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Rosatom DG Alexey Likhachev

## Cross-Cutting Green Agenda

**Rosatom initiates and actively contributes to eco-friendly projects. The Russian nuclear corporation produces carbon-free energy at its nuclear plants and wind farms, decommissions hazardous dump sites and industrial facilities, and strives for worldwide recognition of nuclear energy as a sustainable source of electricity.**

Russia has recognized the significance of nuclear energy and put it on the list of clean and sustainable technologies. Speaking at the plenary session of the 9th Neva International Environmental Congress, Rosatom Director

General Alexey Likhachev quoted the figures showing that global CO<sub>2</sub> emissions would grow by more than 2 billion tons a year if the existing 450 GW of installed nuclear capacity were replaced with hydrocarbon sources of energy. This is almost as much as all the forests on the Earth absorb every year, about 2.5 tons per annum.

Russia has long recognized the value of nuclear energy — it is now included in the government-approved list of eco-friendly and sustainable economic activities. National government agencies are busy drafting laws and regulations related to climate and sustainable finance, yet there is still much left to be done to harmonize Russian and international criteria, metrics and mechanisms.

Despite being a global environmental trendsetter, Europe has not come to a definitive



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conclusion about nuclear. **“Unfortunately, discussion in the European Union and elsewhere in the world is still underway, so our essential task is to facilitate the worldwide recognition of nuclear as a clean energy source that meets the sustainable development goals,”** Alexey Likhachev stressed.

**“If here, in Russia, we think ourselves to be climate positive, but importers of our products, primarily the EU, do not consider nuclear a low-carbon energy source, then our exporters will not be able to leverage the resources we have,”** explains Polina Lion, Chief Sustainability Officer at Rosatom.

It should be noted that Rosatom with its wind generation projects is already on track building sustainable supply chains. Rosatom’s wind division NovaWind sells electricity produced at its wind farms to Russian exporters and international companies and is working on a procedure for issuing ‘certificates of origin’ that will confirm a non-carbon origin of electric power consumed.

### Cleanup on a commercial scale

Another Rosatom’s subsidiary Federal Environmental Operator (FEO) takes part in a number of environment protection and conservation projects initiated by the Russian government.

The closest to completion is a municipal waste disposal site in Chelyabinsk. The site has been reshaped, with gas and effluent collection and treatment systems and a protective screen installed, and then covered with soil to turn into a green hill. The project will be completed by September, and the site will be transferred to local authorities.



According to Andrey Lebedev, Director for Environmental Programs at Rosatom, a waste treatment plant was piloted at a hazardous waste landfill site near Krasny Bor, Leningrad Region. After a multi-stage treatment, liquid wastes are turned into a dry geocomposite material and water, which is clean enough to be used in fish ponds. Tests conducted by an independent laboratory show that the waste treatment plant does its job well.

In Usolye-Sibirskoye, FEO is developing a rehabilitation plan for UsolyeKhimprom, a shut-down chemical plant. The company also holds consultations about the Baikalsk Pulp and Paper Mill with the regulator and researchers from the Russian Academy of Sciences and is preparing to conduct a feasibility study and test the proposed recovery technology.

According to Maksim Korolkov, First Deputy Director for Environmental Projects at FEO, the primary task is to stop accumulation of hazardous industrial waste and eliminate the accumulated damage.

Accumulation of hazardous waste and formation of landfills may be prevented using principles of circular economy with waste fully recycled. A transparent information platform



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might also help, and FEO has already created one. About 60 Russian regions and hundreds of industrial facilities submit information to the Hazard Class I and II Waste Accounting and Monitoring System, which is now in its pilot operation phase. The system is expected to be commissioned in the fourth quarter of this year. The Russian nuclear corporation is also working to build infrastructure for the circular economy. Four of its plants are converted, and another three under construction, to process waste and produce mercury, glass, construction materials and other goods.

**Federal Environmental Operator (FEO)** is Rosatom's organization in charge of waste management. FEO provides radioactive waste management, nuclear legacy elimination, site rehabilitation and radiological monitoring services. In its capacity of a Russian federal waste operator, the company is authorized to handle hazard class I and II waste.

