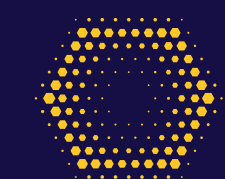


Global Energy Transition: Opportunities and Implications for Mongolia

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11/05/2025

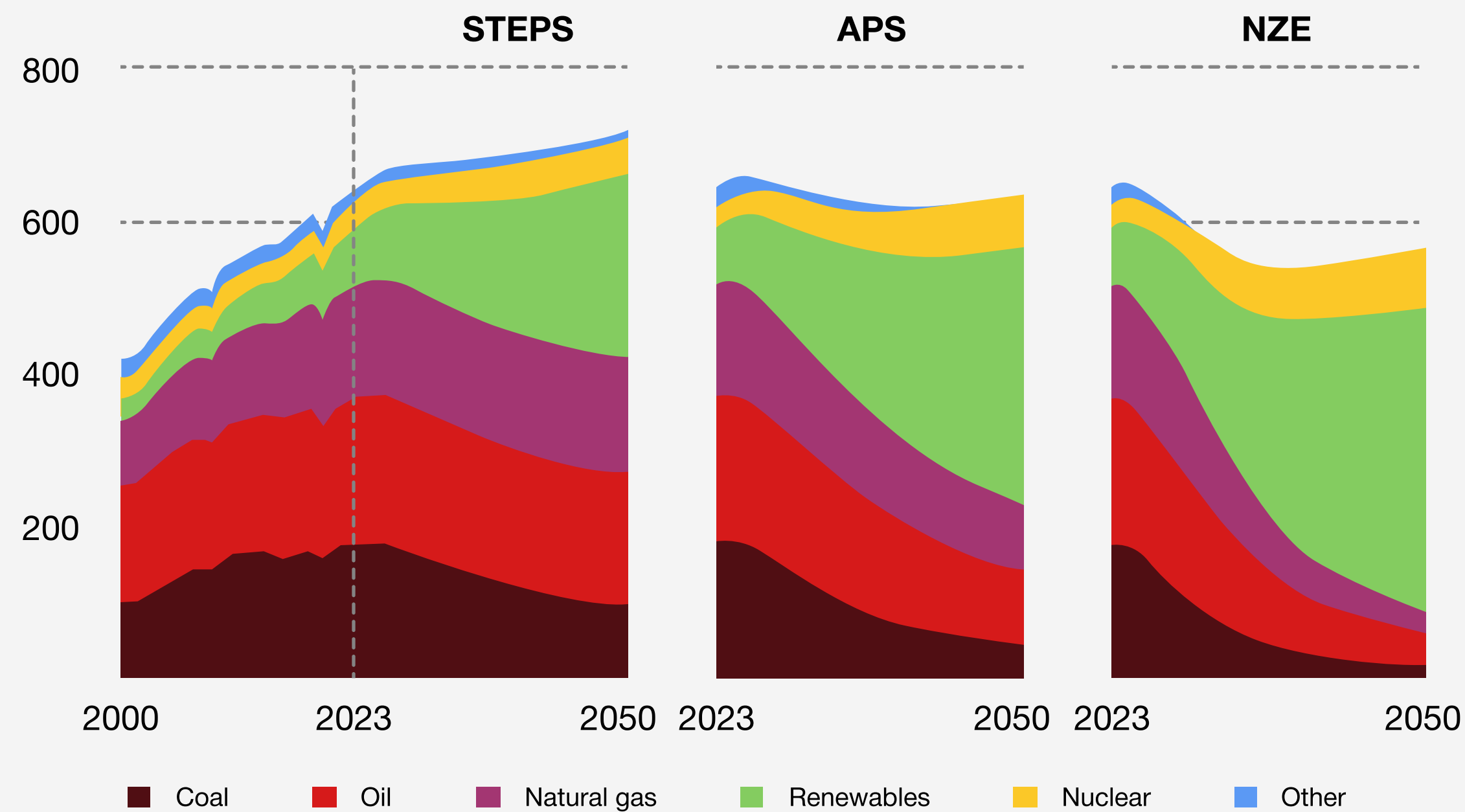
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1. Critical minerals – the cornerstone of global energy transition chain

Global total energy supply by source and scenario, 2000 – 2050
(exajoules)



Source: International Energy Agency (IEA), World Energy Outlook 2024. Fossil fuel share was excluded.
IEA Note: STEPS = Stated Policies Scenario (based on current policies); APS = Announced Pledges Scenario;
NZE = Net Zero Emissions by 2050 Scenario.

