Expansion of Domestic Production of Lithium Carbonate and Lithium Hydroxide to Supply US Battery Industry

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Overview
Expand Lithium Raw Material Base in US

Timeline

Start Date: April 14, 2010

End Date: June, 2014

Barriers

Geothermal Resource
Strength and Viability of Geothermal resource

Forecast Spending

DOE Share - $28.4 million

Rockwood Share - $52.0 million

Partners

Engineering: BE&K (a KBR company), Jacobs Engineering

Environmental Assessment: Nevada Bureau Land Mgmt

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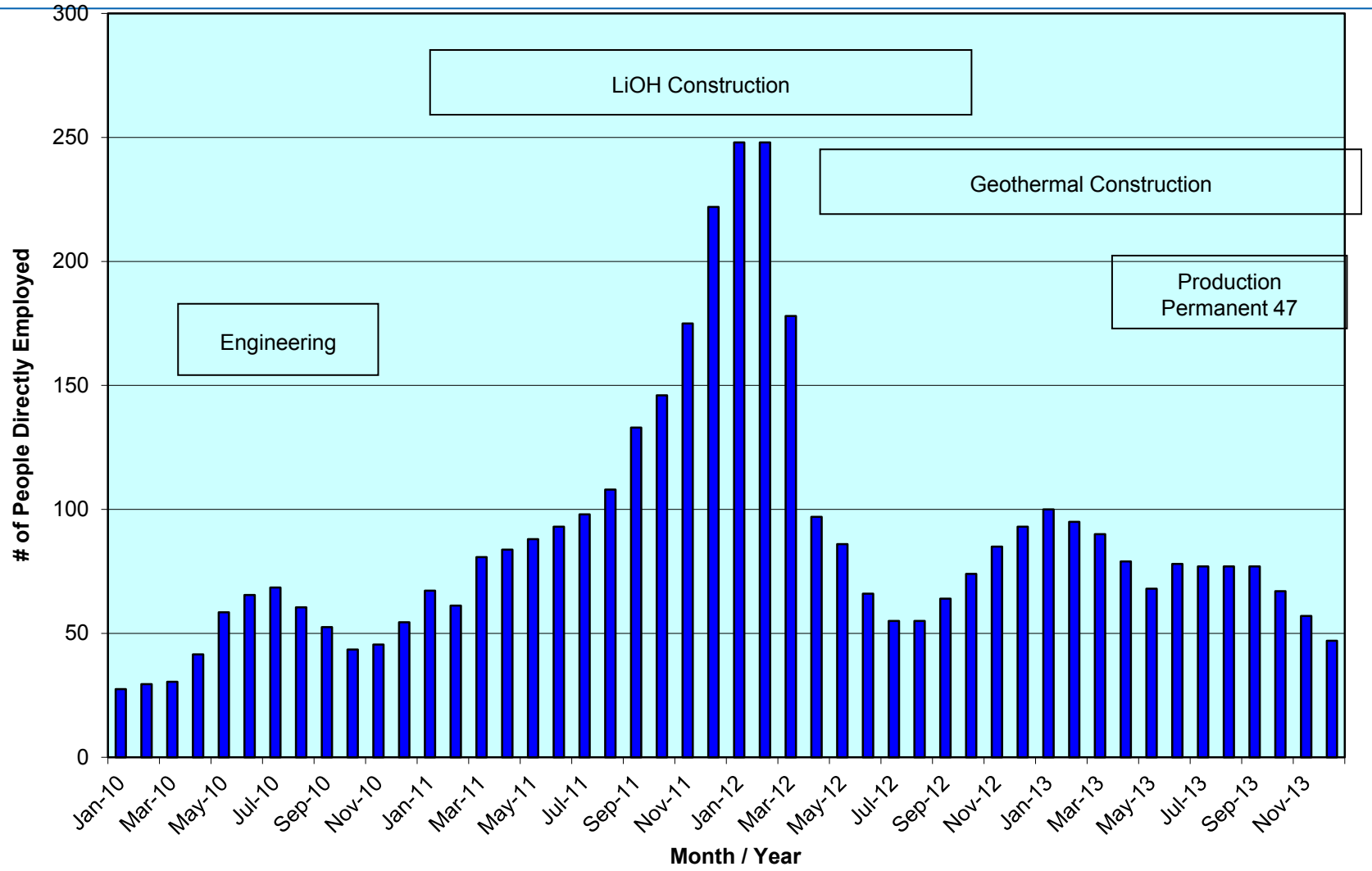
Relevance: Domestic Source of Strategic Materials