**NovaWind** consolidates Rosatom's wind generation assets and is responsible for its wind energy strategy.



## Submersion in Hydrogen

**In the second quarter of the year, Rosatom signed several agreements on the hydrogen economy. These partnerships with high-tech companies and prospective customers are among the first important steps in the transition to a new fuel, which is seen as a cleaner alternative to hydrocarbons.**

### **In Sakhalin**

In late April, Rosatom's subsidiary Rusatom Overseas signed three agreements aimed at establishing a hydrogen economy in Sakhalin.

On April 22, the company signed a trilateral memorandum of understanding with the industrial gas manufacturer Air Liquide and the Sakhalin government. The purpose of the memorandum is to study opportunities for the parties to set up production of low-carbon hydrogen in Sakhalin.

It is assumed that the island will be an experimental ground for achieving carbon neutrality in Russia. **“We plan to finalize a fea-**

**sibility study and draft initial documents for the project by the end of 2021 and then make the most efficient decision about the planned hydrogen output. It is expected to range from 30 to 100 thousand tons per annum,”** President of Rusatom Overseas Evgeny Pakermanov said.

In his turn, Valery Limarenko, Governor of the Sakhalin Region, gave his assurances that local authorities would streamline administrative processes and minimize the time for obtaining construction permits, incorporation licenses and cadastral certificates.

On the next day, April 23, Rusatom Overseas signed a memorandum of understanding and cooperation with TMH Energy Solutions, a subsidiary of Russia's leading rolling stock manufacturer TransMashHolding. The parties intend to build fueling stations and other infrastructure in Sakhalin to enable the operation of hydrogen-powered trains. The second joint task is to participate in the operation of hydrogen transport in Moscow as a developer, supplier of fuel cells, and an owner of fueling stations. (For information about the relations between the two companies see below).

On April 23, another agreement to create and develop a hydrogen cluster was signed. The Ministry for the Development of the Russian Far East and Arctic, the Government of Sakhalin Region, and Rosatom signed a document providing for construction of a hydrogen production facility, building a supply chain for the domestic and external markets, and setting up a competence center for hydrogen and clean energy technology at the Sakhalin State University.

According to Rusatom Overseas, Sakhalin-produced hydrogen has good prospects of

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being exported to Japan and South Korea, which also work on establishing a hydrogen economy.

### With EDF

In late April, Rosatom and EDF (France) signed an agreement on the implementation of clean hydrogen projects. The two companies plan to join their efforts in decarbonizing transport and industry in Russia and Europe. **“Rosatom works consistently to develop carbon-free energy sources and goes beyond its extensive competencies in nuclear energy. We aim to become a key player in the hydrogen production, storage, transportation and consumption chains, which are currently taking shape. The hydrogen economy has much potential as an international playing ground in the context of global decarbonization. I am sure that our partnership with EDF will create strong synergies and help us carry out joint hydrogen projects in Russia, France and all over the world,”** said Kirill Komarov, Rosatom’s First Deputy Director General for Corporate Development and International Business. **“The agreement with Rosatom, our long-standing partner in Russia and a key player in the clean hydrogen market, shows clearly EDF’s intentions to deploy a new energy model with the lowest CO2 emission in every country and region where we operate,”** Beatrice Buffon, Executive Director in charge of EDF’s International Division, supported her colleague.

### At SPIEF

More agreements were signed at the Saint Petersburg International Economic Forum in early June. The partnership between Rusatom



Overseas and TransMashHolding resulted in plans to acquire a stake in TMH Energy Solutions by Rusatom Overseas. The term sheet for the acquisition was signed at SPIEF, with the deal to be closed by the end of this year.

In addition, Rusatom Overseas signed a memorandum of understanding with Metalloinvest, a major Russian steel maker, and Air Liquide. The purpose of the document is to assess technical and commercial aspects of hydrogen production at Metalloinvest production facilities in the Belgorod and Kursk Regions (Russia). The production technologies to be considered are electrolysis and steam methane reforming with carbon capture. The expected amount of hydrogen to be consumed by Metalloinvest plants is up to 150 thousand tons per annum. According to Metalloinvest CEO Nazim Efendiev, the

**Rusatom Overseas** is responsible for the promotion of Rosatom’s turnkey solutions for nuclear power plants and nuclear science and technology centers on international markets. The company is also an integrator for hydrogen economy projects.



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company is already prepared to upgrade its equipment so that hydrogen will make up 30% of reducing gases used in the production process. In the long term, the company might fully replace all other reducing gases with hydrogen.

