

Testimony of Michael L Sanders

Avicenne Energy

Environmental issues and opportunities in the use of electric batteries in transportation and energy storage.

Statement of Michael L. Sanders

Senior Advisor,
Avicenne Energy, US Leader

at the

Dirksen Building - 406

before the

Senate Committee on Environment and Public Works

concerning

Environmental issues and opportunities linked to an increase in the use of electric
batteries in transportation and energy storage.

July 17, 2019

Introduction

Chairman Barrasso. Ranking Member Carper and Members of the Committee, thank you for the opportunity to provide testimony concerning environmental issues and opportunities in the use of electric batteries. I am a Senior Advisor with Avicenne Energy, who is a premier market research and consulting firm focused on the rechargeable battery markets. I have nearly 16 years' experience in the battery market and I am now advising companies in this market.

Testimony

My testimony will cover the following topics: Electric Vehicle and Energy Storage System Demand; Cell Supply Chain; Raw Materials Supply and Demand; Global Recycling and Mandates; and Meaningful areas for the US to participate.

Electric Vehicle and Energy Storage Demand

Electric vehicle demand is growing very rapidly, being led by China for both full electric vehicles and buses. China led with clear direction, along with substantial support, vehicle subsidies, most of these are expiring, however mandates for electrification remain, Many EU countries and cities have also established dates for full conversion to electric vehicles. A large group of US mayors released a target to purchase a very large number of electric buses. The chart highlights the growth in all electric vehicles worldwide:

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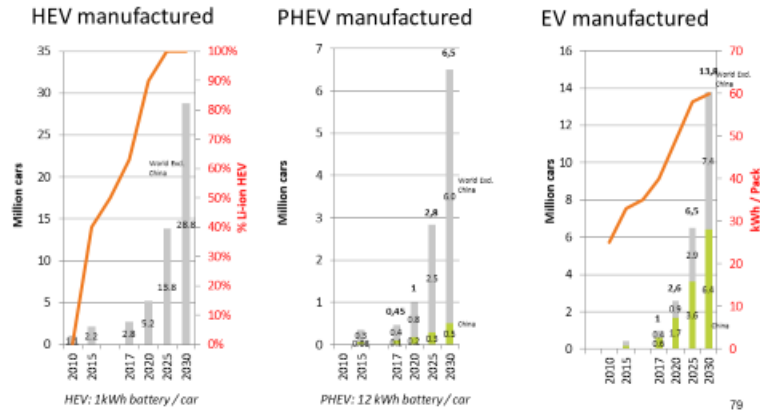
Battery market for xEV and E-buses

December 2018

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HEV, P-HEV, EV 2030 FORECASTS

Realistic Scenario



The forecast of US electric vehicles sold for 2020 is 0.5M, 1.5M vehicles in 2025 and 3.7M vehicles by 2030. The demand prediction is based on current global regulations, supply chain development, known vehicle launches, expected cost improvements reaching cost parity and the growth in transit and utility vehicles. Energy Storage System demands are much lower.

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The rechargeable Battery Market 2017 – 2030

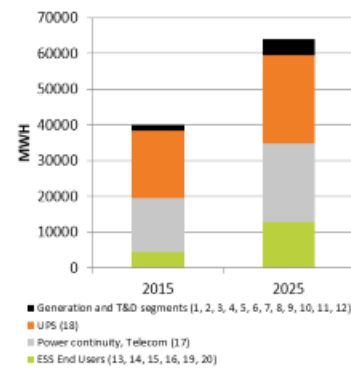
ESS & Industrial Applications

January 2019

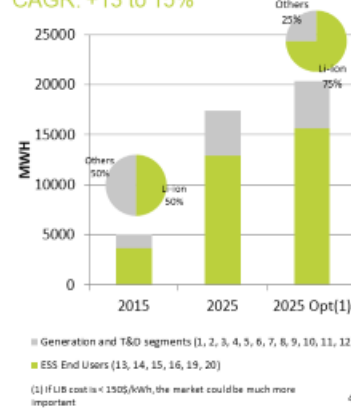
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ESS MARKET & FORECASTS

