# Net zero and energy security: Uranium also matters

TradeTech

uranium prices & analysis since 1968

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# Uranium Prices & Analysis Since 1968

## Core Values


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# Why do we need nuclear?

## Economic benefits

*Cost of 1 kg of enriched fuel is less than $2,000*

*this yields about 360,000 kWh of electricity*

*equivalent to 160 tons of steaming coal*

## Environmental benefits

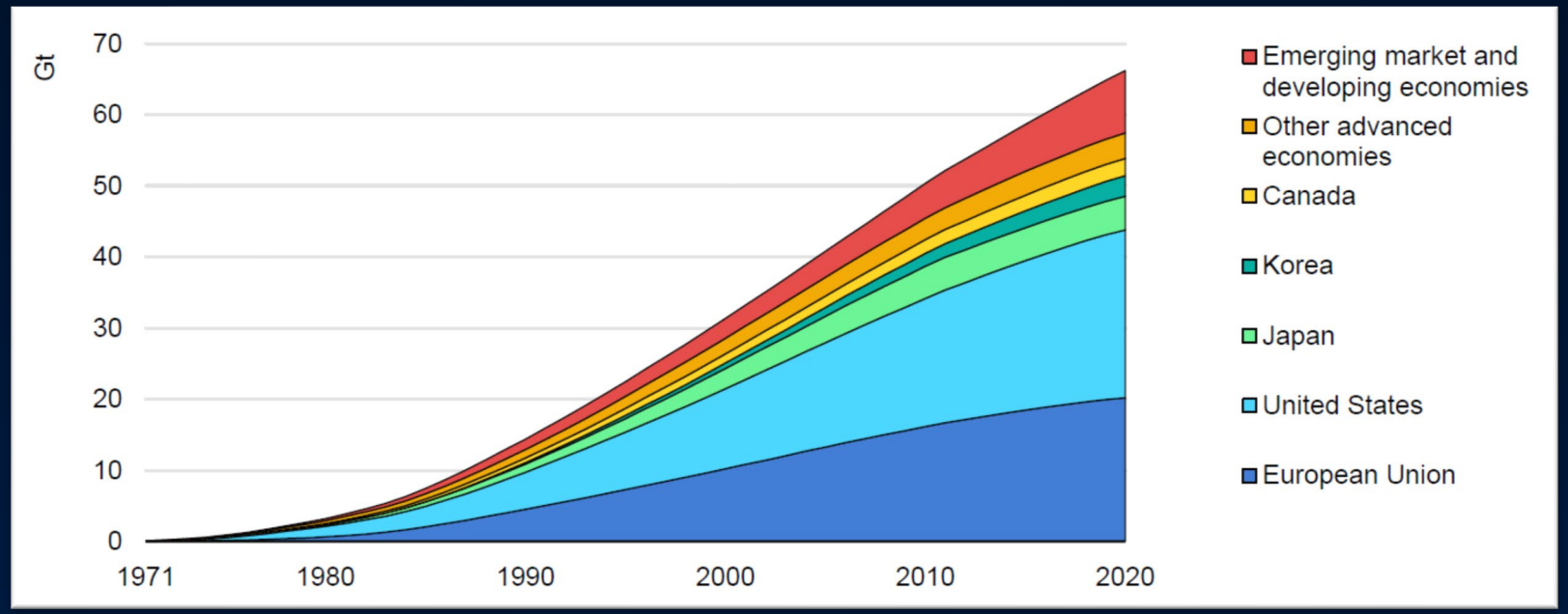
*Nuclear power avoids each year 1.2 to 2.4 Gt of $CO_2$ emissions*

## Security of energy supply

*Amid today's global energy crisis, reducing reliance on imported fossil fuels has become the top of energy security*

