

Entropy is Your Friend

A Cyclical Look at Energy Metals



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The Gigafactory was the battery industry's Big Bang



What a difference three years makes...

Companies in 2014: 16
Companies in 2017: 156

**Lithium ion battery prices (\$ per kWh)
down 60% in 3 years**

EV sales more than doubled globally in 3 years

~\$500M raised YTD for lithium investment – will match the \$1B raised in 2010-2012 soon

This has led to a robust supply chain response, but...



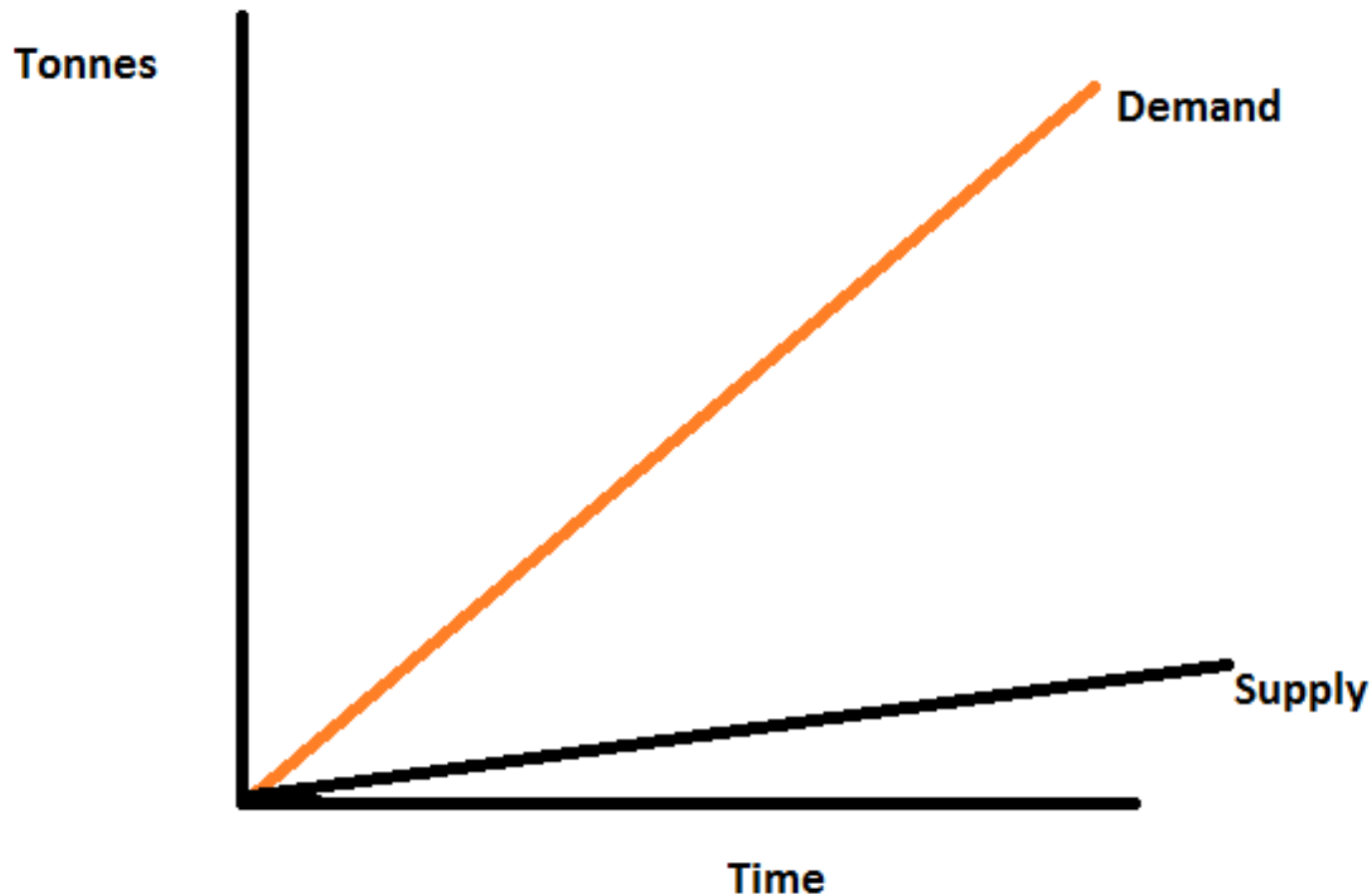
Chinese industrial policy to have 3M EVs on their roads by 2020