- **Objectives**
  - **Expand domestic lithium carbonate and lithium hydroxide production to supply the US electric drive automotive market.**
  - **Deliver high quality lithium products to battery component manufacturers to produce high quality lithium ion batteries.**
  - **Create construction jobs over four years in the US and permanent jobs for production of lithium raw materials.**
  - **Stimulate the US economy with worthwhile long term benefits that will support the conversion to electric drive mobility.**

Relevance: Domestic Source of Strategic Materials

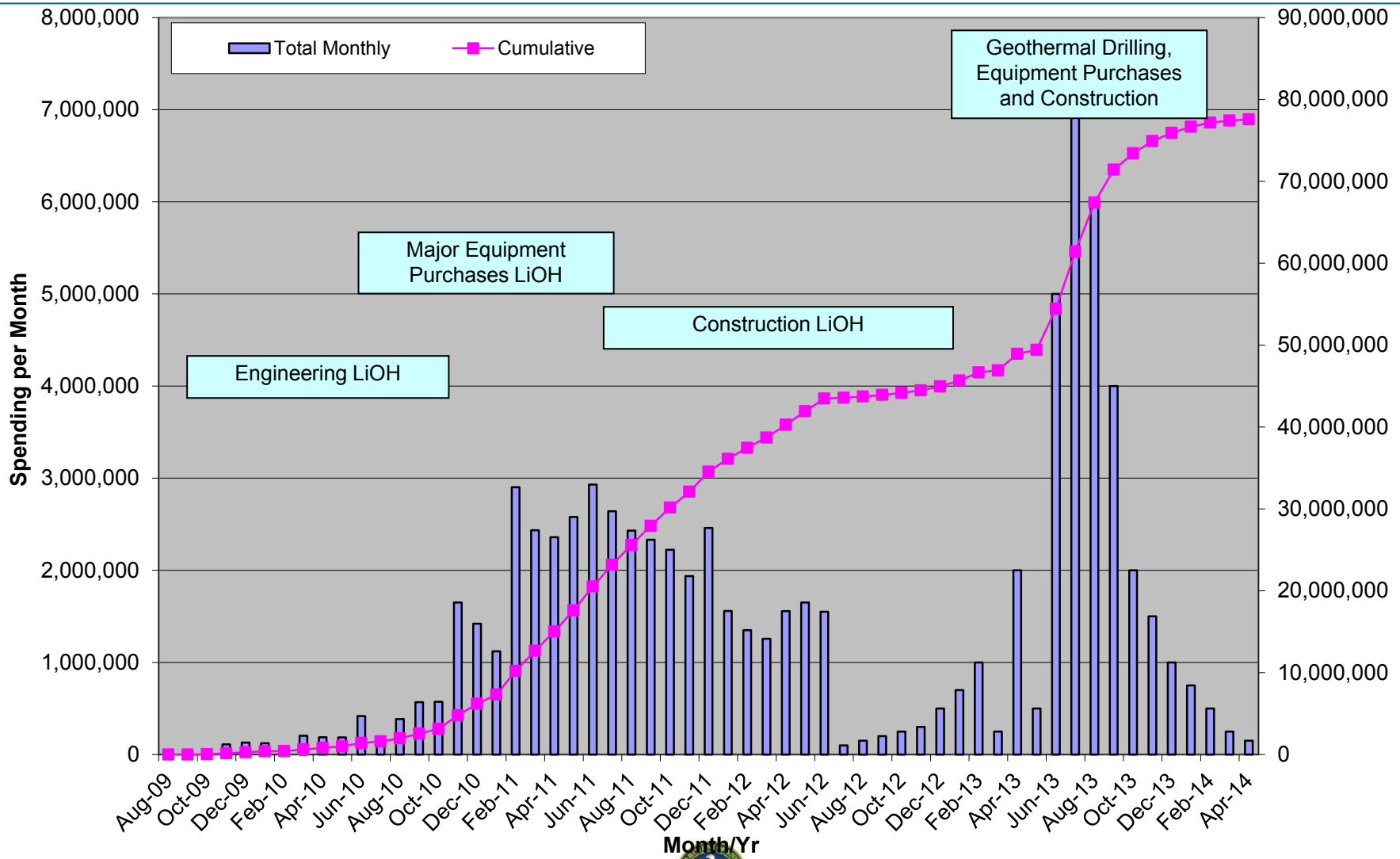
- **Milestones**
  - **Deliver battery grade lithium products to the DOE and component manufacturers in 2012 from this project.**
  - **Maintain the long term viability of domestic production of lithium raw materials by lowering operating cost and at the same time reducing fossil fuel based energy consumption.**
  - **Job Creation throughout 2010-2014 for engineering and construction peak at over 200 workers and 47 permanent positions.**
  - **Stimulate the US economy with over $75 Million in direct spending over the three year period.**