# Slowing the rise in global CO2 emissions

## Cumulative CO2 emissions avoided by nuclear power by country/region



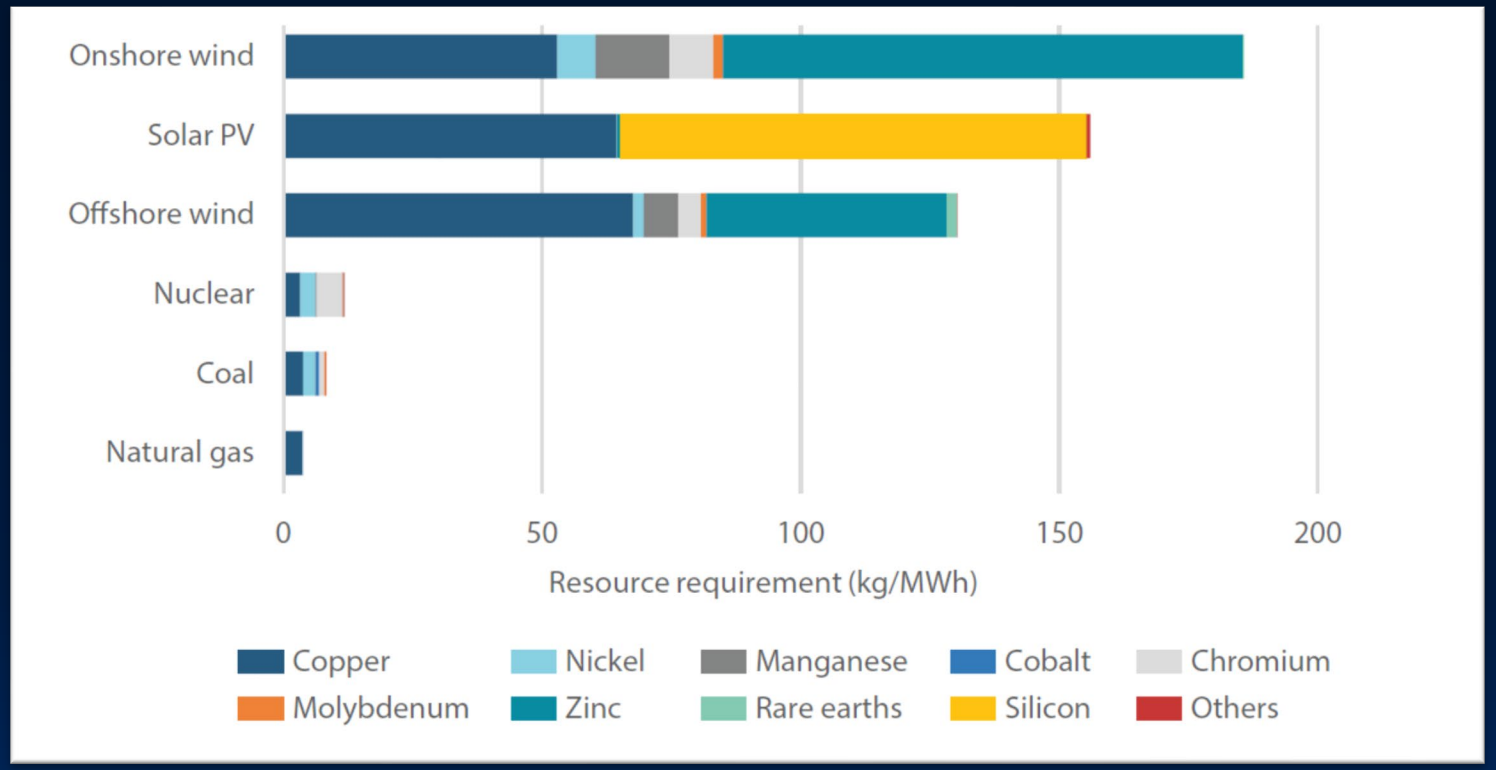

*Source: IEA, 2022*

*Without the contribution of nuclear power, total emissions from electricity generation would have been 20% higher over the period 1971-2020*

*Achieving net zero will be harder and more expensive without nuclear*

# Nuclear: lower needs in critical minerals/metals than other clean energy technologies

*Critical minerals requirements for selected electricity sources*



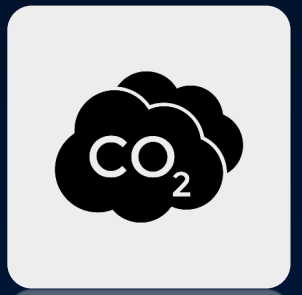

*Sources: OECD IEA, 2021; NEA, 2022*

# Nuclear Energy Today

**440**
Nuclear reactors in operation globally

**32**
Countries with nuclear reactors

**10%**
of global electricity

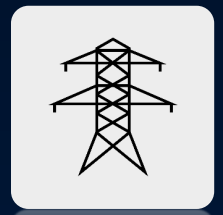



**66 $GtCO_2$**
avoided over the1971-2020 period

*Policy landscape is positive, opening opportunities for a nuclear "renaissance".*
*A growing number of countries announced energy strategies that includes nuclear (France, UK, USA, China, Japan, Poland, India,…)*

