustrzyki), Ropica and many others [*Ropa* is Polish for crude oil – transl.]. But the earliest written references to the use of petroleum products in Mesopotamia can be found as early as the Sumerian "Epic of Gilgamesh" and the "Epic of Atrachaz", created in the 3rd-2nd millennium BCE. The story of the global flood and the rescue of people in a wooden boat with an ark tarred with asphalt is laid out on clay tablets. The most famous was the "inexhaustible" bitumen source located in the village of Hit near Babylon, in the area of present-day Baghdad. The ancient Greek historian Diodorus Scillus wrote about it: "Many amazing things can be found in Babylonia, but none of them can be compared to the source of the infinite bitumen discovered here" (Sicilus: 44). The word "naphtha" – in Poland today we use the term "crude oil" – (a liquid mineral, composed of a mixture of natural gaseous, liquid and solid hydrocarbons and other additives) is most likely of Persian origin "نفت" (phonetically: naft), entered the language through the Greek "ναφθα"(naphta). There are two versions of the etymology of the Persian word *naft*: according to one, it means "wet" (i.e., oil being a kind of moisture, liquid), according to the other, it comes from the Akkadian verb "to vomit" (that is, it is something thrown up from the ground). Other etymological hypotheses are related to the Akkadian "napatum" – "ignition" (which could reflect the fuel properties of oil) or the median "nafata" – "to leak" (from the bowels of the earth). The Germanic languages, which are less prone to direct borrowing, used half-traces from Latin, such as German Erdöl – "earth oil." In the Slavic languages,

in addition to the borrowed form (*ropa naftowa*), the original name "nafta" was used, which meant not only oil and bitumen, but also a solution of salts (the origin of the term "nafta" is related to their use of substances in medicine, especially for healing wounds). It is no coincidence that we find a significant number of toponyms associated with the word "ropa" in oilfield areas. Galician miners extracting oil were called "ripniki", and the term "ropa" itself appears in written sources from the 16th century. In addition, the oil was called "rock oil" in the areas of Subcarpathia and Transcarpathia.

The Polish stage of oil history

Jan Długosz wrote about the use of rock oil (*petrus + oleum = petroleum*), Stefan Falimierz in his work "On Herbs and Their Power" (Falimierz 1534: 99) in 1534 writes about the medical use of rock oil. Hieronim Spieczyński in his 1556 herbarium "O ziołach tuteicznych i zamorskich" and Marcin Siennik in a work entitled "Herbarz, to jest ziół tuteicznych, postronnych i zamorskich opisanie" in 1568. In the herbarium "Herbarz polski to jest o przyrodzeniu ziół i drzew ksiąg dwoje" by Marcin from Urzędów, published in 1595, we read about the method of making candles from rock oil. In Eresma Sykst's work "O cieplicach we Skle, ksiąg troje", published in Zamość in 1617, we read about the occurrence of oil, but also about how to purify it by distillation. He also noted that at the beginning of the 17th century, oil was already being extracted from wells dug near the then Polish city of Drohobycz. Mining engineer Henry Walter (1835-1921), in his article "Beitrag zur Geschichte der galizischen Erdolindustrie", states that in the monastery of the Franciscan friars in Krosno there is a document according to which already in the 16th century the Free Royal Cities of Krosno and Drohobycz had the royal privilege of lighting the city with rock oil mixed with linseed oil (Walter 1916: 3). Albert Tylkowski, in his work "Physica curiosa", published in 1680, mentions oil and natural gas sources in the vicinity of Krosno (NB: in the chapter "De ente rationis" there is a description of a natural gas source near the village of Iwaniec: the Iwonicz gas source "Belkotka"). He also mentions other sources of oil in the Krosno area, and uses expressions like asphalt (*pix natia – native tar*), bitumen, and petroleum to describe liquid bitumen (*Petroleum vocant bitumen liquidum*) (Tylkowski 1680: 106). Fr. Jan Frydwalcki writes the first textbook "Minero-Logia Magni Principatus Transilvaniae Seu Metalla, Semi-Metalla, Sulphura, Salia, Lapides, & Aquae" in Latin, published in Cluj, Romania. There are descriptions of attempts at oil distillation, its properties, occurrence and also applications in this manual. Today, Fridvaldszky János is a great mineralogist from Transylvania, a Hungarian hero, not known to anyone in Poland, including in the scientific community. Stanisław Staszic writes about the accumulation of rock oil in dug wells and depressions, mentioning localities: Bóbrka, Harkłowa, Iwonicz, Klimkówka,

