

# Energy Storage - Lithium will not be Enough!

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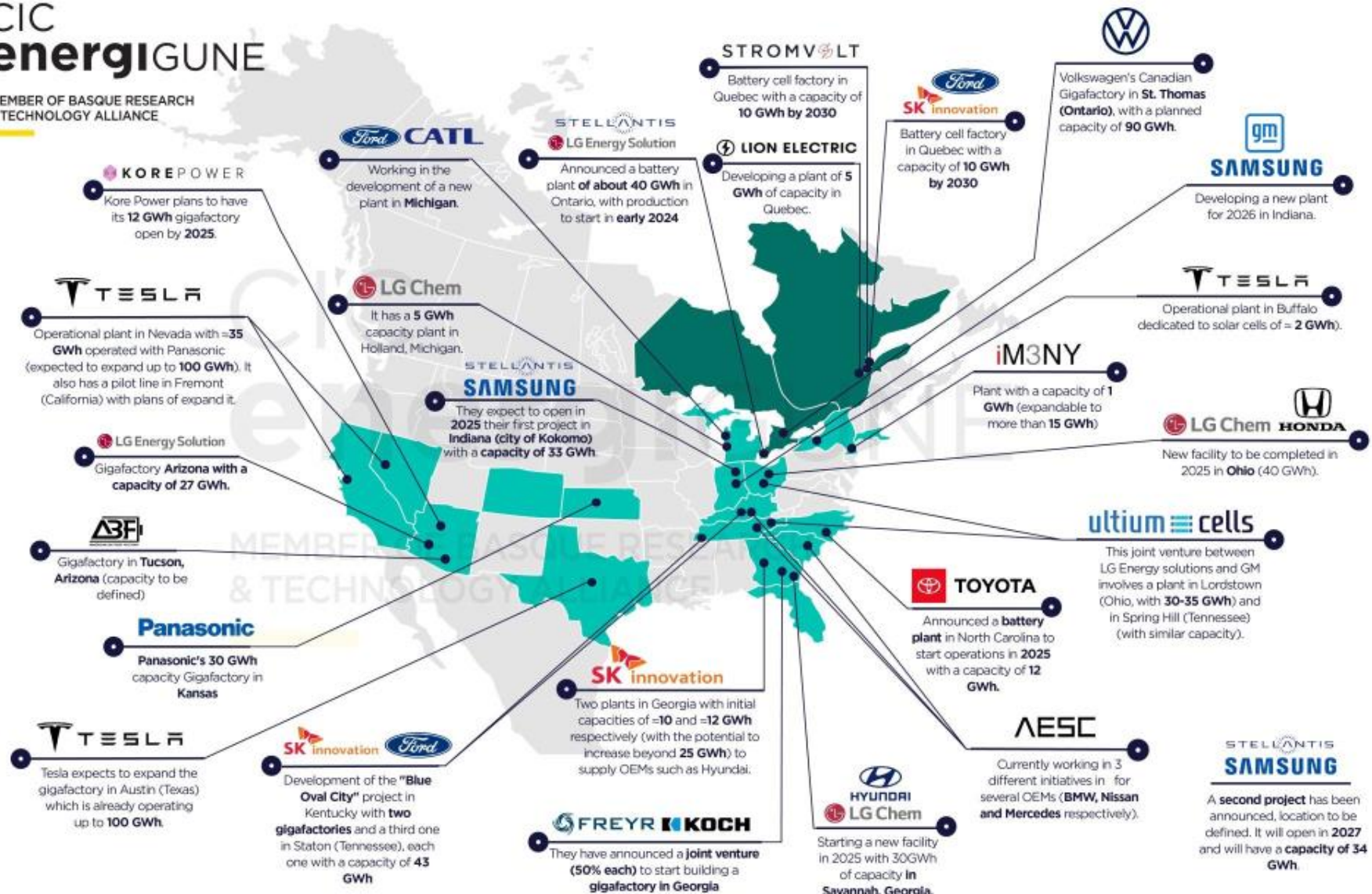
IMRE GYUK, CHIEF SCIENTIST  
ENERGY STORAGE RESEARCH, DOE-OE

