NEVADA

Lithium Capital of North America

Nevada Governor's Office of
ECONOMIC DEVELOPMENT
Empowering Success

STAGE 1
Exploration, Extraction and Processing

COMPANIES
- Albemarle
- American Battery Technology Company
- Cypress Development Corporation (Exploration)
- HeliosX/Dajin US Corp.
- Luna Lithium (Exploration)
- Ioneer
- Lilac Solutions
- Lithium Americas/ Thacker Pass
- Redwood Materials (Processing)
- Schumberger/ NeoLith Energy (SLB)
- Surge Battery Metals (Exploration)
- Tonopah Lithium Corp.

STAGE 2
Refined Chemical Manufacturing

COMPANIES
- Albemarle
- American Battery Technology Company
- Ioneer
- Lilac Solutions
- Lithium Americas/ Thacker Pass
- Redwood Materials
- Tesla
- Western Ceramics
- Company 1, LLC

STAGE 3
Cathode/ Anode

COMPANIES
- Altairnano
- DragonFly Energy
- Lithion Battery
- NexTech Batteries
- Redwood Materials
- Tesla
- Ultion Technologies Inc.

STAGE 4
Battery Cells

COMPANIES
- Altairnano
- DragonFly Energy
- K2 Energy Solutions
- Lithion Battery
- NexTech Batteries
- Panasonic
- Quantum Copper
- Tesla
- Ultion Technologies Inc.

STAGE 5
Battery Packs

COMPANIES
- Altairnano
- DragonFly Energy
- K2 Energy Solutions
- Lithion Battery
- NexTech Batteries
- Quantum Copper
- Tesla
- Ultion Technologies Inc.

STAGE 6
EV Application

COMPANIES
- NexTech Batteries
- Nuro
- Quantum Copper
- Tesla
- Ultion Technologies Inc.

STAGE 7
Recycling

COMPANIES
- American Battery Technology Company
- Aqua Metals
- LiNiCO Corporation
- Redwood Materials
- Tesla
- Ultion Technologies Inc.

***As of January 2023, the companies listed are to the best of our knowledge.**
To be listed, please contact Carli Smith: c.smith@goed.nv.gov.

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STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
Exploration, Extraction and Processing	Refined Chemical Manufacturing	Cathode/ Anode	Battery Cells	Battery Packs	EV Application	Recycling

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Nevada is the only U.S. state that encompasses every facet of the lithium-ion battery economy and life cycle, from the exploration and mining of natural Lithium deposits to the research and development to production and assembly, and finally the recycling operations.

DEFINED STAGES

STAGE 1: Exploration, Extraction and Processing

1. Exploration is the first step in identifying a lithium deposit that can be developed into a mine. Exploration involves drilling and performing other tests to determine whether there is a lithium deposit that can be profitably mined. If the results are positive, companies then seek permits to develop the mine and processing facilities.
2. Mining involves extracting the lithium minerals either from lithium-rich claystone rocks or brines. Although most Nevada lithium deposits consist of claystone rocks that must be excavated from the ground, the only lithium currently being mined in Nevada is extracted from a lithium-enriched brine that is pumped to the surface for processing. There are several advance-stage Nevada lithium claystone deposits that are expected to become mines in the next several years. Exploration for new brine deposits is also underway.
3. Processing involves a series of physical and chemical steps to extract the lithium from the mined ores or the pumped brines to produce high-purity lithium carbonate or lithium hydroxide that can be further refined in Stage 2 into battery-grade lithium to meet a battery manufacturer's specifications. In addition to recovering lithium, processing may also produce marketable byproducts.

STAGE 2: Refined Chemical Manufacturing

1. Lithium solution is treated through crystallization to remove other minerals such as magnesium and potassium from the solution.
2. Lithium batteries require highly purified lithium chemicals. Significant refinement is necessary to remove contaminants to as low as 1 part per billion.

STAGE 3: Cathode/Anode/Separator/Electrolyte

CATHODE

Lithium chemicals are blended with a chemical "sponge" to make a cathode. The chemicals in the sponge could include cobalt, iron phosphate, manganese oxide, nickel or aluminum. When a battery is being charged, the cathode send energy to the anode for use.

ANODE

1. Anodes are typically made from graphite that has been treated to absorb lithium during the discharge of the battery.
2. Anode can be sourced from natural sources (mines) or synthetically produced.

SEPARATOR

Common plastic is prepared to be as thin as possible with special ion conducting channels. These channels act like the highway allowing the lithium to move from the cathode to the anode during discharge, and flow back to the cathode during charging.

ELECTROLYTE

The electrolyte is a liquid that transports the lithium atoms between the cathode and anode through the separator. This also uses ultrahigh purity lithium carbonate in it's manufacture.

STAGE 4: Battery Cells

1. Each battery contains a series of anodes and cathodes assembled into thin metal foils. These foils collect the current from the anode and cathode and move them to the electrical pickups on the cell. The foils are "stacked" with a separator in between.
   - For cylindrical batteries the series of foils are wound together like a cinnamon roll. These rolls are then inserted into the can or battery cell.
   - For rectangular (prismatic) batteries, the anode, separator and cathode foils are stacked like a layer cake before being inserted into the rectangular pouch or battery cell.
2. The cell is then filled with electrolyte and sealed.

STAGE 5: Battery Packs

1. The battery cells are assembled into packs that fit within the structure of an EV or other appliance.
2. The battery packs include Battery Management Systems, which are computers, high-power electronics, and connections that maintain the internal temperatures and manage the battery charging and discharging.
3. The structure of the battery pack includes armor to protect the user and equipment.

STAGE 6: EV Application

Electric vehicles contain the battery pack, the motor assembly with final drive and the electronics to manage the flow of energy from the battery pack to the motion of the vehicle. The motor assembly can act as a motor or generator to recover the energy of the vehicle when it slows.

STAGE 7: Recycling

With good design and use, lithium batteries can last decades. Ultimately, however, they will fail when the atoms that make up the battery end up in the wrong place to store and discharge energy. Through recycling, many of the materials can be reprocessed and refined into new batteries.