DOCKETED	
Docket Number:	20-LITHIUM-01
Project Title:	Lithium Valley Commission
TN #:	243673
Document Title:	Presentation - Convening of the Lithium Valley Commission
Description:	"This document supersedes TN 243570" -Presentation Slideshow of June 16, 2022 Lithium Valley Commission meeting.
Filer:	Erica Loza
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	6/22/2022 3:00:36 PM
Docketed Date:	6/22/2022

Convening of the Lithium Valley Commission

Convocatoria de la Comisión de Lithium Valley

June 16, 2022

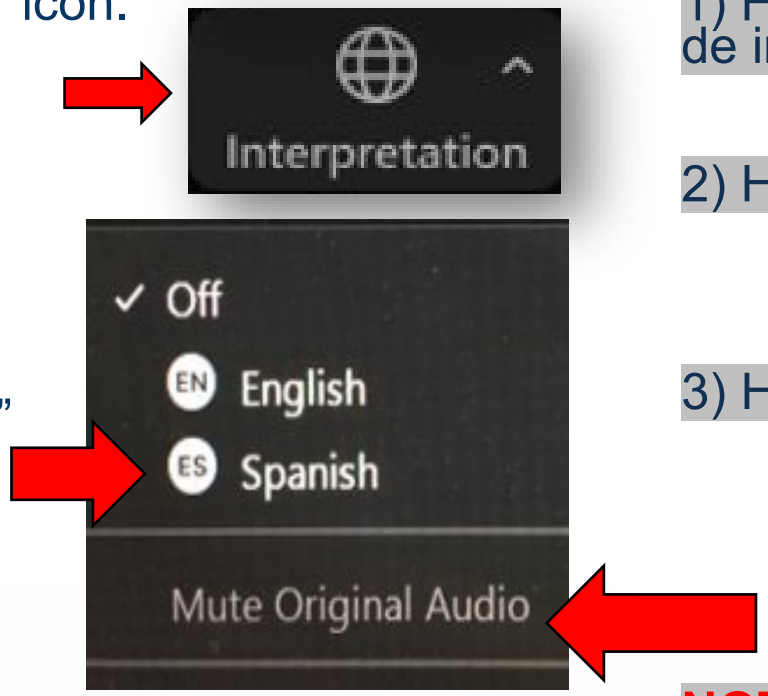
16 de Junio de 2022

Interpretation / Interpretación

1) Click globe “Interpretation” icon.

2) Click “ES Spanish” option

3) Click “Mute Original Audio”



1) Haga clic en el icono del globo de interpretación

2) Haga clic donde dice “ES Spanish”

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NOTE: To access interpretation, download Zoom application on your device. Interpreter will relate everything from English to Spanish during meeting and will inform you when to make public comment. Speak in Spanish and interpreter will relate comments to English.

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Steps to Select English Channel

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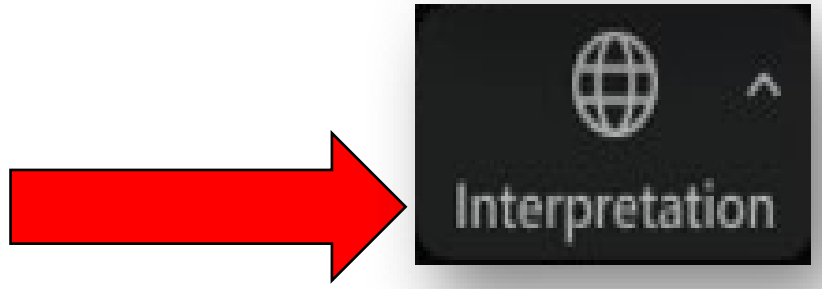
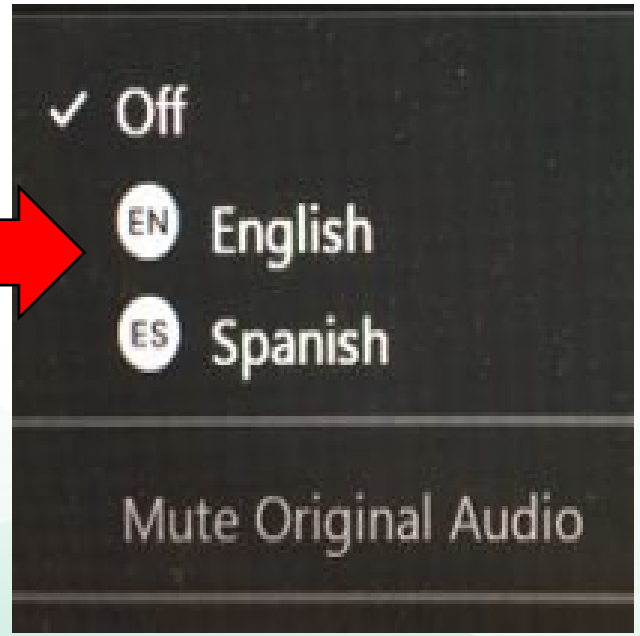


2) Click “EN English” option



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- Meeting conducted with in person locations and remotely via Zoom
  - Recorded and transcribed by court reporter
- To participate in public comment
  - By computer: use the “raise hand” feature in Zoom
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- Questions and Comments can be entered in the Q&A section of the Zoom application

- Reunión realizada de manera presencial y remota a través de Zoom
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- Para participar en los comentarios públicos
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  - Por teléfono: marque *9 para “levantar la mano” y *6 para silenciar y activar el sonido

Instructions / Instrucciones

- Written comments
  - Submit through the e-commenting system at: https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-LITHIUM-01
- Website and Docket
  - www.energy.ca.gov/LithiumValleyCommission
  - https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-LITHIUM-01

- Comentarios por escrito
  - Se deben enviar a través del sistema de comentarios electrónicos en: https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-LITHIUM-01
- Página web y la Unidad de Expedientes de la CEC
  - www.energy.ca.gov/LithiumValleyCommission
  - https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-LITHIUM-01

Welcome and Roll Call / Bienvenida y paso de lista

Agenda / Agenda

1. Welcome and Roll Call
2. Workshop on the Role of Existing and New Geothermal Facilities in the Salton Sea Region to Support Reliability, Grid Stability, Resiliency and Clean Energy Goals
    a) Discussion Among Lithium Valley Commissioners
3. Workshop on Overcoming Challenges Extraction, Processing, and Production of Lithium from Geothermal Brine
    a) Panel Discussion with Lithium Extraction Project Developers
    b) Challenges and Solutions to Lithium Extraction from Geothermal Brines in the Salton Sea
    c) Discussion Among Lithium Valley Commissioners
4. Discussion and Possible Action on Draft Findings and Recommendations Identified During the Incentive Workshop Held on May 26, 2022
5. Planning for Upcoming Lithium Valley Commission Meetings and Activities
6. Administrative Items
    a) Approval of Meeting Action Minutes for the Meetings on March 24, 2022; May 12, 2022; and May 26, 2022
7. Informational Items
    a) Media and Legislative Updates
    b) Lithium Valley Commissioner Updates
8. Public Comment
9. Adjourn

1. Bienvenida y paso de lista
2. Taller sobre el Papel de las instalaciones geotérmicas existentes y nuevas en la región de Salton Sea para apoyar la fiabilidad, la estabilidad de la red, la resiliencia y los objetivos de energía limpia
    a) Discusión entre los comisionados de Lithium Valley
3. Taller sobre la Superación de los desafíos de extracción, procesamiento y producción de litio a partir de salmueras geotérmicas
    a) Panel de discusión con desarrolladores de proyectos de extracción de litio
    b) Desafíos y soluciones de la extracción de litio de las salmueras geotérmicas en Salton Sea
    c) Discusión entre los comisionados de Lithium Valley
4. Discusión y posibles medidas sobre los borradores de los resultados y recomendaciones identificados durante el Taller de incentivos que se realizó el 12 de mayo de 2022
5. Planificación de próximas reuniones y actividades de la Comisión de Lithium Valley
6. Temas administrativos
    1. Aprobación de las actas de acción de las reuniones del 24 de marzo de 2022, 12 de mayo de 2022 y 26 de mayo de 2022
7. Temas informativos
    1. Actualización sobre medios y legislación
    2. Actualización sobre el comisionado de Lithium Valley
8. Comentarios del público
9. Cierre de la sesión

Workshop on the Role of Existing and New Geothermal Facilities in the Salton Sea Region to Support Reliability, Grid Stability, Resiliency and Clean Energy Goals / Taller sobre el Papel de las instalaciones geotérmicas existentes y nuevas en la región de Salton Sea para apoyar la fiabilidad, la estabilidad de la red, la resiliencia y los objetivos de energía limpia

Erica Brand

Electric Generation System Program Specialist

Siting Transmission, and Environmental Protection Division (STEP)

California Energy Commission

Resource Build to Achieve 100% Clean Electricity

June 16, 2022

Presenter: Erica Brand, Land Use and Infrastructure Planning Unit

Siting, Transmission, and Environmental Protection Division

California's Clean Electricity Goals

2020

33%

2030

60%

Under the Renewables Portfolio Standard, eligible resources include solar, wind, geothermal, biomass and small hydroelectric.