Energy Storage has finally  
Gained International Acceptance

# NORTH AMERICAN BATTERY INITIATIVES

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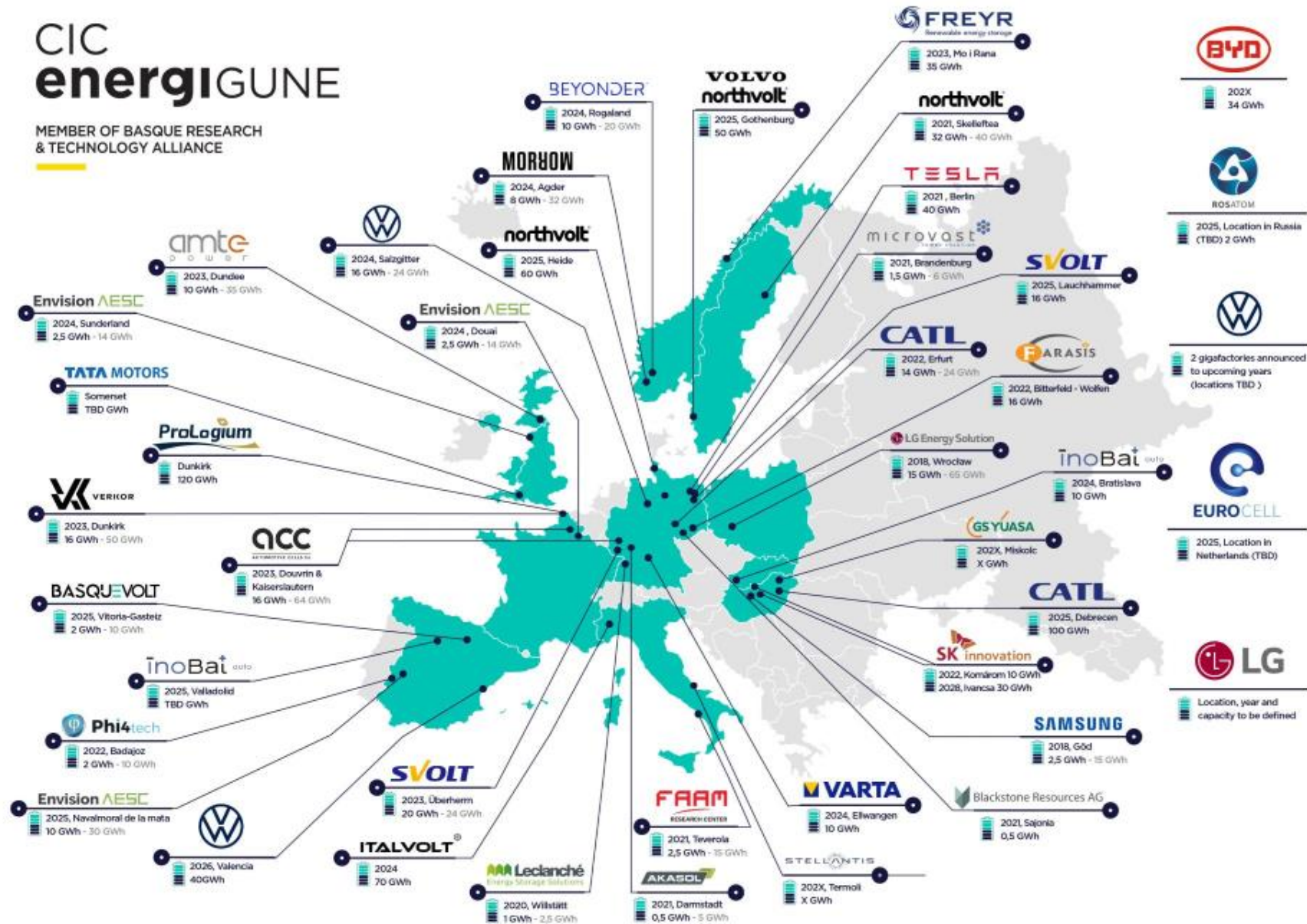


.... also in Europe  
Australia, China, Korea ....