The global energy transition unfolds in a chain: growing electricity demand powers renewables growth, which in turn intensifies demand for critical minerals.

1. Rising global energy demand

- Global energy demand is growing, with electricity demand leading the growth, spurred by increasing demand from data centers and AI in OECD countries.

2. Renewables to become dominant source of electricity

- Renewable energy is projected to become the largest global energy source for electricity generation by 2030, encouraged by declining costs and continued policy support.

3. Increasing renewables implies increasing demand for copper and rare earth elements (REE)

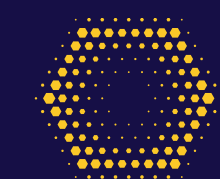
- Copper is essential for renewable energy technologies. Construction, grids, industrials, and electric vehicles (EVs) are set to drive growth in copper demand, with China leading the demand.
 - Global copper demand is projected to grow by over 40% by 2040, but a supply deficit is expected to develop later this decade.
 - AI and data centers are also driving this copper demand surge.
- REE play a vital role in the shift to renewable energy — these 17 elements are essential to advanced technology, particularly those needed to make REE magnets that are used in EVs and wind turbines.
 - Demand for magnetic REE is projected to triple over the next decade.
 - There are immense concerns around supply chain stability given that mining and refined supply of REE are highly concentrated in China.

4. Mongolia's strategic role

- Mongolia's large copper and REE reserves could allow the country to play a key role in the global energy transition.
- Redirecting investment to copper and REE may offer a path to sustaining economic growth and building resilience.