From 40 GWh to 65 GWh in 2025
CAGR: +6%



ESS excl Telecom & UPS
CAGR: +13 to 15%



Source: AVICENNE Energy

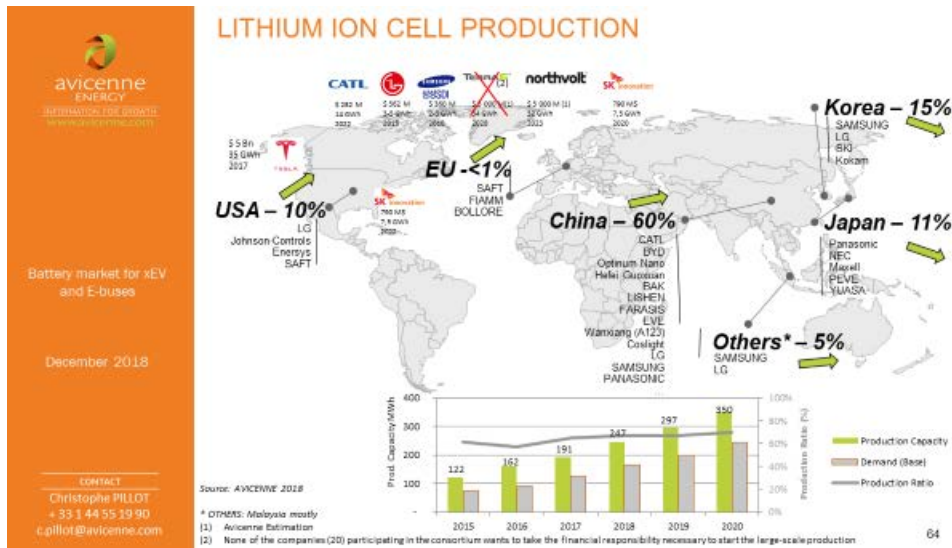
Cell Supply Chain

The cell production is continuing to expand in China, many announcements and construction has begun in the EU and the US has only one major announcement.

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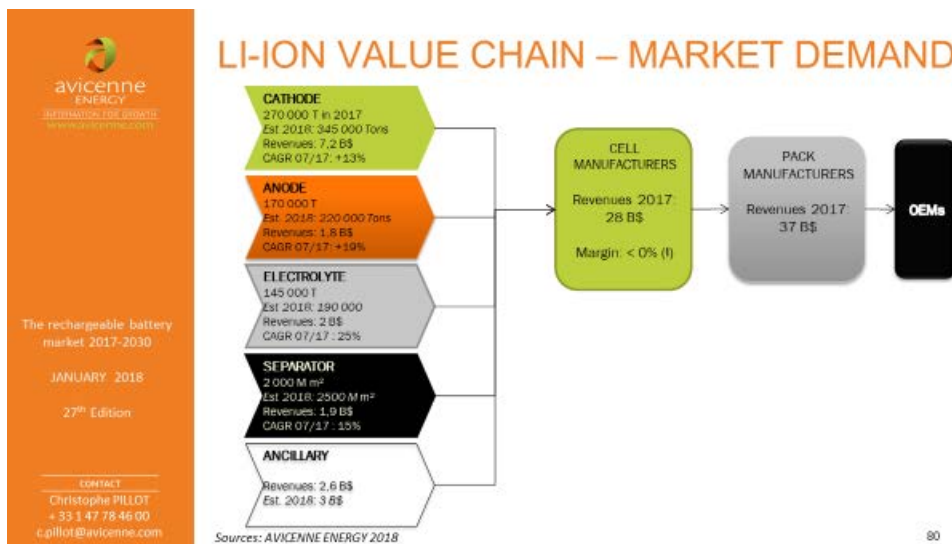
Environmental issues and opportunities in the use of electric batteries in transportation and energy storage.



In the EU the plants are mainly by industry leaders, some OEM investments with start-ups and two pending government consortiums in Germany and France.

Raw Materials Supply and Demand

Lithium Ion Cells are made from many different components to produce a cell. The value chain map starts with the main components of the battery and ends with the OEMs



There is a well-established value chain and as cell plants have been established in the US most of the raw materials come from Asia. We are seeing expansions in the EU that leading raw

