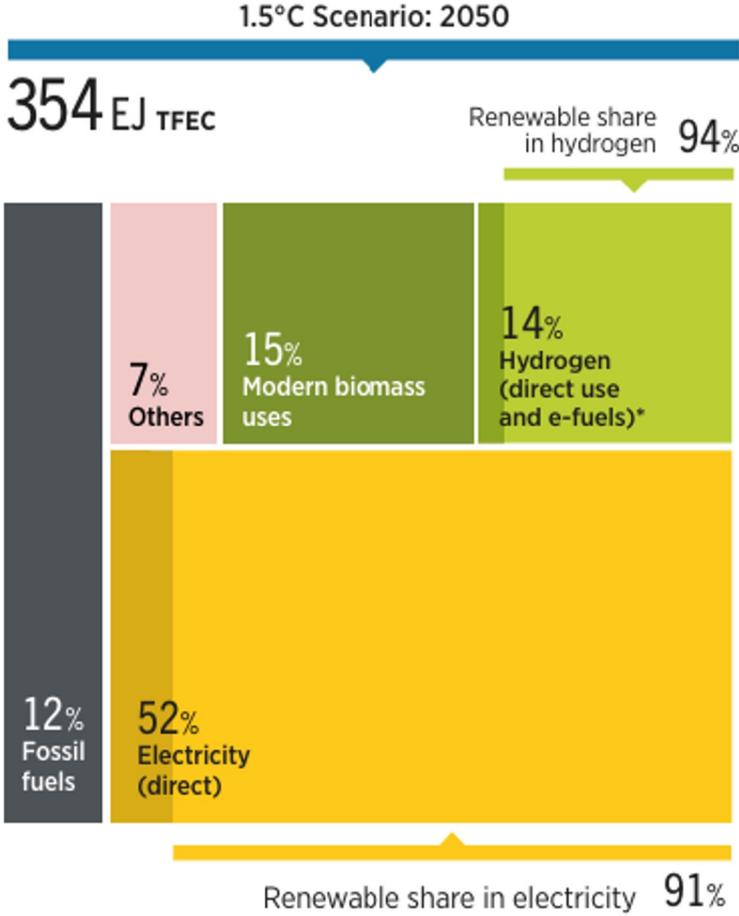
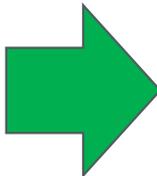
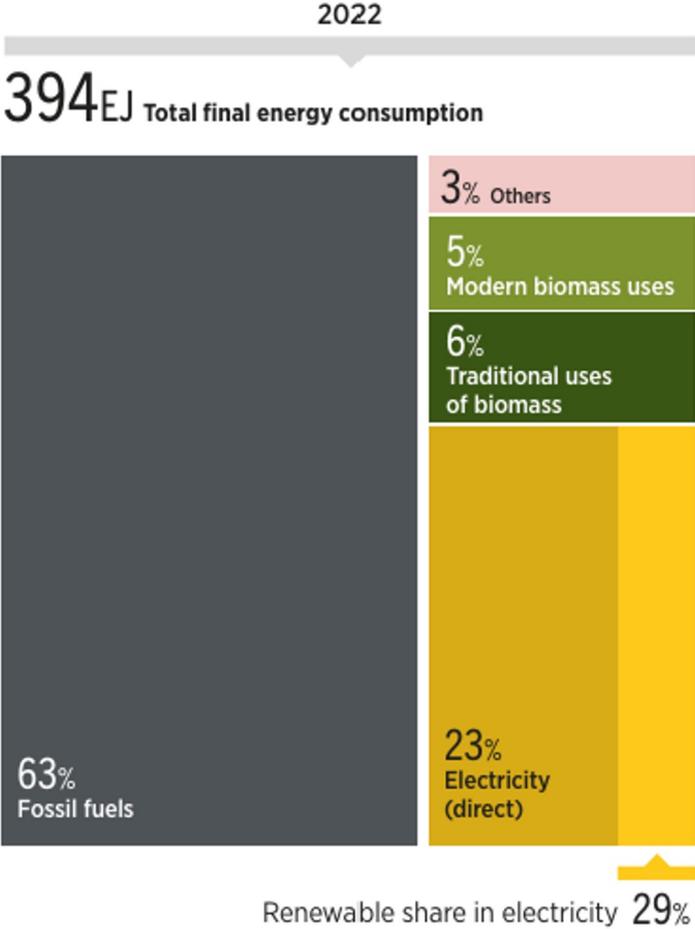