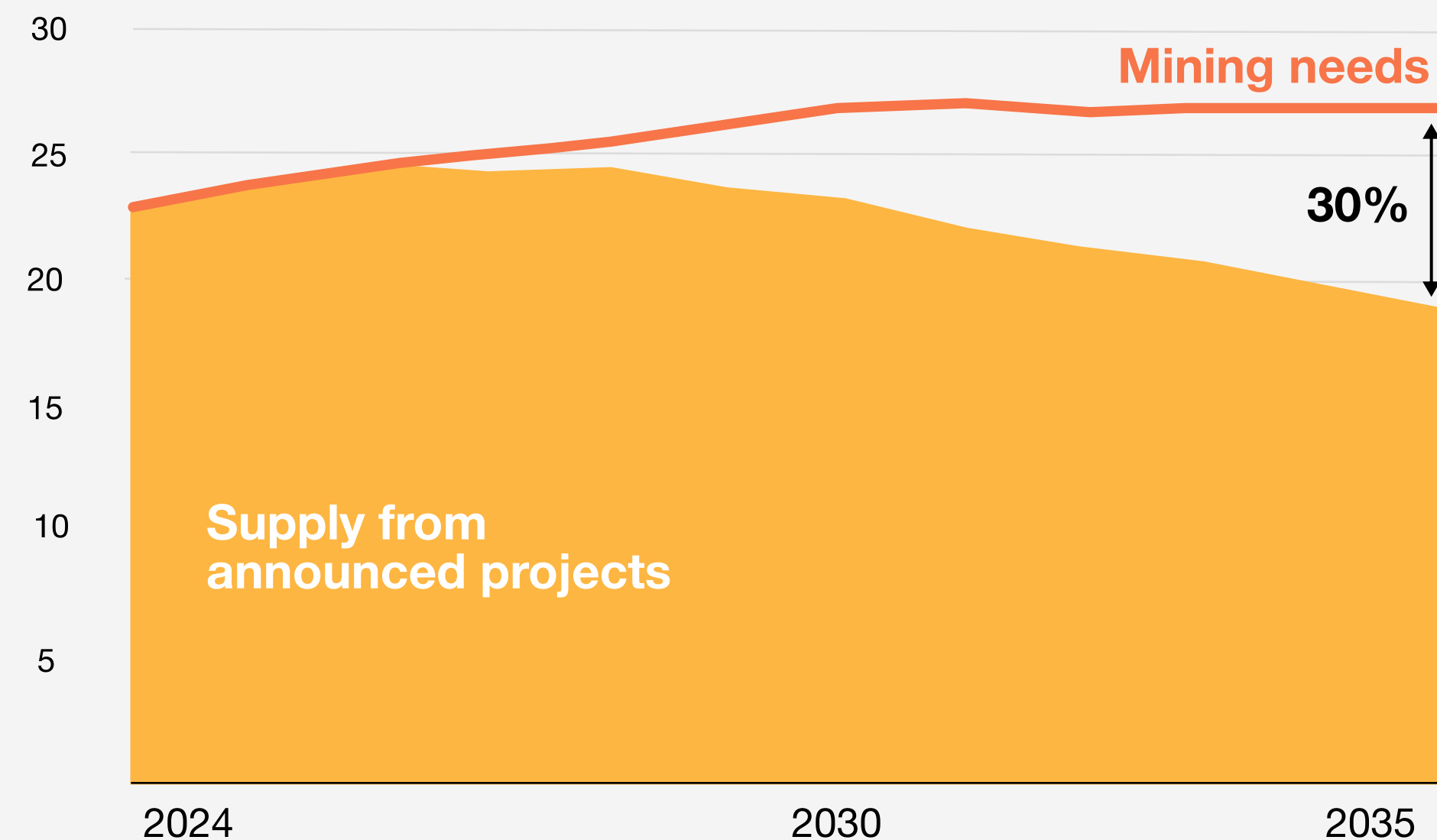


Can intensifying global demand for critical minerals, including copper and REE, enable Mongolia to transition from a coal-reliant economy to a strategic critical minerals supplier?



2. Energy transition brings focus to Mongolia's copper

There is a projected gap between supply and demand for copper
(million tonnes)



Source: International Energy Agency (IEA). Forecast is under STEPS scenario, with the deficit widening under APS and NZE scenarios to 35% and over 40%, respectively.

IEA Note: Expected mine supply from existing and announced projects and mining requirements for copper under today's policy settings, 2035.

Challenges:

- Key challenge lies in utilizing this opportunity window. Though copper production is growing, there is minimal value-added processing.
- Exploratory projects slowing down and governance, corruption, and financing hurdles also pose significant challenges.

Ranking around 12th globally with ~60 million tons of copper resources and reserves, the increasing call for decarbonization and potential copper supply deficit later this decade present an opportunity for Mongolia to position itself as a key player in the global copper supply chain.

Copper demand is surging at a time when Mongolia is ramping up its copper production

- Copper and coal export are expected to drive Mongolia's growth from 2026 – 2028.
- Currently, the Erdenet and Oyu Tolgoi mines play a key role in Mongolia's copper production, both exporting copper concentrate to China.
 - Annually, Erdenet mine produces approximately 600,000 tons of copper concentrate, whereas Oyu Tolgoi produces 120,000 – 150,000 tons.
 - From 2028 to 2036, Oyu Tolgoi's copper production is projected to reach 500,000 tons annually, and 350,000 tons annually for a further 5 years.
 - Achit Ikht and Erdmin, hydrometallurgical plants, rely on Erdenet to produce combined 13,000 – 20,000 copper cathods annually.
- Erdenet's copper reserves are estimated at 3.9 million tons of copper, while Oyu Tolgoi's reserves are estimated at 31.5 million tons.