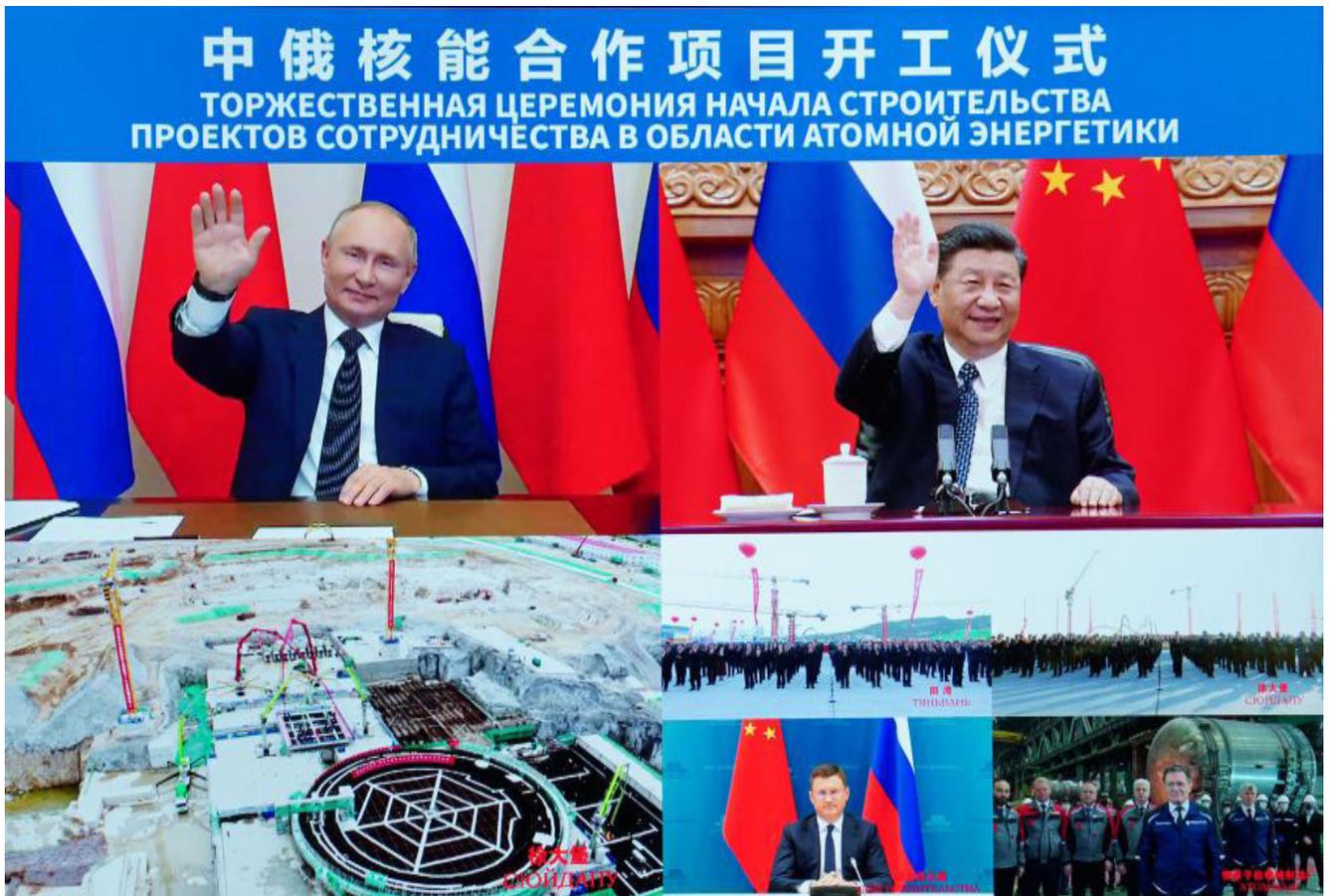
### Global Scale

According to the estimates of Rosatom Overseas, the global demand for hydrogen is about 74 million metric tons, including 5 million tons in Russia. Petrochemical companies are key consumers of hydrogen. Production of ammonia and methanol accounts for up to 70% of the total consumption. Steam methane conversion is the cheapest and thus most widespread hydrogen production technology,

but European regulators concentrate their efforts on increasing the share of hydrogen obtained by electrolysis. Hydrogen obtained from natural gas with CO<sub>2</sub> captured is also considered acceptable.