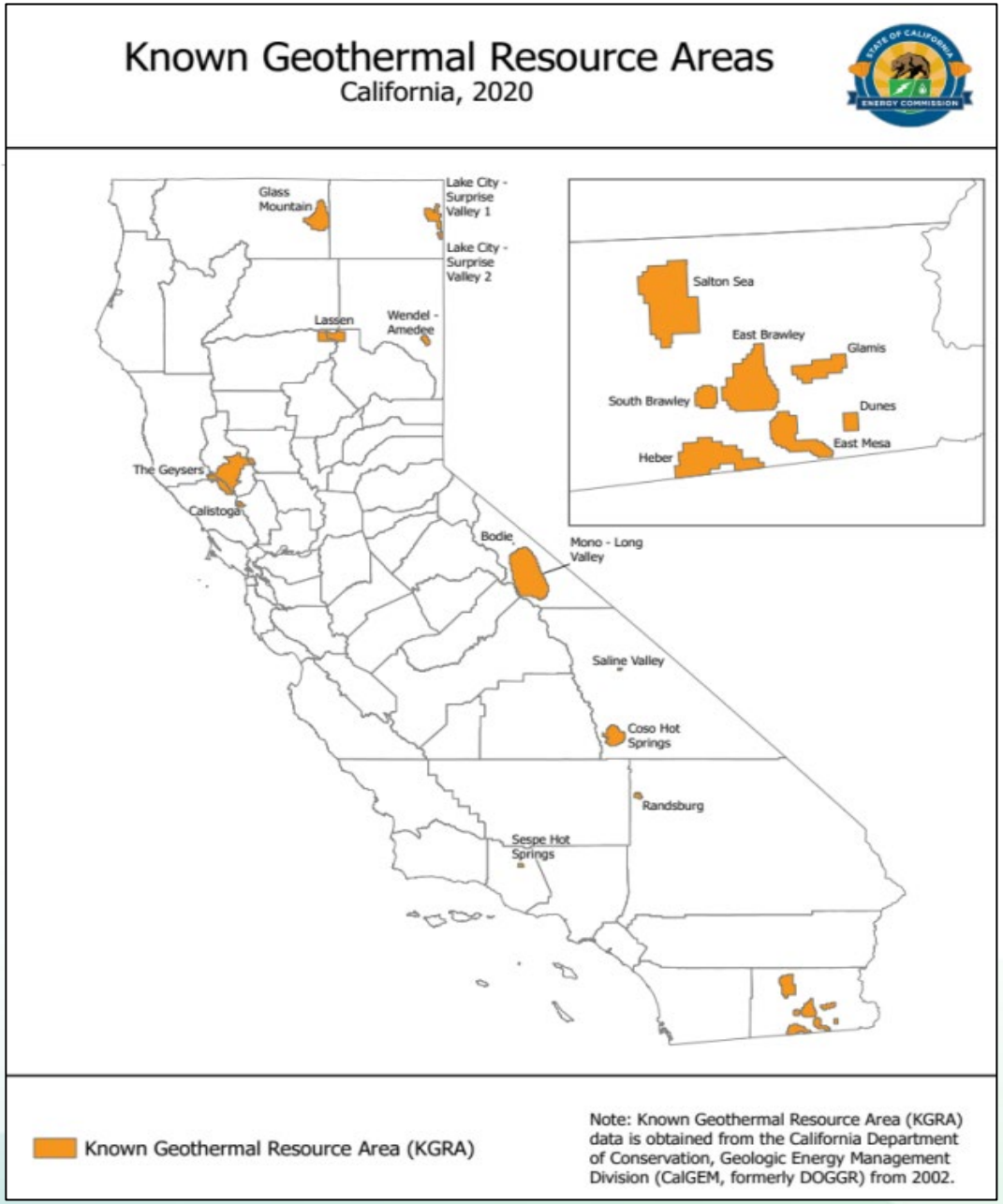
2045

100%

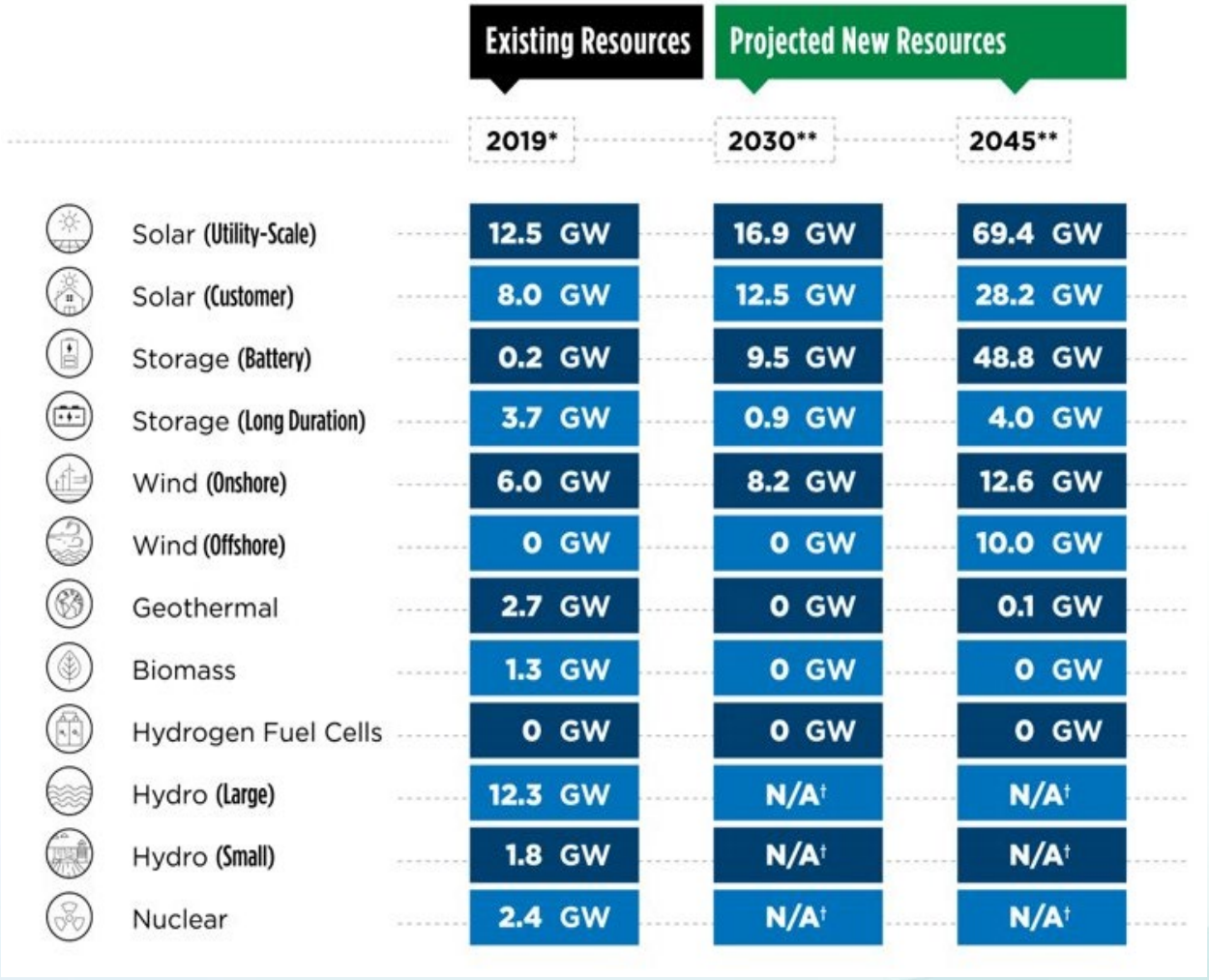
Under SB 100 which expands eligibility to include additional carbon-free resources

Geothermal Energy

- Provides an important California source of renewable energy
- Considered a “firm resource”
- Supports a diverse clean energy portfolio
- Has a small land use footprint compared to other renewable energy generation sources



Geothermal Energy in the 2021 SB 100 Report



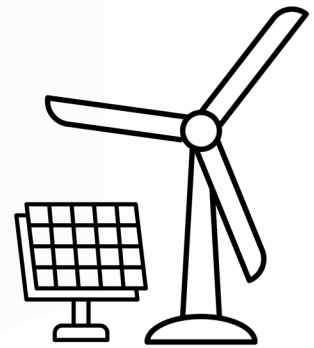
	Existing Resources	Projected New Resources	
	2019*	2030**	2045**
Solar (Utility-Scale)	12.5 GW	16.9 GW	69.4 GW
Solar (Customer)	8.0 GW	12.5 GW	28.2 GW
Storage (Battery)	0.2 GW	9.5 GW	48.8 GW
Storage (Long Duration)	3.7 GW	0.9 GW	4.0 GW
Wind (Onshore)	6.0 GW	8.2 GW	12.6 GW
Wind (Offshore)	0 GW	0 GW	10.0 GW
Geothermal	2.7 GW	0 GW	0.1 GW
Biomass	1.3 GW	0 GW	0 GW
Hydrogen Fuel Cells	0 GW	0 GW	0 GW
Hydro (Large)	12.3 GW	N/A†	N/A†
Hydro (Small)	1.8 GW	N/A†	N/A†
Nuclear	2.4 GW	N/A†	N/A†

Findings

- Core scenario includes **135 MW** of geothermal in 2045
- Model selected up to **2 GW** of geothermal when new out of state wind or offshore wind are not available
- Additional analysis is needed to understand geothermal energy's potential

To Achieve Clean Energy

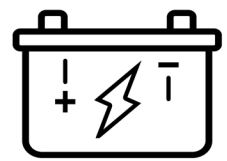
Development Needs To Rapidly Accelerate



Solar & Wind

3X

Solar and wind build rates need to nearly triple*



Battery

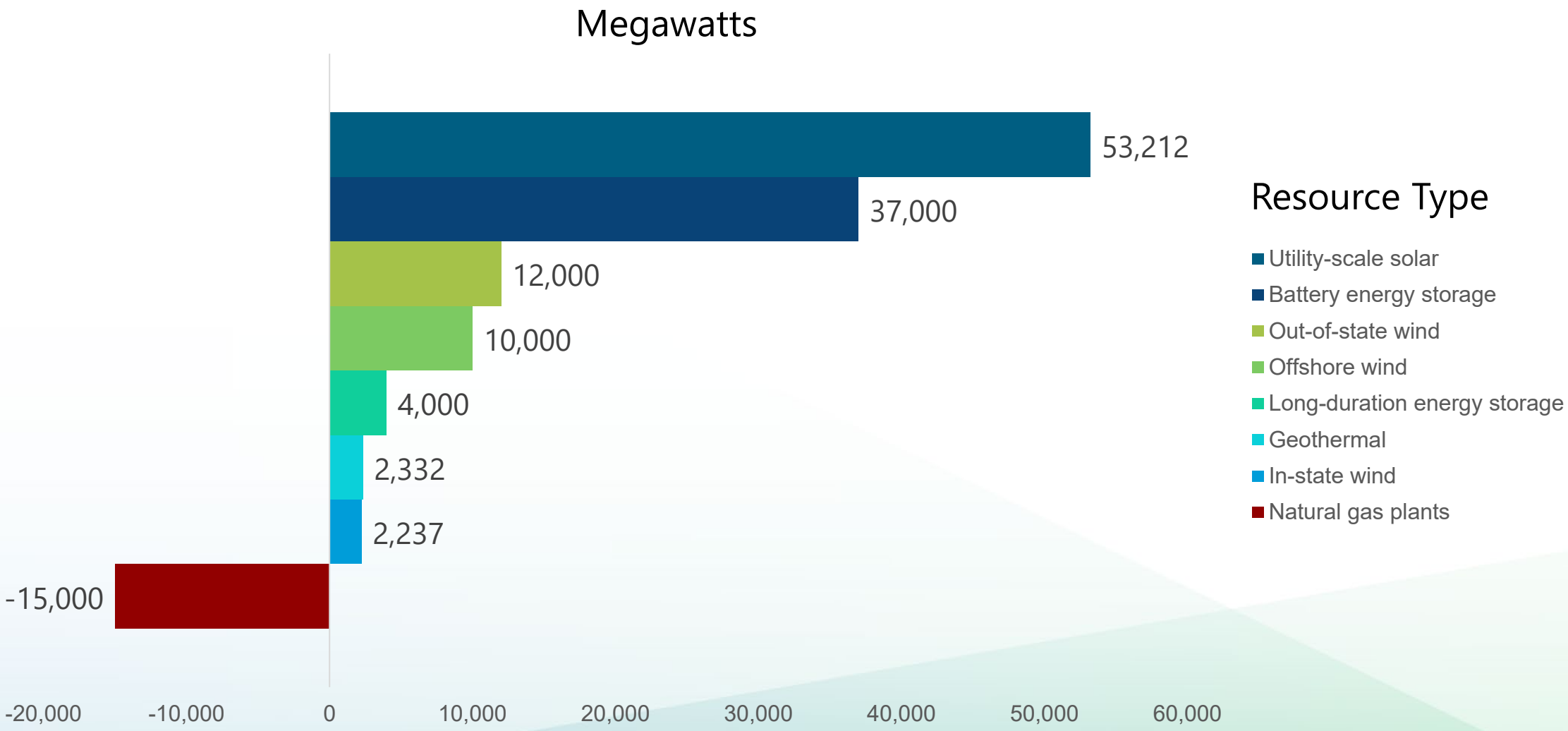
8X

Battery storage build rates need to increase by nearly eightfold**

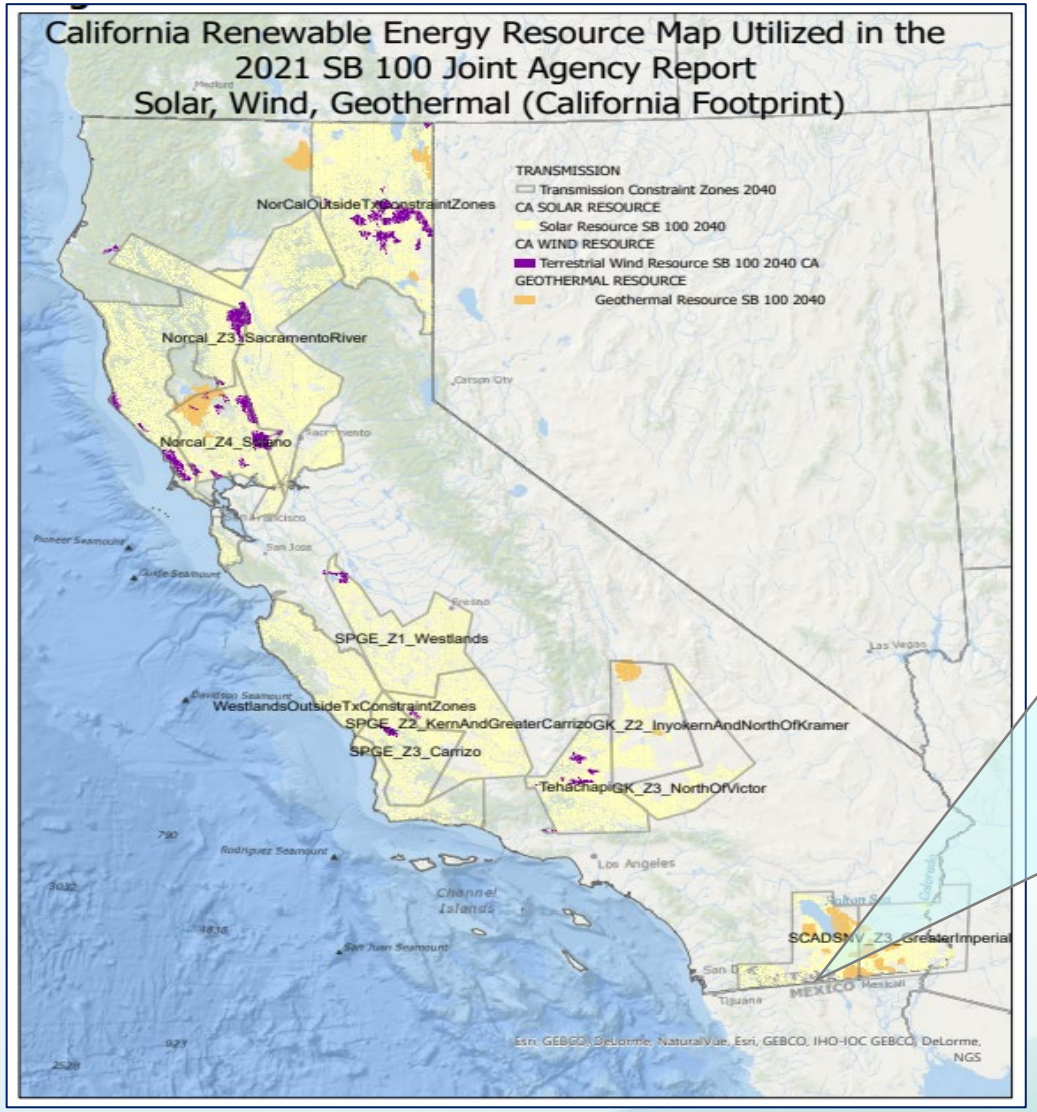
*Based on 10-year average | **Based on 2020