Urban Mining Forum

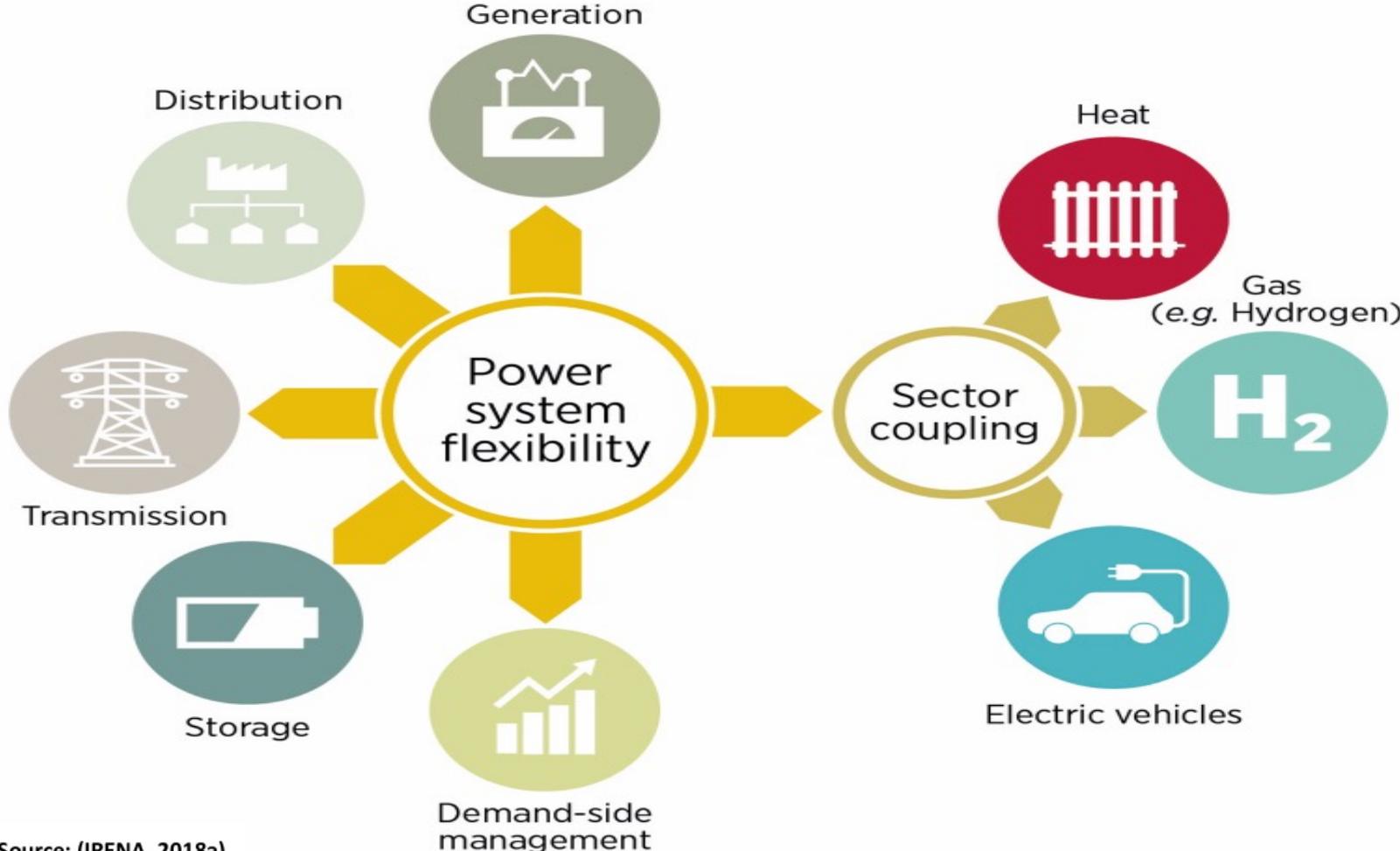
IRENA's Insights on Critical Materials for the Energy Transition
Francesco La Camera – Director-General

Rapid Electrification via renewables is necessary for rapid decarbonisation



Source: (IRENA, 2024)

