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The forecast is made in line with ACRA's [General Principles of Socioeconomic Indicators Forecasting](#).

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"Accumulative" effect: growing production of lithium and cobalt to impair their prices

Rechargeable battery metals market: 2022 forecast

From late 2015 to March 2018, lithium carbonate prices have grown by 150% up to USD 14,500/ton, but we expect the prices to go down to USD 9,200/ton by 2022. A surge in demand for electric cars seen in 2014–2017 triggered the demand for lithium and drove lithium prices up to USD 14,000–15,000/ton in South America, a key lithium supplier to the global market. By 2022, the demand for lithium may double, driven by the increased consumption by electric car and rechargeable battery manufacturers. On the other hand, the lithium carbonate production capacities are underutilized today, and large companies may double the production by 2022, which may push the prices down. The current lithium prices are much higher than the prime production costs of the least effective lithium producers, which may further contribute to the decline in prices.

From late 2015 to March 2018, cobalt prices grew by 260% up to USD 87,000/ton, but we expect the prices to go down to USD 38,000/ton by 2022. The demand for rechargeable batteries grew concurrently with the falling prices for nickel and copper, along with which cobalt is produced. According to ACRA estimates, in the nearest years, revamping production of industrial metals after a price rally in 2016–2017 and a range of new cobalt production facilities to be commissioned in DR Congo can push down cobalt shortage and market prices.

Cobalt and lithium markets to favor Russian producers in the forecast period (2018–2022). Regardless of the decline in Co and Li prices expected by 2022, their market prices are projected to be higher than the prime production costs within the entire forecast period, enabling Russian producers to increase the production volumes of Co and Li and to maintain high returns.

China is a key investor in the Co and Li market. High lithium production potential in Argentina and Chile amid a prospective surge in demand for lithium raises the demand for shares in lithium producing companies. Therefore, Chinese companies invest heavily into international projects. Cobalt production in DR Congo has already strengthened the positions of China in the market, but the concentration on a single country is rather risky. ACRA expects Chinese investors to diversify cobalt sources to include, among others, non-conventional cobalt reserves in Russia.

Table 1. Russian and world prices and production indicators for Co and Li in 2018–2022

Indicator	UoM	Actual			Estimate	Forecast				
		2014	2015	2016	2017	2018	2019	2020	2021	2022
Lithium										
World production	t	31,000	31,500	38,000	43,000	51,338	69,454	79,417	85,990	90,290
World consumption	t	31,920	34,650	41,370	45,570	51,870	58,800	70,350	79,800	83,790
Lithium carbonate price	USD '000/t	5.5	6.5	14.0	14.4	13.6	10.7	10.2	10.1	9.2
World reserves	mln t	40.1								
Russia production	t	1,617	1,610	1,384	1,566	1,607	2,003	2,047	2,059	2,060
Russia reserves	mln t	0.9								
Cobalt										
World production	t	91,754	98,113	100,942	97,097	100,010	106,436	126,648	141,629	151,886
World consumption	t	82,000	89,000	93,950	105,000	115,500	112,048	124,671	138,247	148,631
Cobalt price	USD '000/t	31.2	28.6	25.6	56.2	74.2	55.1	40.4	37.7	37.9
World reserves	mln t	7.1								
Russia production	t	5,700	5,000	5,000	5,600	5,768	6,139	7,304	8,168	8,760
Russia reserves	mln t	0.25								

Source: USGS, Albemarle, SQM, electra.com, Bloomberg, Wood Mackenzie, Ereport, Cobalt Institute, metal companies, ACRA estimates

Electric cars drive demand for metals used in rechargeable batteries

This ACRA research is an overview of the market of lithium and cobalt, which are used in the batteries and energy storage devices.

The history of these metals is quite long, but it is in the last two years that the interest in them has increased significantly owing to the success of electric car manufacturers. From the end of 2015 to March 2018, prices for lithium carbonate and cobalt grew by 150% and 260%, respectively (for comparison, industrial metals went up by 46% in the same period).

Lithium shortage arose in 2014–2017 on the backdrop of underutilized production capacities, and lithium production has failed to keep pace with the growing demand in recent years. In the cobalt market, we see that the production is lagging behind the demand: 57% of cobalt is produced as a by-product for nickel and copper, whose production volumes have recently declined amid falling prices in 2014–2015.