# EUROPEAN GIGAFACTORIES MAP

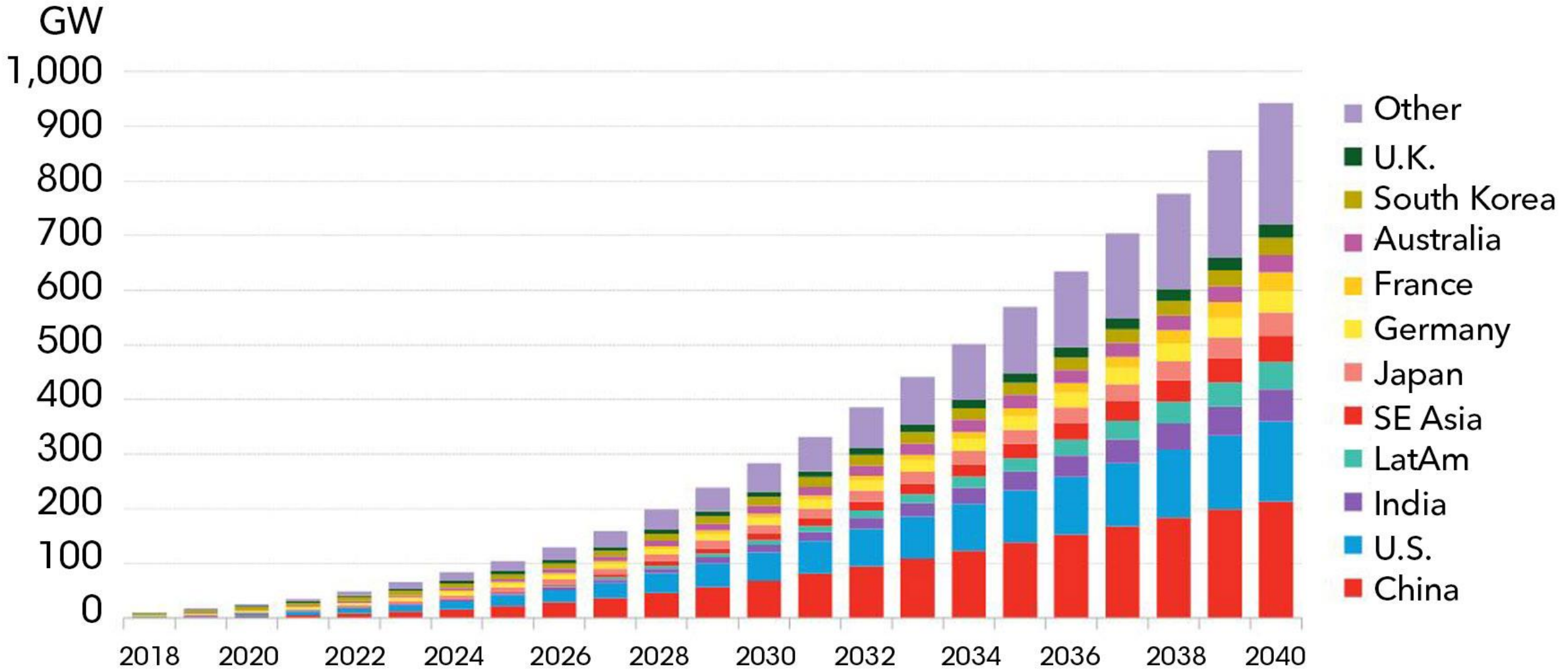
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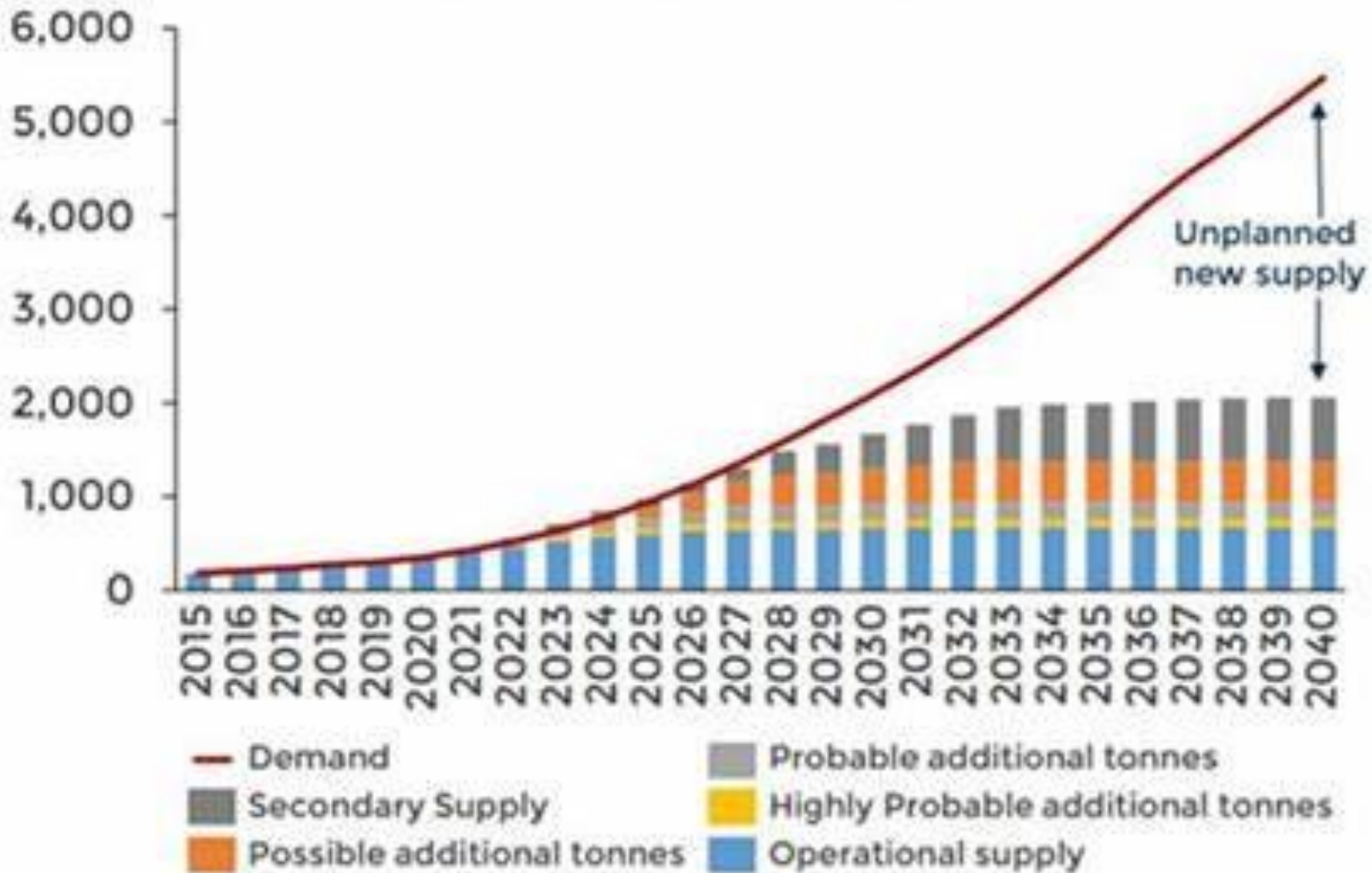
Cumulative Deployment of Storage  
is continually Increasing  
around the World.

