LITHIUM 2019

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Sediment Hosted Lithium – the unconventional hydrocarbon of the new energy economy?

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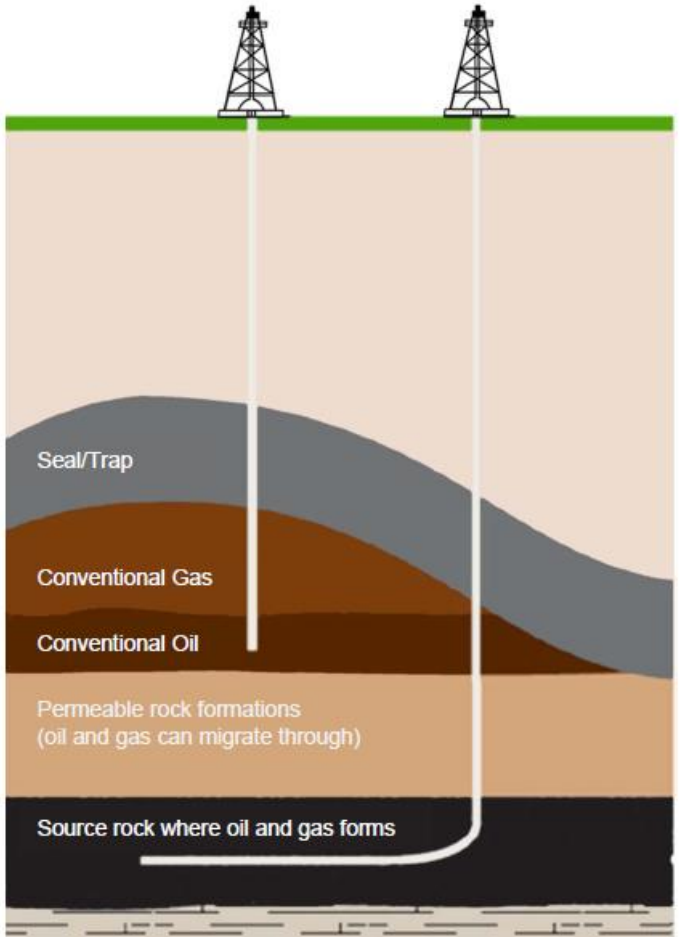
Unconventional Hydrocarbons

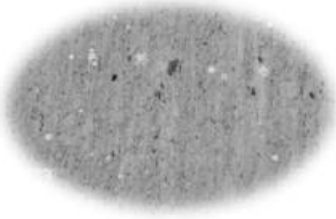
CONVENTIONAL



- High permeability
- Fracking: minimal
- Principal evaluations:
  - Trap
  - Seal
  - Source
  - Reservoir
  - Migration
  - Timing
- Primary risk: geologic
- Access: vertical wells



UNCONVENTIONAL

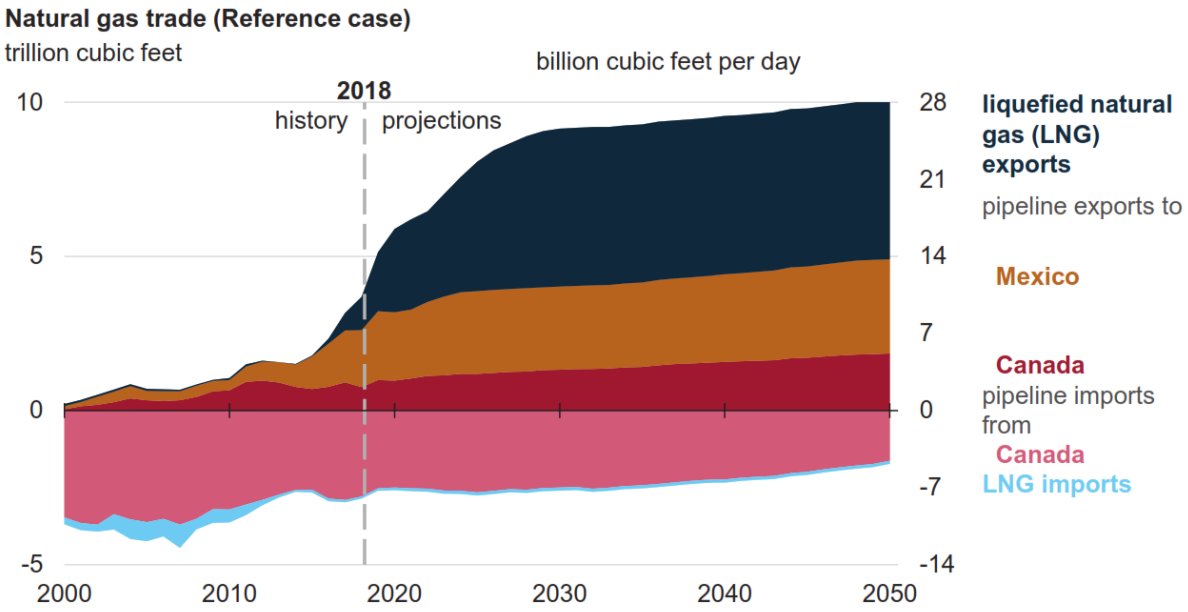


- Ultra tight rock
- Fracking: large, hydraulic
- Principal evaluations:
  - Kerogen content
  - Maturity
  - Clay content
  - Pressure
  - Bulk volume Hydrocarbon
- Primary risk: economic
- Access: horizontal wells