Relevance: Job Creation



Relevance: Economic Stimulus

Direct Spending (not including peripheral effect)



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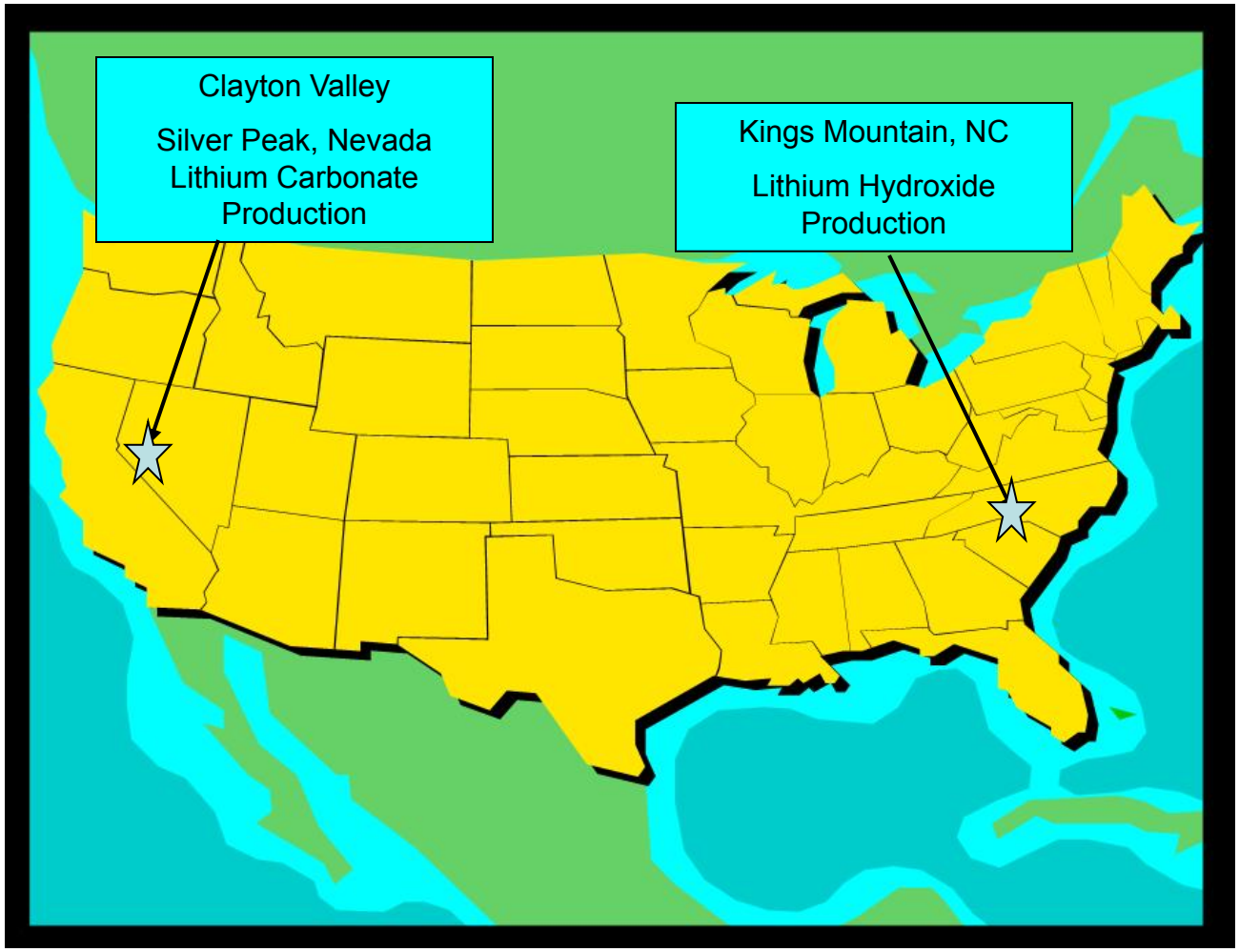
Approach: Expand Domestic Production of Key Lithium Raw Materials