We expect the demand for Co and Li to grow further in view of the following:

- The number of electric vehicles tend to increase globally (according to various estimates, the number is expected to grow from 2 million in 2016 to more than 50–70 million by 2025);
- Energy storage technologies become cheaper (today, the price per kilowatt-hour for the entire life cycle of a lithium battery (EUR 330–820/MWh, with the prospective reduce down to EUR 100–210/MWh by 2030) is comparable, for example, with consumer electricity prices in Germany (EUR 290/MWh), one of the leading EU economies).

Co and Li production volumes are to grow rapidly as, in addition to established industry players, other major companies can also go into various mining projects (like Codelco in Ecuador and Glencore and China Molybdenum in DR Congo). The growing demand and increasing production of Co and Li are expected to contribute to price decline.

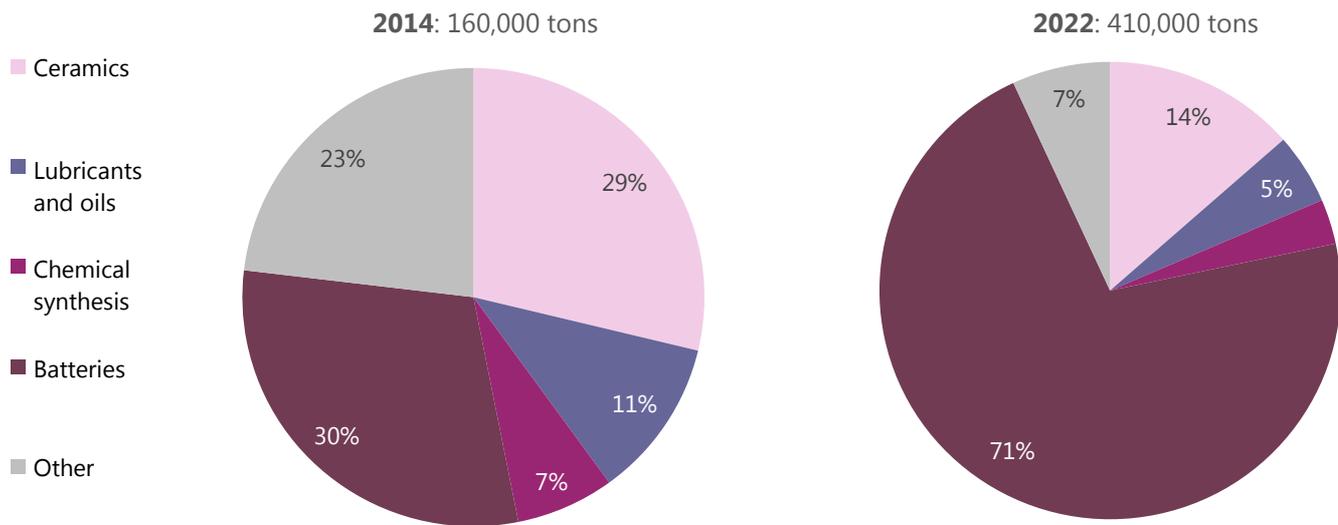
Lithium: secret metal gaining in popularity

Lithium is used by a variety of industries. Historically, it has been used in the manufacture of ceramics, as lithium additives improve product quality, heat resistance and chemical resistance. In ferrous and non-ferrous metal industries, metallic lithium and its silicon and calcium alloys are used to remove undesirable impurities. Lubricants containing lithium are in demand in aviation and military industry, since they are applied in equipment operated under extreme temperature conditions (from -50°C to +150°C). With the increasing consumption of smartphones and wearable gadgets, Li-Ion and Li-Pol batteries have become widespread.

Today, there is a trend for introduction of Li-Ion batteries instead of the heavier and less convenient lead-acid batteries in the car industry. Taking into account the forecasted growth in the number of electric vehicles (from 2 million in 2016 to 20–25 million by 2021 and 50–70 million by 2025), the automotive batteries segment of lithium products may increase from 30% to 71% in this period.