# Nuclear Energy Tomorrow
# Small Modular Reactors (SMRs)

## On-Grid



*Designed primarily for on-grid power generation.*
*Well-suited to coal power plant replacement*

## Off-Grid

*Alternative to diesel in remote communities and at mining sites.*
*Could be used to provide power and heat for various purposes*

## Heat

*Many SMRs designs will operate at higher temperatures, creating opportunities for decarbonization of hard-to-abate sectors*

## Marine Merchant Shipping

*A low carbon alternative for marine merchant shipping propulsion*

# Nuclear Prospects and Uranium Requirements

## Technology and Market Signals

*Capital investments in nuclear technology grew more than 9,000% between 2015 and 2022;*

*Interest in large reactors but also SMRs and advanced reactor designs*

## New Generating Capacity

*Construction is underway on 56 reactors worldwide*
*Construction started on 18 reactors in the last three years; several are in China*

## Global Uranium Requirements

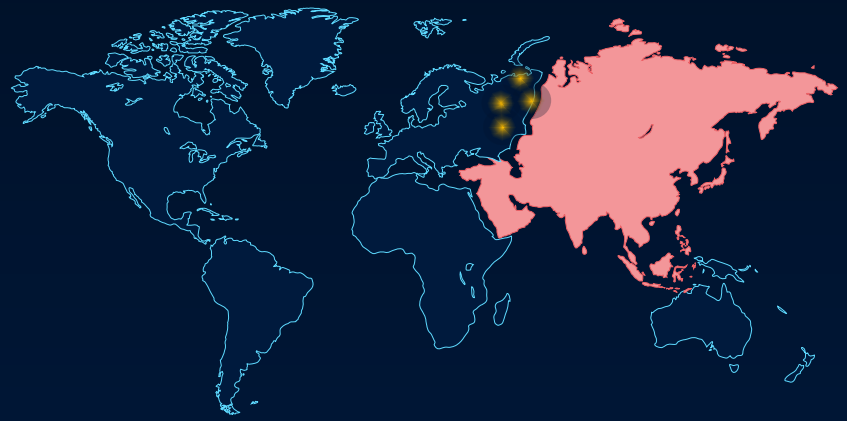
*U3O8 reactor-only requirements forecasted to reach 230 million pounds $U_3O_8$ (about 89 ktU) by 2030*