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Approach: Lithium Carbonate Expansion Solar Evaporation Ponds in Silver Peak, Nevada

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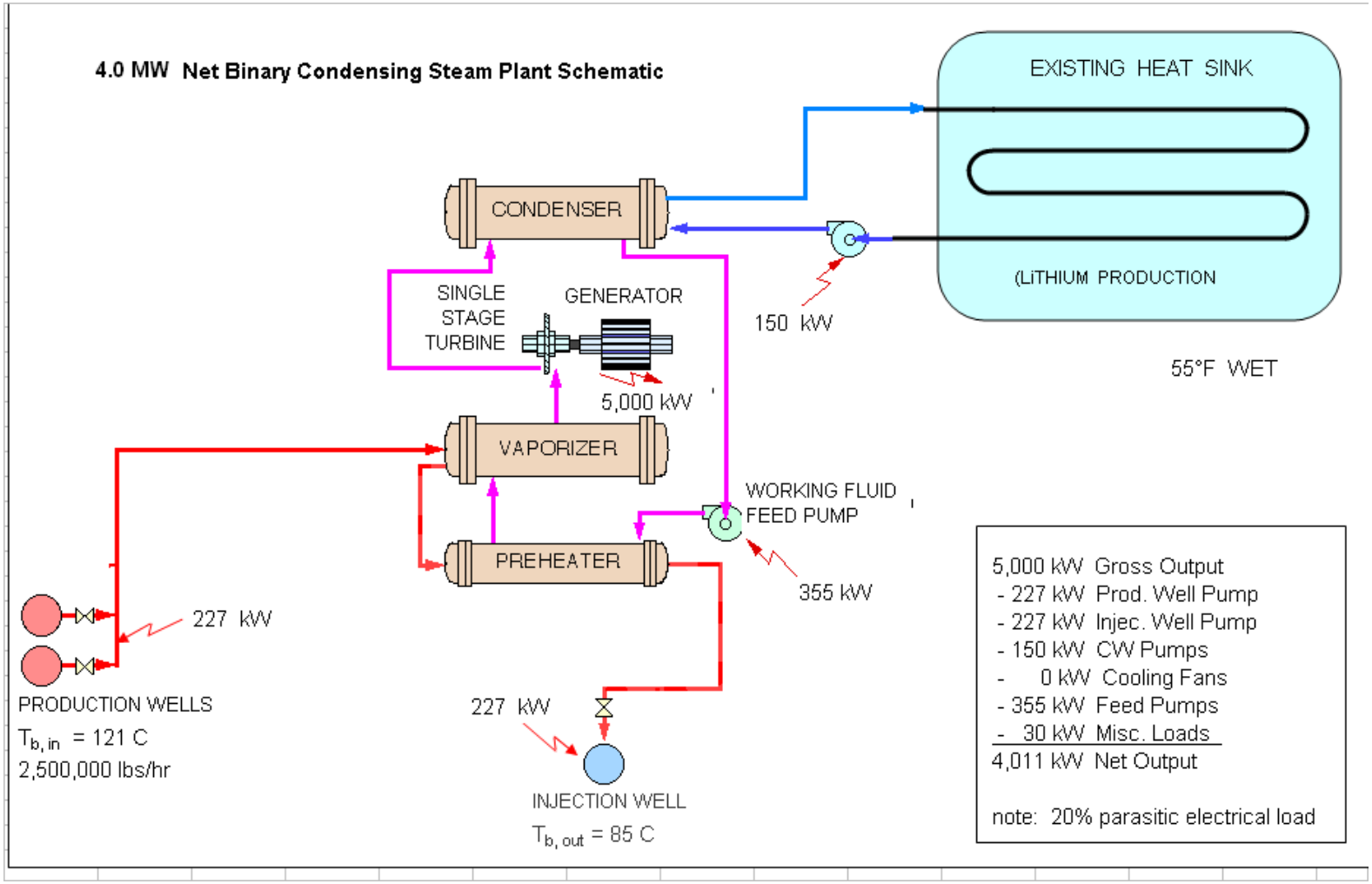
Approach: Lithium Carbonate Expansion