Cobalt and lithium are used in Li-ion batteries, where cobalt is a cathode, lithium is electrolyte, and graphite is an anode.

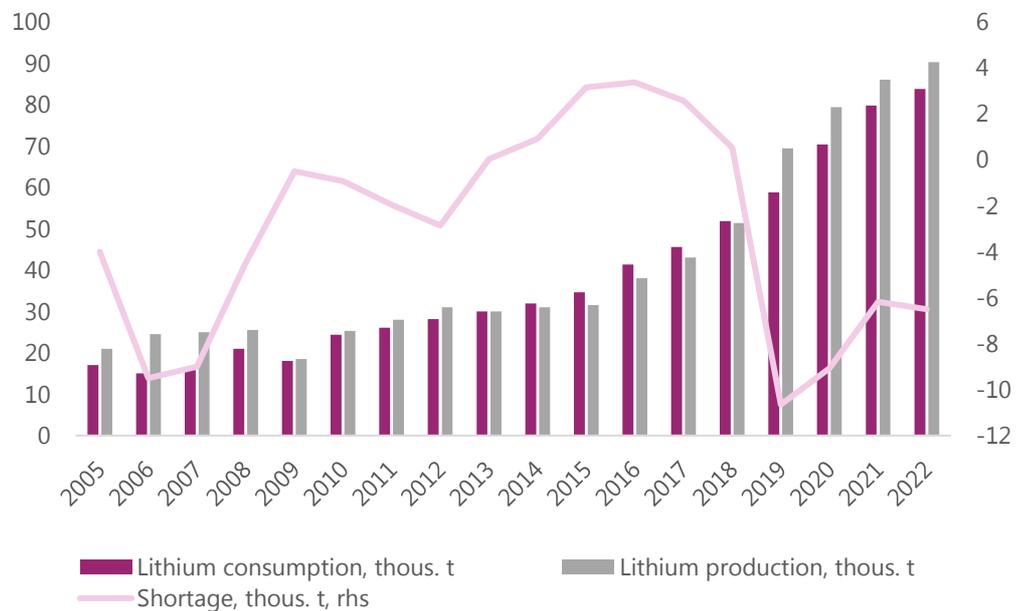
Figure 1. Battery manufacture as a main driver of demand for lithium carbonate



Source: Albemarle, ACRA estimates

Lithium is produced mainly from brine or spodumene ores. About 60–70% of the total lithium volume is produced from brine, therefore, its consumption and production is usually estimated by the equivalent of lithium carbonate (Li₂CO₃), where the share of pure metal is 18%. For the convenience of forecasting, ACRA operates with statistics on consumption and production of pure metal.

Figure 2. Lithium production growth to drive market surplus



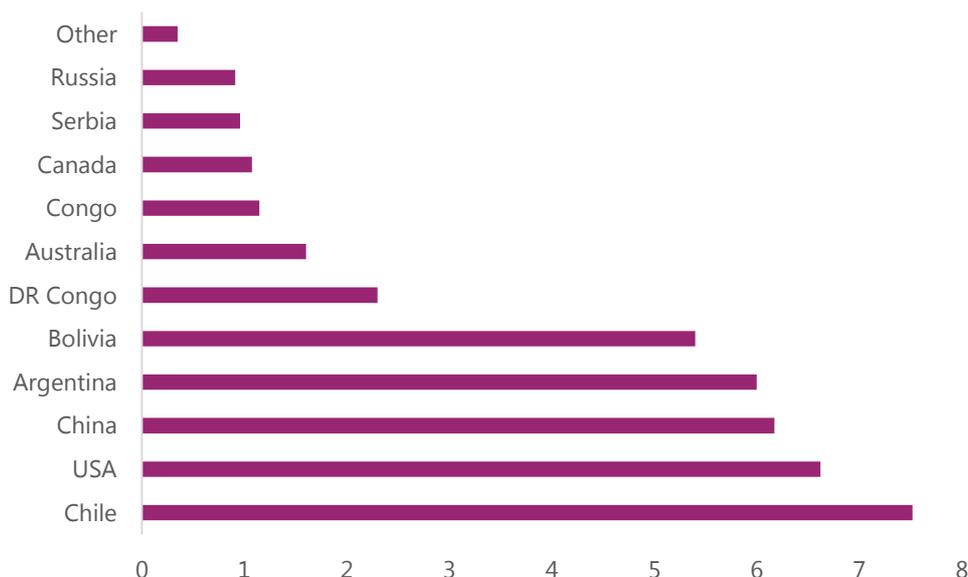
Source: USGS, Albemarle, SQM, ACRA estimates

