



SUMMARY OF DISCUSSION POINTS

Batteries vs. Oil: What will fuel the future?

Thursday 5 November 2020

INTRODUCTION

At its latest roundtable on Thursday 5th November 2020, The London Energy Club (LEC) addressed the role of batteries and storage technologies in superseding oil in the global energy transition.

London Energy Club Chair, **Mehmet Ögütçü** was joined by **Andrew Leyland**, *Head of Strategic Advisory, Benchmark Mineral Intelligence*, **Ahmed Mehdi**, *Research Associate, Oxford Institute for Energy Studies*, and **Xin Ma**, *Managing Director, Asia Platform, Total Carbon Neutrality Ventures* in the discussion.

Introduction

Over the past decade a surge in lithium-ion battery production has led to an 85% decline in prices, making electric vehicles and energy storage commercially viable for the first time in history.

Batteries hold the key to transitioning away from fossil fuel dependence and are set to play a greater role in the coming decade. Over the next ten years the energy storage market in the United States could grow to as much as \$426 billion, and there are many ways to buy into the surge, including chemical companies, battery cell makers, car companies, solar companies and utility companies.

Capturing the massive economic opportunity underlying the shift to controls and battery-based energy systems requires that planners, policymakers, regulators, and investors take an ecosystem approach to developing these markets.

Signatories to the 2016 Paris climate accord are working towards emissions reduction targets and, as part of this, replacing gasoline and diesel vehicles with cleaner alternatives will be essential. The UK and France have declared they will halt sales of fossil fuel-burning cars by 2040, while China and India are also keen to restrict the vehicles.

The challenge is that batteries will have to play a key part in this transformation; as well as in other areas such as storing unused energy produced both by alternative energy and by power stations using fossil fuel.

Conventional batteries are working at the edge of the rules of physics and chemistry and will require ever larger quantities of rare earth minerals, such as lithium. It is not clear that there is sufficient supply in the world. But, advances are being made. Battery costs, currently estimated at \$190- 210 kWh, are forecast to drop to \$125-150 kWh as soon as 2020-2024.

AHMED MEHDI, RESEARCH ASSOCIATE, OXFORD INSTITUTE FOR ENERGY STUDIES

COVID-19 has had an impact on the oil industry – but there was already an emerging theme of energy transition.

In the past hundreds of years, we have seen an energy transition from wood to coal to oil and now renewables. The main risk to the environment is transport, which is responsible for one third of greenhouse gas emissions. The biggest reduction in demand in 2020 has been in aviation. With lockdowns, there has been less mobility and demand has reduced by 17-18m barrels per day. Although gasoline has recovered (90-95% in some areas).

There is a growing concern about the use of oil and, at the same time, batteries are becoming more effective.

In terms of batteries, the cost-competitiveness of lithium/ion improves every year.

There are two key issues:

1. The Government response to changes. Fiscal stimulus for green energy.
2. To what extent has there been permanent demand destruction?

How is the oil industry viewed by investors? Cyclical business in oil: cost cutting, fiscal discipline in past. But will this be enough?

What are the investment choices? There is a move towards renewables and a significant decline in investment in hydrocarbons. There is a capital shortfall for upstream investments – a looming challenge for the industry.

In this process of transition, are the oil companies the right stewards of capital allocation; they have a mixed record. From the mid-2000s to 2019 the capital employed for each barrel of oil was between \$47 and \$100; therefore investments were based on higher prices. But the long-term projections are much lower, which is the crux of the problem, which they will have to resolve.

For instance, in the USA where capital is cheap, the knock-on effects have been bankruptcies and consolidation in 2020.

But capital deployment in clean energy is low. See the need for much larger amounts.

100m barrels market last year and a 4-5% decline in oil fields. Need to sustain investment and half a trillion dollars is required to match needs. And there is a very competitive market, with a number of lower cost producers adjusting strategies.

Saudi Arabian oil has the lowest carbon intensity of oil, hedging against carbon taxes. Ironically, there is an opportunity for Middle East oil producers to diversify into renewables and increase their market share and take advantage of the oil price cost curve. Making more resilient around \$40-50.