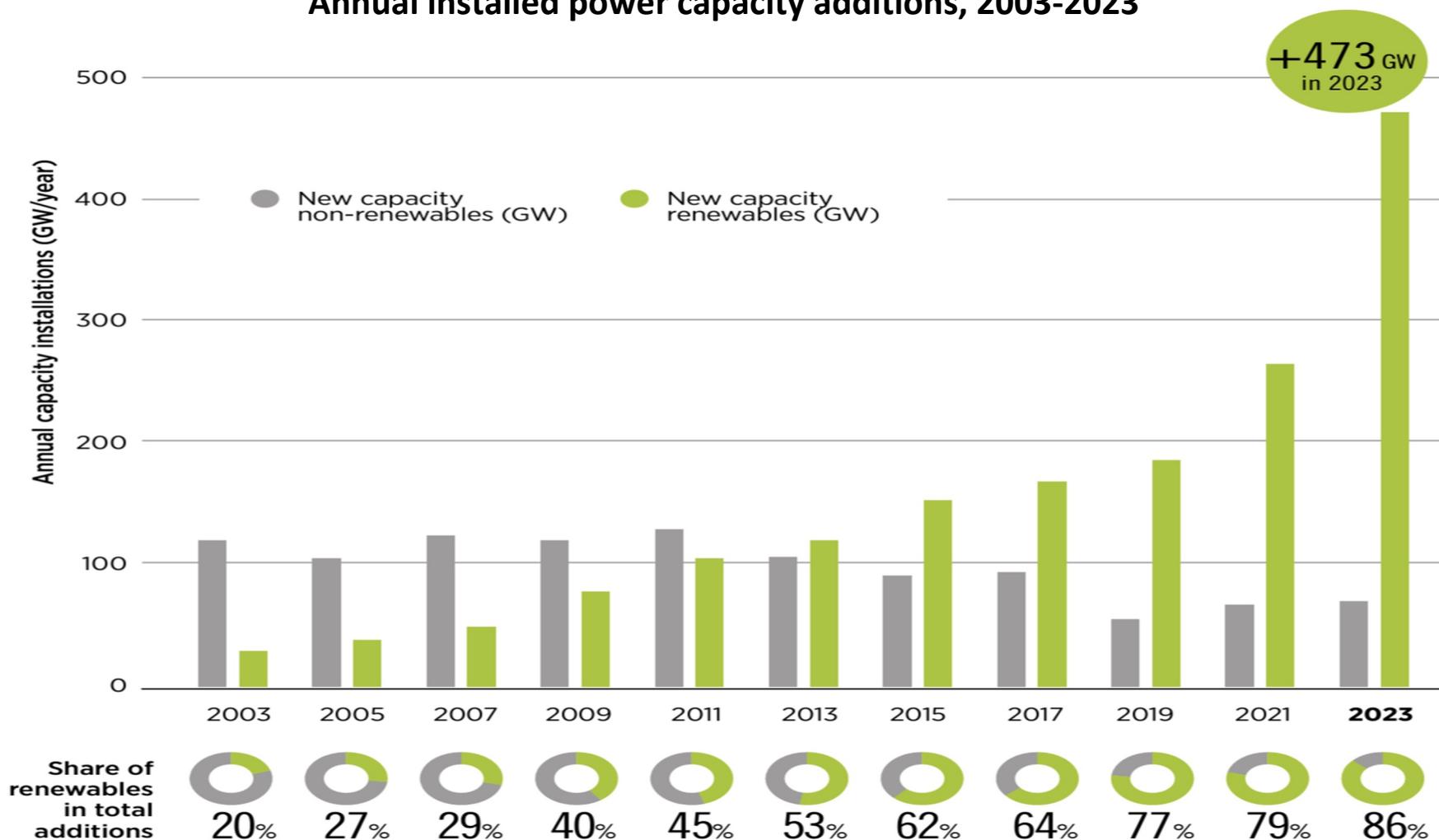
Enablers of power system flexibility in the energy sector