ACRA notes that the lithium shortage in the period from 2014 to 2017 was largely caused by the cautious increase in lithium output volumes on the backdrop of underutilized capacities in the industry. Such cautious approach was related to the production of lithium in various forms (carbonate/hydroxide, etc.), as well as the presence of lithium in the strategic reserves of consumer countries (lithium is categorized as a strategic metal, and information on its reserves is considered a state secret in many countries, as lithium can be used to produce fuel for fusion reactors in the future).

ACRA expects the production capacity utilization ratio to grow from 78% in 2016 to 81% by 2022, taking into account new projects launched by both established industry companies and new players. In terms of pure metal, the lithium production volume may reach 90,000 tons by 2022 (against 43,000 tons in 2017).

The world lithium reserves, although not completely disclosed (due to the information confidentiality regime), are estimated at 40 million tons (Fig. 3).

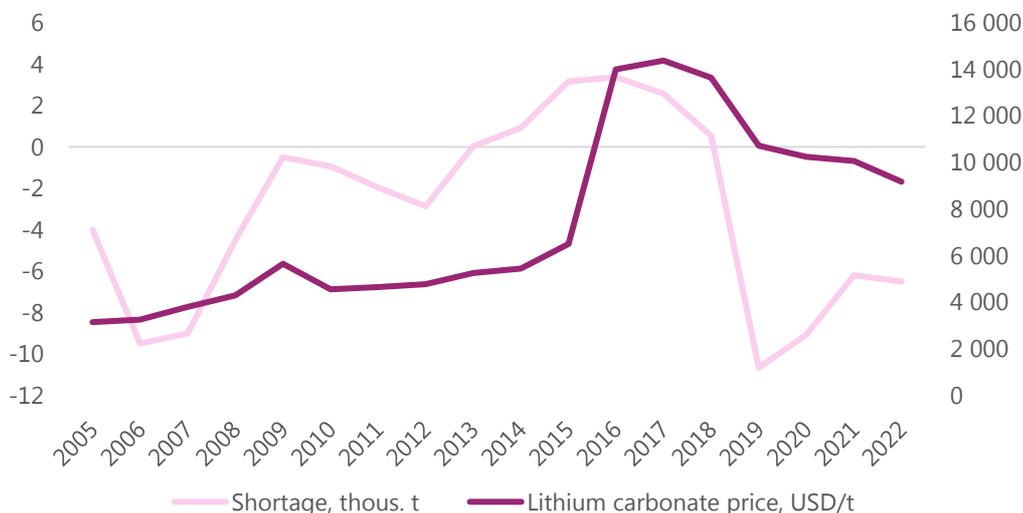
Figure 3. World lithium reserves are high enough for over 100 years of extraction, mln t



Source: USGS, electra.com

Lithium carbonate prices strongly correlate with lithium shortage in the market, however, the estimation model that includes a qualitative factor (the increased demand for electric cars) is more accurate. Electric cars entered the public space in 2016–2017 on the back of Tesla's success, which coincided in time with a surging demand for lithium and a corresponding explosive growth in lithium prices.

Figure 4. Lithium carbonate price is to decline on the back of growing lithium shortage