- **Expand lithium carbonate plant in Nevada using green technology.**
  - **Expand use of solar energy used to evaporate water and concentrate lithium in brine.**
  - **Install a new geothermal power plant to provide electricity for pumping and processing lithium brines and conversion into lithium carbonate.**
  - **Create the greenest lithium carbonate plant in the world with an energy usage of 99+ % solar and geothermal.**
  - **Technical barrier is geothermal viability. Exploration will determine whether sufficient resource is available. Early indications are favorable.**
  - **Go/no-go decision on geothermal in 2013 based on resource temperature and flow.**
  - **Environmental assessment of geothermal production currently underway in joint effort between Chemetall Foote, DOE and Nevada BLM.**

Approach: Geothermal Power Plant



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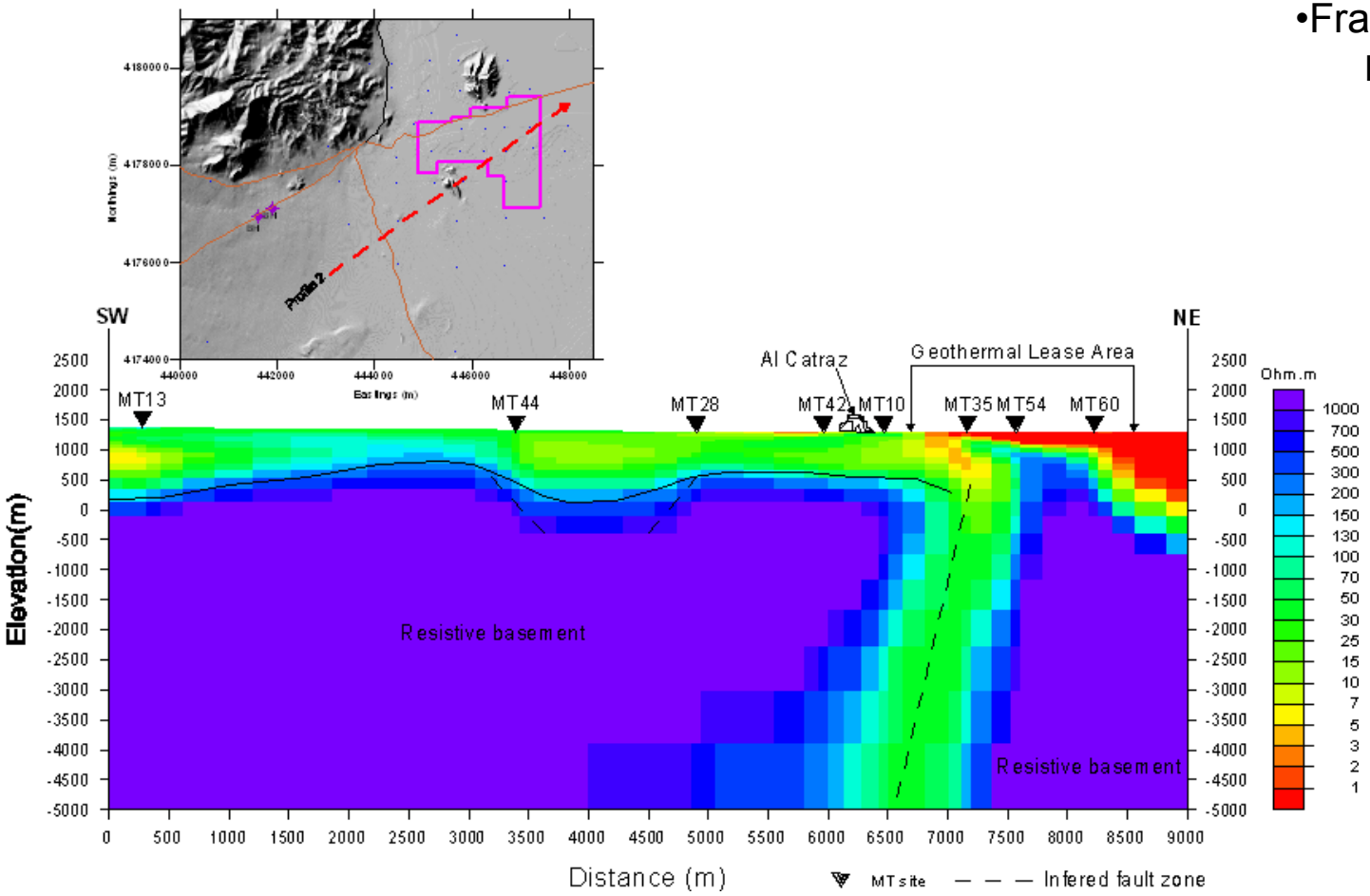
Approach: Geothermal Power Plant
Results of Geotechnical Evaluation



