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## What Are the Top Oil and Gas Companies in Nanotechnology Patenting?

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Activity in the field of oil and gas entails the use of various technologies. It is undeniable that one of the technologies which has found its way into various industries, including the oil and gas sector, is nanotechnology. As an interdisciplinary technology, nanotechnology has attracted the attention of large oil and gas companies. A look at the current status of these companies indicates that, depending on the significance they attach to nanotechnology, they have dedicated a remarkable part of their innovations and inventions to this technology.

With the advent of nanotechnology, numerous scientists predicted that this technology would penetrate varied areas and become one of the most vital tools to meet technological challenges. In this regard, the oil and gas industry would be considered a key industry in the world, the developments of which have tangible effects on other sectors.

This report aims to examine patents, as one of the important indicators to study the degree of penetration and impact of nanotechnology in the oil and gas sector. To do so, the statistics pertaining to nanotechnology patents of several large companies active in the field of oil and gas in the world have been scrutinized. The Forbes and Fortune websites have been used to compile a list of the top oil companies, while the Orbit database has been employed to extract patent statistics for these companies. Forbes is a business company offering invaluable information in the fields of economics, finance, industry and market, and Fortune is an American business magazine that works in the area of ranking various companies. The original companies have been used to extract the statistics, whereas their subsidiaries, which have different names from the main companies, have not been examined.

Table 1 presents a list of the 25 largest oil companies with the most patents related to nanotechnology. These patents have been issued or registered in different years by the US Patent and Trademark Office (USPTO) and the European Patent Office (EPO). The table also outlines the number of nano patents issued by these companies by USPTO and EPO, the

number of patents in all fields of science and technology, the share of nano patents from all the patents, and the country where the companies are located. The entire number of patents issued by these top 25 companies in the field of nanotechnology amounts to about 5005, of which more than 84% have been published in the USPTO and about 16% in the EPO.

Of the 25 companies listed, nine are owned by the [United States](#), and a total of around 58% of the nano patents issued by these 25 oil and gas companies are held by US companies. Among these companies are Baker Hughes Company and Halliburton, which have issued 940 and 731 patents in the area of nanotechnology, and are ranked first and third in this regard respectively. The second place belongs to the Saudi Arabian Oil Company (Saudi Aramco), which has had a significant growth in the issuance of patents in the field of nanotechnology in the past few years. Another fact is the presence of three companies from [Japan](#), a country which possesses scarce oil and gas resources but has a serious presence in this field having registered 205 nano patents.

Table 1. The world's top oil and gas companies based on the number of patents and patent applications issued in the field of nanotechnology.

Rank	Company	Main Nationality	EPO Nano Patents	USPTO Nano Patents	Total Nano Patents	Total patents	Ratio of Nano Patents to Total Patents
1	<a href="#">Baker Hughes Company</a>	<a href="#">United States</a>	56	884	940	15079	6.23%
2	<a href="#">Saudi Arabian Oil Company (Saudi Aramco)</a>	<a href="#">Saudi Arabia</a>	63	689	752	7859	9.57%
3	<a href="#">Halliburton</a>	<a href="#">United States</a>	51	680	731	23019	3.18%
4	<a href="#">ExxonMobil</a>	<a href="#">United States</a>	88	459	547	12250	4.47%
5	<a href="#">Schlumberger</a>	<a href="#">United States</a>	35	314	349	19547	1.79%
6	<a href="#">Total</a>	<a href="#">France</a>	87	138	225	5041	4.46%
7	<a href="#">Chevron</a>	<a href="#">United States</a>	18	173	191	11529	1.66%
8	<a href="#">SK Innovation</a>	<a href="#">South Korea</a>	37	152	189	1663	11.37%
9	<a href="#">Royal Dutch Shell</a>	<a href="#">Netherlands</a>	53	99	152	17924	0.85%
10	<a href="#">Eni</a>	<a href="#">Italy</a>	42	79	121	1232	9.82%
11	<a href="#">Sinopec</a>	<a href="#">China</a>	44	75	119	1444	8.24%
12	<a href="#">BP</a>	<a href="#">United Kingdom</a>	36	81	117	5954	1.97%
13	<a href="#">Idemitsu Kosan</a>	<a href="#">Japan</a>	37	56	93	6886	1.35%
14	<a href="#">Nippon Oil</a>	<a href="#">Japan</a>	35	44	79	4865	1.62%