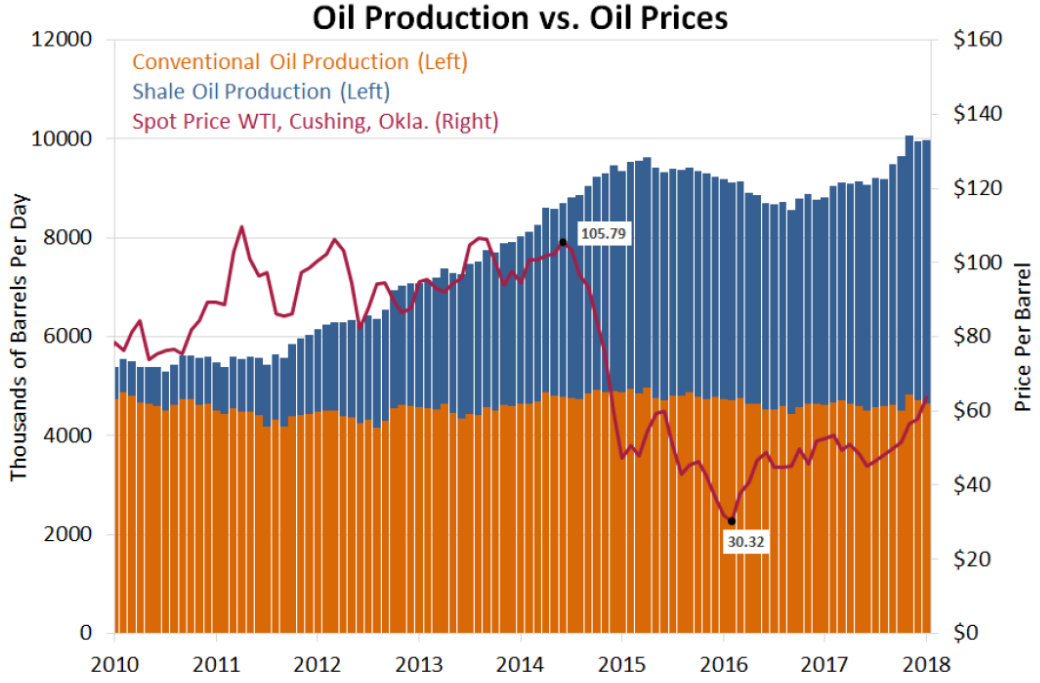
Source: Pioneer Natural Resources 2014

Significant impacts

- US net imports of natural gas rose 41% from 1995 to 2007 (LNG import terminals built).
- Yet in 2009 the US passed Russia as the world's largest producer of gas; domestic gas price falling.
- By 2013 LNG terminals converted to export LNG & coal fired power stations switching to gas.
- US became the world's largest crude oil producer in 2018; expected to be a net energy exporter by 2020.
- Making US industry more competitive with additional geopolitical implications.