ANDREW LEYLAND, HEAD OF STRATEGIC ADVISORY, BENCHMARK MINERAL INTELLIGENCE

There have been huge improvements in batteries. The cost per cell has reduced from \$1,000 down to c\$100 KWH. This is the magic number to get to be competitive in the mass market, and improvements in costs are continuing.

In 2015 there were only three plants manufacturing Lithium-Ion batteries, producing 1GWH of power. There are now 170 plants, and 80 in production. Economies of scale. In addition, improvements in high nickel cathodes has improved the energy of cells.

This means that electrical vehicles can now be produced for c\$30,000 and aiming for c\$25,000, which will break into the mass market.

There is not a huge difference in Chinese production costs, but their capital intensity means that they have 70% of the world's production and capacity.

Big worry to the rest of the world – the energy of the future car. The Chinese never had a share in the internal combustion engine and so have

concentrated on electric. Both a world leader in this area and real benefits from air quality in cities .

China has been overtaken by Europe in the new sales of electrical vehicles. The sale of electrical vehicles is being held back by supply rather than demand. Can't build quickly enough. They are all pre-sold. A far cry from the internal combustion engine.

Will battery fuels lead to the end of the type of geopolitical issues caused by oil? Different type of resource nationalism. Five processes for Lithium-ion are extraction, chemical, cathode and anode production, cell, application. Four of those stages can be done anywhere. But you can't change geology and geography. Cobalt from the DRC, Lithium from Latin America. So, China is making strategic investments to obtain access. 25% stake in the Chilean lithium mine SQM, for instance.

But this demand for raw material will not result in war or changes of governments. What risk? The assets are not as strategic as oil. Not sufficient value; at present the Lithium-ion raw materials amount to a total of \$50bn. But suppliers need access to the materials. Security of supply is the key issue.

So, China is stockpiling cobalt and the USA may well reinvigorate the Defence Logistic Agency to oversee ensuring that the raw material will be available for the supply chain to be supported. Access rather than control.

And there is no need for an organisation like OPEC to control the market for battery fuels: Cobalt, Lithium and Manganese. There is no OPEC for iron ore.

XIN MA, MANAGING DIRECTOR, ASIA PLATFORM, TOTAL CARBON NEUTRALITY VENTURES

The IOCs will play a critical part in energy transition, and decarbonisation. But there are many moving parts.

There is a need to develop a less-carbon-intense industry and to add more renewables (in particular, wind and solar). And there is a different requirement. Address end solutions rather than products. But what pathway?

Investment will support changing models of technologies and pathways. Capex will be provided by different sources: Government, investors and infrastructure funds, which will make sure that the transition works smoothly. But there will be a squeeze for oil and gas in funding. There will be tensions. In particular capex allocation. But there will be many new different sources of capital. In addition, traditional investors are changing.

Pension funds and infrastructure funds are now environmentally sensitive in their investments. New money is coming in.

In parallel the IOCs are under healthy structural pressure, and face strategic challenges and change. For instance, BP has defined a completely new strategy and reorganisation going forward. IOCs are energy majors these days, not oil majors. For instance, Total is targeting production of 35GW of green energy by 2025. BP and Shell are producing similar plans.

Chemicals are a third of the total for recycled in Total. Recyclable chemicals provide mobility and charging (80% at home and in the office). For instance, Total is providing charging stations and providing multi-modal hubs for mobility – an open rather than a closed system. Similarly Shell and BP.

There are a huge number of start-ups which are entering the market, focussing on area such as ride sharing, car pooling, battery charging and smart energy.

Subsidies

What will be the effect when governments reduce subsidies to oil industry and allocate elsewhere, such as to renewables?

Capital allocation strategies and diversified; spending in non-core areas are developing. The trends are: increased demand for electricity and decarbonisation of the generation side. Creates opportunities across the whole energy industry. Oil has taken the biggest hit and renewables investment continues to increase, in 2020. But capital allocation still relatively small. Clean energy is only c5-7% of Capex. And R&D for batteries has surged.

Decision making on capital allocation is not being made based on subsidies. Misconceptions 10 years ago on relative returns: oil v renewables. But now is not a big gap in the relative rate of return. Costs upstream are increasing and renewables are providing a better return. Reflected in equity markets, and destruction in value of oil companies. Structural shift.