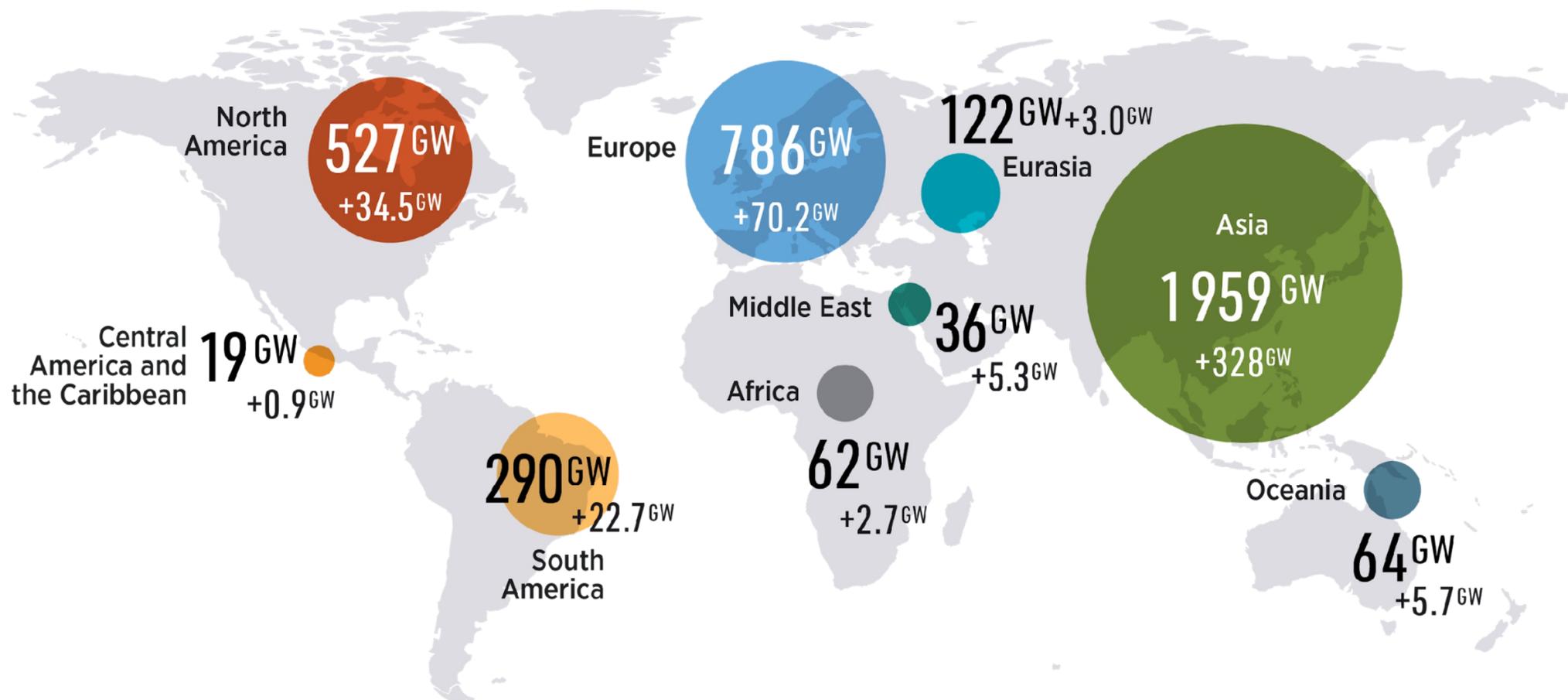
Source: (IRENA, 2018a).