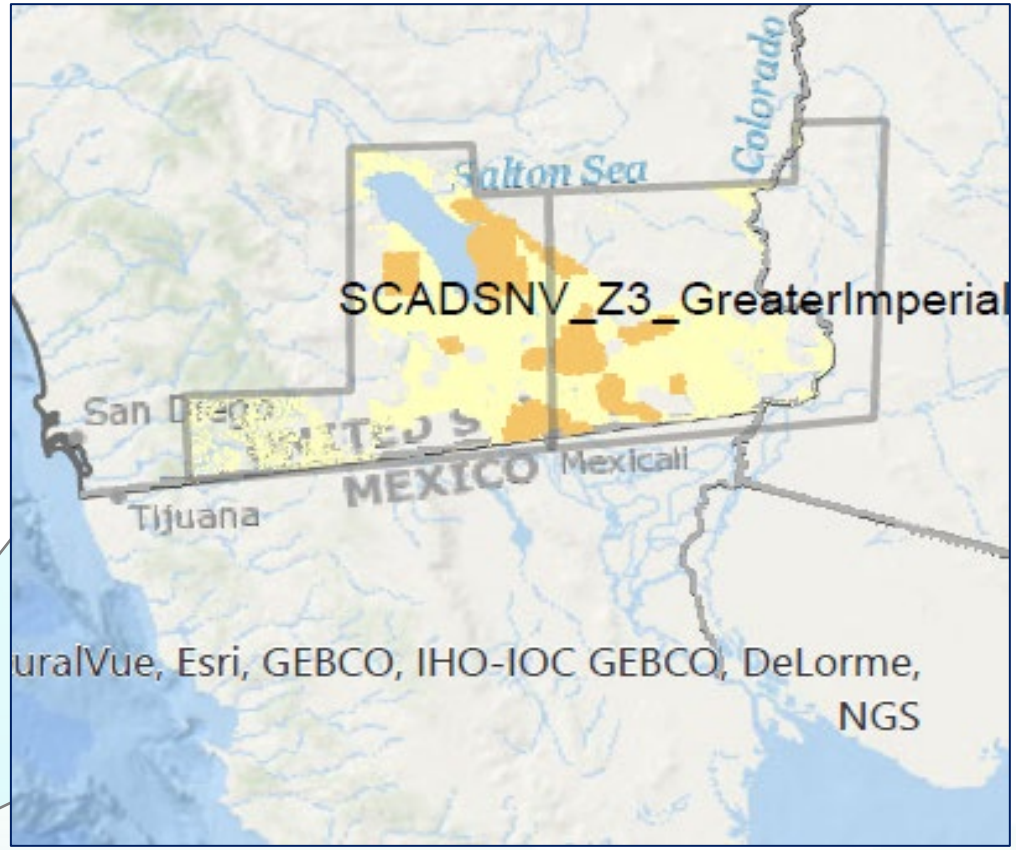
SB 100 Planning and Resource Build Activities

Starting Point Scenario (2040)



Starting Point Scenario: Geographic Allocation of Resources





The map above highlights geothermal resources in the Salton Sea Region and Imperial Transmission Zone

2022 Priority Land Use Activities

1. Continue interagency coordination on land use in energy resource planning.
2. Solicit input on future SB 100 modeling to best incorporate land use implications.
3. Expand local outreach and engagement on future resource build pathways to achieve SB 100.
4. Coordinate with CEC Integrated Energy Policy Report (IEPR) team on California Planning Library that includes land use information.

Contact

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Jared Ferguson

Senior Regulatory Analyst

Energy Division

California Public Utilities Commission

Integrated Resource Planning (IRP)

June 16, 2022

Lithium Valley Commission Workshop on the Role of Existing and New Geothermal Facilities in the Salton Sea Region

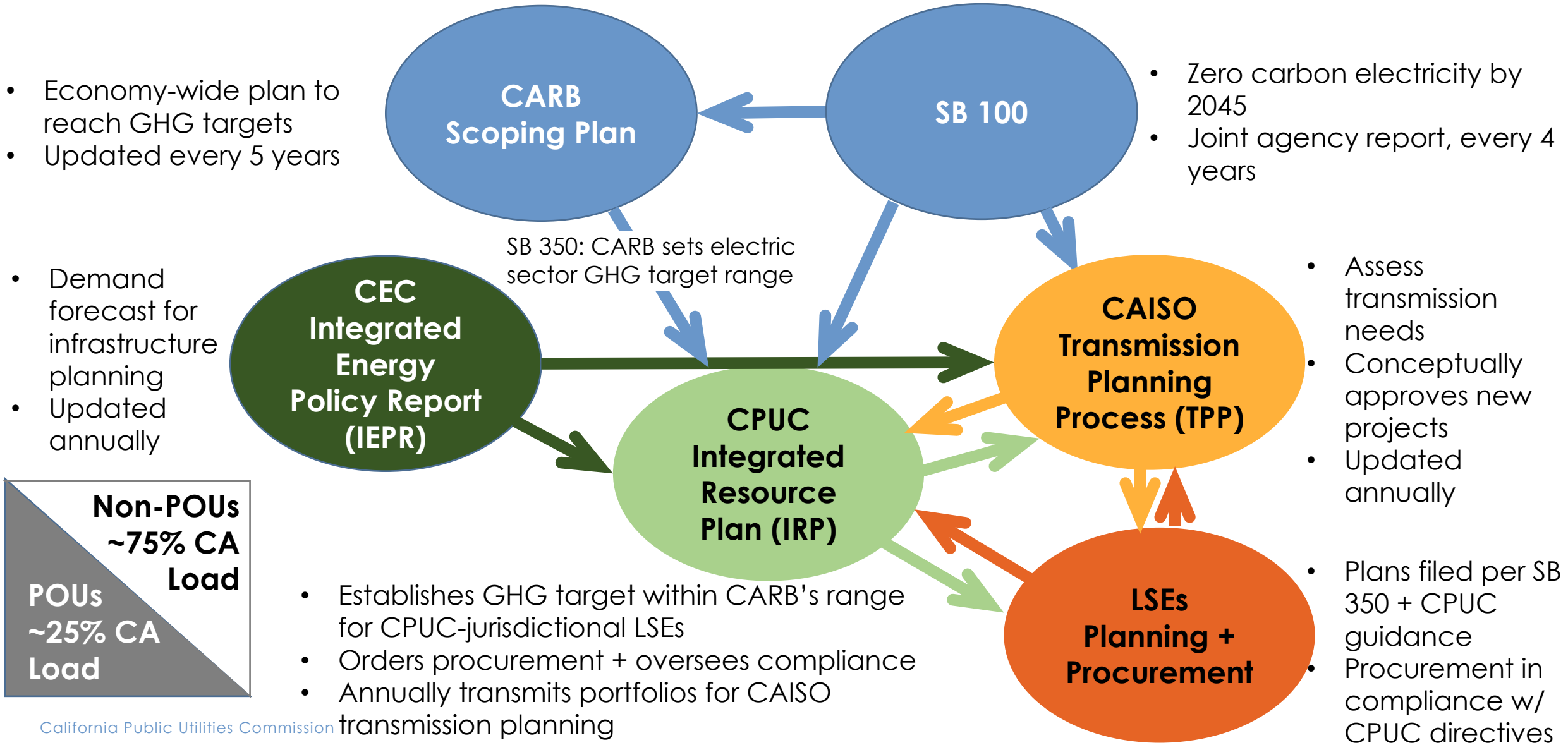
Energy Division Staff Presentation

California Public Utilities Commission

Integrated Resource Planning (IRP) in California Today

- IRP Objective: Reduce the cost of achieving GHG reductions and other policy goals by looking across individual load serving entity (LSE) boundaries and resource types to identify solutions to reliability, cost, or other concerns that might not otherwise be found.
- Specific goals of the just completed 2019-2021 IRP cycle:
  - Ensure that the electric sector is on track to help California reduce economy-wide GHG emissions 40% from 1990 levels by 2030, per SB 32,
  - Explore how achievement of SB 100 2045 goals could inform IRP resource planning in the 2020 to 2032 timeframe.
- The IRP process has two parts:
  1. It identifies an optimal portfolio for meeting state policy objectives and encourages the LSEs to procure towards that future.
  2. It collects and aggregates the LSEs' collective efforts for planned and contracted resources to compare the expected system to the identified optimal system. The CPUC considers a variety of interventions to ensure LSEs are progressing towards an optimal future.

California's Electricity Planning Ecosystem



- Economy-wide plan to reach GHG targets
- Updated every 5 years

- Zero carbon electricity by 2045
- Joint agency report, every 4 years

- Demand forecast for infrastructure planning
- Updated annually

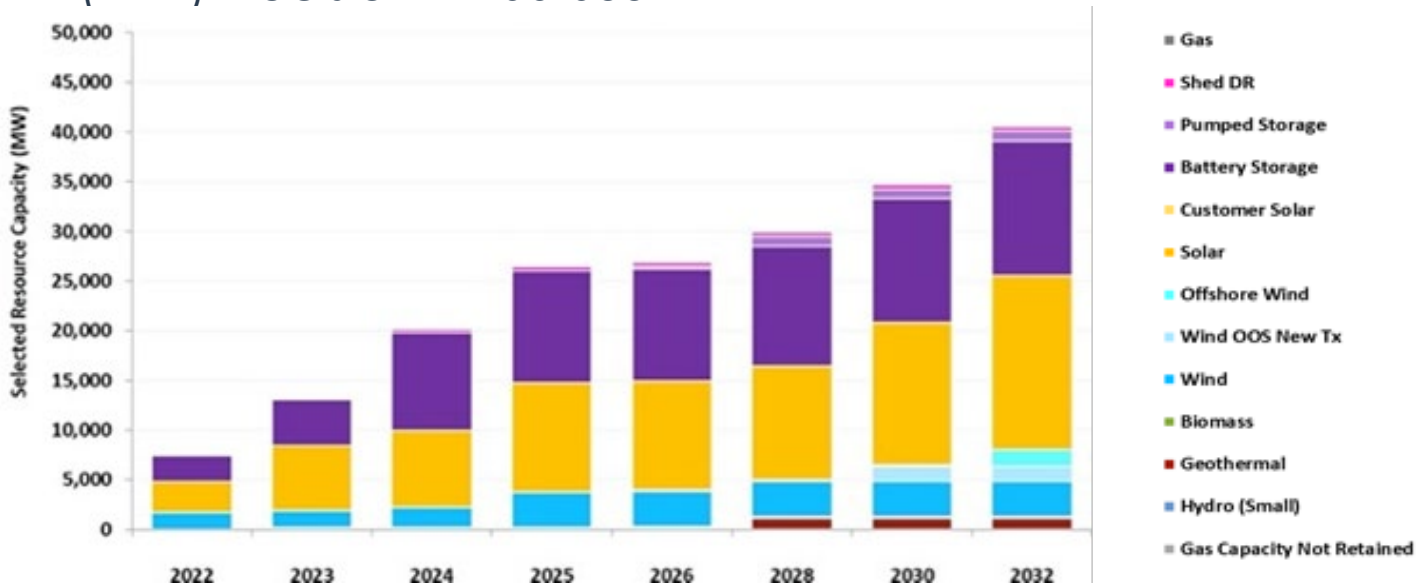
- Assess transmission needs
- Conceptually approves new projects
- Updated annually

- Establishes GHG target within CARB's range for CPUC-jurisdictional LSEs
- Orders procurement + oversees compliance
- Annually transmits portfolios for CAISO transmission planning

- Plans filed per SB 350 + CPUC guidance
- Procurement in compliance w/ CPUC directives

2021 Preferred System Plan (PSP)

- Decision adopted by the CPUC on February 10, 2022:
  - Lowers the 2030 GHG target to 38 million metric tons (MMT) from the previous 46 MMT target adopted for the RSP earlier this cycle. Also tells LSEs to plan for both 38 MMT and 30 MMT targets next cycle.
  - Includes a **PSP Portfolio** for use in planning, procurement, and to be transmitted to the California Independent System Operator (CAISO) for use in the 2022-23 Transmission Planning Process (TPP).
- **PSP portfolio** includes ~25,500 MW (nameplate) of new supply-side renewables and ~15,000 MW of new storage and demand response resources by 2032.
  - Includes aggregated LSE plans and assumes procurement in compliance with the Mid-Term Reliability (MTR) Decision 21-06-035



Resource Type	MW by 2032
Biomass	134
Geothermal	1,160
Wind	3,531
Wind OOS New Tx	1,500
Offshore Wind	1,708
Utility-Scale Solar	17,506
Battery Storage	13,571
Long-duration Storage	1,000
Shed Demand Response	441
Total	**40,551**

Geothermal resources in the 2021 PSP

- By 2032, PSP portfolio contains over 1.1 GW of new geothermal.
  - Geothermal selection spurred by the Mid-Term Reliability (MTR) Decision 21-06-035 requirements for LSEs to procure 1,000 MW of clean firm resources, such as geothermal.
- Geothermal resources in the PSP portfolio were then mapped to specific areas through the busbar mapping process.
  - **Busbar Mapping** is the process for translating geographically coarse portfolios developed through IRP to plausible locations for use in the CAISO's annual Transmission Planning Process (TPP).
  - Joint effort using stakeholder vetted methodology by a working group comprised of CPUC, CEC, and CAISO staff.
  - Utilizes commercial development interest, land use/environmental constraints, and transmission capability limits to optimize the locations of potential new resources.