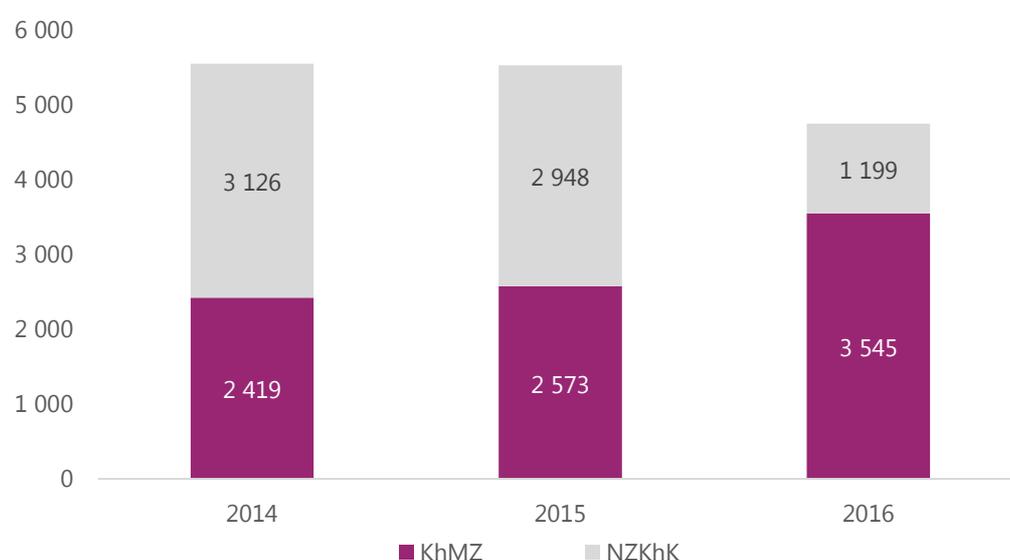
Source: Bloomberg, ACRA estimates

ACRA expects the demand for electric vehicles to decrease, along with the declining shortage in the lithium market, in the period from 2018 to 2022, and, as a result, the speculative demand for lithium carbonate to go down, and its prices in South America (the key lithium supplier to the world market) to drop from USD 14,000/ton in 2017 to USD 9,200/ton by 2022.

Lithium tears in Russia: still no growth in production

In Russia, lithium is produced only by Rosatom companies, including KhMZ and NZKhK. UC RUSAL has plans to build a pilot production project at Yaroslavsky Mining and Concentration Works, Primorsky Region. The total officially known volume of lithium hydroxide produced in Russia in 2016 does not exceed 5,000 tons.

Figure 5. Estimated lithium output in Russia, t



Source: corporate reports

The main lithium deposits in Russia are the Kolmozerskoye, Goltsovoye, Urikskoye, Znamenskoye, Polmostundra, Ulug-Tanzek deposits, Taschelginsky pegmatite ore field, and two oil and gas fields containing associated brines: Verkhnechonskoye and Yarakinskoye. It should be noted that there are no precise data on reserves in Russia. We do not forecast a significant increase in lithium production in Russia in 2018-2022, as we do not see major projects in their final stages, while the implementation of a full-scale lithium production project from scratch requires over seven years.

The Russia's share in the world lithium market does not exceed 4%, and we expect it to go down to 2-3%, following a significant production growth in China, South America and Australia.

China to replicate its steelmaking success in the lithium industry

China, being the world's largest manufacturer of batteries for wearable gadgets and motor vehicles, has been active in lithium production. To date, the country controls up to 20% of the world's known lithium reserves, and Chinese companies have shares in enterprises that control another 40% of world reserves. In addition, Chinese companies are considering options for cooperation with enterprises in Chile and Australia, which are leaders in the global lithium mining market.

See ACRA forecast [Recovering prices for non-ferrous metals to boost import substitution in Russia](#) of September 13, 2017.

Lithium hydroxide (LiOH) is used to produce lithium salts; a component of electrolyte in alkali batteries.

Lithium carbonate (Li₂CO₃) applications include fireworks, glass, electric insulating ceramics, plastics; it is also used in ferrous metal industry; further treatment is needed for lithium carbonate to be used in battery electrolytes.

ACRA expects China to increase significantly its lithium carbonate and lithium hydroxide production capacities, in addition to increased lithium output.