Unprecedented growth in renewable power additions in 2023

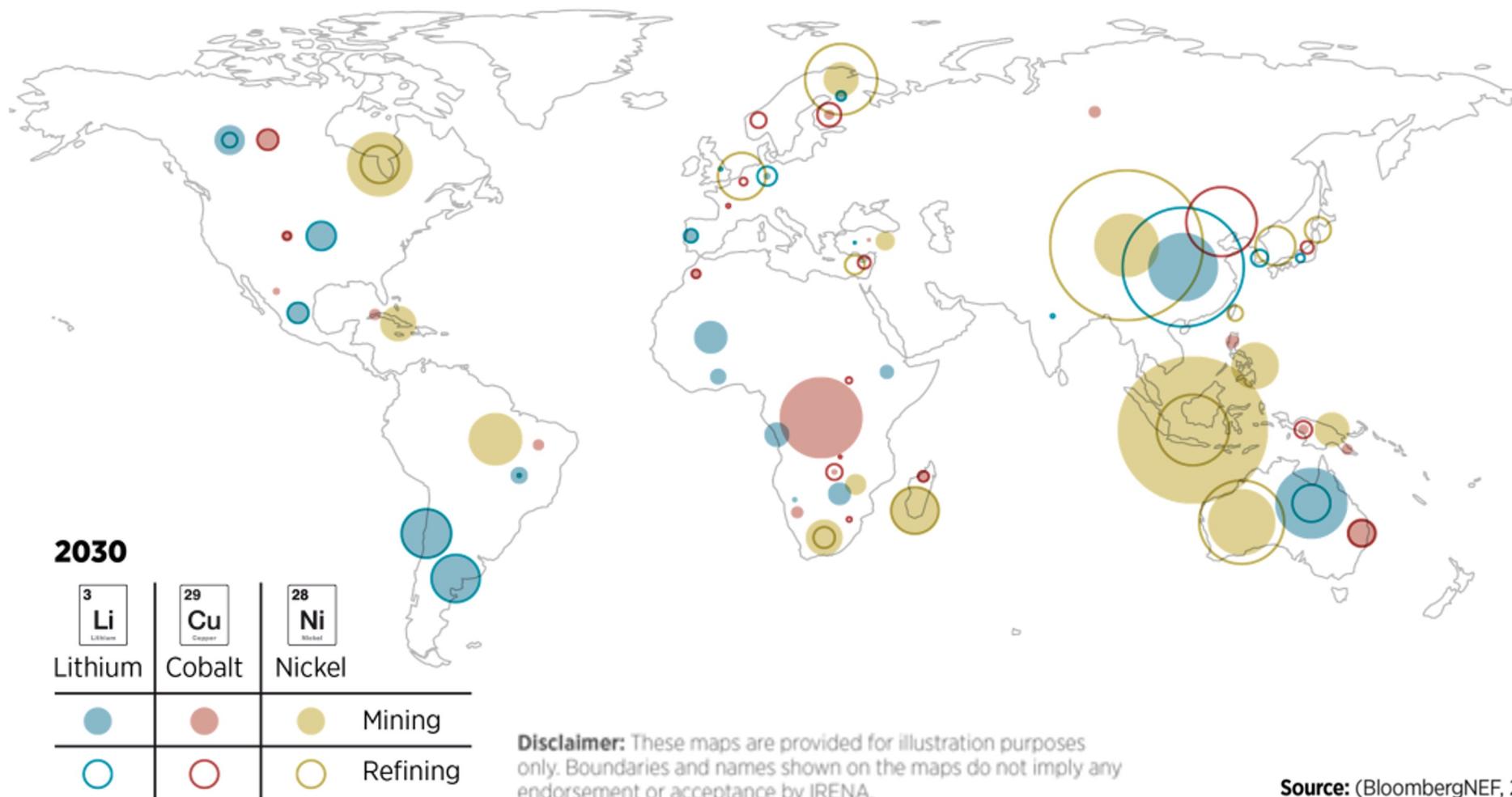
Annual installed power capacity additions, 2003-2023



Renewable power capacity by region and additions in 2023



Critical Minerals mining and refining supply forecasts in 2030



In the long-term, the availability of resources is not a constraint for the energy transition

Comparison of the estimated 2030 demand for selected critical materials with the estimated identified resources

Material	Estimated annual demand in 2030 (Mt/year)	Estimated Resources (Mt)	Resource-to-Annual Demand Ratio
Lithium	1.7 – 2.3	560	240 - 330
Cobalt	0.24 – 0.39	25	65 – 105
Graphite	6.5 – 7.4	800	1110 – 1200
Nickel	3.9 – 4.7	350	75 – 90
Copper	31.3 – 38.1	2,100	55 - 70
Phosphorous	28.2 – 29.2	30,000	1,030 – 1,060
Manganese	22.5 – 26.0	17,000	660 - 760