Rosatom plans to develop a hydrogen economy not only in Sakhalin, but in Western Russia as well. One of its projects provides for the production of hydrogen by electrolysis at nuclear power plants, and the other at wind farms. Building new wind farms and using their energy in hydrogen production is a potential pattern for cooperation with European countries. Rosatom sees its role in those projects as that of a co-investor, technology partner and hydrogen supplier. 

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## Tianwan, Xudabao Enter Construction Phase

Today, we have a good reason to tell our readers about China as mid-May saw the launch of construction at two nuclear plants, Tianwan and Xudabao. Large-scale power projects are not, however, the only focus of interest for Russia and China, two major players of the global nuclear market.

### Official kickoff

President of Russia Vladimir Putin and President of China Xi Jinping gave the go-ahead to

the construction at Tianwan and Xudabao via a video link. The new units are yet another milestone in the cooperation between the two countries.

General contracts for the construction of four power units, two at Tianwan and two at Xudabao, were signed in 2019. According to the contracts, Rosatom will design nuclear islands and supply key equipment and fuel for the Tianwan units. At Xudabao, the Russian nuclear corporation will deliver the same scope of work and also provide design supervision, installation and commissioning services. Commissioning of the four units is scheduled for 2027–2028.

The new units are the third stage of cooperation between Russia and China in commercial nuclear power generation. The initial stage



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included construction of the first two units at Tianwan (commissioned in 2006 and 2007). At the second stage, which started in 2010, Rosatom and China National Nuclear Corporation (CNNC) signed a general construction contract for Units 3 and 4. They were commissioned in 2017 and 2018. **“The Tianwan nuclear power plant operates reliably for the good of the Chinese people and makes a substantial contribution to China’s energy security. The power units built with input from Russia have generated more than 270 billion kilowatt-hours of electricity,”** said Rosatom Director General Alexey Likhachev.

He took part in the kickoff ceremony while visiting Atom mash, part of Rosatom’s power engineering division AtomEnergomash (AEM) and a manufacturer of key machinery and equipment for the Chinese nuclear power plants. The equipment is being produced ahead of schedule. **“Despite a backlog of orders at Atom mash and coronavirus restrictions, the equipment for the Chinese nuclear plants is manufactured faster than set out in the contracts,”** Alexey Likhachev said.

In October 2020, Atom mash got started with the production of a reactor for Tianwan Unit 7. All in all, the company will produce two reactor pressure vessels complete with re-

actor internals and RPV heads and two sets of steam generators for Units 7 and 8. The lower half of the reactor vessel for Unit 7 is ready — it could be seen in the background of the live transmission from Atom mash during the kickoff ceremony.

Work on the equipment for Xudabao is also in progress. According to the latest news, the Petrozavodsk production facility of AEM Technologies (also part of Rosatom’s power engineering division) set to manufacture primary coolant pump casings for Xudabao Unit 3. Petrozavodsk quality inspectors and representatives of CNNP Suneng Nuclear Power Co. Ltd. (CSNP, one of Xudabao project owners) examined the first two spherical workpieces for the compliance with nuclear equipment standards and requirements. Each reactor unit has four primary coolant pumps.

Participants of the official ceremony made it clear that new power units were far from being the last joint project. Yu Jianfeng, Chairman of China National Nuclear Corporation (CNNC), proposed to expand cooperation in such areas as pressurized water reactors, fast neutron reactors, and refabrication of spent nuclear fuel. **“We offer our Chinese partners to enter a new stage of cooperation and work harder together on fast neutron reactors and spent fuel refabrication. We believe this will help us demonstrate the world the leading role of Russia and China in promoting nuclear power and developing new nuclear technologies,”** Alexey Likhachev supported his colleague.

It is likely that the cooperation will be even broader. **“We are discussing China’s participation in the international consortium to build a multi-purpose fast neutron research reactor in Dimitrovgrad,”** Vladimir Putin said.



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Xi Jinping proposed to promote the creation of “**a fairer, more balanced and more transparent system of global energy management**” and strive for innovative development. According to him, an emphasis should be made on environmental responsibility in the nuclear industry, nuclear medicine, nuclear fuel, fundamental research into key technologies, innovations, and state-of-the-art digital technologies.