# Uranium Market Dynamics

Western

*includes Japan

CIS



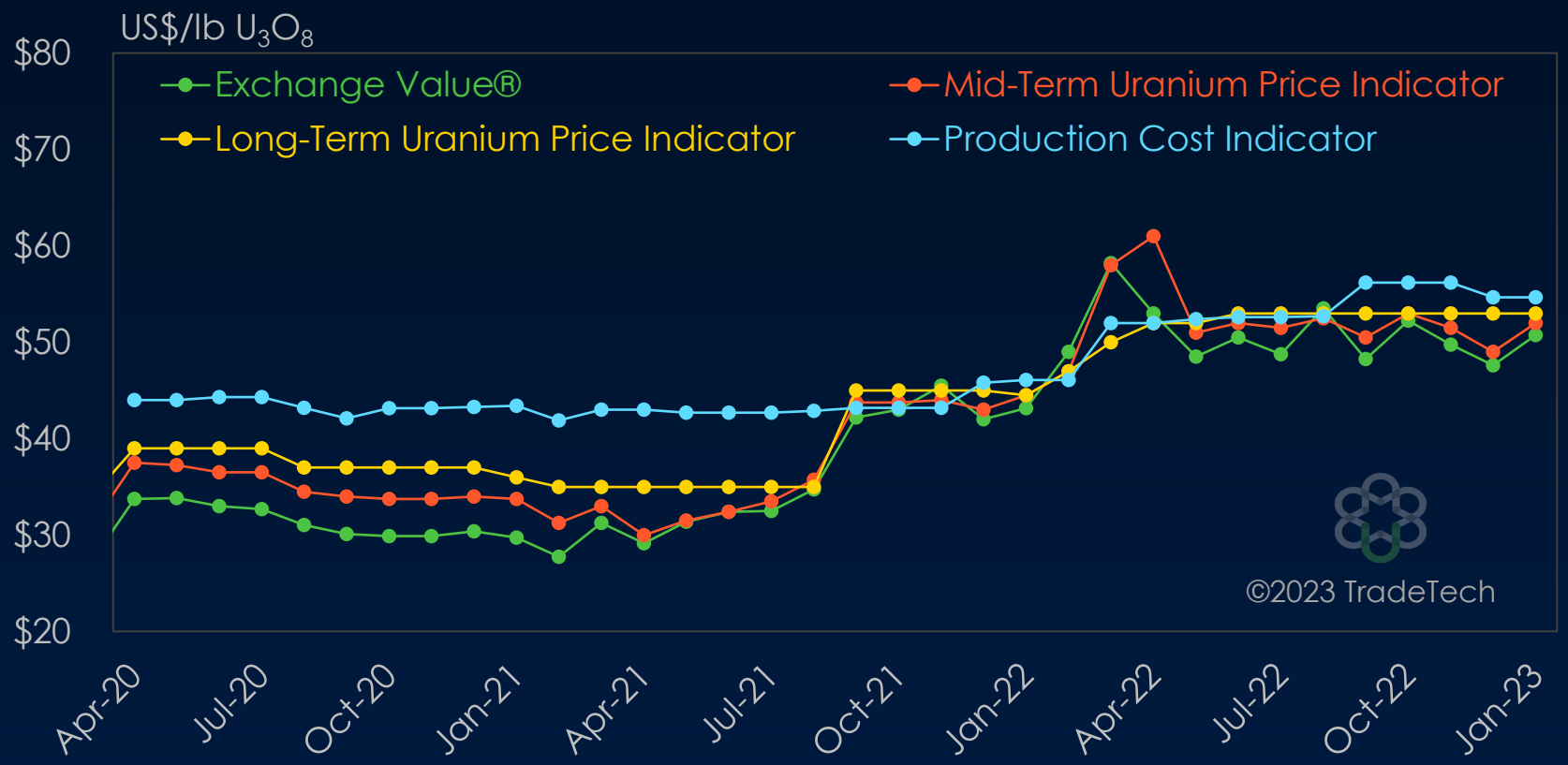
Russia's invasion of Ukraine has brought severe economic sanctions,
However, sanctions on nuclear fuels have been limited

By law or by choice, commercial entities are distancing themselves from Russian exports

*The uranium market is bifurcating*

Both supply and demand may develop further into separate markets
defined by national interests

# TradeTech Uranium Market Indicators




February 14th TradeTech Daily Spot Price

$XX.XX/lb $U_3O_8$

January 2023 Published $U_3O_8$ Prices:

TradeTech Exchange Value: $50.75/lb $U_3O_8$

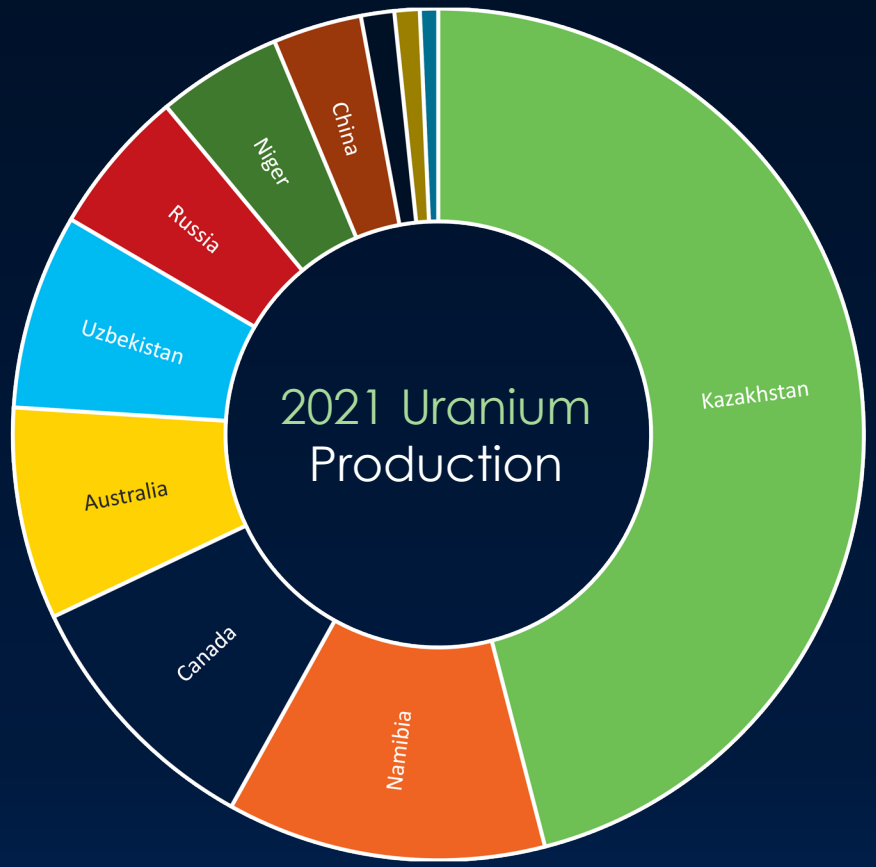
TradeTech Mid-Term Price Indicator: $52.00/lb $U_3O_8$