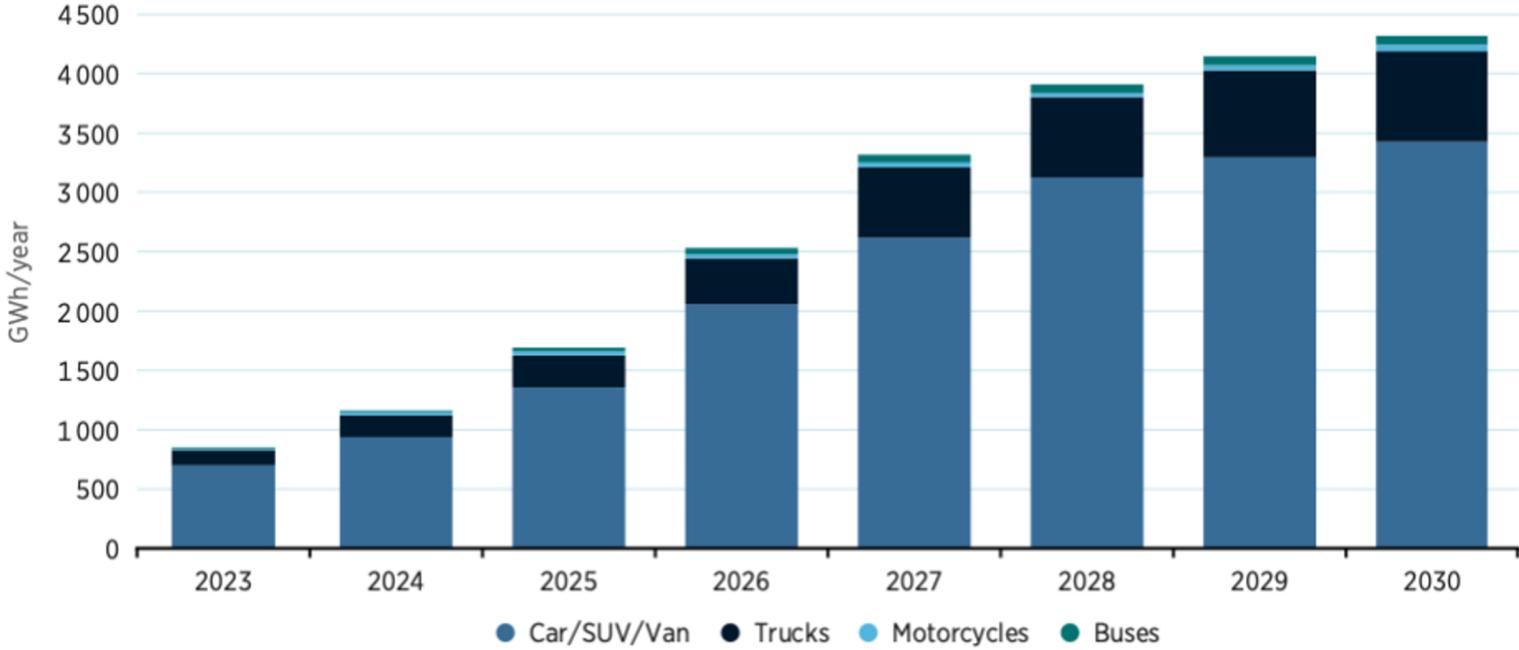
Source: Estimated resources based on (HAIM'an, 2023; USGS, 2024).

However, **efforts are needed** to mitigate **supply risks**, and to timely and effectively **scale up production** to meet growing demand in the **short-to-medium term**.

Key geopolitical risks to the supply of materials

- 1 External shocks** Natural disasters, pandemics, wars, mine accidents, etc.
- 2 Resource nationalism** Tax disputes, expropriation, foreign investment screening, etc.
- 3 Export restrictions** Export quotas, export taxes, obligatory minimum export prices, licensing, etc.
- 4 Mineral cartels** Co-ordination of production, pricing, market allocation, etc.
- 5 Political instability and social unrest** Labour strikes, violence, corruption, etc.
- 6 Market manipulation** Short squeezing, market cornering, spoofing, insider trading, etc.