Geothermal Area	MWs Mapped
Imperial Valley (IID)	600
Southern Nevada	440
Eastern Sierras (Mono County)	41
Geysers (Lake County)	79
Total:	**1160**

Geothermal resources selected by 2032 by area in the 2021 PSP portfolio.

IRP and Transmission Planning

- The CPUC typically transmits multiple distinct portfolios developed in the IRP process to the CAISO for use in their annual Transmission Planning Process (TPP):
  - **Reliability and Policy-Driven Base Case portfolio** -> used by the CAISO in the TPP assessment to identify transmission solutions that then go to the CAISO Board of Governors for approval
  - **Policy-Driven Sensitivity portfolio(s)** -> used for study purposes and transmission solutions that generally have not gone for approval; results provide transmission information for future IRP work
- Mapped 2021 PSP portfolio was transmitted to the CAISO for use as the base case portfolio in the current 2022-23 TPP, which will study the transmission needs in 2032.
- Mapped sensitivity portfolio will be transmitted to the CAISO at the end of June.
  - Utilizes a high electrification load assumption, a 30 MMT GHG target by 2030, and models resource build out to 2035.
- The 600 MW of geothermal mapped in the Imperial area aligns with the past two base case portfolios utilized for the 2020-21 TPP and 2021-22 TPP.

For more information:

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Jamie Asbury

Manager

Energy Department

Imperial Irrigation District

THE ROLE OF GEOTHERMAL

Lithium Valley Commission

June 16, 2022

IID
A century of service.

Imperial Irrigation District

- Load Serving Entity
  - *158,000 Retail Customers with a Peak Load of 1185 MW*
- Generation Resources
  - *629 MW*
- Procured Resources
  - *315 (includes 70 MW of geothermal)*
  - *65 MW under contract to COD 2024 and beyond*
- Balancing Authority
  - *1310 MW of Third Party Interconnected Generation*

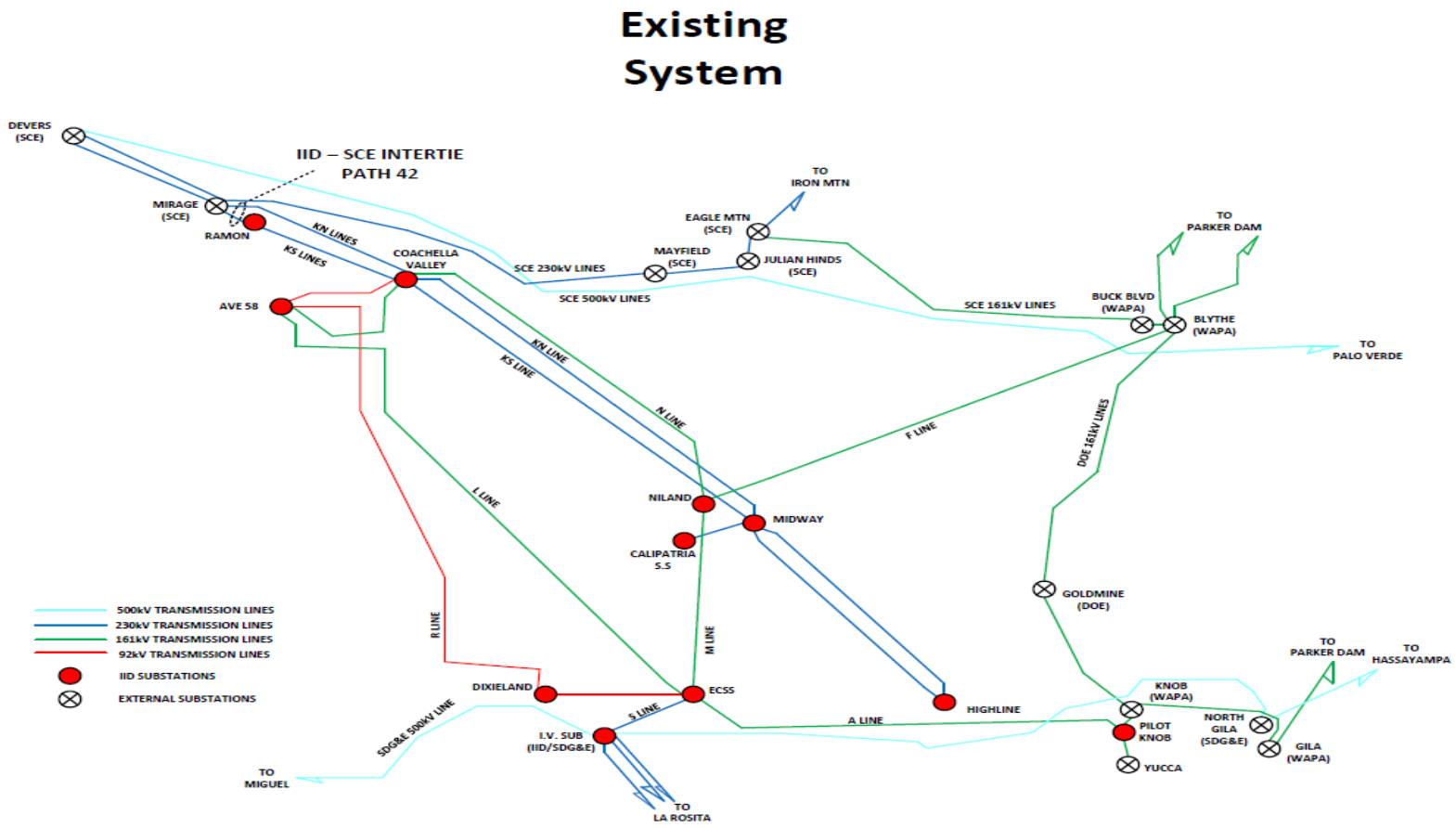
Existing Geothermal

- Existing Geothermal
  - *17 Plants*
  - *Nameplate Capacity: 652 MW*
  - *Existing Salton Sea KGRA Capacity: 488 MW*
  - *Salton Sea KGRA Facilities: CalEnergy (11 plants) and EnergySource (1 plant)*
  - *Exports to CAISO and to Salt River Project*
  - *Remaining geothermal is from plants owned and operated by Ormat located at East Mesa, Heber and North Brawley.*

Queued Geothermal Projects

- IID's current interconnection queue:
  - *21 projects (biomass, geothermal, solar and storage)*
  - *Proposed capacity of 2370 MW*
- Queued Geothermal:
  - *Proposes new capacity of 907 MW*
  - *All located in the Salton Sea Region*
  - *Generally associated with secondary process for lithium extraction*

Transmission to Facilitate Export

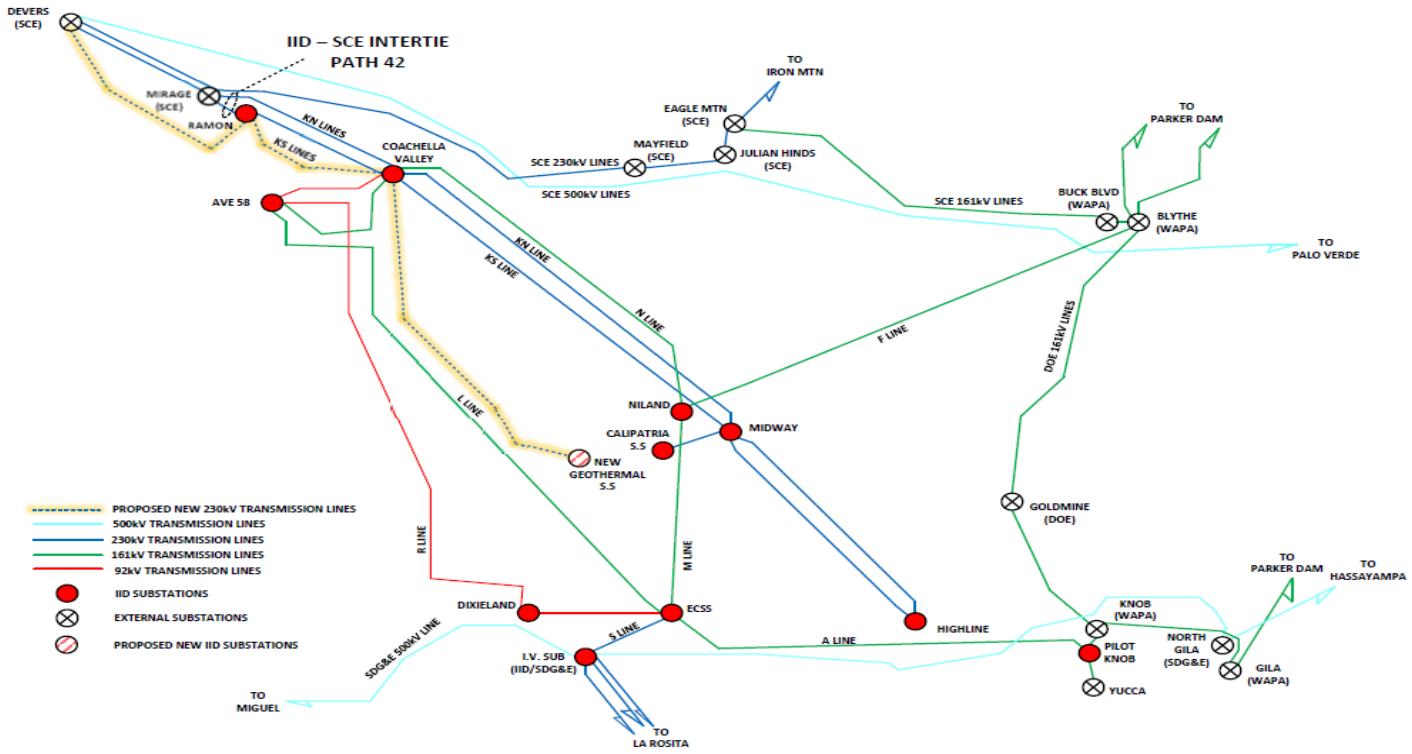


IID

A century of service.

Transmission – Interim Solution

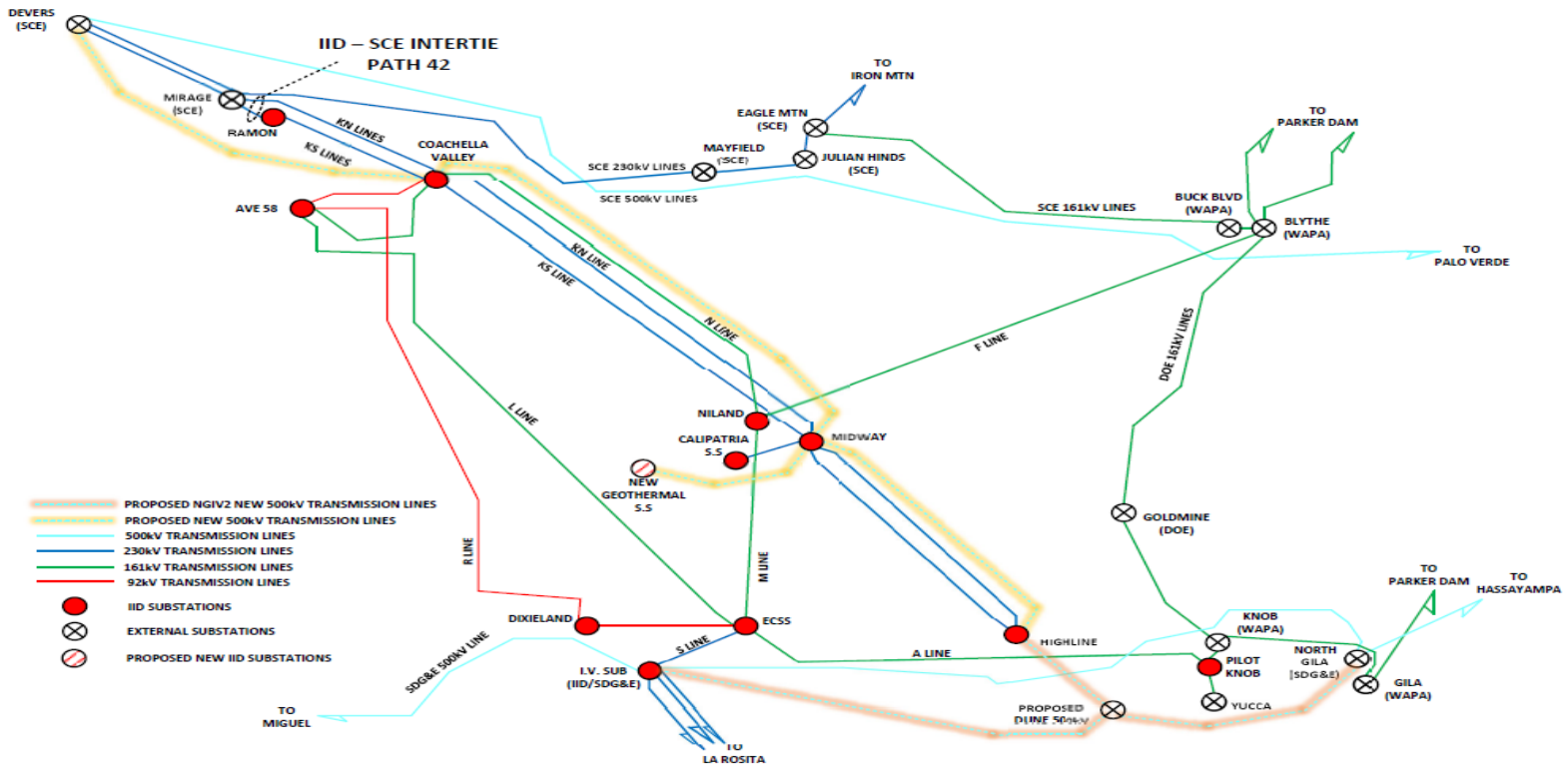
Proposed 230kV Geothermal Configuration



IID
A century of service.