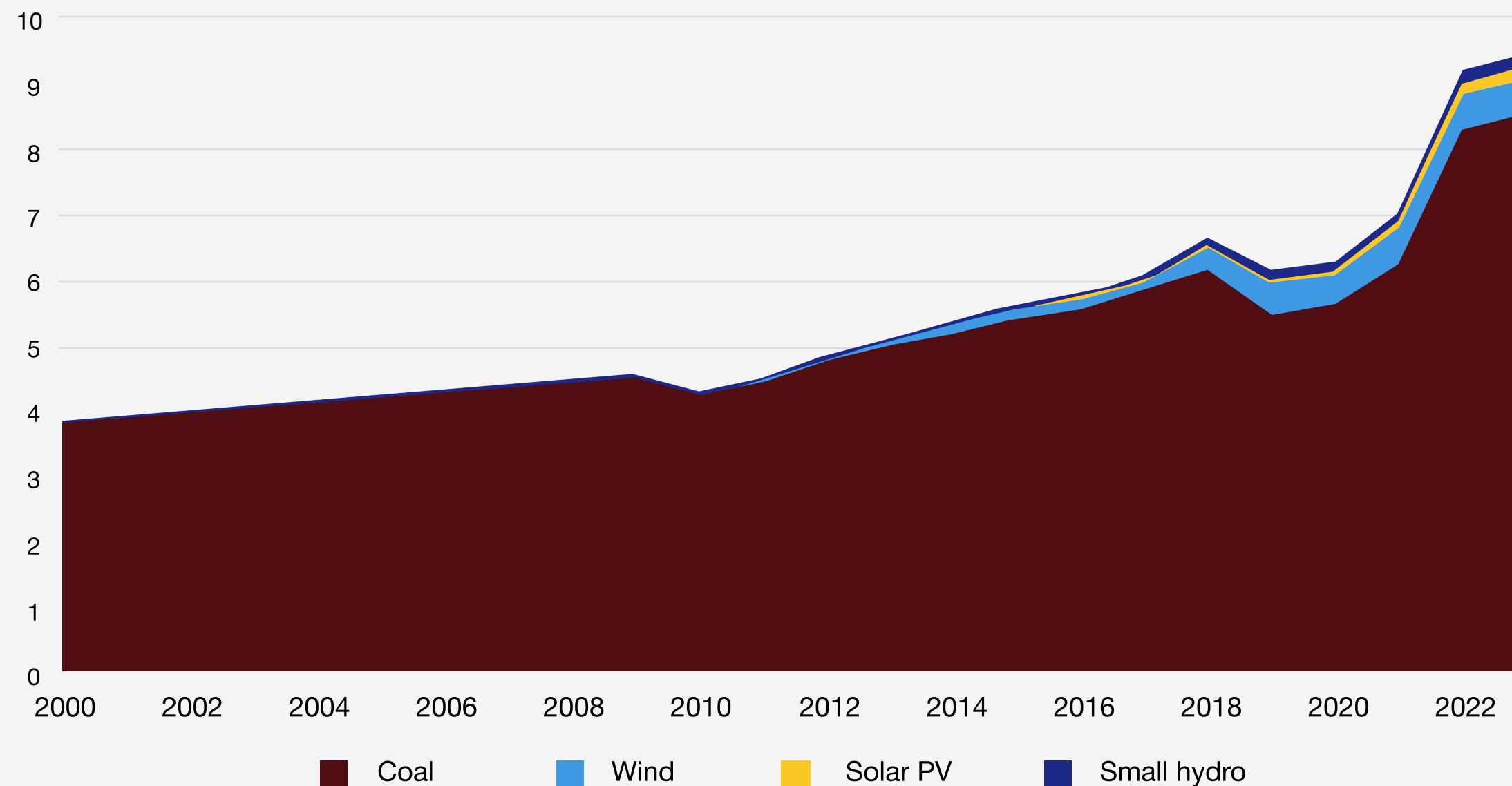
Several new copper opportunities are emerging

- Tsagaan Suvarga, expected to produce 320,000 tons of copper concentrate annually with a deposit estimated at 1.6 million tons, is still in development, progressing slowly due to financing and political challenges.
- Kharmagtai, expected to contain 2.3 million tons of copper and situated in close proximity to Oyu Tolgoi, is in exploration stage.
- Zuun Mod, one of Asia's largest undeveloped molybdenum-copper deposit located less than 200 kilometers from China, has recently undergone updated resource estimate and test drilling is planned in Q4 2025.

3. Mongolia has exceptional wind & solar potential

Mongolia's annual electricity generation, by technology

(Terawatt-hours)



Source: BloombergNEF, Ministry of Energy. Oil and diesel category was minuscule and thus excluded.
BloombergNEF Note: Excludes energy imported from other markets. Only includes grid-connected assets. PV is solar photovoltaic.

Challenges:

- Key challenges lie in implementation (including lack of transmission infrastructure and storage), financing, and geographic barriers.
- Political disincentives to move away from coal also pose a significant challenge.

Mongolia has over 2,600GW of renewable potential; yet, current installed renewable capacity is around 0.3 GW (~0.2GW wind, ~0.1GW solar, remaining mostly hydro), accounting for 18% of total installed capacity. The Government aims to increase this share to 30% by 2030 and make significant efforts to develop renewable energy.