Table 2. LiOH and Li₂CO₃ production capacities expected to be commissioned in China, thousand t

Company	LiOH	Li ₂ CO ₃	Commission
Jiangxi Jiujiang Ronghui Lithium	8	8	2018
Jiangxi Yun Lithium Materials	0	15	2018
Tianqi Lithium	24	0	2018
Hebei Tianyuan Lithium Materials Co., Ltd	4	12	2018
Jiangxi Special Motor	5	20	2018
Sichuan Dingsheng Lithium	5	5	2018
Sichuan Zhiyuan Lithium	5	10	2018
Jiangxi Ganfeng Lithium	20	17.5	2018
Fancy Resources	0	10	2018

Source: Metall Bulletin

Lithium projects are generally completed behind schedule, and ACRA does not expect new production facilities with the capacity of 71,000 tons of lithium hydroxide and 97.5 thousand tons of lithium carbonate to be commissioned simultaneously. Nevertheless, the increased production volumes are to drive the supply, which is negative for prices.

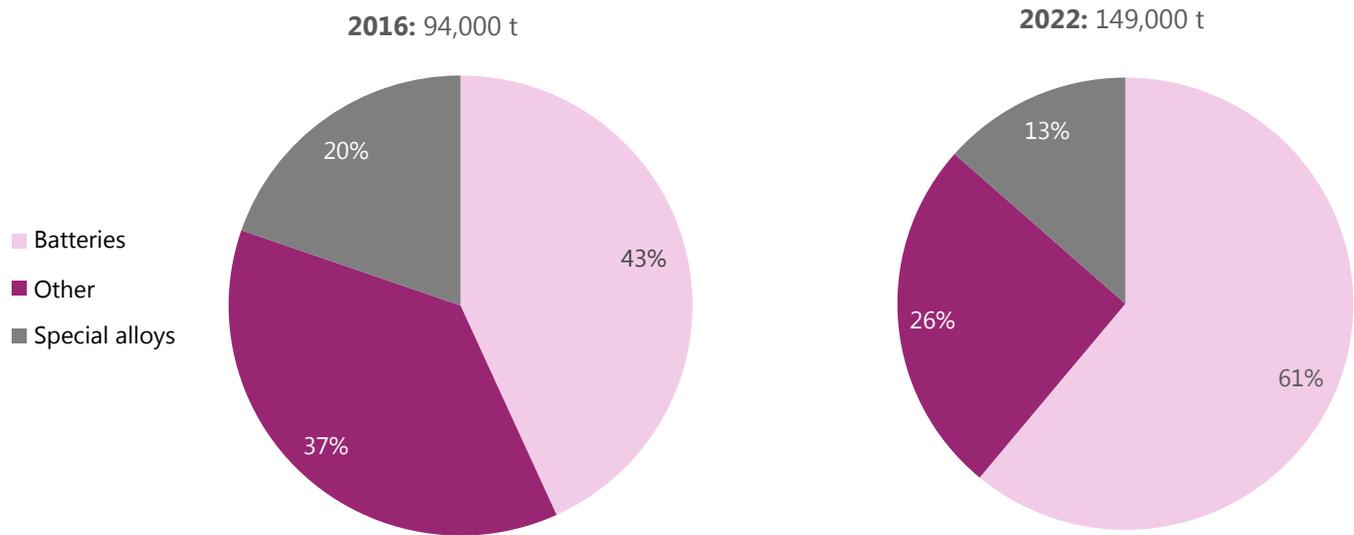
ACRA expects all lithium projects to be completed by 2022 and the share of lithium production capacities of China to reach 40–50% of the global volume, which is comparable to the country's share in the steel market.

Cobalt: by-product that has become high in demand

Historically, the largest cobalt consumers have been producers of special alloys (predominantly high-speed steels), since alloying with cobalt increases shock and heat resistance of metals. However, growing wearable gadget and electric car markets drove the consumption of cobalt used in batteries. Taking into account the electric car market forecasts, ACRA expects the world cobalt consumption to increase from 94,000 tons in 2016 to 149,000 tons by 2022. At the same time, the share of cobalt used in batteries is projected to grow from 43% to 61% of the total consumption.

ACRA expects the annual cobalt production to grow quite rapidly: from 101,000 tons in 2016 to 152,000 tons by 2022, with the highest increase expected in DR Congo that controls up to 60% of the reserves. Despite that the unstable political situation in the country and the new cobalt mining tax led to a certain shortage in the cobalt market, the participation of Chinese investors in cobalt mining projects in DR Congo stopped the local conflict and allows us to expect the production to grow. In addition, cobalt is mostly (57%) extracted as a by-product in the course of nickel and copper production process; therefore, along with the growing output of nickel and copper, ACRA expects a corresponding increase in cobalt production.