Long-Term Solution

Proposed 500kV Geothermal Configuration with NGIV2



Geothermal – System Benefits

- Provides grid resiliency
  - *Assists in integration of intermittent resources*
  - *Rotating mass acts as a form of shock absorber for transient system events*
- True baseload renewable resource
  - *Fuel source is naturally occurring heat and effluent*
  - *Sustainable and stable source of generation*
  - *Technology is evolving; ramping capability will provide further benefits*

Geothermal Resource Defined

California Public Resources Code Section 6903:

". . . 'Geothermal resources' shall mean the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such natural heat and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon, gas, or other hydrocarbon substances."

Geothermal Royalties

- Payment for the use of ***geothermal resource***:
  - *Produced from the Property or Unitized Lands;*
  - *Electricity Generated by a facility using Geothermal Resources produced from the Property or Unitized Lands;*
  - *Minerals Extracted from the Geothermal Resources produced from the Property*
- Royalty generally determined based upon type of transaction, i.e., sale of the resource, energy produced from the resource, or minerals extracted
- Generally arise in the context of a real property lease or reserved right

Mineral Royalties

- Lessee receives payment from the sale or use of Geothermal Resource for extracted minerals
  - *Dependent upon type of transaction*
    - Related vs. unrelated entities (i.e., arms' length transactions)
  - *Royalty generally based upon gross production*
  - *Royalty value/percentage is negotiable*

IID's Royalty Interests

IID receives approximately $400,000 annually +/- based upon gross production;

Royalties paid under a lease arrangement

There are 20 remaining overriding royalty holders to whom IID pays a proportional share of the annual interest, based upon retained interests under separate agreements

Value of future royalties payable to IID will depend upon the gross production and use of the resource

William Thomas

Geothermal Resource Director

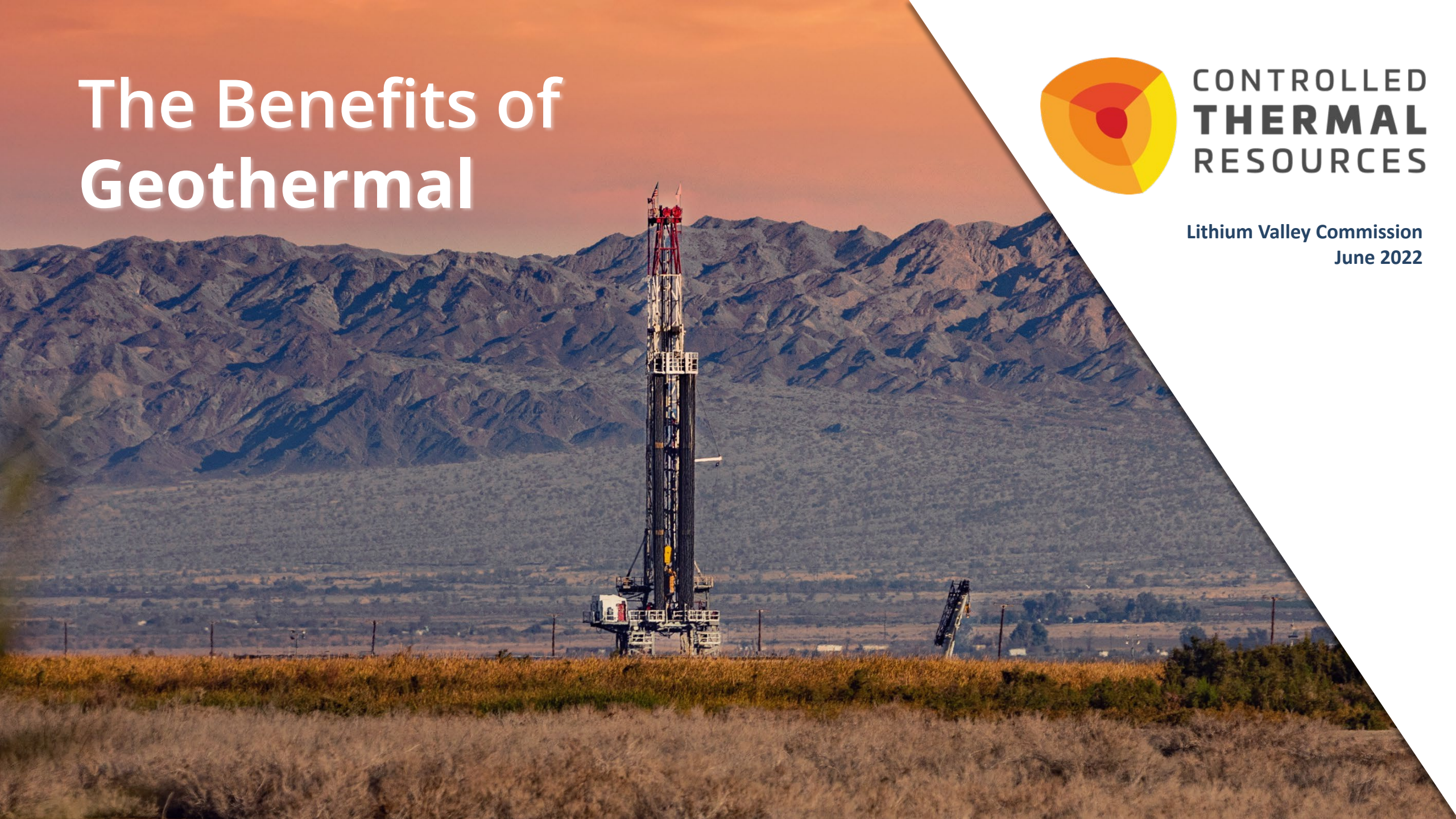
BHE Renewables

Jim Turner

Chief Operating Officer and Director

Controlled Thermal Resources

The Benefits of Geothermal

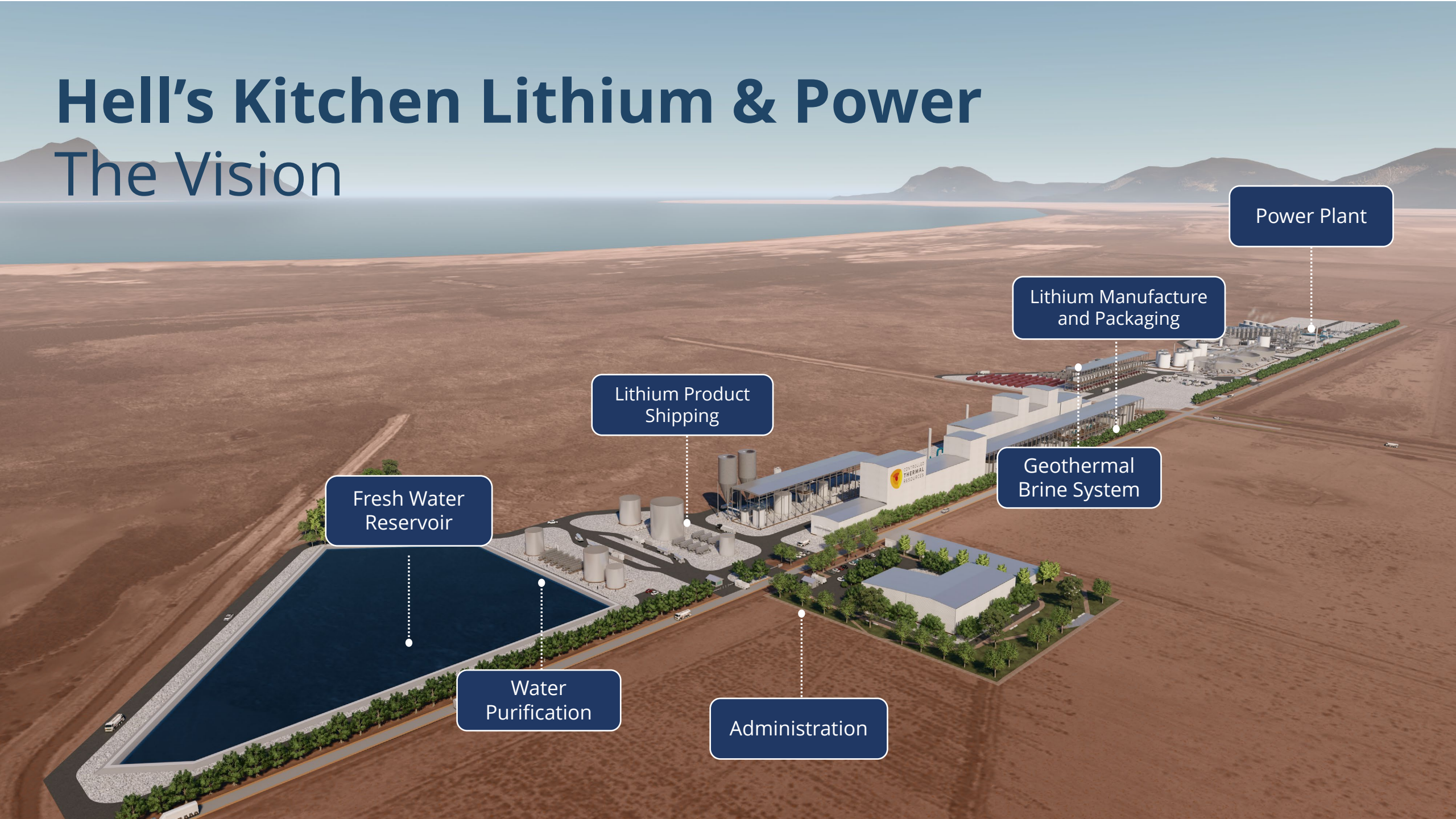


CONTROLLED THERMAL RESOURCES

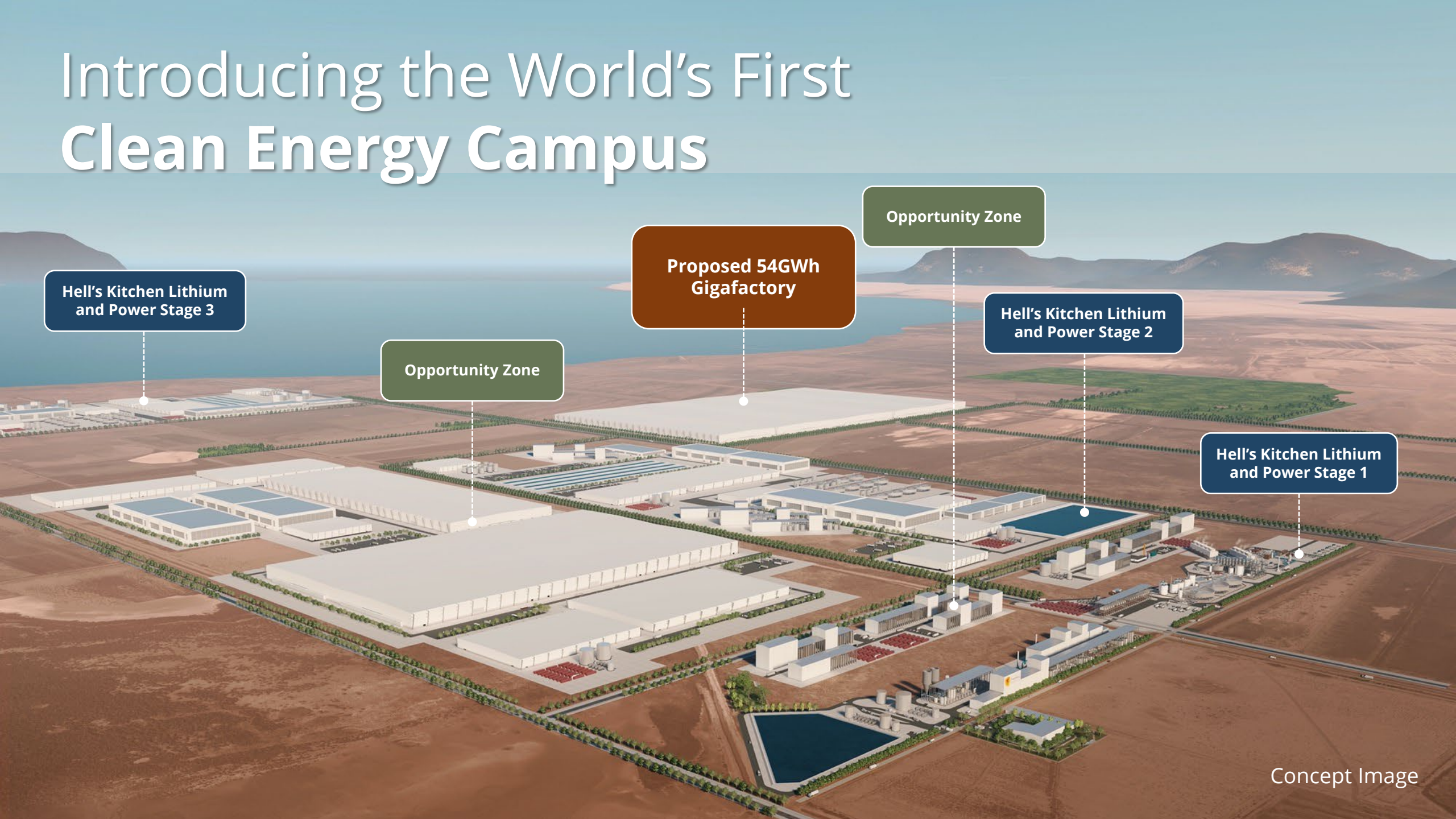
Lithium Valley Commission
June 2022

Hell's Kitchen Lithium & Power

The Vision



Introducing the World's First **Clean Energy Campus**



Concept Image

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Thank you

www.cthermal.com

Discussion Among Lithium Valley Commissioners / Discusión entre los comisionados de Lithium Valley