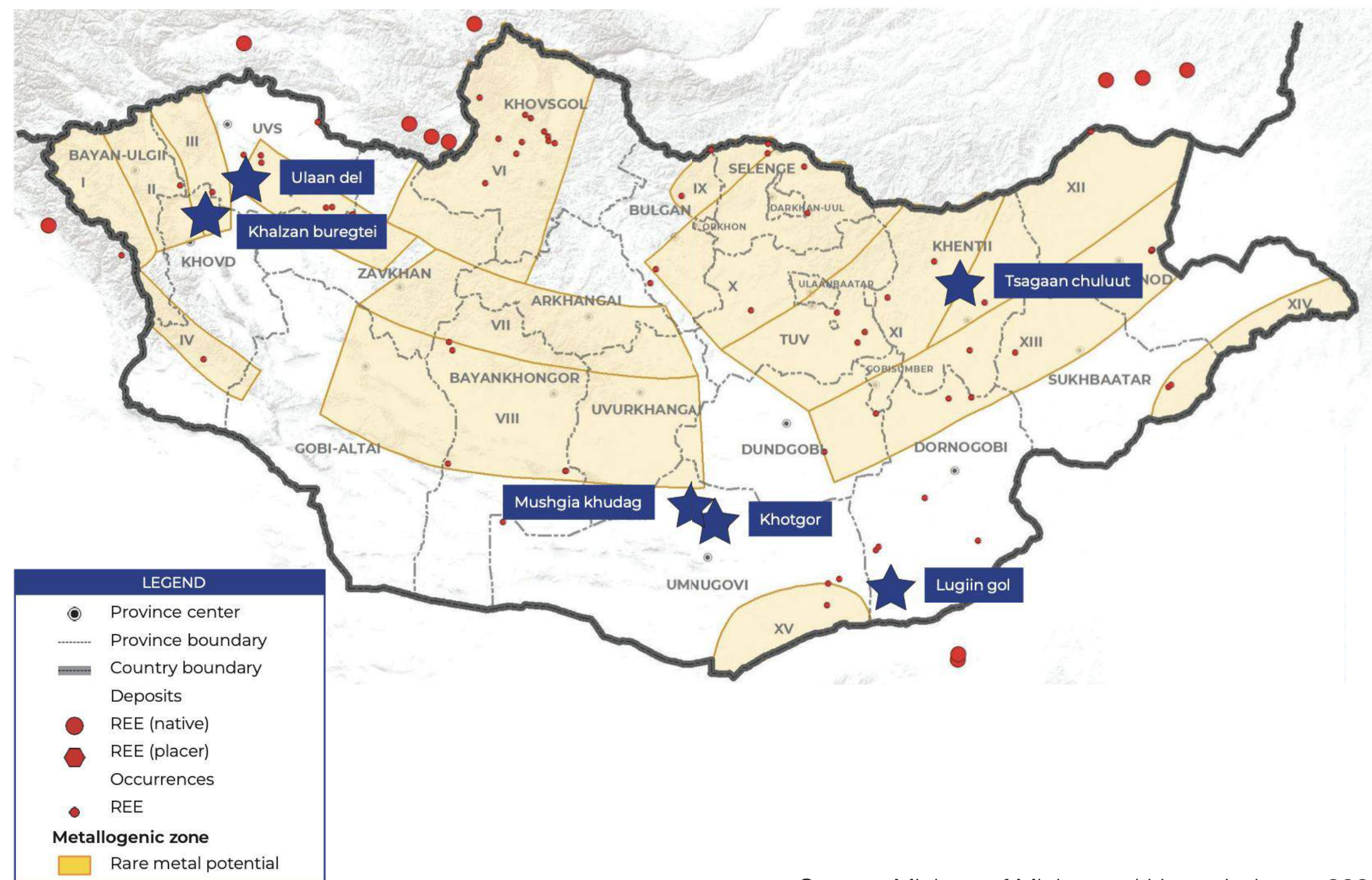
Mongolia's renewables potential is enough to power northeast Asia

- Mongolia has the potential to produce 5,457 terawatt-hours of electricity via wind and solar, equal to about 63% of China's total electricity generation in 2022.
 - This is enough to meet its own energy demand and can meet northeast Asia's regional energy demand given sufficient transmission infrastructure.
- As of 2023, however, renewable energy only comprised 9% of total electricity production in Mongolia. In comparison, renewables produced ~30% of global electricity in 2023.

Mongolia's renewables production is likely to increase

- Mongolia currently have 11 solar farms, 3 wind farms, and 7 hydropower plants that are operational.
- In 2025, a collaboration agreement was signed with EBRD, which aims to construct 0.3GW solar and 0.2GW wind plants with energy storage and transmission infrastructure by 2028.
 - Also in 2025, the Government launched a tender with ADB support for a 19.8MW solar plant.
- The Government has outlined 14 Mega Projects including 90MW Erdenburen hydropower plant and 310MW Eg River hydropower plant, both of which are still in development.