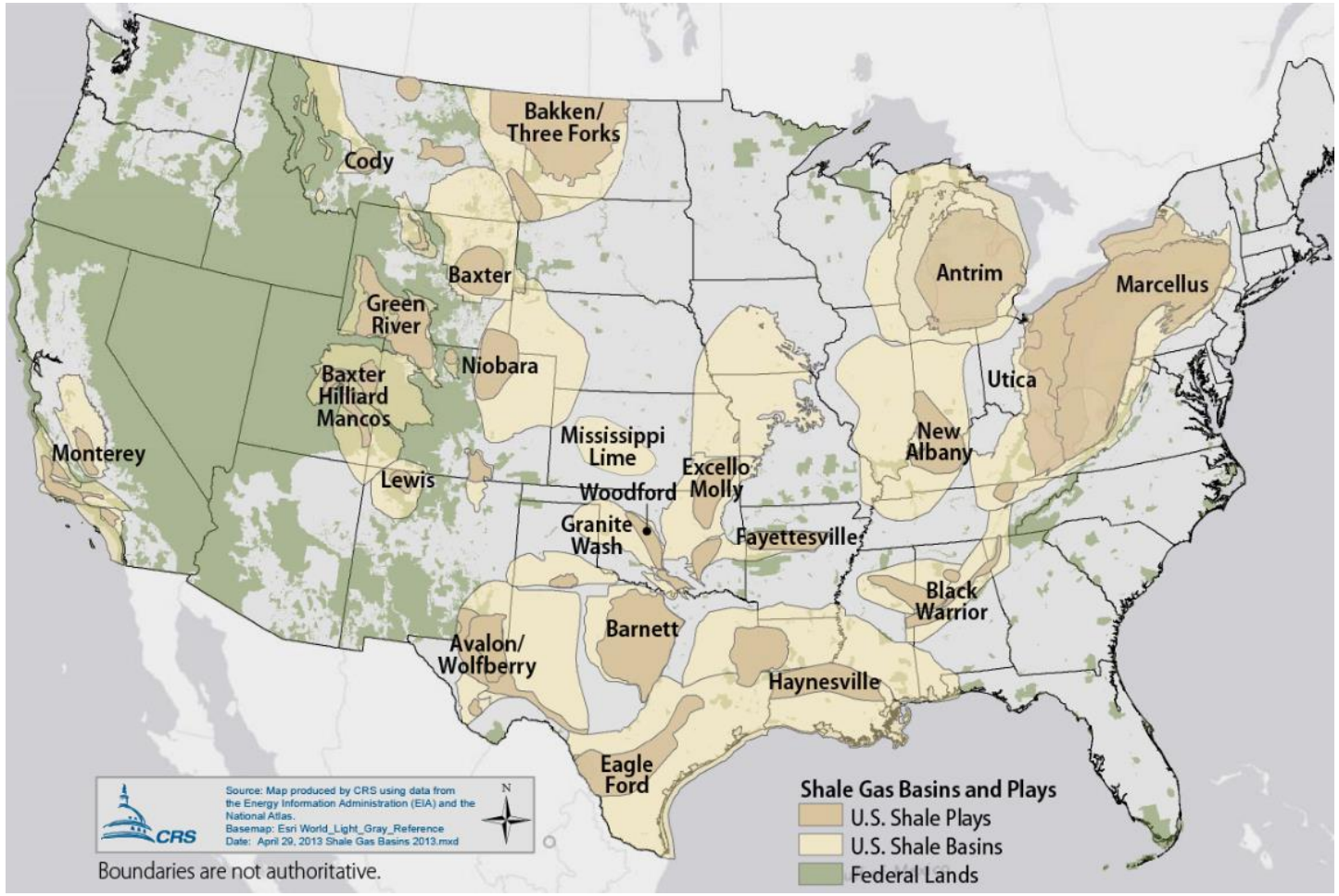


Sources: US EIA Annual Energy Outlook 2019 and other reports



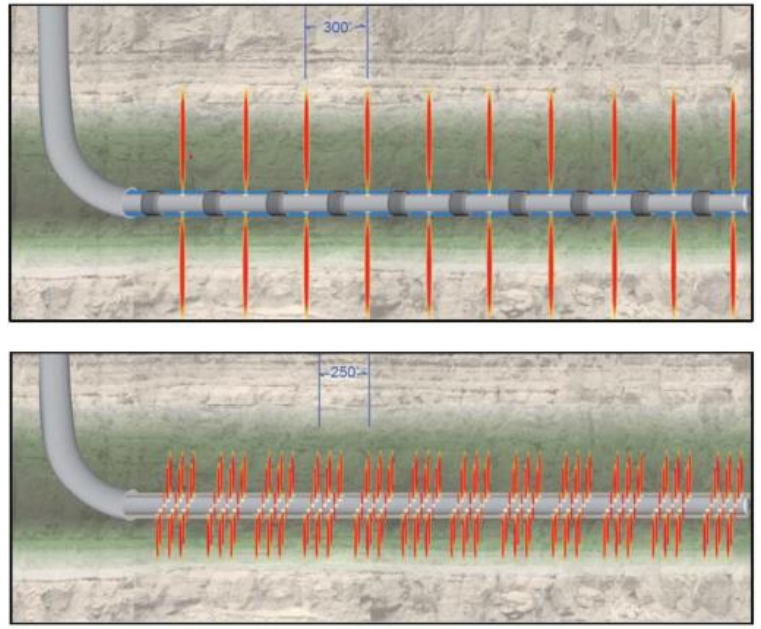
SOURCES: Energy Information Administration and FRED (Federal Reserve Economic Data).