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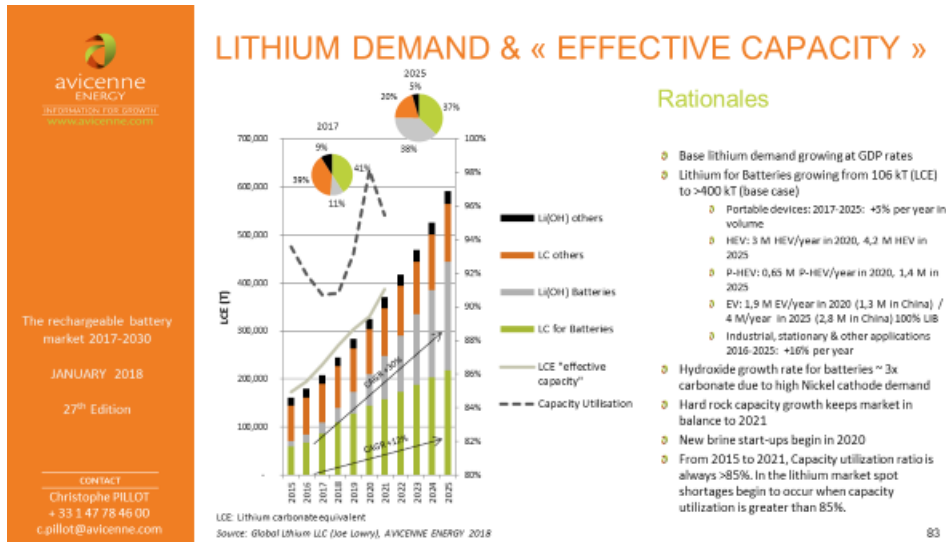
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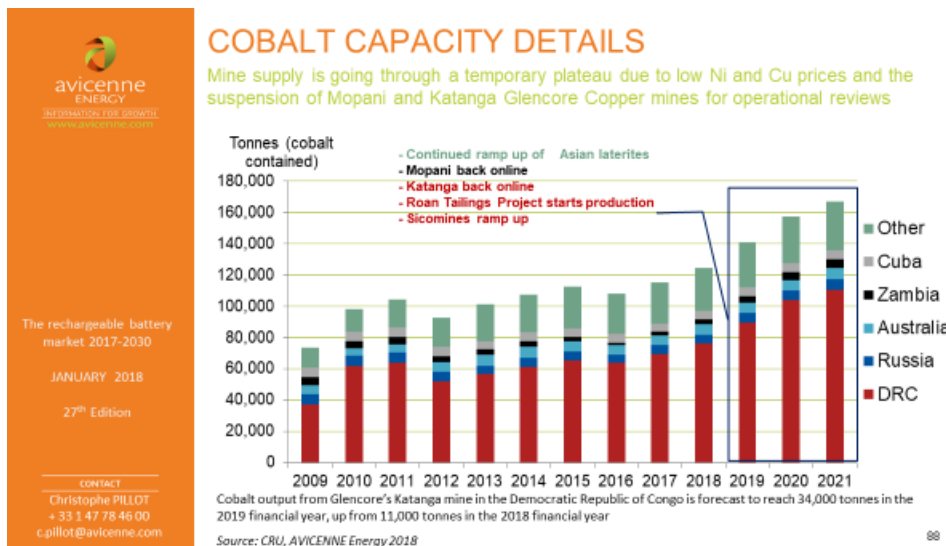
materials suppliers are expanding in the EU. The industry is very risk averse providing only

limited opportunity of new entrants. The US has industry leaders that produce metals raw

materials that go into cathode and salt such as Lithium (Albemarle and Livent).



There have been announcements in Lithium investments in the US: American Lithium, Nemaska, Piedmont and others as examples. To become a supplier these companies will need to demonstrate products that meet quality requirements and have costs that are competitive.



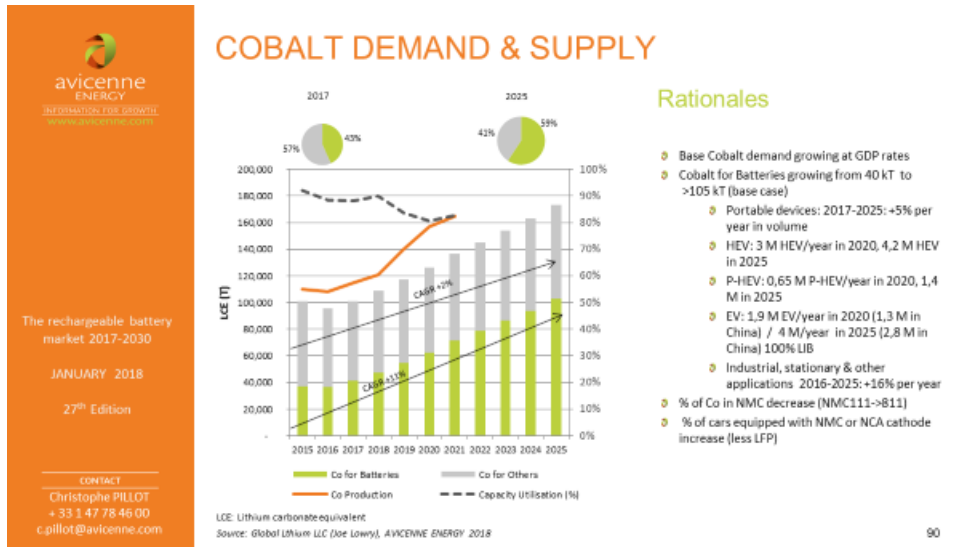
In cathodes Cobalt is a major component and the US does not have a significant position.