Kobylanka, Libusza, Potok, Rogi, Ropienka, Równe, Wietrzno, and Węglówka. He also goes on to write that the oil occurrence stretches across 1,484 kilometres of the Carpathian Mountains (Staszic 1815). Few also remember that in 1837, at the Ecole Centrale des Arts et Manufactures in Paris, the scientific fractional distillation of crude oil was carried out and published (in “Recherches chimiques sur les bitumes”, Journal de Pharmacie in 1840) by Filip Neriusz Walter (Dębski 1955) (a distinguished Polish chemist) and Pierre Joseph Pelletier (Brzozowski 1994).

History of oil and more in the village of Siary

After crushing Emperor Napoleon I, the Russians made their stand in Paris in March 1814. Standing is a euphemism: they drank and enjoyed other pleasures for days and nights. They didn't have time to participate in dinner celebrations: they frequented lavish establishments, where they sabre-rattled and called for a meal. They rushed the staff by calling out: Bistro, BISTRO!!! [Russian for “quickly” – adopted and to this day in Paris they know what bistro means.... Grand Duke Constantine found Mrs. Teodora Walewska (yes, of those Walewskis...) at the American embassy to organise a grand ball to welcome Tsar Alexander I. The Tsar was welcomed by Tadeusz Kościuszko, who so delighted him that a year later he offered our head of state leadership in the creation of the Kingdom of Poland, the latter, offended by the borders, refused. Mrs. Walewska was accompanied by her 15-year-old son, later Prince Stanisław Jabłonowski of the Prus III coat of arms. The young boy was so eager to become a soldier that he joined the tsar's service, passed the exam and, as a cadet of a positional artillery battery, was sent to the mounted guard, where in two years he was already a lieutenant. Unfortunately, this splendidly promising career ended a year later: conflicted with the Grand Duke (due to Countess Joanna Grudzińska of the Grzymala coat of arms – for whom Konstantin Pavlovich Holstein-Gottorp-Romanov, Grand Duke and heir to the throne, renounced all titles), he resigned and returned to Warsaw. Here he married Maria Wielopolska, thanks to which he acquired an estate in Kobylanka near Gorlice.

It is not a coincidence that between Lviv and Vienna the imperial railway line was used by a young pharmacist's helper, Ignacy Łukasiewicz, who carried petrol from the capital to Piotr Mikulasch's pharmacy "Under the Golden Star". In this pharmacy worked Jan Zeh from Łańcut, who obtained his Master of Pharmacy degree in Vienna on August 8, 1846 (NB: Ignacy at that time had already been imprisoned for half a year in a Rzeszów prison, and after his release on December 27, 1847, thanks to the help of his brother, a lawyer, he obtained his Master of Pharmacy degree at the University of Vienna on July 30, 1852). Zeh had been researching oil distillation for several years, studying different varieties of oil, reading old manuscripts, working nights, reeking of oil, wandering like a madman

through the backstreets of Lviv arguing with himself (Iwanow 2009: 372). In 1852, he was joined by Ignacy Łukasiewicz and in 1852/53 succeeded in obtaining a distillate that was pure, reasonably odourless and "safe". Lviv tinsmith Adam Bratkowski constructed the first kerosene lamp, which illuminated the laboratory and the pharmacy's storefront on March 20, 1853. A tin casing with forced-air vents, a mica window and a burner that allowed secondary burning of the gases reduced smoking. Initially, the lamps were not popular. It wasn't until dozens of kerosene lamps illuminated the operating room of Lviv's General Hospital on July 31, 1853, that interest emerged. Zeh applied in May 1853 for a privilege (patent) for chemical purification of crude oil and received it in December of the same year. He soon set up a store and Galicia's first distillery, and supplied kerosene to light the streets of Lviv, also to Vienna. In 1854, at the Munich Exhibition, he received a diploma of commendation for the excellent quality of his distillate. Until he finally obtained a pure distillate, which he confirmed with a Viennese patent.