US industry growth factors



Source: US Congressional Research Service 2015

- Geology
- Technology
- Infrastructure

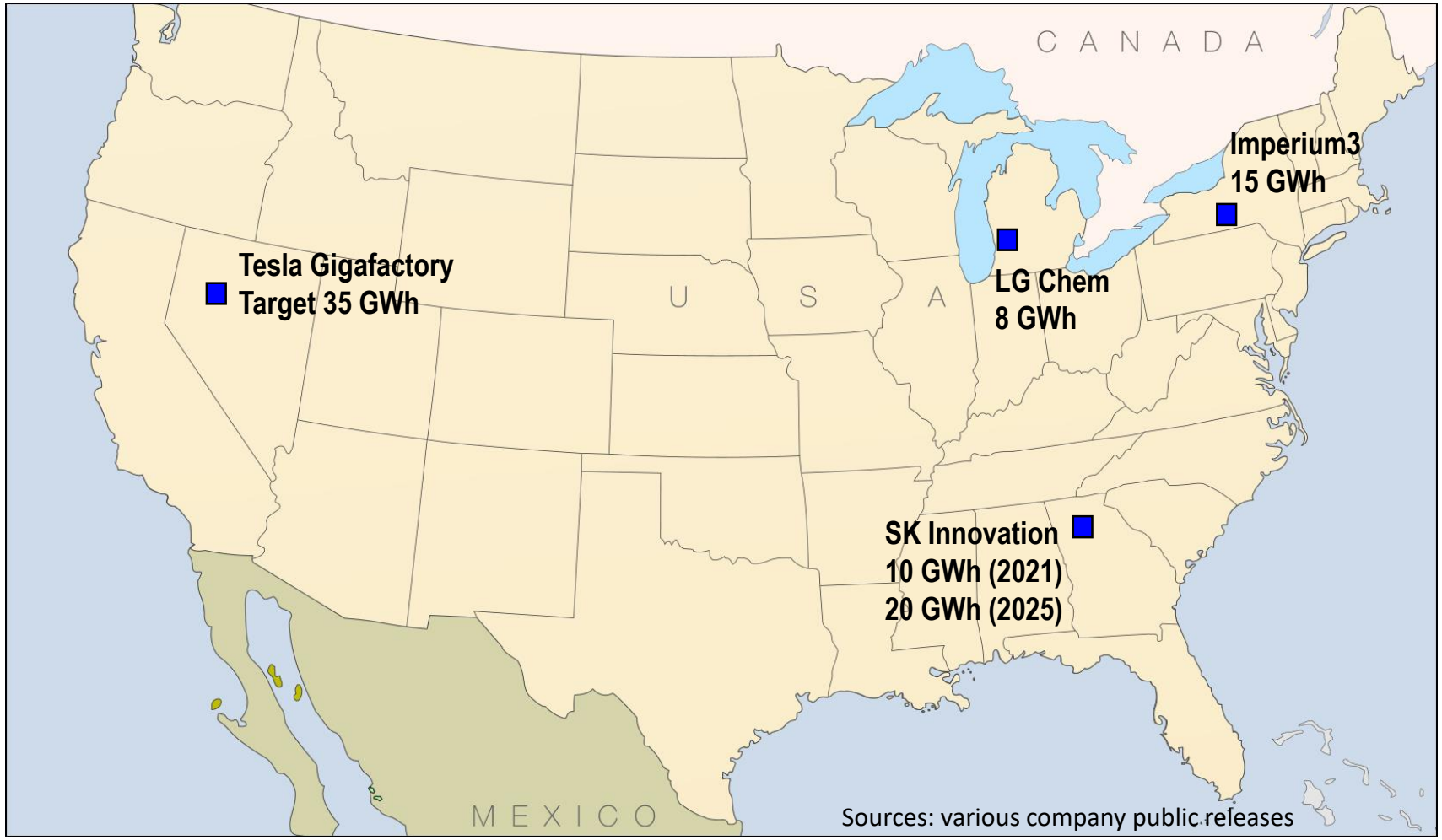


Source: Whiting Petroleum 2014

US reliant on imported Li

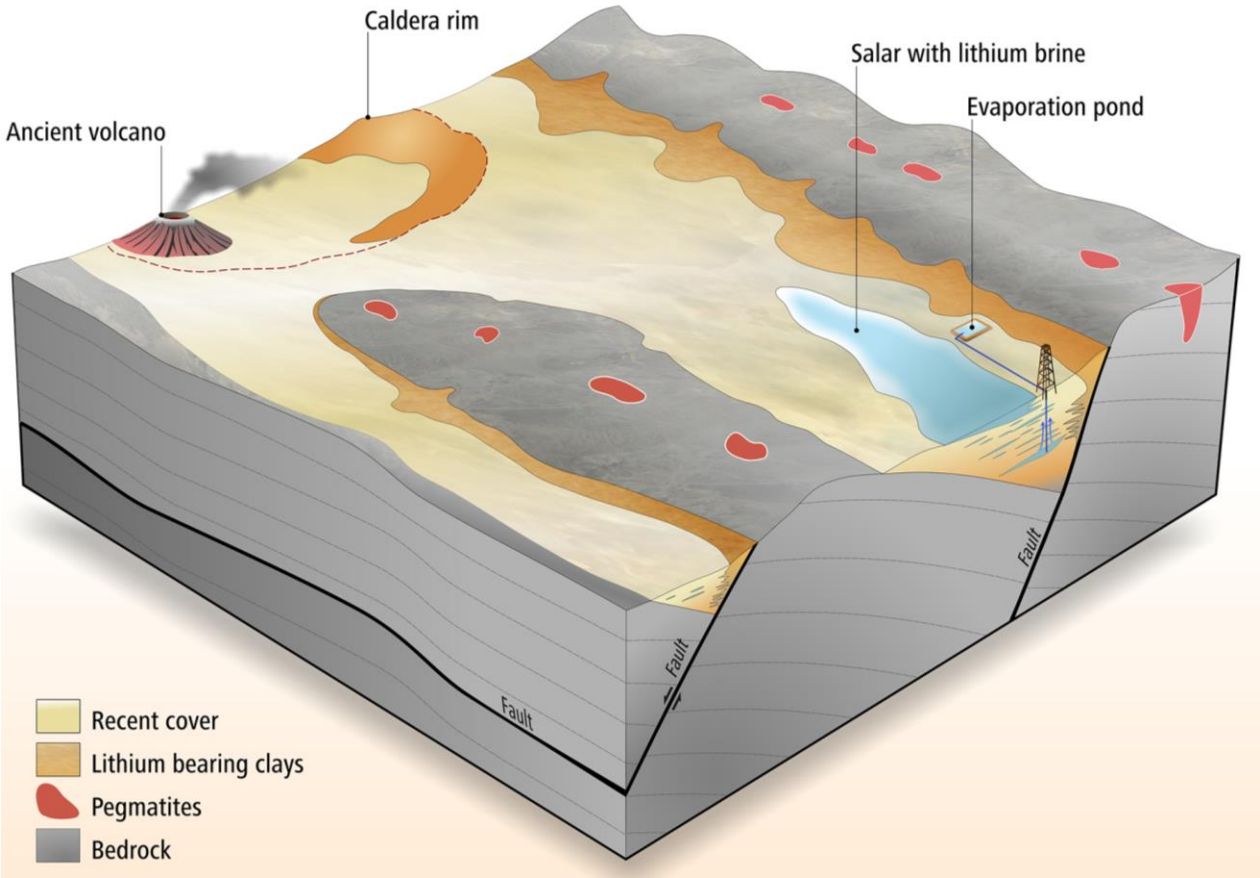
- Worldwide Li demand increasing at CAGR ~17% (UBS).
- 100% of growing US Li-ion supply chain demand is satisfied by imported Li chemicals and finished products.
- One small US operation (brine).
- “the US produces 1% of global lithium supply and only 7% of the refined lithium chemical supply while China produces 51%” (Simon Moores, Benchmark Mineral Intelligence 2019).
- Chronic import reliance recognized by Federal agencies:
  - Executive Order ‘Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals’, December 2017.
  - US Department of the Interior report June 2018 includes Lithium as critical to economic and national security.
  - Bipartisan Bill ‘American Minerals Security Act’ introduced May 2019 to secure mineral resources and reduce reliance on foreign sources.

Growing US demand



- US Li-ion battery factories planned or under construction will require ~66 ktpa Li carbonate.
- Demand from US car industry expected to grow further.

Lithium Sources



- Current supply from pegmatite and brine sources.
- Sediments a potential new source of large amounts of Li.
- Identified by USGS in 1970's.
- Lithium is hosted within or adsorbed onto clay minerals.
- No commercial production yet, but adequate scale for long mine lives (>16Mt of contained LCE in US alone).
- Proposed process routes leach or calcine-leach lithium and other elements.
- Pilot plant in Mexico has produced battery grade carbonate for 2 years (Bacanora Lithium plc, AIM:BCN).
- Second pilot plant shortly to commence operation in Nevada (Lithium Americas TSXV:LAC).