A foundation for expanding the cooperation in R&D and spent fuel refabrication is already in place. Rosatom’s Research Institute of Atomic Reactors will conduct in-pile tests and post-irradiation analysis of graphite samples for China’s Fangda Carbon New Material Co. TVEL will produce fuel for the first load of the Chinese fast neutron reactor CFR-600 and subsequent reloads during seven years. Deliveries are scheduled to begin in 2023.

### Diversity of projects

China has one of the world’s largest nuclear reactor fleets. According to the IAEA, the country operates 50 nuclear power plants with a total installed capacity of 47,528 MWe. In 2019, China’s nuclear plants generated 348.36 TWh of electricity, a little

**AtomEnergMash (AEM)** is Rosatom’s power engineering division and one of Russia’s largest power machinery producers providing comprehensive solutions in design, manufacture and supply of machinery and equipment for nuclear, thermal, petroleum, shipbuilding and steel-making industries. Its production facilities are located in Russia, the Czech Republic, Hungary and other countries.

less than 5% of the total electric power output in the country. China boasts one of the most ambitious nuclear energy programs in the world. At present, the country is building 14 more power units with a total installed capacity of 13,175 MWe. The range of technologies employed includes pressurized water reactors, fast neutron reactors, liquid metal cooled reactors, and HTGRs. A tokamak is also under construction. China expects its total nuclear generating capacity to reach 70 GW by 2035. This goal is included in a draft version of the 14th five-year plan for national economic and social development (2021–2025) and long-range objectives through the year 2035. <sup>NL</sup>

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## Metals: Shortage Foretold

The International Energy Agency (IEA) has published a report entitled ‘The Role of Critical Minerals in Clean Energy Transition.’ The report highlights that the rapid deployment of clean energy technologies might cause disruptions in the supply of certain non-ferrous, rare-earth and precious metals, drive up their prices, and thus slow down the growth of renewable energy generation. In this respect, deployment of nuclear energy is less risky given its low demand for these metals. And this is yet another argument for a larger share of nuclear energy in the global energy mix.

Energy transition and deployment of clean energy technologies stimulate demand for metals. **“A typical electric car requires six times the mineral inputs of a conventional**

**car, and an onshore wind plant requires nine times more mineral resources than a gas-fired power plant,”** these are the figures quoted in the report. According to the authors of the report, the renewable energy industry, particularly electricity grids, energy storage systems and electric vehicles, will account for 40% of the total demand for copper and rare-earth metals, 60% for nickel and cobalt, and almost 90% for lithium.

There is a risk, however, that supply of metals will lag behind demand, **“The prospect of a rapid increase in demand for critical minerals — well above anything seen previously in most cases — raises huge questions about the availability and reliability of supply.”**

### Iron ore out of focus

The authors of the report compare demand for metals from different types of energy generation, but only those metals that are



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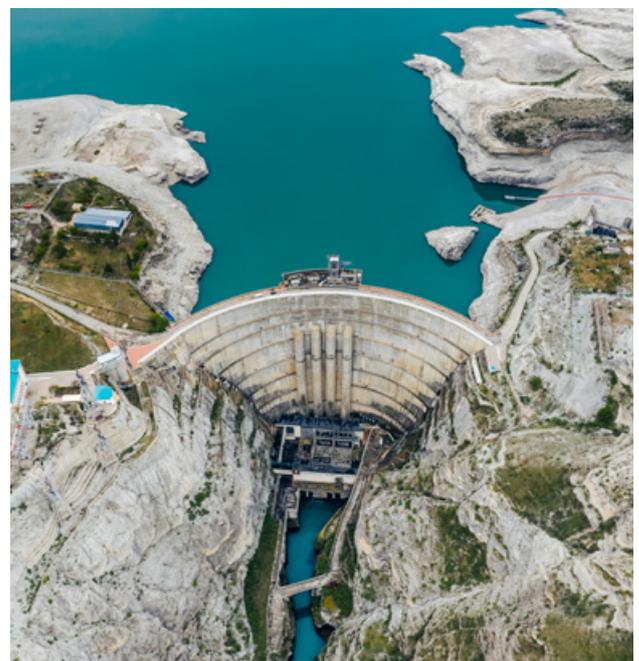
used in capital construction and production of equipment. Metals required during operation, such as uranium, are not taken into account. **“Our analysis focuses on the requirements for building a plant (or making equipment),”** the report says.