In the 17th century, the Mining Court in Drohobycz issued an official government document, the "Order of the Court Chamber", declaring oil a mineral, which bound its extraction to the provisions of mining laws. Oil was produced at the former Svoboda Rungurska (Kołomyjszczyna) deposits since at least 1711. At that time, rich oil deposits were also discovered in a strip from Dobromil through Drohobycz to Kuty and on to Romania. The largest deposit of the time appeared in 1800 near the village of Pohar (now Lviv Region), near the Ropianka stream. According to descriptions by Austrian geologist Emil Tietz, up to 260 tonnes of oil per year were extracted here from wells 5-7 to 70 metres deep. Individual attempts to industrialise the Borysław field in 1810-1817 are known, but they did not achieve sustainable development due to the lack of significant demand for petroleum products.

It should be noted that the imperfect distillation of rock oil has been known since ancient times, even ancient physicians (in particular, Cassius Felix) and mediaeval Arab alchemists used it. Among the industrialists who distinguished themselves with the introduction of primary oil refining technologies are the Arkhangel'sk mineralogist Fyodor Priadunov, who built an industrial oil distillation plant at the settlement of Ukhtyn in 1746; the Dubynin brothers, who invented the oil distillation cube and applied it in 1823. in the Mozdok fields; mining engineer Mykola Voskobochnikov, under whose leadership the first oil refinery was built in Absheron (1837) (Biletskyi, Hayko, Orlovsky 2019). Pharmaceutical processing of crude oil to the level of "shale oil" had been successfully carried out in Italy. Work on the industrial processing and refining of crude oil in the UK began in 1851. But all these technologies did not provide pure distillate. The resulting substances burned in the lamps (as well as vegetable oils and animal fats) gave dim light,

a stench, and lots of soot, which quickly contaminated the lamp, reducing the transparency of the mica (used for lack of glass as window protection). In 1852, Piotr Mikulasz, the owner of a Lviv pharmacy, set up a chemical-pharmaceutical laboratory (distillery), bought from Drohobycz businessman A. Schreiner, centnar of Borysław, an imperfect mountain oil distillate and commissioned Zeh to distil (rectify) this product to the degree of the so-called "album Oleum petrae" ("rock oil"), which was delivered to the pharmacy from Italy. After weeks of numerous laboratory experiments, in which Ignacy Łukasiewicz participated, full distillation and separation of the oil into separate fractions was carried out for the first time. The pharmacists used concentrated sulphuric acid and soda solution to clean the oil. In May 1853, Zeh submitted invention materials (the "privilege") for chemical oil purification and received them in Vienna in December of the same year. In 1854, at the World Economic Exhibition in Munich, Zeh received "commendable recognition for the complete distillation of oil". 1854 is when the Bóbrka mine is established. The road to it led Łukasiewicz through Rzeszów, Łańcut, Lviv, Cracow and Vienna. But it also led through Gorlice, where oil had long been known and used to light up cities: Łukasiewicz, after a conflict with Zeh in 1853, left Lviv and took a job in Gorlice at Ludwika Bartkowa's pharmacy. Here he saw the development of oil activity: the oilmen collecting black oil from puddles and ponds in the village of Łosie, here he watched the 30 fathoms deep diggings – wells with oil built there for centuries and then developed by Prince Jabłonowski, here he watched his factory of asphalt and lubricants, which the whole world already knew about. Here he also witnessed major disasters, fires in mines, explosions in primitive distilleries. Here he learnt about Jabłonowski's trips to the Krosno area, seeking oil-bearing areas. This is how he became a partner with other industrialists, the founders of the mine in Bóbrka were: Ignacy Łukasiewicz – the modest pharmacist; Tytus Trzećieski – a landowner and initiator of the founding of the mine; and Karol Klobassa-Zrencki – owner of the village of Bóbrka. Thanks to the concerted cooperation, commitment and high operability of the creators, the world's first multidimensional oil company was created. A refinery was built in Chorkówka (Pilecki 1957: 97), a steel mill and smelting furnace in Polanka, a forge producing augers and mine equipment in Potok, a drillers' school in Wietrzno, a gas-fired Krosno Basin Power Plant in Brzezowka (now Męcinka) (on the site of Alfred Nobel's gold mine...) and in 1873 a real school with a department for training electricians. From this area, Polish industrialists and mine workers went on apprenticeships to the United States and Canada, to technical universities throughout Europe, here went the "Baciarzug" – the train carrying drillers to Drohobycz and Borysław. Here investors, labourers, carpenters, roofers, locksmiths were drawn from half of Europe, bridges, roads, railways, banks, insurance companies, health insurance companies, annuity