Source: Jindalee

Sediment hosted lithium

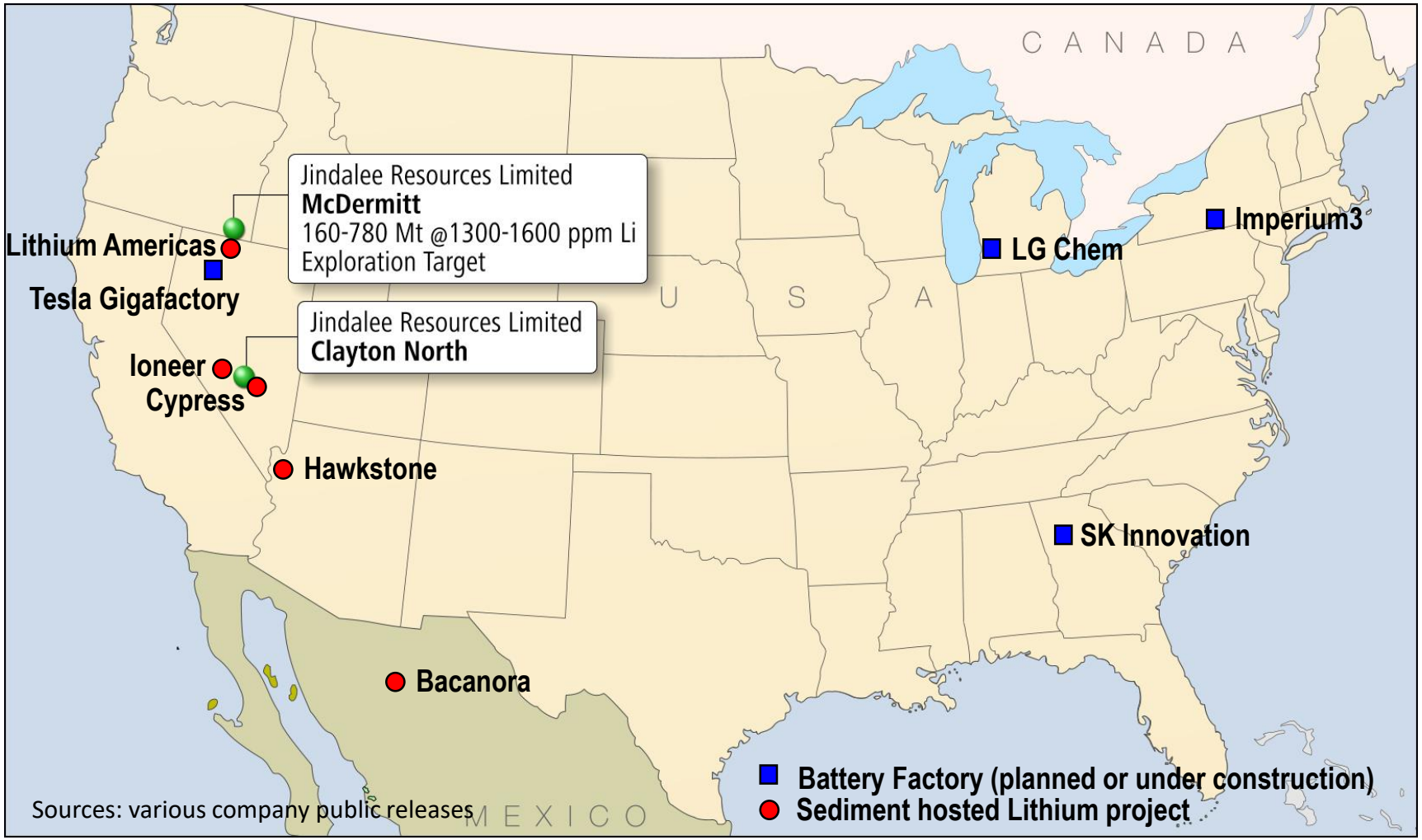




Outcropping lithium rich sediments at McDermitt. Images: Jindalee

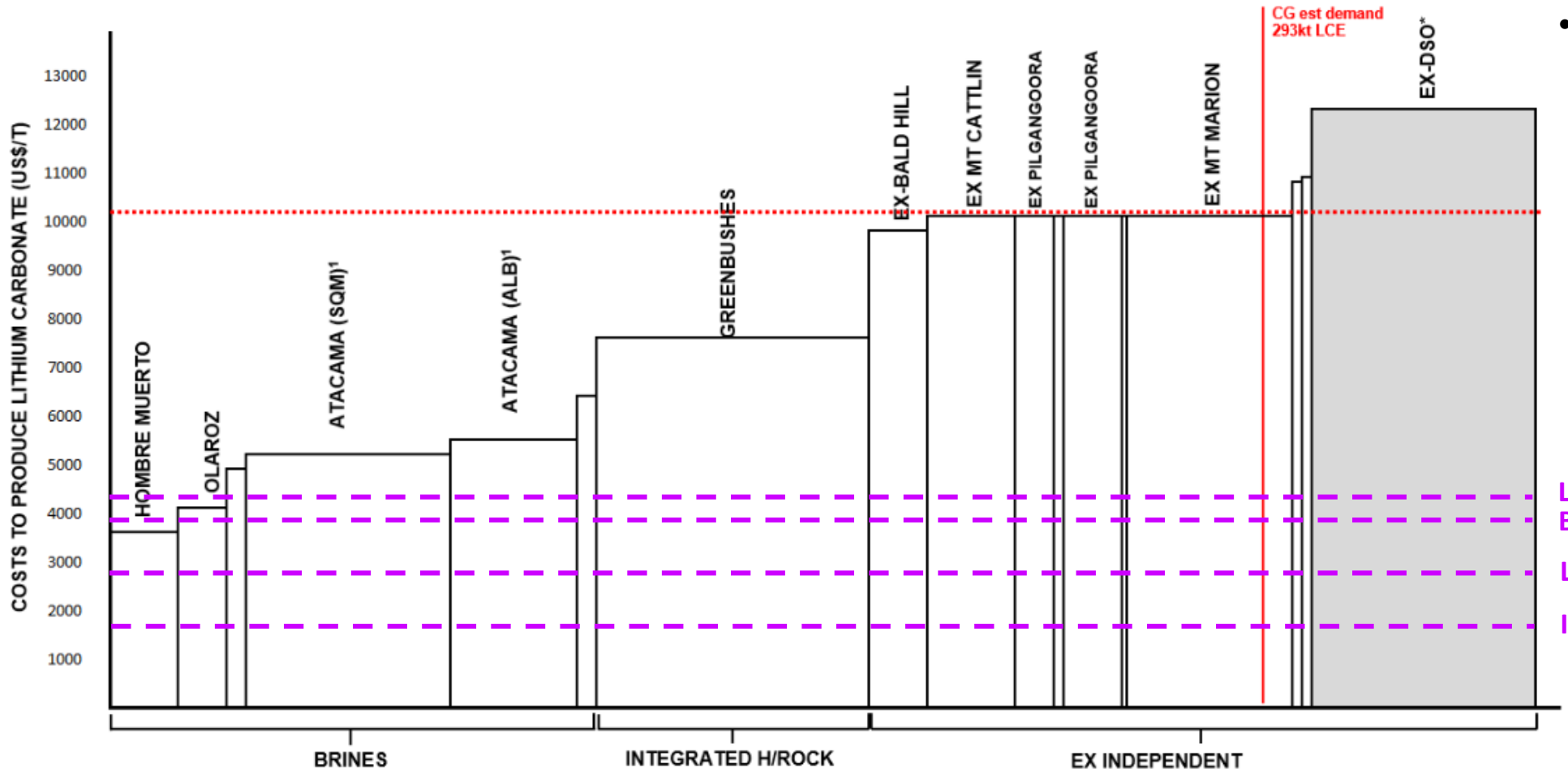


Existing projects



- Published sediment hosted lithium resources in US host >16Mt contained LCE.
- Long mine-life development options.

Cost competitive



- Feasibility studies show sediment hosted Li projects can be long life, highly competitive sources of battery chemicals.

SEDIMENT HOSTED LITHIUM OPEX FROM RECENT STUDIES