Public Comment / Comentarios del público

Comment Instructions:

Limited to 3 minutes per comment

By computer: use “raise hand” feature in Zoom

By telephone: dial *9 to “raise hand” and *6 to mute/unmute your phone line

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Instrucciones para los comentarios:

Límite de 3 minutos por comentario

Por computadora: use la función de “levantar la mano” de Zoom

Por teléfono: marque *9 para “levantar la mano” y *6 para silenciar y para activar el sonido

Workshop on Overcoming Challenges Extraction, Processing, and Production of Lithium Geothermal Brine / Taller sobre la Superación de los desafíos de extracción, procesamiento y producción de litio a partir de salmueras geotérmicas

- Panel Discussion with Lithium Extraction Project Developers
- Panel de discusión con desarrolladores de proyectos de extracción de litio

Jim Turner

Chief Operating Officer and Director

Controlled Thermal Resources

Jon Trujillo

Director

Geothermal Development

BHE Renewables

Workshop on Overcoming Challenges Extraction, Processing, and Production of Lithium Geothermal Brine / Taller sobre la Superación de los desafíos de extracción, procesamiento y producción de litio a partir de salmueras geotérmicas

- Challenges and Solutions to Lithium Extraction from Geothermal Brines in the Salton Sea
- Desafíos y soluciones de la extracción de litio de las salmueras geotérmicas en Salton Sea

Michael McKibben, Ph.D

Research Professor (Economic Geology & Geochemistry)
Department of Earth and Planetary Sciences
College of Natural & Agricultural Sciences
University of California, Riverside

Challenges and solutions to geothermal lithium recovery

Michael A. McKibben, Ph.D.
Research Professor (Economic Geology & Geochemistry)
Department of Earth and Planetary Sciences
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Lithium Valley Commission
June 16, 2022

Direct Lithium Extraction (DLE) Technology

Selective removal of Li from brines using a variety of engineered materials; most are now focused on Li adsorption/desorption on fabricated micro- or nanomaterials. Not "new", developed in the 1980s by Dow Chemical and commercialized in the 1990s by FMC for use on salar Li brines in Argentina.

The ratio of Li to other cations deposited on the materials' adsorption sites:

[Li]/[Na, K, Ca, Mg, Zn, Mn, etc.]

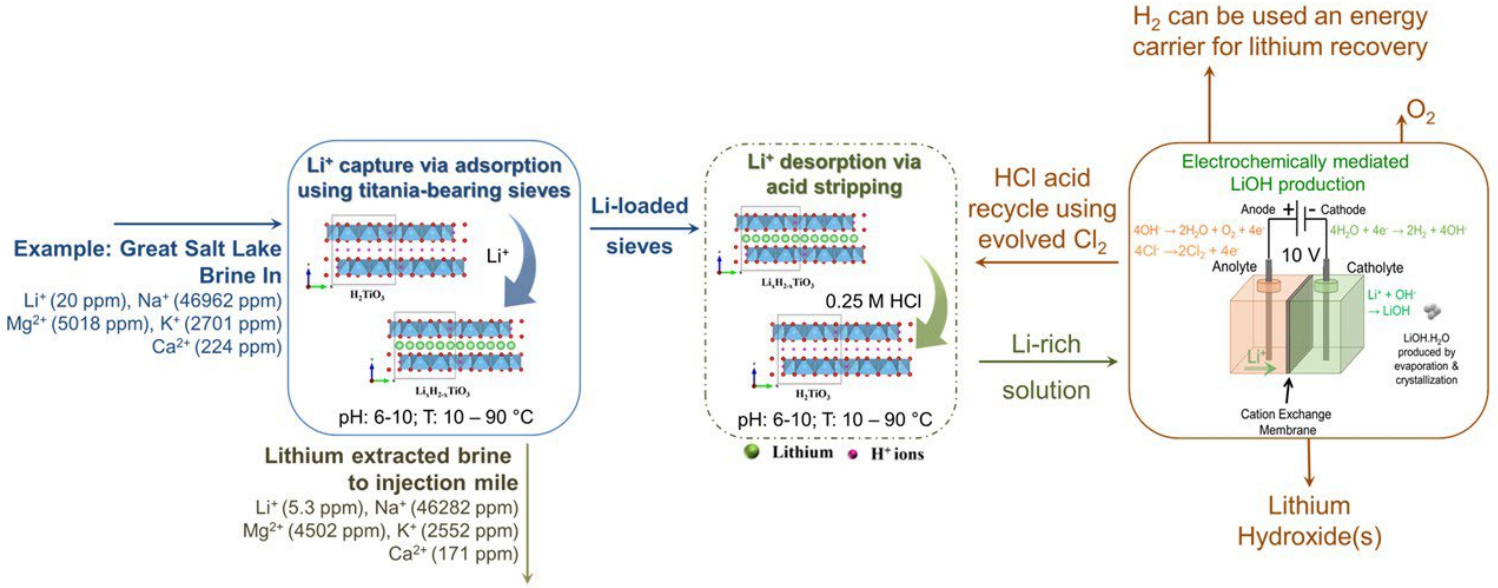
defines the extraction efficiency and the initial lithium product purity of the process.
For the Salton Sea brines, Mn, Ca and Mg are the most problematic interfering cations.

Preventing precipitation of SiO_2 and Fe compounds on the adsorbents is also critical, so they stay reactive - this requires brine clarification and the avoidance of further cooling. This issue plagued early efforts to develop the SSGF and extract metals, before the reactor-clarifier technology was perfected.

For some adsorbents, Li extraction efficiency is higher at higher Li concentrations and temperatures, favoring geothermal brines. Some adsorbents remove over 90% of the Li in the brine in one pass.

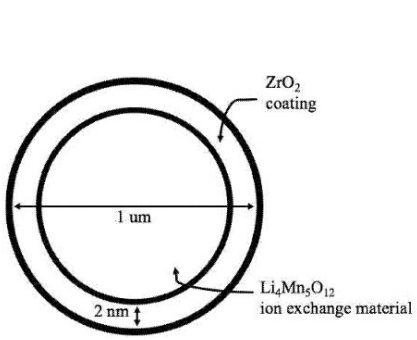
3 types of adsorbent micro- or nanomaterials are in common use: Al, Mn or Ti oxides.

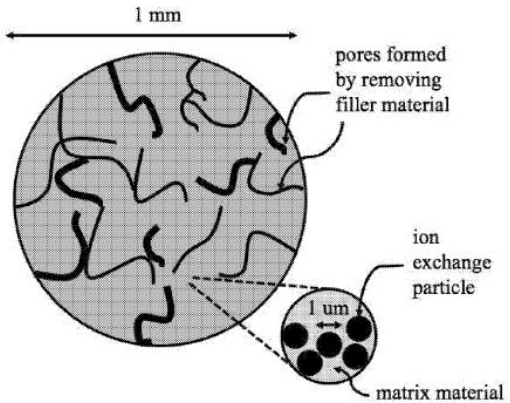
"ion sieves"
e.g. H_2TiO_3



Precipitation and filtration are an alternative to electrodialysis (lower energy costs)

These adsorbent particles are coated onto or embedded into a larger porous particle (e.g. ceramic beads or pellets) that can be packed in reactors, exposed to high brine flow, and then washed and eluted to release the Li ions.
e.g. CTR will be using Lilac Solutions' Mn oxide beads



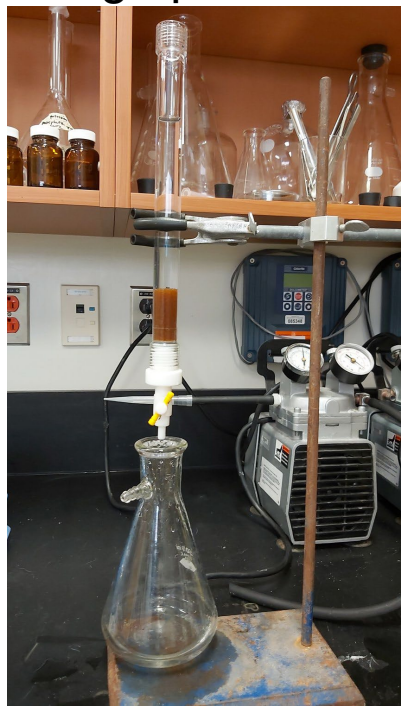


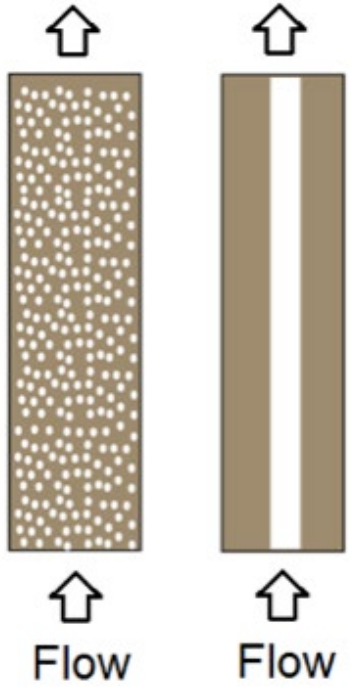
Stringfellow,W.T.; Dobson, P.F., 2021, Technology for the Recovery of Lithium from Geothermal Brines. Energies 14, 6805. https://doi.org/10.3390/en14206805
Warren, Ian. 2021, Techno-Economic Analysis of Lithium Extraction from Geothermal Brines. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5700-79178. https://www.nrel.gov/docs/fy21osti/799178.pdf

Technological challenges in applying such DLE technology to Salton Sea KGRA brines:

- Removing interfering cations and preventing SiO_2 and Fe precipitation.
- Keeping the brines from exposure to air (oxidation enhances Fe precipitation).
- Thermal and pH stability of adsorbents (how many cycles can they last?).
- Bead/pellet washing and Li elution (stripping) - reagent cost and reconstitution (water, acids).
- Process water availability (IID canal vs shallow wells vs self-supplied S.C. vs RO/desalinated).
- Process for conversion of LiCl to Li_2CO_3 or $LiOH{\cdot}H_2O$ – energy use and reagents.

Scaling up all of this – pilots are critical (one example from Zn plant mistakes made in 2003):





slug channelized

>80% Zn recovery efficiency on lab bench scale

<20% Zn recovery efficiency at full plant scale

Solution: use a reactor that maximizes brine-adsorbent contact

This is why testing a 1/10 scale pilot plant before developing a full commercial operation is a sound strategy.

Main economic challenge for geothermal DLE (Direct Lithium Extraction): how to compete with salar (salt flat) brine producers in South America

Their advantages:

Inexpensive labor

Free sunlight energy does the concentration work

Some use/are switching to DLE to process more brine more quickly (wastes far less water and land, but uses far more electricity)

Their disadvantages:

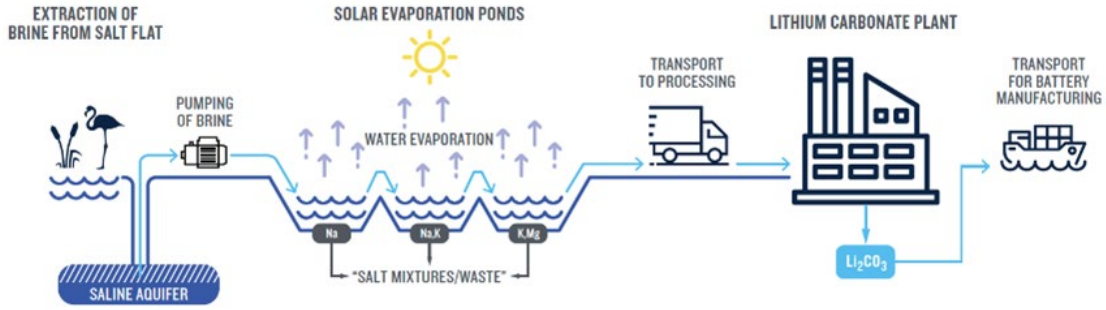
1-2 year solar process (vs. days for DLE)

Infrastructure issues - roads, power at remote Andean elevations (e.g. Bolivian salars)

Growing local environmental backlash over water use and footprint (e.g. flamingoes)

Nationalization threats: Chile, Mexico – many operations are foreign-owned/partnerships

SQM



Source: Adapted by authors from https://doi.org/10.1016/j.scitotenv.2018.05.223.