IOCs and NOCs are responding to the tension. Will be a central part of the energy transition; capital, scale, relationships. Need to deploy capital efficiently.

Subsidies for Battery Storage?

The key debate is around the time and durability of storage solutions.

Lithium-ion not yet deployable on a large scale. Capacity still relatively small.

Solid State

Solid state technology is yet to be deployed at scale. Provides better energy density. The problem is not the technology, but the price. The lithium in the anode is very expensive (energy intensive). And cannot fit into a \$35,000 car. Too expensive. But anode-less technology will come in the late 2020s.

Investment not yet been ramped up.

Future Investment

Agile and innovative. Investment will not be just by M&A. Joint venture at an earlier stage. Less expensive; less exposure; see where technology is going. Invest \$5m not \$100m.

Future energy storage

Refiners under pressure: excess capacity and slowing growth. Utilisation rates have fallen dramatically. Next 5 years, 6m barrels of additional capacity in ME and Asia. Large-scale refineries. Integration in low margin business and storage solutions become important. Integrating renewables into base load and shifting yield. Margins terrible. So, capacity rationalisation. And with structural oversupply, move to more NAFTA etc. Will not offset the electrification of transport. But alternative strategy.

What about the social, political and economic stability of the Middle East?

Tale of two regions. The significance of oil will decline. Are they prepared for this? Bottlenecks and prices.

Carbon intensity of crude production. Saudi is lowest. Hedge against world of rising carbon prices. Even with regulatory changes, Saudi is well placed.

How do you become more resilient. Gas displaces crude, reduce carbon intensity, energy efficiency. Many actions taken. But more to be done.

Saudi has 1.5 to 2m barrel surplus to use for negotiation.

Saudi is prepared. Others are not prepared at all. Iran, Iraq and other major producers. Huge difference in carbon intensity. Misconception that they are all alike. The whole region is different.

And renewable costs are falling significantly. Saudi Arabia and the UAE are integrating renewables into their upstream oil and gas operations. More resilience.

Developing carbon capture for increased oil recovery. Attracting capital. But problems of cost and economies of scale.

Energy Infrastructure now redundant? And less attractive because of battery and storage.

There is investment in Lithium-ion, for new ways to use batteries, storage and even in gas-powered power stations, for efficiency. But will not change the world overnight. No scale or capacity.

But in 10 years, batteries will be everywhere. Cars, infrastructure, grids, peak shifting. So there will be a decentralised grid, without any planning.

Growing 20% per year, and for next 20 years just for electrical vehicles. Political mandates to phase out the internal combustion engine. There will be a huge growth in batteries.

What about Hydrogen?

European Governments are putting significant investment into hydrogen. But is it suitable for vehicles?

Lithium-ion won the technology race. Being spent out 50-1 with hydrogen. Hydrogen has a problem with the expense of charging. Best if used in a closed loop system (such as a bus company or warehouse). Advantage is that only takes 5 minutes to charge, as against one hour for electrical. Investment will come in due course. At the moment, outclassed by Lithium-ion.

What role for Governments?

The Chinese Government champions its battery industry; supporting and subsidises.

We cannot ask Governments to do all the work. Consumer needs best sorted by commercial companies. For instance, charging has been left to the marketplace.

But there is a bigger role in standardisation in the charging industry and batteries. For battery swops.

But does need to be Government investing in hydrogen and the charging facilities. Consumer activity can take up behind.

Key Messages

- We are in the middle of an unprecedented energy transition. Electrification trend. Challenges and opportunities.
- Governments need to regulate and facilitate the transition.
- Lithium-ion batteries have won the technology race. Costs are declining.
- There is a need to reduce the environmental footprint of the battery industry. More energy to produce than internal combustion engine. Focus on: mining, chemicals and cell production and destruction. It is part of getting to the net zero footprint.
- Electric vehicles do not answer the climate question.
- There is a growing trend in the electrification of demand and decarbonisation of generation side.
- Investment allocation will be very important in moving the process forward. Previous strategies will not work
- Oil demand will not fall off a cliff. Other parts of the barrel. The oil majors need to be resilient.

Next Meetings:

10th December (1400 GMT). How will US energy policy change under the Democrat President Biden.

21st January (1400 GMT). The future of the nuclear Industry – in the UK and around the World.