LAC: US$4088 no by-products
BCN: US$3910 incl. by-products

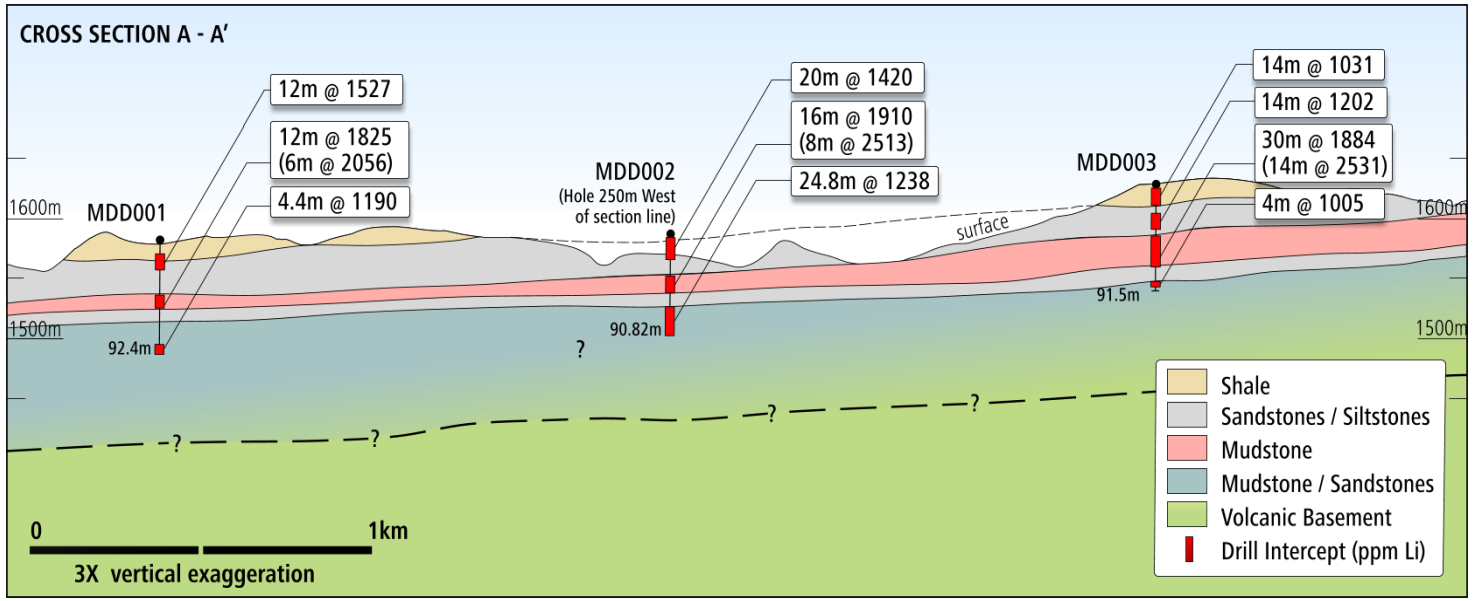
LAC: US$2570 incl. by-products

INR: US$1796 incl. by-products

Sources: Canaccord 30/10/2018 and various company reports

McDermitt Project drilling

- Four holes drilled September 2018 intersected significant thicknesses of flat lying Lithium mineralization[1].
- Open in all directions and at depth.





[1] JRL's ASX announcement 8 November 2018: "More wide intercepts from McDermitt Lithium Project".