4. Mongolia's vast yet untapped REE potential



Source: Ministry of Mining and Heavy Industry, 2024

Challenges:

- Commercial extraction and export are not expected in the near future.
- All deposits are remote, requiring great infrastructure investments, and the concentrates have to be transported to/via China or Russia.
- Mongolia's rare earth processing capabilities are non-existent. Raw materials from mines would likely require export to China for processing.

REE are expected to see 3 to 7 times higher demand in 2040 than today, according to IEA. With its substantial rare earth resources, Mongolia can play a strategic role in the global energy transition supply chain.

At a glance

Reserve size:

- Though outdated, according to a 2009 estimation by the US Geological Survey, Mongolia should have 31 million tons of REE reserves, second only to China (44 million tons).
- 6 deposits have been identified so far with additional occurrences and mineralized points.

Strategically important REE:

- The Halzan Buregtei deposit is potentially one of the few active sources of Heavy Rare Earth Elements (HREE) globally, including dysprosium (Dy) and terbium (Tb), and comprises approximately 50% of Mongolia's total rare earths resources.
 - HREE are crucial for clean energy technologies critical for global energy transition.

Current mining & cooperation activities:

- MNREC LLC's Khalzan Buregtei rare earth project is 100% Mongolian-owned and is the only Mongolian rare earth project at the preliminary feasibility stage compliant with international standards, with final feasibility study underway.
- In 2024, the rights to Khotgor, one of the world's largest undeveloped rare earth deposits, were acquired by Temarise. The deposit has a confirmed resource of neodymium (Nd) and praseodymium (Pr), two of the most valuable REE, used in REE magnets.
- Mongolia and South Korea signed a Memorandum of Understanding in 2023 to collaborate on a rare metal supply chain, with a joint research center to be established.

5. Opportunities and policy considerations

While electricity generation continues to drive coal demand, its share in the electricity mix is falling. Though China currently remains the largest coal consumer, accounting for 56% of global coal use, its coal consumption is expected to peak around 2028, marking the beginning of a transitional phase with gradual consumption decline. Mongolia thus faces **a narrow but critical window** to reinvest its windfall revenues into future industries, notably REE and copper, and, contemporaneously, use its exceptional solar and wind potential to pursue energy diversification and regional exports.

Looking forward, Mongolia could unlock several opportunities:

1. Renewable Energy Export Hub

- Mongolia's vast solar and wind potential offers a significant opportunity for the country to serve as a core energy supplier in the region.
- Mongolia's Gobi desert would play a large role in a hypothetical regional renewable energy network. Joining such an "Asian super grid" could enable the country to improve its energy security and overcome its reliance on coal.

2. Green Data Centers

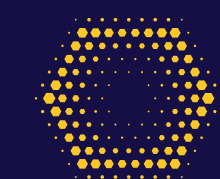
- As global demand for data centers rise, Mongolia's abundant energy resources, favorable climate, unique geographic location, and low risk of facing natural disasters provide an opportunity for the country to establish an international data center market.
- Mongolia plans to build data centers powered by renewable energy and special economic zones dedicated for data centers.

3. Rare Earths Diplomacy

- Surging demand for REE is accompanied by an increasingly volatile geopolitical landscape.
- In this context, its positioning between Russia and China and its status as a potential alternative source for REE provide Mongolia both a geopolitical advantage and a challenge.
- Mongolia may leverage its strategic REE positioning to establish beneficial international partnerships and expand diplomatic ties.

Policy considerations to keep in mind:

- All these opportunities would require years of steady, high-level investments and political commitments to materialize in a substantive way.
- **The private sector should be allowed to lead in the energy transition.** Innovation and competition in the private sector may prove to be the key in overcoming challenges in the energy sector and unlocking the clean energy potential of the country.
- The necessary reforms to encourage the private sector and long-term investments, such as clear regulatory frameworks, consistent application of the law, and predictable policies, must be addressed.
- **Expanding Mongolia's climate financing options, including developing a carbon credit market framework with a robust monitoring, reporting, and verification system is essential in supporting its economic development.**



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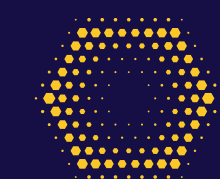
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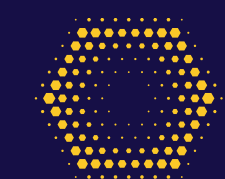
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