companies were built. Here, in Krosno, next to the Stawiarski Refinery, the Russians built their first airport, and the gas helped to create a glass, linen-making area. Here, Karol Klobassa-Zrencki funded a spa in Bóbrka, where mineral waters and balneological treatments treated 5,000 patients a year in the 19th century. This was the *perpetuum mobile* of Poland's development.

Successors of Ignacy Łukasiewicz

There are many such names, but it is worthwhile when writing about oil to stop and recall one more: Witold Leon Julian Zglenicki. He was a graduate of the Faculty of Mathematics and Physics at the Warsaw Main School (now University of Warsaw), a pupil of Mendeleev at the Mining Institute in St. Petersburg, and considered the "father of Bakiya kerosene" or the "Polish Nobel". Inventor, scientist, industrialist, and philanthropist. 30% of the world's oil production comes from offshore drilling – which he devised, designed, and patented. Shah Mozaffar ad-Din Shah Qajar awarded him the Order of the Lion and Sun for his geological discoveries in Persia. He was a partner of the Nobels and Rothschilds in business, while suffering from diabetes he established the Foundation for the Promotion of Science (on May 20, 1991, the Józef Mianowski Fund was reactivated as the Foundation for the Promotion of Science) and donated a huge fortune to it for the development of Polish science. The amounts at the time were estimated to be in the vicinity of \$220 million with a \$150 million Nobel fund. This "modernised estimate" makes it possible to claim that the value of the funds of the Foundation for the Promotion of Science can be estimated at more than \$4,000,000,000 today. Unfortunately, the property was seized and squandered by the Soviet and Polish communist authorities, who, despite numerous requests from heirs and representatives of science, do not respond to demands for the return of the Foundation's assets. His bequest to the Mianowski Fund surpassed (...) the bequests of Queen St. Jadwiga – for the restoration of the Cracow Academy, or its foundation in the 14th century by King Casimir the Great," wrote Marek Zawadzki, president of the Polish Science Foundation. Today, the Polish Science Foundation is a charitable institution, donating modern laboratory equipment in the field of power electronics to Polish technical schools – secondary and higher education.

Conclusion

Ensuring the continuity of fuel supplies is a concern of politicians, polemologists and economists today. Looking with pride at the more than four hundred outstanding Poles associated with petrochemistry and influencing progress on all continents – we must remember that the preservation of their testament today – depends on us. Ignacy Łukasiewicz died by a wood-burning fireplace, today, thanks to the work of this humble pharmacist, processed petroleum is not only aspirin and

ibuprofen, clothing and cosmetics, it is first and foremost the basis of the energy industry, the automotive industry, we will meet paraffin in hair shampoo and in the cellphone, in the propulsion of vehicles, machinery and equipment. The world and humankind owe much to Łukasiewicz and many other nameless contributors to development and progress.

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