- Fractured zones (fault lines) identified
- Blue = rock
- Red = brine

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Silver Peak Equipment

Silver Peak Equipment

Geothermal Generator Set

Approach: Lithium Hydroxide Plant

- **Kings Mountain Lithium Hydroxide Plant will use best available technology developed by Chemetall Foote.**
- **Combination of purification techniques will provide battery grade lithium hydroxide for the automotive industry.**
- **Key parameters are low variability, low concentration of contaminants.**
- **Major milestones are start of construction late 2010 and startup early 2012.**
- **PROJECT COMPLETED IN 2012**

Technical Accomplishments and Progress

- **Project Approved April 14, 2010.**
- **KINGS MOUNTAIN PORTION**
  - Lithium Hydroxide Basic and Detailed Engineering Complete
  - Started Up Lithium Hydroxide Plant May 2012 (segment complete)
- **SILVER PEAK PORTION**
  - Geotechnical evaluation completed at Silver Peak showed high feasibility for geothermal power plant
  - Lithium Drill Rig in operation (complete project early 2013)
  - Geothermal Test Well in progress
- **OVERALL**
  - Overall Spending over $45 Million of $80 Million forecast and 2 of 3 projects completed successfully

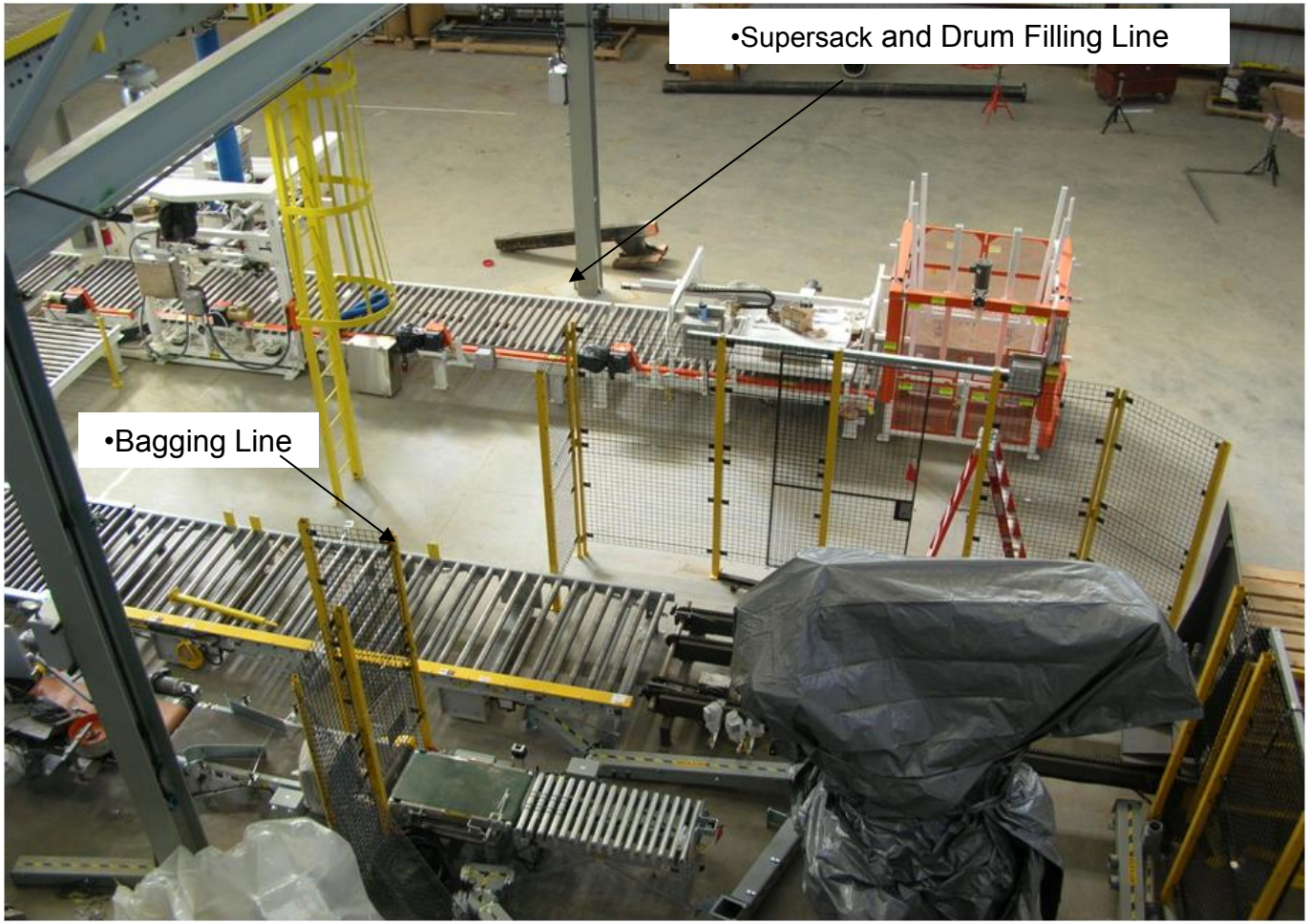
Lithium Hydroxide Expansion

•New LiOH Unit

Lithium Hydroxide Expansion

•Condensers

Lithium Hydroxide Expansion



Collaborations/Partnerships

- **Engineering on LiOH complete has been primarily in conjunction with BE&K (a KBR company located in Birmingham, AL).**