Experts chose to analyze the supply of non-ferrous, rare-earth and precious metals. Is this reasonable? The report ignores, for reasons unknown, everything related to steels and alloying metals and thus to iron ore. Steel, however, is used to make transmission towers, reinforcement structures in hydropower dams, and electrical equipment. According to the United States Geological Survey, steel accounts for 71% to 79% of the total weight of a wind turbine. Another 5% to 17% is a share of iron and cast iron. That means the share of iron ore derivatives in a wind turbine can be as large as 96%. In a nuclear power plant, the share of steel and other iron ore derivatives is also large as they are used in the structures and equipment of the plant.

It is quite likely that the IEA does not consider iron supplies to be at risk. Thankfully, iron ore is produced and offered for sale by many mining majors in the world, but the price of iron ore is one of the most volatile among the prices of minerals. Volatility and price growth constitute another risk that is mentioned in the IEA report as the second most significant to supply disruptions, **“In the past, strains on the supply-demand balance for different minerals have prompted additional investment and measures to moderate or substitute demand. But these responses have come with time lags and have been accompanied by considerable price volatility. Similar episodes in the future could delay clean energy transitions and push up their cost.”**

In March 2021, iron ore was priced at \$88 per metric ton and reached \$230 as soon as May. The output of ore in 2020 amounted to 2.2 billion tons. The price of steel may also change dramatically. In China, the price of reinforcement steel bars grew from \$660 per ton early this year to \$865 per ton in early May. **“These prices are record high — they exceed the peaks reached during the previous market booms,”** Interfax quoted Clarksons Platou Securities as saying at that time. Two weeks later, on May 24, reports came in that the iron ore prices plummeted by 20% from the peak in May. The decline was caused by an announcement made by China’s National Development and Reform Commission in late May that it plans to fight monopolies in the commodities markets, price manipulations, speculative activity, dissemination of false information, and accumulation of excessive reserves.

This means that the iron ore and steel prices are much more significant for the power industry than the prices of non-ferrous, precious and, even more so, rare-earth metals.





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reliable and cost-efficient**

Offshore wind turbines use most of non-ferrous and rare-earth metals as compared to other technology, nearly 16 tons per megawatt of installed capacity, IEA experts say. Copper and zinc have the largest shares in this amount. Onshore wind turbines come second, with more than 10 tons of non-ferrous and rare-earth metals needed per megawatt. Solar panels are in the third place (7 tons of metals per megawatt). Nuclear energy consumes the smallest amount of those metals (less than 6 tons per MW) among the other clean energy technologies — only coal-fired and gas-fired power plants consume less.

The authors of the report assessed the significance of certain metals for the nuclear industry as medium and low. Only hydropower is as sensitive to them as nuclear power. The other clean energy technologies are much more sensitive and depend heavily on one or two metals. Electrical vehicles and storage batteries are the most sensitive. According to the IEA, those two segments are badly in need of copper, cobalt, nickel, lithium, rare-earth metals, and aluminum, or six out of nine metals in consideration. This means the risk of disruptions in supply and, consequently, production increases sixfold.

IEA experts forecast in their Stated Policies Scenario (STEPS) that demand of the nuclear industry for non-ferrous and other metals will grow globally by less than 10,000 tons, from 50,000 tons in 2020 to less than 60,000 tons in 2040, which is even somewhat lower than in 2030. In its Sustainable Development Scenario (SDS), the IEA forecasts the annual demand might be a little above 80,000 tons, **“In the SDS, average annual mineral demand from nuclear power between 2031 and 2040**



**grows by around 60% compared to 2020 levels, reaching 82 kt. It is dominated by chromium (42%), copper (28%) and nickel (25%). Yttrium demand in 2040 is around 7.7 tons, or around 0.0015% of current global reserves.”** STEPS is a scenario that follows the existing (stated) government policies. SDS assumes an accelerated transition to clean energy sources in different industries.

**“Along with hydropower, nuclear is one of the low-carbon technologies with the lowest mineral intensity. Key mineral needs include chromium (2 190 kg/MW in 2019), copper (1 470 kg/MW), nickel (1 300 kg/MW), hafnium (0.5 kg/MW) and yttrium (0.5 kg/MW) (EC JRC, 2011),”** the report says.

In other words, the nuclear industry will not stimulate an expected hike in the demand for metals and, therefore, will not contribute to an increase in prices or supply disruptions.