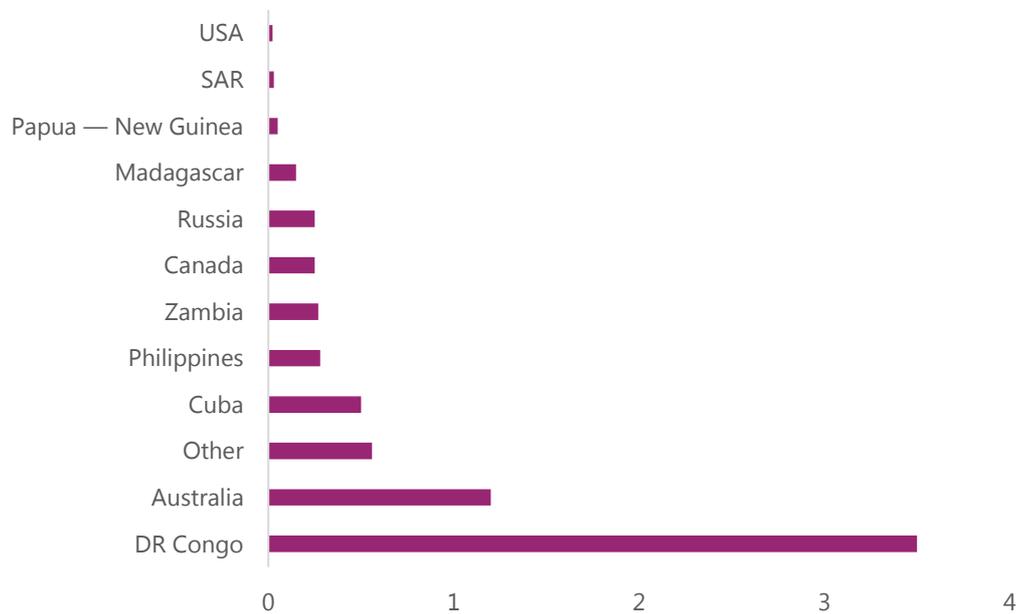
Figure 6. Battery manufacture to dominate cobalt consumption, thousand t



Source: Wood Mackenzie, ACRA estimates

The world's known cobalt reserves do not exceed 7.1 million tons, but this figure is unreliable as the data is scarce and incomplete. The estimated cobalt resources exceed 120 million tons and, with an increase in production volumes and, consequently, exploration areas, the reserves are expected to grow further.

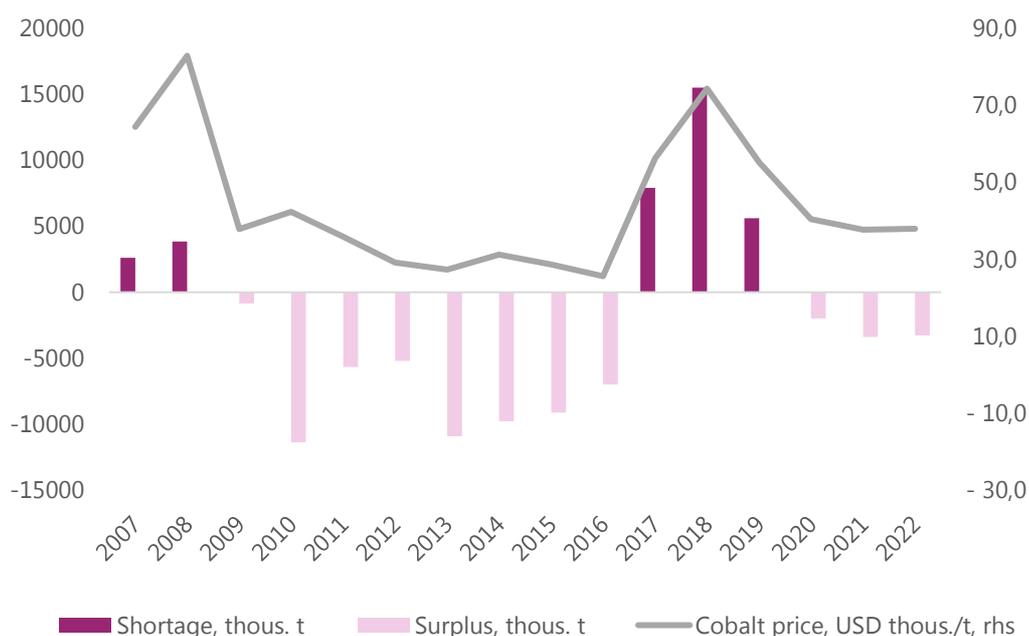
Figure 7. DR Congo and Australia are leaders in cobalt reserves, mln t