DLE from geothermal brine is projected to stay competitive with salar brine production.

DLE from oilfield brines in Alberta, Arkansas has similar OPEX estimates ($4-5k/ton LCE).

Hard-rock mines in Australia and China are far more costly: blasting, crushing, roasting, leaching, coal-fired electrical usage – and Li recovery efficiency is only 50-70%.

What could help keep geothermal DLE costs **competitive**:

Self-supplied electricity (parasitic load)

Self-supplied thermal energy (waste heat harvesting from power plants)

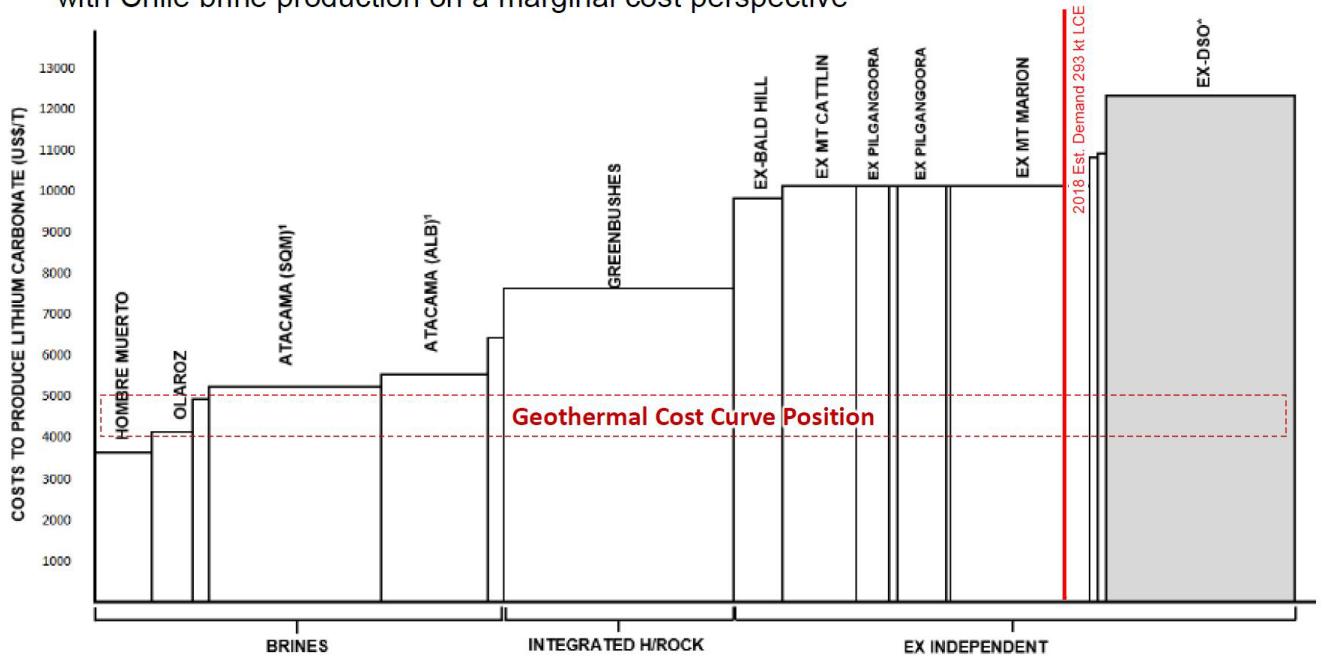
Self-supplied clean process water (steam condensate)

Co-products (Mn, Zn, K, etc.)

Cost per ton LCE: brines vs. hard rock mining

- Lithium in high demand and growing rapidly
- High market prices set by marginal cost of hardrock lithium mining
- Geothermal brine expected to be competitive with Chile brine production on a marginal cost perspective

Besseling (2018)



Source: CANACCORD | Genuity Specialty Minerals and Metals Report (16 April 2018)

Solutions: recovering additional strategic commodities from the brines

Field:	Salton Sea
Well:	S2–14[b]
Temperature (°C)[g]	330
Depth (m)[h]	2500–3220
Constituent	
Na	54,800
Ca	28,500
K	17,700
Fe	1,710
Mn	1,500
SiO_2[i]	>588
Zn	507
Sr	421
B	271
Ba	≈210
Li	209
Mg	49
Pb	102
Cu	7
Cd	2
NH_4	330
Cl	157,500
Br	111
CO_2[i]	1,580
HCO_3	NA
H_2S	10
SO_4	53
TDS	26.5%

Commodity	Main use	Import reliance	Import sources	US Depletion allowance*
Li	Batteries	>>25%	Argentina, Chile, China	22%
Mn	Steel-making	100%	S. Africa, Australia, Gabon, Georgia	22%
Zn	Galvanizing	76% (refined Zn)	China, Peru, Australia	22%
K	Fertilizer	93%	Canada, Russia, Belarus	14%
Sr	Magnets	100%	Mexico, Germany, China	22%
Rb	Quantum computers	100%	Canada, China	14%

*The **depletion allowance** is a tax deduction from gross income allowed in order to compensate for the depletion or 'using up' of natural resource deposits such as oil, natural gas, minerals, timber etc. It incentivizes companies to continue to develop natural resources by allowing them to offset the disadvantages of operating a depleting asset.

The US government sets high domestic depletion allowances for critical minerals in order to promote development of domestic sources, rather than relying on imports.

What actions would make geothermal DLE **non-competitive**?

A regressive tax or royalty that:

1) makes geothermal DLE marginal costs higher than salar brines, and
2) raises geothermal DLE costs closer to parity with hard-rock mine marginal costs.

Examples of regressive state taxes that have sent miners packing:

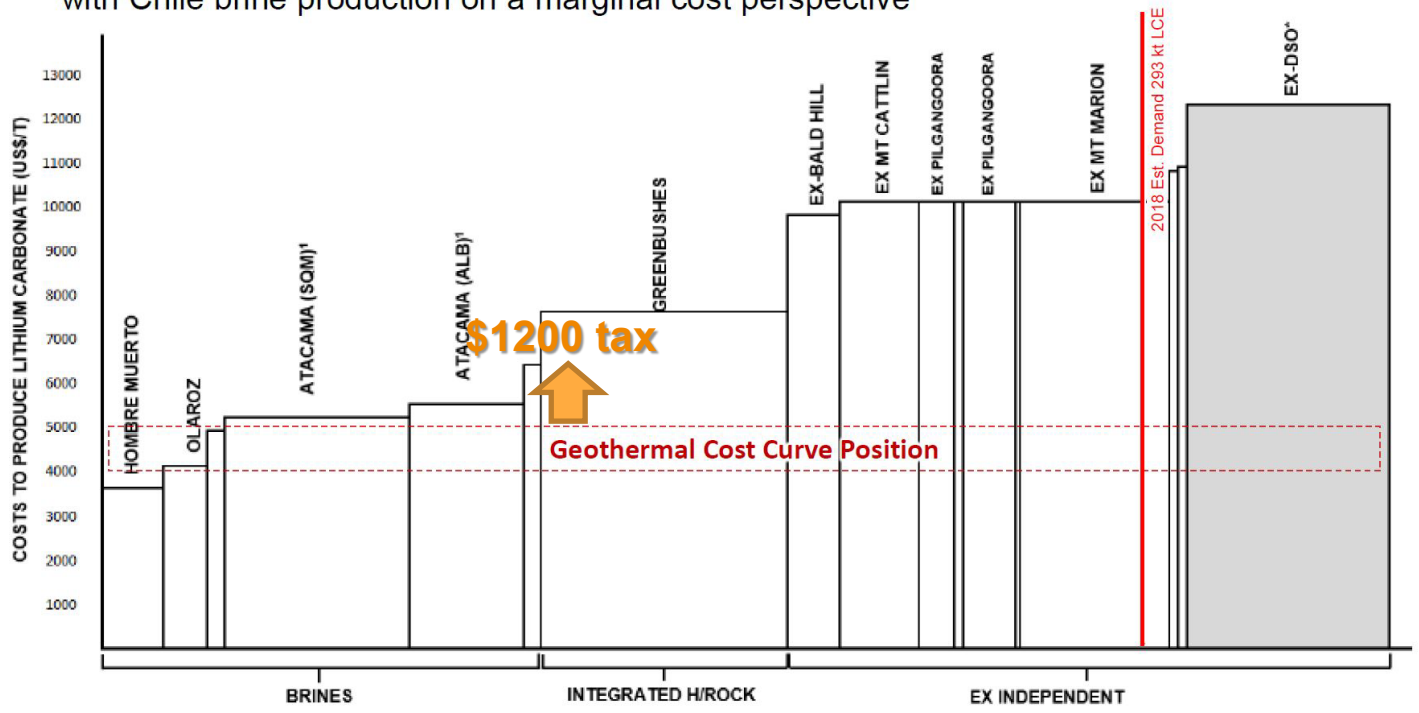
Minnesota's high taxes on iron mining in the late 20th century. Mines closed and Brazil and Australia took over the market.

British Columbia raised their mining severance taxes so high in 1975 that many companies moved their operations to Alaska and the Yukon.

Cost per ton LCE: brines vs. hard rock mining

- Lithium in high demand and growing rapidly
- High market prices set by marginal cost of hardrock lithium mining
- Geothermal brine expected to be competitive with Chile brine production on a marginal cost perspective

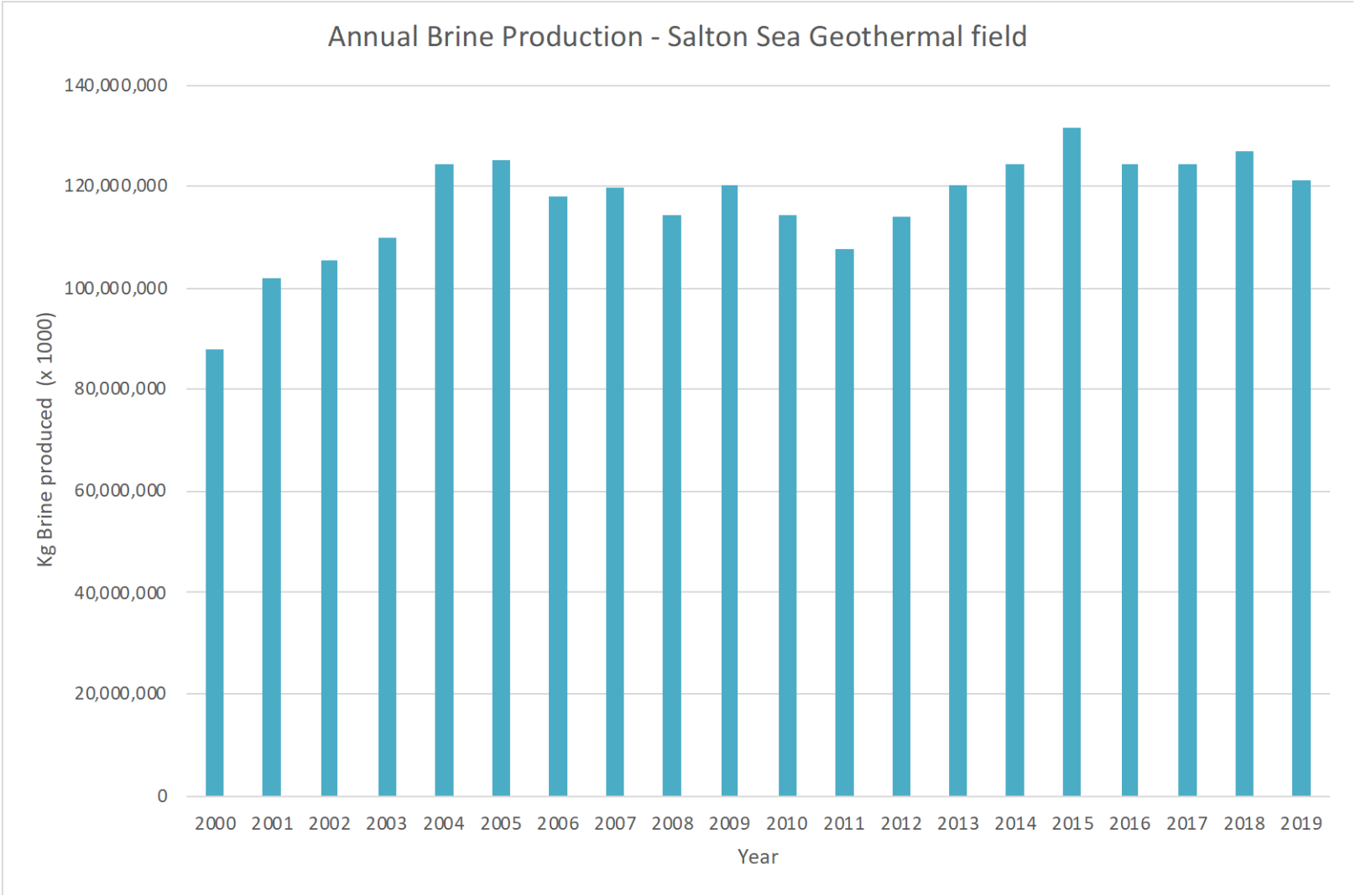
Besseling (2018)



Source: CANACCORD | Genuity Specialty Minerals and Metals Report (16 April 2018)

Marginal costs are the variable costs (e.g. labor, raw materials) that it takes to produce an additional unit of a commodity. Excludes fixed costs (e.g. administration, advertising).