What is more, the long investment cycle for nuclear power plants and equipment makes it possible to predict demand for metals on at least a one-year horizon. As a result, it is possible to minimize the risk of supply disruptions and price growth by making contracts in advance.



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The IEA data, therefore, allows us to conclude that nuclear energy is one of the most secure sources of clean energy in terms of supply and price fluctuations.

### Green price spiral

IEA experts' concerns with the price and supply stability on the back of production growth in the clean energy segment have been voiced amid demands addressed to mining companies to reduce the carbon footprint. In this situation, they become suppliers of raw materials for the clean energy industry and consumers of clean energy. By making their production 'greener', they stimulate the same demand they are meant to satisfy.

One of the conclusions made in the IEA report is as follows, **“Rapid, orderly energy transitions require strong growth in investment in mineral supplies to keep up with the pace of demand growth. Policy makers can take a variety of actions to encourage new supply projects: the most important is to provide clear and strong signals about energy transitions.”**

But what will happen when the requirement for 'strong growth in investment in mineral supplies' is met? Mining companies will acquire new facilities and increase their output. They will need much money as each new construction will be a capital-intensive project because the existing mines with high ore grades and extensive infrastructure are almost depleted or close to depletion. New production facilities stimulate demand for more energy and transport, which are to be clean and, therefore, more expensive than conventional ones. All those additional costs will be weighed against investment attractiveness of new projects and have an indirect



influence, through supply and demand, on market (if any) and contract prices of commodities. Even if new construction projects are launched, their costs will be higher. And because the number of projects able to survive through a period of low prices will decrease, the lower threshold of metal prices will be higher to prevent shortage and a new price hike.

The growth of metal prices translates itself into growing costs in every metal-intensive industry, including clean energy generation, which then drives production costs in the metal and mining industry, and then the spiral — inflation spiral — makes another turn. And this is a moderate scenario that does not account for 'black swans', or events that are hard-to-predict, totally unexpected and consequential. Here is a non-exhaustive list of the factors that have influenced mining companies' prices, supplies and plans in recent years: a lengthy financial crisis, strikes at mines, coups, coronavirus pandemic, customs and antimonopoly regulation, deployment of more cost-efficient mining and extraction technology that makes the previously infeasible deposits viable options. And, of course, this list would be incomplete without the low-carbon requirements for supplies.



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The result is sharp increases and declines in prices. A good example is the price of copper that fell to less than \$4,750 per ton and soared to more than \$7,880 per ton in 2020. In 2021, it came close to \$10,400 per ton.

In this sense, nuclear energy is an epitome of stability as it can guarantee consumers, including mining companies, stable pricing for the entire service life of a power unit, now believed to be able to reach one hundred years. This is a time that exceeds the development period of a majority of current non-ferrous and rare-earth metal deposits. Besides, nuclear power plants guarantee a reliable supply of electricity that does not depend on the vagaries of weather or climate changes as they are capable of operating in any climatic zone, from the tropics to the Arctic.

That means nuclear energy can support mining operations without driving up the price of metals. Mines powered by nuclear power plants will have a flat electricity component of the production cost for decades and up to a century.

Russia already has examples of a symbiotic relationship between nuclear and mining. In early June, a power transmission line connecting Peschanka, a large copper and gold deposit, and Kekura, a smaller gold deposit, with the Bilibino Nuclear Power Plant based in the same-name Arctic city (Chukotka Autonomous Region). Electricity from the nuclear power plant is needed for construction of a mining and processing plant (Baimsky GOK) at Peschanka. The cooperation between Rosatom and Peschanka owner KAZ Minerals (Kazakhstan) might be continued as the parties discuss the possibility of building several floating power plants with RITM-200 nuclear reactors for Baimsky GOK.

### Moderate regulation

IEA analysts call national governments to take action to prevent a rise of metal prices and shortage of supply: **“Policy makers need to explore a range of measures to improve the resilience of supply chains for different minerals, develop response capabilities to potential supply disruptions and enhance market transparency. Measures can include regular market assessments and stress tests, as well as voluntary strategic stockpiles in some instances.”** But price mechanisms that the governments have are not many. The commercial metal market has a huge size and international significance. Government regulation or sanctions even against a single large manufacturer of copper, aluminum or nickel will affect an enormous number of market players. The market will look for any, including regulatory, mechanisms to improve the situation.