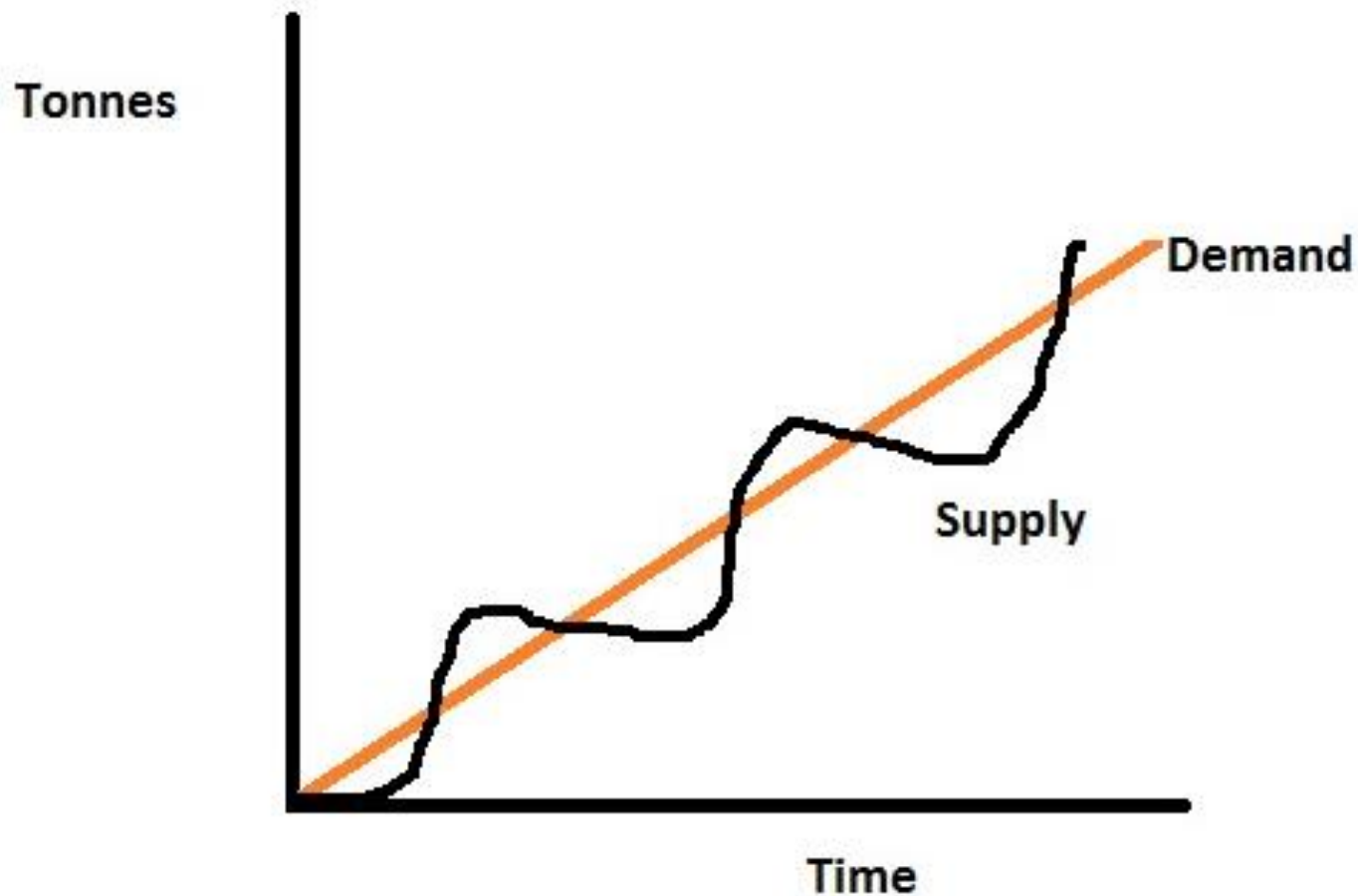
Dozens of OEMs investing



...has allowed cognitive biases to run wild



Reality is much more complex



Capital allocation here is like The Wheel of Fortune

Opaque pricing

Small markets

Oligopolies

Financing availability

Off take agreements

Product differentiation

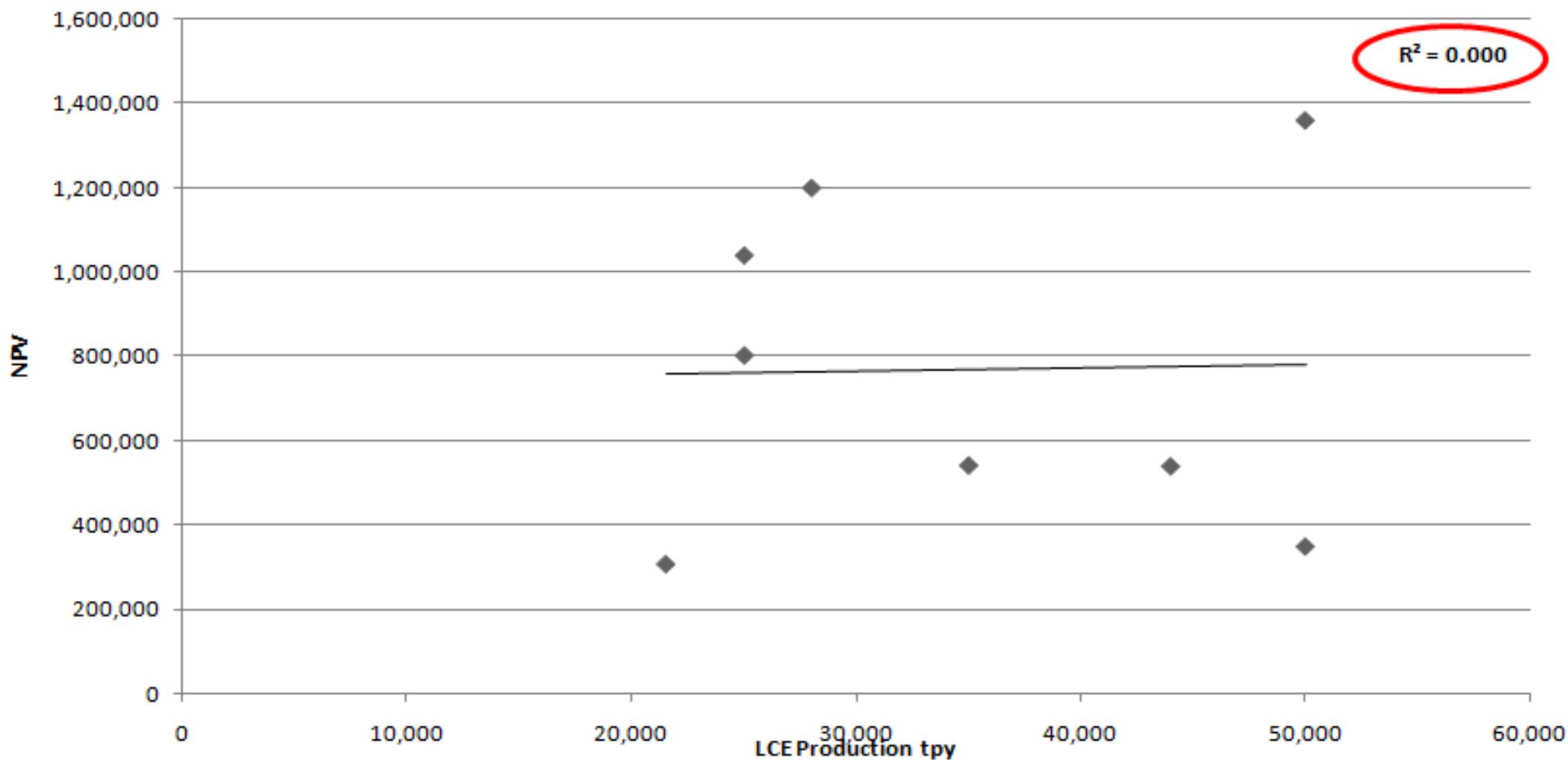
Where is the “moat”?

Byproducts can affect economics

Demand destruction



NPV and expected production of 8 near-term lithium producers – bigger ISN'T better



What you should consider at this stage of the cycle

You need the ability to hold two competing ideas in your head

Think about Albemarle's lithium demand forecasts versus NanoOne's plan to use technology re-shape cathode demand/production

What you should consider at this stage of the cycle

Pay attention to margins

Are they expanding or contracting?

Which is preferable: ALB at a 40% EBITDA margin or Panasonic at 5%?

What you should consider at this stage of the cycle

Where is the moat?

Look to technology as this will likely allow companies to compete