- **Environmental assessment for Geothermal is a joint effort by DOE, Chemetall Foote and the Nevada BLM.**
- **Engineering for Geothermal power plant in conjunction with Jacobs Engineering, Greenville SC**

Completed and Future Work

- **2010**
  - Completed basic engineering Lithium Hydroxide, purchased major equipment, started preparation for construction
  - Completed exploration for Silver Peak Geothermal viability
- **2011**
  - Completed purchase of equipment and detailed engineering for lithium hydroxide plant
  - Completed majority of construction of lithium hydroxide plant
- **2012**
  - Started up lithium hydroxide plant May 2012 (COMPLETED PROJECT SEGMENT Kings Mountain)
  - Continue lithium carbonate expansion drilling program
- **2013**
  - Complete lithium carbonate expansion drilling program
  - Drill observation and first production well for geothermal plant and reach second go/no-go point
  - Complete geothermal production well drilling and pipe line construction
  - Build geothermal power plant
- **2014**
  - Startup geothermal power plant

Summary

- Objective: Supply key raw materials to lithium battery industry and create jobs and support stimulus of US economy.
- Relevance: Chemetall Foote is only domestic supplier to lithium battery industry and is expanding operations.
- Approach: Lower costs and improve technology to enhance ability to be long term supplier to industry.
- Milestones: Hydroxide and carbonate portions completed. Geothermal plant go/no-go feasibility decision point to be evaluated in 2013.
- Timeline: All projects implemented between first quarter 2012 and first quarter 2014.