# Global cumulative storage deployments



Source: BloombergNEF

# Lithium Demand vs Supply Forecast



source: Benchmark Minerals



Lithium Supply and Production  
will become Constant  
and fall short of Demand!

By 2040, Demand will be  
twice the available Supply!

Lithium Dominates both  
Stationary and  
Vehicle applications

However,  
with increasing Penetration  
and Limited Resources  
there will be Competition  
and increasing Prices!

Vehicle Batteries  
must have high Energy Density  
while  
Stationary Applications  
must have Low Price

Lithium supply cannot cover  
Vehicular and Stationary Supply.  
In a Resource Competition  
Vehicle Applications will win!

Unless Lithium sources  
in huge amounts  
suddenly become available  
Stationary Applications  
will have to turn to new;  
cheaper types of Batteries  
Relying on more  
Earth abundant Materials

ZnBr Flow Batteries,  
Redox Flow Batteries, V, Zn, Fe,  
Organic Electrolytes  
Solid State, Na-ion, L/A



**Invinity:** Oxford 5 MWh  
Commiss. July 5, 2022  
Planned: Australia 8MWh  
+6MWh PV ► 10GWh/year  
Vanadium supply line!



**ESS:** Stanwell Power Station  
Queensland, Australia  
150MW / 8-10 hours  
Option for 200MW total  
Iron Flow Battery



JAC EV powered by 25kWh Na-ion Battery – 250 km/charge



Such Batteries  
will also be required  
for Medium Duration Use -  
4 hours to 12 hours,  
where Li is not Competitive.

Meanwhile,  
Lithium-ion Batteries  
will find Application  
For Transportation:  
Cars, Boats, Trains, and Planes

For true Long Duration  
Energy Storage,  
12 hours to 3 days,  
we will have to turn to  
Thermal, Gravity, or Chemical  
Storage

We will need  
Short, Medium, and Long  
Duration Storage  
and we will need a Portfolio  
of all available Technologies!