Source: USGS

Cobalt prices strictly correlate with cobalt market imbalances. Separate price surges were observed in the periods of high prices for associated metals, in particular, nickel. Taking into account the expected increase in cobalt production, ACRA forecasts a drop in cobalt prices from USD 87,000/ton in March 2018 to USD 38,000/ton by 2022.

Figure 8. Correlation between cobalt price and cobalt market surplus/shortage



Source: Ereport, Cobalt Institute, ACRA estimates

Cobalt production may grow in Russia thanks to non-conventional reserves

In Russia, cobalt was produced by Norilsk Nickel and two small companies: South Urals Nickel Plant (Mechel Group) and Ufaleynickel (B&N Bank Group). In view of the nickel production unprofitability under current market conditions, SUNP and Ufaleynickel have ceased to produce cobalt.

The total cobalt output in Russia does not exceed 5–6 thousand tons. The current share of Russia is 5% of the world market. At the end of 2017, Norilsk Nickel signed an agreement with BASF on the supply of cobalt and nickel products used in batteries. Due to this, cobalt production in Russia may increase, but it is not expected to exceed 5-8% of the world market.

The main Russian cobalt reserves are located in the Norilsk-1, Talnakh and Oktyabrskoye fields (Norilsk ore region), as well as in the Zhdanovsky and Zapolyarnoye deposits (the Kola Peninsula). The total Russian cobalt reserves are estimated at 250,000 tons, but there are hopes associated with the potential cobalt mining in the International Seabed Area (the Magellanic Shelf, the Marcus-Wake Rise and the Wake-Necker Ridge, the seabed of the Marshall Islands, the Line Islands), with about 10 million tons of estimated cobalt resources attributable to Russia. The deep sea mining technology is still underdeveloped, but certain progress is seen in both foreign countries and Russia.

Russian Co and Li producers are likely to increase the production of lithium (slowly) and cobalt (faster) because, even after a plunge, the prices are likely to remain high enough (higher than the 2015 levels) amid low prime costs in Russia coupled with significant reserves, which may increase the cash flows from Co and Li mining business.

Chinese cobalt: focus on DR Congo may require diversification

The extensive involvement of Chinese businesses in cobalt extraction in DR Congo has significantly strengthened the positions of Chinese companies in the world cobalt production. In the absence of its own cobalt reserves, China provides up to 80% of the chemical production of cobalt (63,000 tons or 58.6% of the world volume).

The most prominent deal between a Chinese consortium and Sicominex, a Congolese company, was to invest USD 6 billion in DR Congo's infrastructure in exchange for supply of 10 million tons of copper and 600,000 tons of cobalt. Such contracts and direct investments into Congolese companies are a common practice for Chinese companies, which can drive their production volumes in the future.

On the other hand, the Chinese focus on the extractive sector of DR Congo poses certain risks, as the Sicominex deal has already been modified by the Congolese government under the pressure of the IMF. In addition, Western companies question the legality of cobalt purchases from small Congolese suppliers who exploit child labor. A separate problem may be the concerns of large Western players (including Glencore) about Chinese monopolization of the world cobalt market, which may result in trade restrictions against Chinese products.

Therefore, China may be interested in diversifying its sources of cobalt, and Russian resources can play an important role in China's commodity security.

Investments of Chinese battery manufacturers into lithium and cobalt mining projects in South America and Africa, as well as in Russia and the CIS, are expected to push down production expenses that grew in 2016–2017 as a result of co and li price surge.

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