15	<a href="#">Indian Oil</a>	<a href="#">India</a>	26	42	68	527	12.90%
16	<a href="#">Ashland</a>	<a href="#">United States</a>	9	38	47	1820	2.58%
17	<a href="#">ConocoPhillips</a>	<a href="#">United States</a>	3	39	42	1970	2.13%
18	<a href="#">PetroChina</a>	<a href="#">China</a>	7	31	38	384	9.90%
19	<a href="#">Phillips 66</a>	<a href="#">United States</a>	0	36	36	595	6.05%
20	<a href="#">Osaka Gas</a>	<a href="#">Japan</a>	15	18	33	901	3.66%
21	<a href="#">Petrobras</a>	<a href="#">Brazil</a>	12	19	31	867	3.58%
22	<a href="#">Neste</a>	<a href="#">Finland</a>	16	13	29	946	3.07%
23	<a href="#">RIPI</a>	<a href="#">Iran</a>	8	18	26	62	41.94%
24	<a href="#">Repsol</a>	<a href="#">Spain</a>	13	12	25	405	6.17%
25	<a href="#">Smith International</a>	<a href="#">United States</a>	3	22	25	2600	0.96%

Studies reveal that, in total, the two continents of North America and Asia have the highest number of companies regarding nanotechnology patents in the oil and gas sector, followed by Europe and South America. Figure 1 illustrates the share of different continents with regard to the top companies in this field.



Figure 1. Share of different continents with regard to the top companies active in the oil and gas sector in the dissemination of nano patents.

Figure 2 shows the patent release trends for the top 5 companies in this field between 2010 and 2020. One of the highlights of Figure 2 is the significant growth of nanotechnology patents by the Saudi Arabian Oil Company (Saudi Aramco) from 2017 onwards. Between 2010 and 2013, Aramco published less than 10 inventions in the field of nanotechnology every year, but in 2014, experiencing a noticeable growth, it increased the number of inventions in the field of nanotechnology to over 10. However, the most significant growth of this company started from 2017 onwards, with the company registering the highest number of patents in the field of nanotechnology among all the top 5 companies in 2018, while it achieved the second position in nano patent issuance by November 2021.

The other top four companies issued similar numbers of patents in the field of nanotechnology in 2010, whereas Baker Hughes Company with an increase in patent

numbers in this field in 2012 was able to widen the distance with the other companies, taking the first place. In 2020, with the exception of the Saudi Arabian Oil Company (Saudi Aramco), the other four companies faced a decline in patent releases, a fact which is also observed in 2021. One of the reasons for this could be the outbreak of the Covid-19 pandemic and its devastating impact on the global economy, including the oil and gas sector and companies active in this field, which has led to a degeneration in research and development in these companies.



Figure 2. Number of patents issued in the field of nanotechnology by the top 5 companies in the oil and gas sector over the last 10 years.

One of the indicators proposed in this research is the ratio of patents in the field of nanotechnology to the total patents published in all fields of science and technology. This indicator shows the role of nanotechnology and its impact on the overall findings of a company. In this regard, the highest share of nanotechnology patents in the total number of patents belongs to the Iranian Petroleum Industry Research Institute (RIPI), at 41.94%. Of course, this company does not possess a significantly large number of patents, with a total of 62 patents in the two offices in the [United States](#) and Europe. The second position, according to this criterion, is held by the Indian Oil Company with a share of 12.90%, while SK Innovation ranks third having a share of about 11.37%. Among the companies with an American nationality, Baker Hughes Company and Phillips 66 account for the largest share of nano patents with a total of more than 6%.

The Middle East is one of the richest oil and gas fields in the world, and the countries in this region are among the most active countries that produce and export oil and gas. A review of the companies and patent registration trends for the countries in the region indicates that only two countries, [Saudi Arabia](#) and [Iran](#), have companies which are among the top 25 oil and gas companies investing in nanotechnology. In recent years, [Saudi Arabia](#) has expanded its patent-related efforts in the field of nanotechnology with the cooperation of other countries, including the [United States](#), while taking advantage of international researchers in this field. [Saudi Arabia](#)'s strategic planning for nanotechnology reveals the following as its oil

and gas priorities: improving catalysts, increasing corrosion resistance, increasing yields, increasing well productivity, and developing well drilling equipment.