EV battery production needs to grow five-fold by 2030



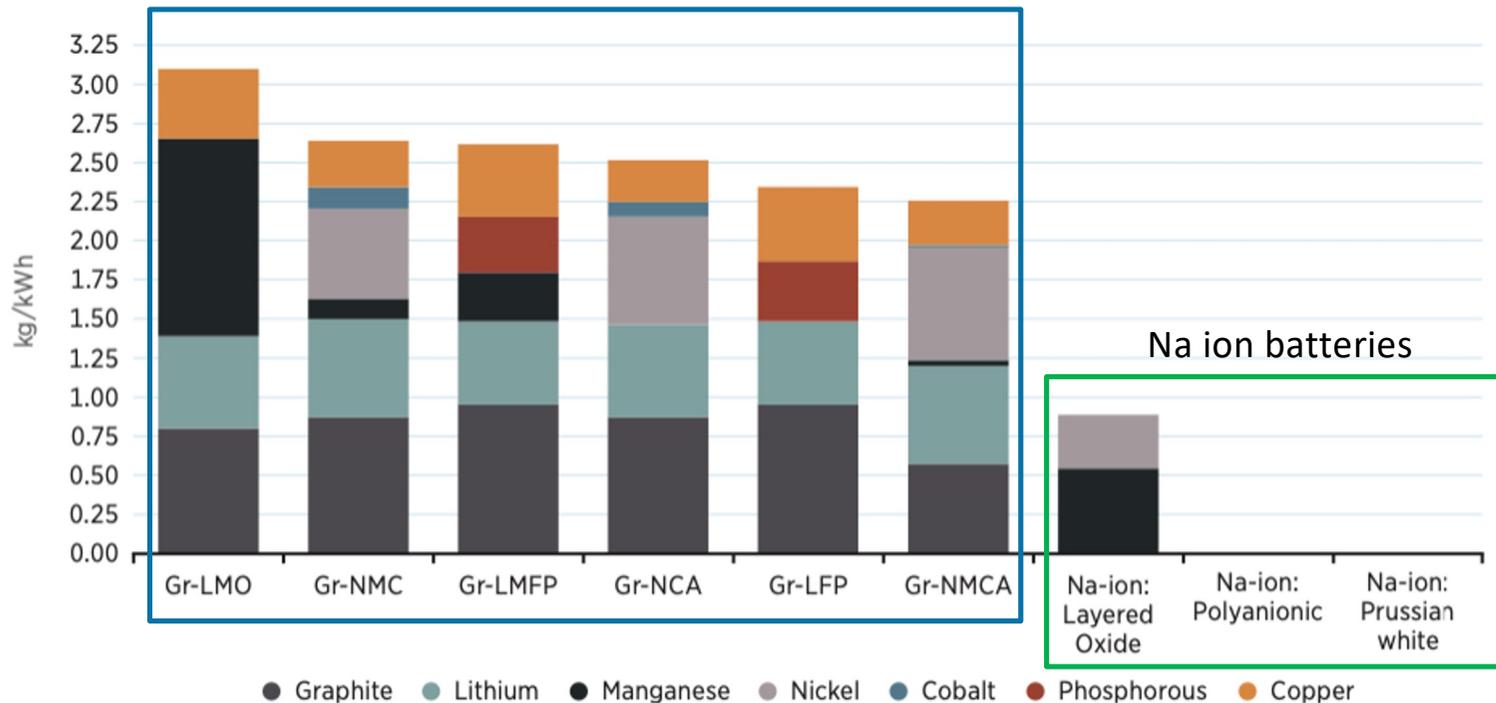
EV battery demand in IRENA's 1.5°C Scenario:
4,300 GWh per year by **2030**.

Notes: Includes battery EVs and plug-in hybrid EVs. GWh = gigawatt hour; SUV = sports utility vehicle.

Staying aligned with **IRENA's 1.5°C Scenario** would require global EV sales to continue growing to about **60 million** passenger vehicles per year by 2030.

Innovation reduces the need for critical materials

Nickel and LFP Battery chemistries



- Lithium iron phosphate type batteries (LFP) which are becoming dominant can be produced without nickel or cobalt.
- Sodium-ion batteries could be adopted in the near future for some market segments and can be produced with minimal to no use of critical materials

Based on: Argonne National Laboratory (2022, 2024), Bernstein (2021) and Maisel *et al.* (2023).

Securing inclusive supply of critical materials



Comprehensive, economy-wide evaluations of critical material demand are vital to identify potential risks and help avoid sector competition



Collaborative strategies that benefit all involved need to be developed and implemented



Conduct thorough assessments of critical materials for each mineral to understand dependencies, risks, and innovations affecting supply and demand



Mitigate geopolitical risks by investing in research and development for alternative solutions, efficiency, recycling, and repurposing options



Greater data transparency and oversight of certain critical materials are required to mitigate uncertainty in supply and demand projections



Developing countries can enhance economic value and promote global equity and stability through tapping into their mineral resources



International co-operation is crucial in creating transparent markets with coherent standards and norms, grounded in human rights, environmental stewardship and community engagement

Thank you for your attention!