As the Chinese practice shows, it is true that the government threatening to punish for speculative activity in the market might cool down prices. By contrast, procurements for national reserves have only a limited effect. Even in the USA, the world’s largest economy, the 2022 budget does not allocate money to buy uranium from American uranium compa-





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nies for the national uranium reserve, which was established by Trump’s administration to support local producers. And no government funds will be enough to make any sizable reserves of copper or aluminum.

Another proposal made by IEA experts is to support geological surveys and prospecting: **“Resource-owning governments can support new project development by reinforcing national geological surveys, streamlining permitting procedures to shorten lead times, providing financing support to de-risk projects, and raising public awareness of the contribution that such projects play in the transformation of the energy sector.”** No doubt these measures are useful and important, but surveying is not what mining companies spend most of their money on — it is construction of mines. So, if we talk about government support for mining companies, we should first talk about infrastructure development through co-financing of roads,



power transmission lines and substations, electricity subsidies to mining companies, and co-financing of new generation capacity. Such mechanisms of support are considered by the Russian government. One of the potential targets might be Baimsky GOK we mentioned above. <sup>16</sup>

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## Importance of Training

**Egypt's Nuclear Power Plants Authority announced the date when it expected to obtain a construction permit for the country's first nuclear power plant. Meanwhile, extensive preparations for the construction are underway. In particular, a sea berth is being constructed to receive equipment for the plant.**

Amged El-Wakeel, Chairman of the Nuclear Power Plants Authority (NPPA), said they

expected to obtain a construction permit for El Dabaa NPP in mid-2022.

The application for El Dabaa construction permit was filed with the Egyptian Nuclear and Radiological Regulatory Authority (ENRRA) in March 2019. By now, the authority has approved a site for the construction of a 4,800 MW nuclear power plant with VVER-type reactors.

The next stage is to finalize the documents and have them reviewed to obtain a construction license. Everything required to obtain the license is done by the Russian company AtomStroyExport (a general contractor of the project) and NPPA. After the permit is



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obtained, concreting the foundations for the buildings and nuclear island facilities will commence.

Meanwhile, extensive preparations for the construction of Egypt's first nuclear power plant are underway. Since last July, a sea berth to receive equipment for the plant has been under construction. Amged El-Wakeel stressed that the sea berth had a number of advantages, including time and cost savings, because it would be very difficult to transport heavy equipment by land and land transportation required well-developed infrastructure, such as roads and bridges. The berth is expected to be completed in the first half of the next year.

Most nuclear power plants are built in the vicinity of water bodies, whether natural (as El Dabaa NPP) or artificial. Dr. Yusri Abu Shadi, a nuclear expert and a former chief inspector of the IAEA, in an interview to Al Alam al Youm explained why it was the case. He said that stations generating large amounts of energy needed much water to cool down and liquefy the steam that moved the turbine.

A large body of water nearby is the simplest and best solution for the plant to take cold water from. This is the reason why nuclear power plants are built on the shore of a sea or ocean or, less preferably, near rivers.

As for effects of a nuclear power plant on the water ecosystem, the former IAEA chief inspector explained the cooling loop did not emit radiation because it did not contact the nuclear reactor. Since the primary and sec-

**AtomStroyExport (ASE)** belongs to Rosatom's engineering division, which is a global leader constructing most of the nuclear power plants abroad and having the world's largest portfolio of nuclear construction contracts. The division is active in Europe, Middle East, North Africa, and Asia Pacific. ASE's core activities are project management in the construction of thermal and nuclear power plants, construction and design supervision, and related consultancy services.

ondary coolant loops are separated from one another, the third loop has no contact with radioactive materials, so it cannot affect the environment negatively.

**“Safety of a nuclear power plant for coastal and water ecosystems can be illustrated by an international fishing competition organized by the Russian nuclear corporation Rosatom. In 2019, a fishing team from the Matrouh Governorate won the first prize at the competition held in the Gulf of Finland near Russia's largest Leningrad nuclear power plant. One of the goals of the competition was to demonstrate safety of nuclear power plants for animals and plants living in nearby water bodies. The fishermen caught fish that was subsequently tested for radiation. They had a chance to see for themselves that nuclear power plants do not have a negative effect on the local environment,”** Dr. Yusri Abu Shadi pointed out. <sup>NL</sup>

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