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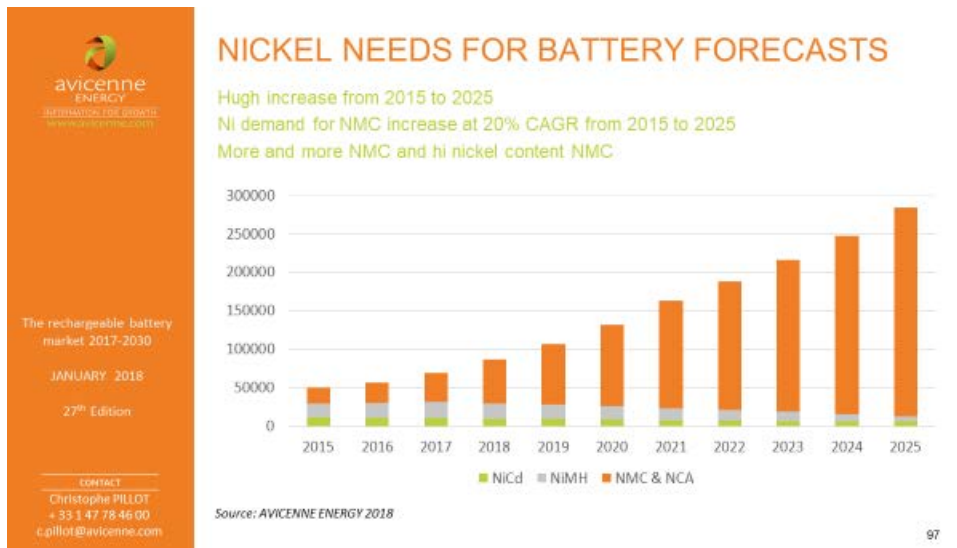
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Significant development has been progressing well for low Cobalt or no Cobalt systems. OEMs have gone to significant efforts for materials traceability to ensure that the supply is responsibly sourced.



Nickel is much more abundant, and the US is in a better position to provide Nickel precursors.



Aluminum is used in cathodes, current collectors, cell casing and structural components. The US is in a very good position in Aluminum with major producers like Alcoa, Novelis and Granges.

Global Recycling Challenges and Mandates

Recycling of lithium ion batteries and establishing the complex value chain is being led by China. They began with guidance documents in the late 1990s and moved to requirements for recycling for electric vehicles and consumer electronics. Substantial development has been completed in spent battery collection, centers to prepare batteries for recycling facilities and transportation hubs. The industry leaders in recycling have established processes that can recover the metal precursors. The piloting facilities have not reached profitability, but with larger scale facilities we have projected them becoming profitable. Korea is rapidly gaining ground on China to support their very large cell producers. The EU has established battery recycling mandates requiring 50% of the materials to be recycled before significant growth in auto. The EU has auto mandates for 90% of the materials be recycled. The EU is reviewing the battery mandate and there is a major meeting in the EU this week.

Meaningful areas for US to participate

The US could play an ever-increasing role throughout the value chain: the first major change is for additional cell plants to be built for local supply and materials demand; second is for local components manufacturing and finally to establish meaningful recycling of spent batteries. This should offer significant opportunities for the US to become more relevant in this market while managing the environmental and supply concerns. I think a “China-like” model of starting the process by establishing targets, assisting pilot facilities for collection and recycling could go a long way in demonstrating commitment and the focus on getting results.

Closing

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Chairman Barrasso. Ranking Member Carper and Members of the Committee, again thank you for the opportunity. I look forward to answering any additional questions and supporting the committee's work in the future.