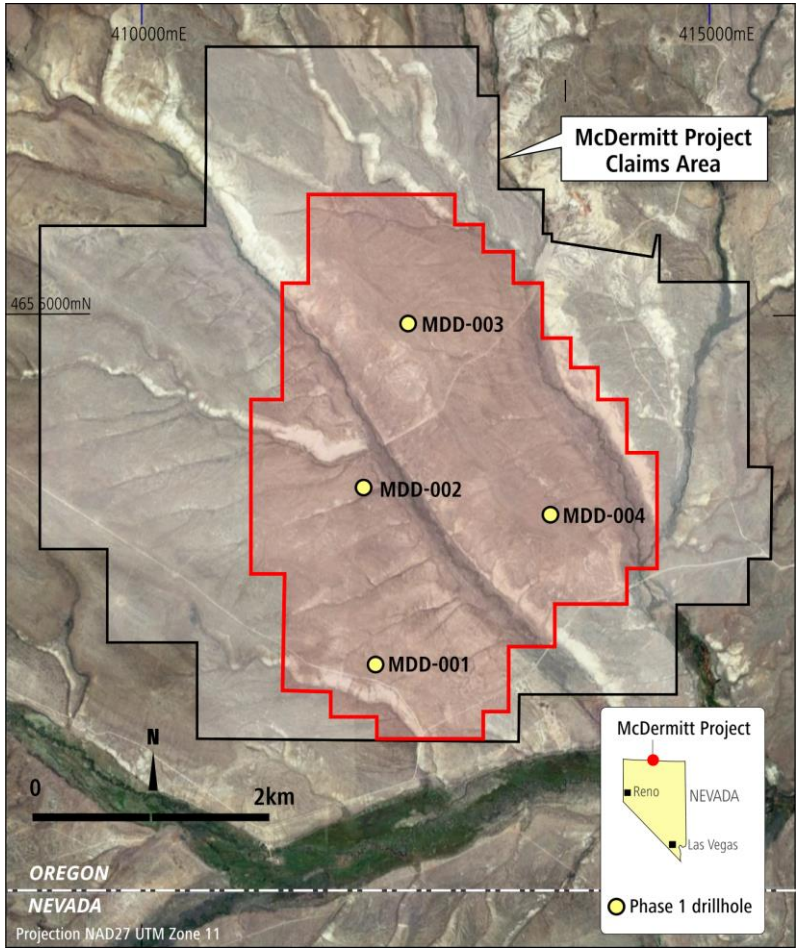
McDermitt Exploration Target*

*Note that the potential quantity and grade of the Exploration Target is conceptual in nature, there has been insufficient exploration to estimate a Mineral Resource and it is uncertain if further exploration will result in the estimation of a Mineral Resource.

- Continuity of mineralised zones supports Exploration Target Range of 160-780Mt @ 1300-1600 ppm Li[2].

Cut Off (ppm Li)	Lower (Mt)	Upper (Mt)	Grade Range (ppm Li)
1000	160	780	1300-1600
1500	40	210	1800-2200
2000	20	80	2100-2600

- Imminent follow up drilling to support resource estimation.
- Mid-range of Exploration Target would contain ~2.5Mt LCE.
- Metallurgical tests show up to 97% of Li can be leached using conventional means in 2 hours[3].



[2] JRL's ASX announcement 20 November 2018: "Lithium Exploration Target at McDermitt".
[3] JRL's ASX announcements 2 April 2019: "excellent Metallurgical Test Results from McDermitt", and 19 June 2019: "US Lithium Project Update".

Conclusions

- US heavily reliant on Li imports, 100% of growing Li-ion demand satisfied by imported material.
- One US producer.
- A domestic supply option is available:
  - Geology - huge amount of contained Li (10's Mt LCE).
  - Infrastructure – chemical industry, transport,……
  - Technology – conventional extraction processes – future improvements?
  - *Bonus* - no currency or political risk for US consumers (e.g. Tesla), plus tariff advantage.
- No technological constraint, but lack of an operating example and perceived high CAPEX are key hurdles. Two pilot plants and current domestic energy security focus mean these hurdles will likely be overcome in the near future.
- Jindalee is well placed with a large, 100% owned ground position over this key deposit style.
- Not a question of if, but <u>when</u> will the US have its 'unconventional' Li moment?

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Thank you

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Competent Persons Statements:

The information in this presentation that relates to Exploration Results is based on information compiled by Mr Pip Darvall. Mr Darvall is an employee of the Company and a Member of the Australasian Institute of Mining and Metallurgy and the Australian Institute of Geoscientists, and has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activities undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves' (JORC Code). Mr Darvall consents to the inclusion in this presentation of the matters based on the information in the form and context in which it appears.

The information in this Report that relates to the Exploration Target for the McDermitt deposit is based on information compiled by Mr. Arnold van der Heyden, who is a Member and Chartered Professional (Geology) of the Australian Institute of Mining and Metallurgy and a Director of H&S Consultants Pty Ltd. Mr. van der Heyden has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves' (JORC Code). Mr. van der Heyden consents to the inclusion in this report of the matters based on the information in the form and context in which it appears.

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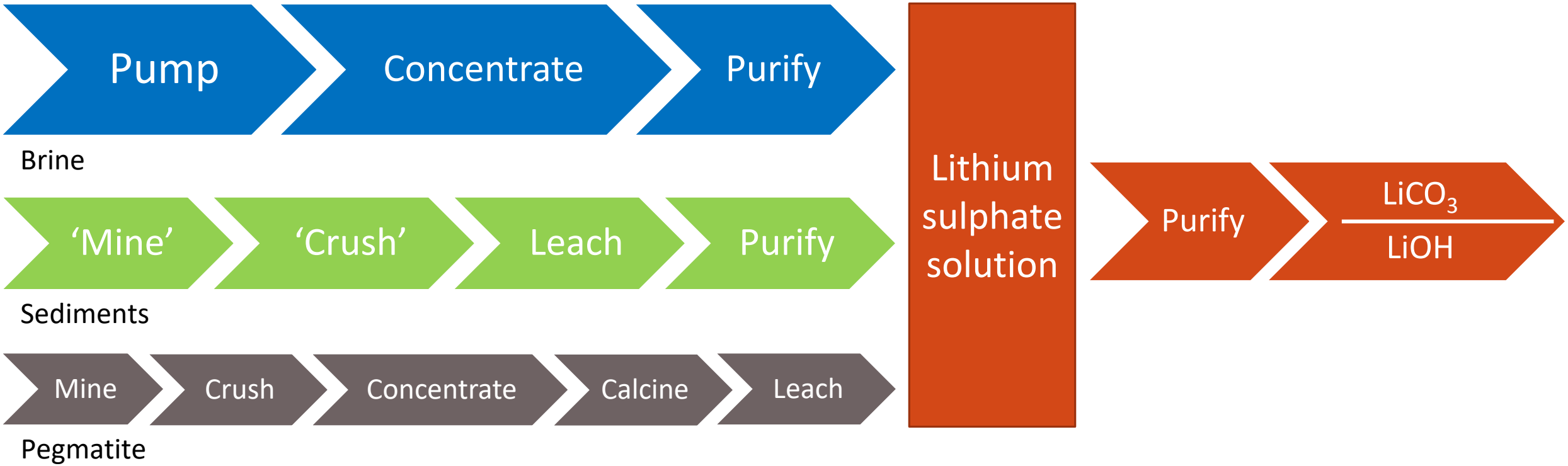
Appendix 1 - Processing Routes