TradeTech Long-Term Price Indicator: $53.00/lb $U_3O_8$

TradeTech Production Cost Indicator: $54.65/lb $U_3O_8$

# Where is uranium coming from?

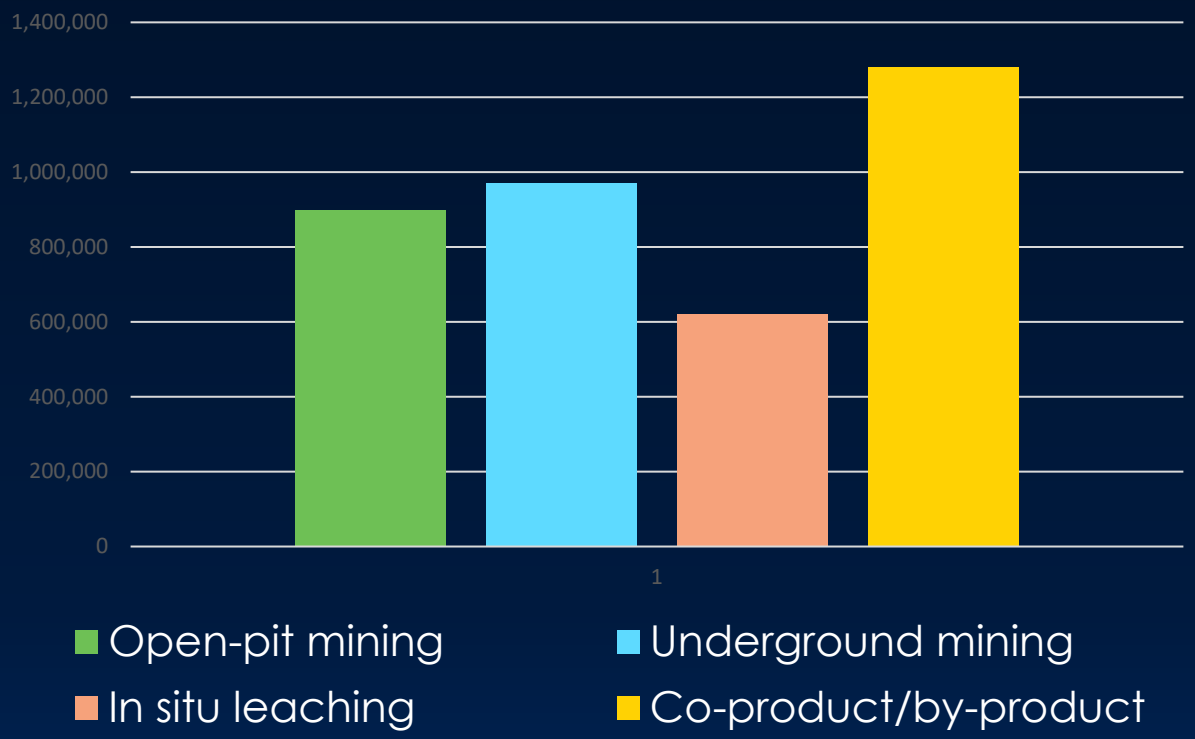

8 million tonnes of uranium (tU)
at a cost less than $50/lb U3O8




123 million pounds U3O8 (about 47ktU)

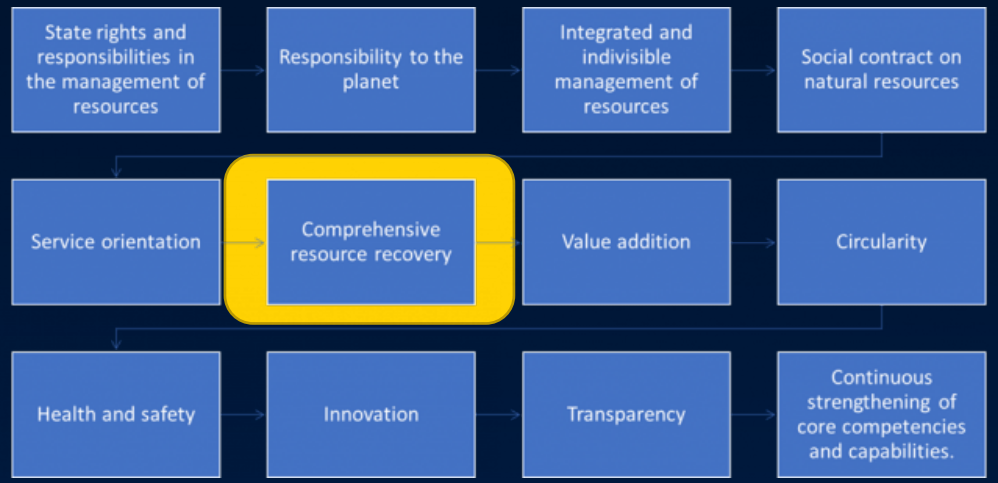
# How can we have a Sustainable Uranium Resource Management?

*Uranium resources by production method (tU)*




Resources (measured & indicated): recoverable at a cost less than $50/lb U3O8

*United Nations Resource Management System (UNRMS) Principles*




*Comprehensive Resource Recovery:*

*the environment should be disturbed minimally by the recovery of all possible values (co-products and by-products)*

# Uranium & critical minerals as by-products/co-products

## Olympic Dam Copper Mine Australia

- Polymetallic Fe-oxide breccia-complex: copper, gold, silver and uranium (U) by-product;
- Australia's largest uranium mine, global largest uranium resource and one of the largest copper mine in the world
- 1.3 million tU recoverable resources @0.05% U; nominal production capacity 3,250 tU/year

## In Situ Leaching (ISL) Mines Kazakhstan

- Global largest share of uranium production (40%); ISL method
- Other valuable by-product components such as rare earth elements (REE), Scandium (Sc) and Rhenium (Re) can be recovered from pregnant ISL solutions in several mines in Kazakhstan

## Terrafame polymetallic mine Finland

- Black schist-hosted nickel, zinc, copper, cobalt Talvivaara deposit; U by-product
- Uranium recovery plant on site; production 200 tU/year to start by 2024.
- Finish government granted a uranium license in 2020; in 2021, the Supreme Administrative Court confirmed the license

# Final thoughts: Uranium also matters

## Climate change and energy security

*All available low-carbon technologies have to be deployed to reach the targets*
*Nuclear has a role to play*

## The focus on critical minerals became vital

*Nuclear energy technologies require less minerals/metals than renewables counterparts*

## Uranium

*A small amount contains considerably more energy than other energy sources*
*Largest uranium deposits contain also other minerals/metals critical for clean energy technologies*
*Opportunities and risks: sustainable uranium resources management*

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