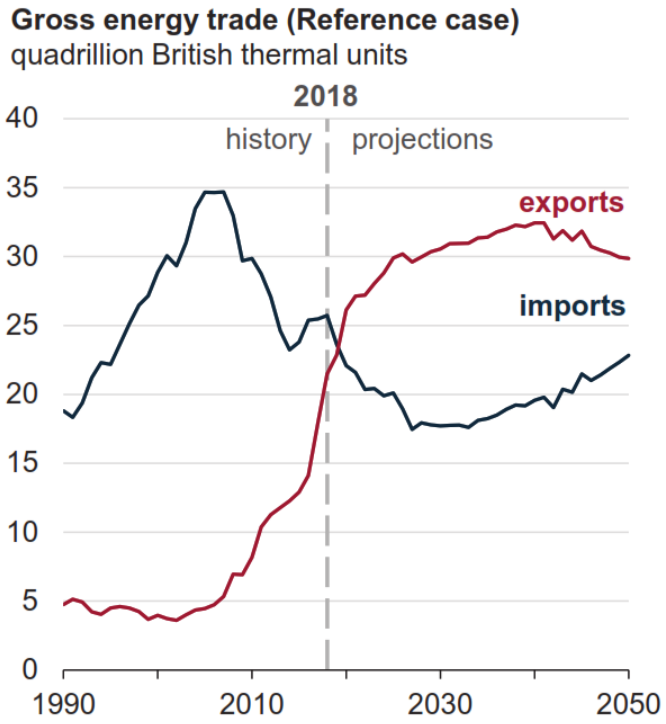


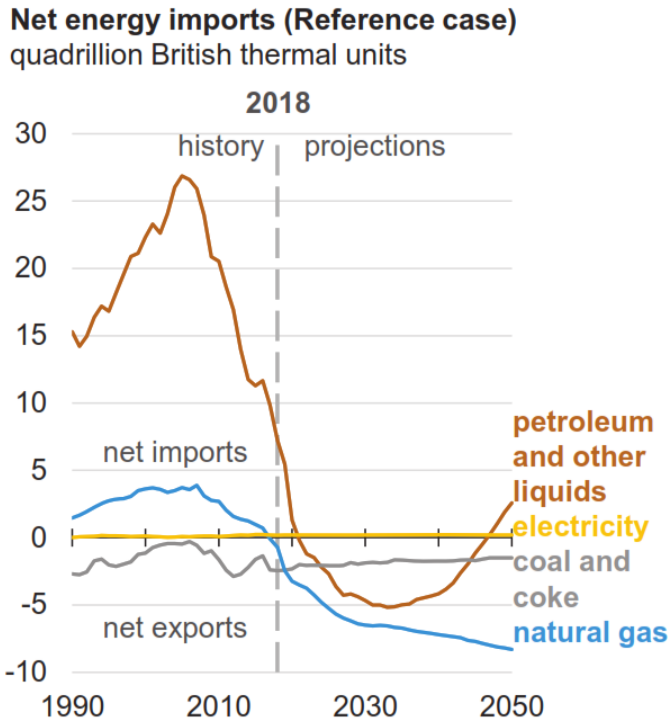
- CAPEX figures for brine and sediment projects include the co-located processing plants producing the chemical outputs.
- Processing plants (and their costs) are typically not incorporated into pegmatite projects.

Sources: Various company presentations and studies.

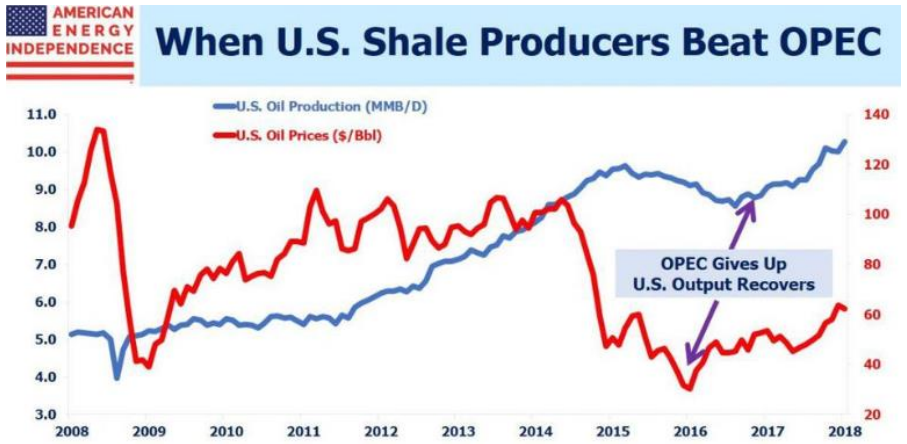
Appendix 2 – Transformational

- Oil price war 2014, continued innovation allowed shale industry to remain competitive and OPEC capitulated in 2016





Source: US EIA Annual Energy Outlook 2019



Source: Forbes 2018