There are also reservoir limits on how much Li can be recovered annually - brine production rate and recovery efficiency determine this



Annual cumulative brine production rates (CA Dept. of Conservation, 2021).

For the current field's (400 MWe) brine production rates: the total amount of Li contained in produced brine over a year = 120,000,000 kt x 0.0002 (200 ppm Li) = 24,000 tons Li metal/yr @ 400 Mwe, equivalent to 128,000 tons LCE/yr @ 400 MWe.

At 90% recovery efficiency: = **115,200 tons LCE/yr @ 400 MWe**

115,200 tons LCE/yr @ 400 MWe
= **288 tons/yr LCE per MWe**

Planned expansion of the geothermal field over the next several years:

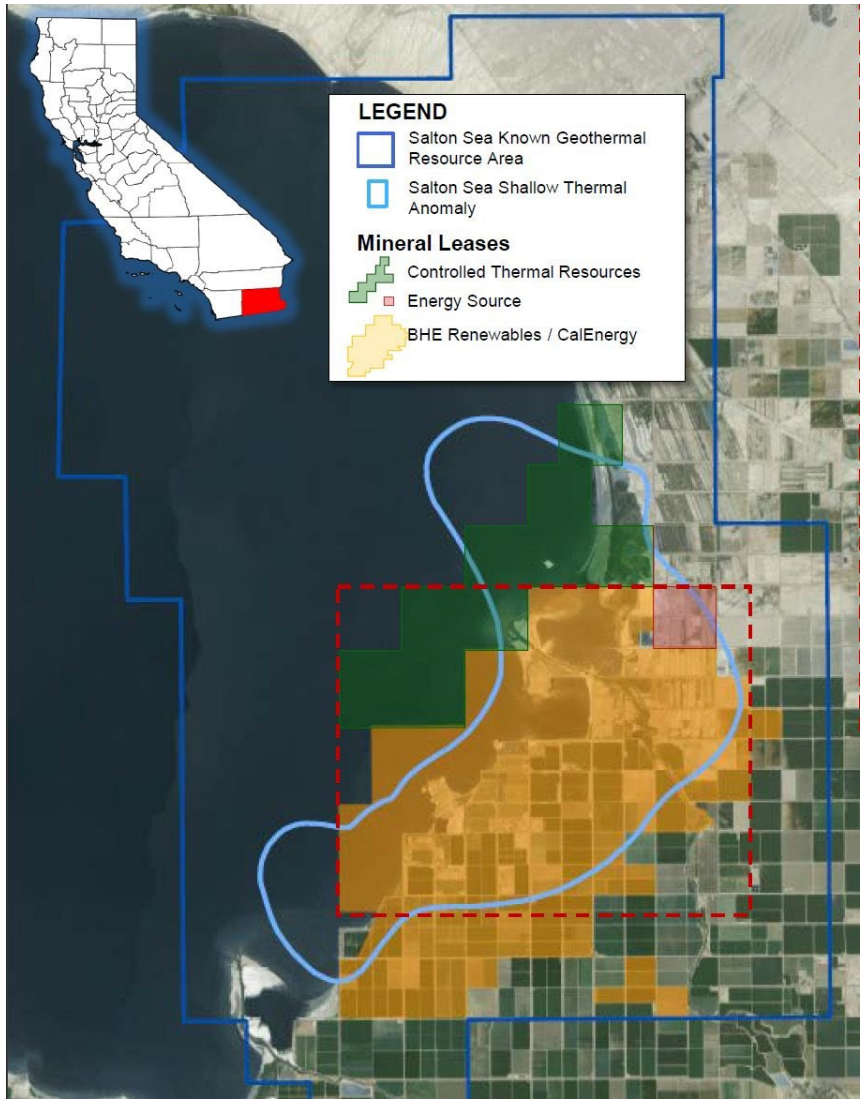
- BHER current = 345 MWe
- BHER additional = 395 MWe
- ESM current = 60 MWe
- CTR Stage 1 = 50 MWe
- CTR Stage 2 = 260 MWe

Total = 1,110 MWe x 288 tons LCE/MWe

= **320,000 metric tons LCE/yr recoverable @ 1,110 MWe**

= 60% of global Li production in 2021 (532,000 metric tons of LCE)

576 kt/yr @ 2 GWe; 864 kt/yr @ 3 GWe



How long will the Li production last?

For a maximum of 320 kt/y of LCE at current planned geothermal field expansion:

"Reserves"	Annual depletion rate	Years of production
5 Mt LCE (conservative)	6.4%	16 yrs
16 Mt LCE (half optimistic)	2.0%	50 yrs
32 Mt LCE (optimistic)	1.0%	100 yrs

But we need far more sophisticated reserve and depletion estimates that take into consideration Li dilution due to reinjection and Li replenishment due to reaction of reinjected brines with the reservoir rocks, all of which require a *better brine reservoir model*.

Solution: try to reinject the spent brines into the Li source rocks, to replenish the Li. Not always feasible due to injection well permeability issues.

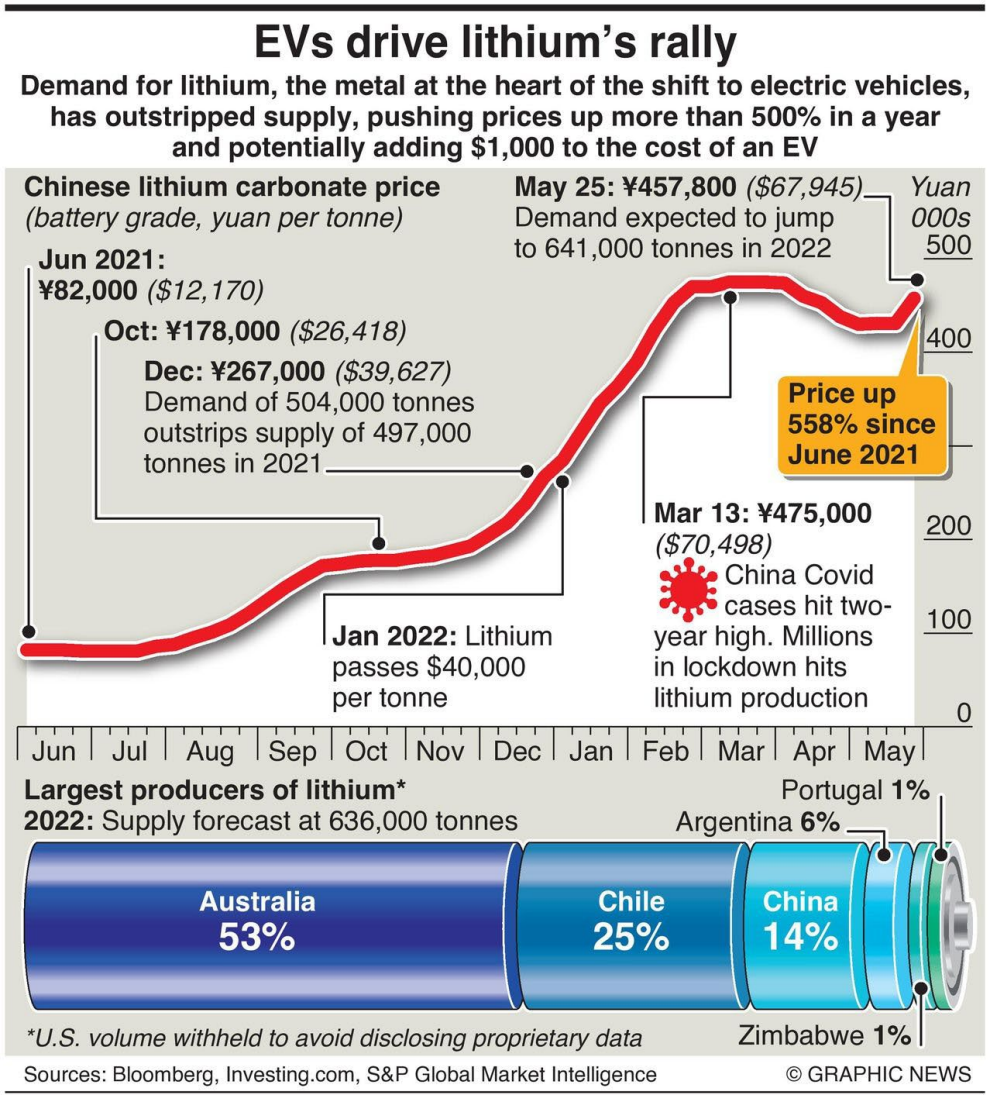
Market challenges due to Lithium supply and demand

Short-term: price volatility as world responds to impacts of pandemics and wars on Li-Ni-Co supplies, energy, and sales trends for EVs and energy storage batteries.

Goldman Sachs: Price explosion in 2021-2022 to be followed by temporary over-supply and temporary price decline because of recent rush of investments into “white gold”? Benchmark Minerals, Bloomberg and S&P disagree!

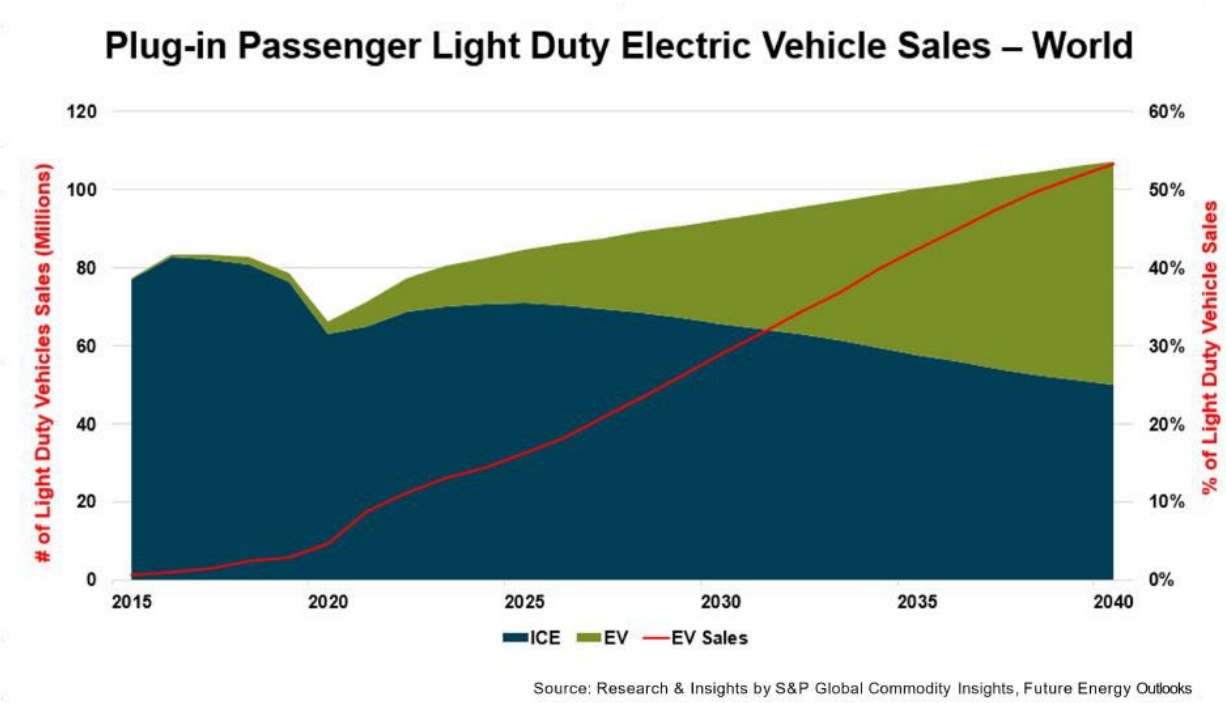
Long-term: the market should become more stable as the winners in the production cost battle appear and global decarbonization trends take over:

- Salar producers (esp. those switching to DLE instead of evaporation ponds).
- DLE from geothermal and oil field brines.
- Hard rock mines: highest costs/impacts and lowest recovery rates; may eventually be marginalized.



Graphic News 2022

BloombergNEF, S&P: Sales of ICE-powered vehicles peaked in 2017 and have been in permanent decline since then. Sales of plug-in EVs are expected to triple their current levels by 2025.



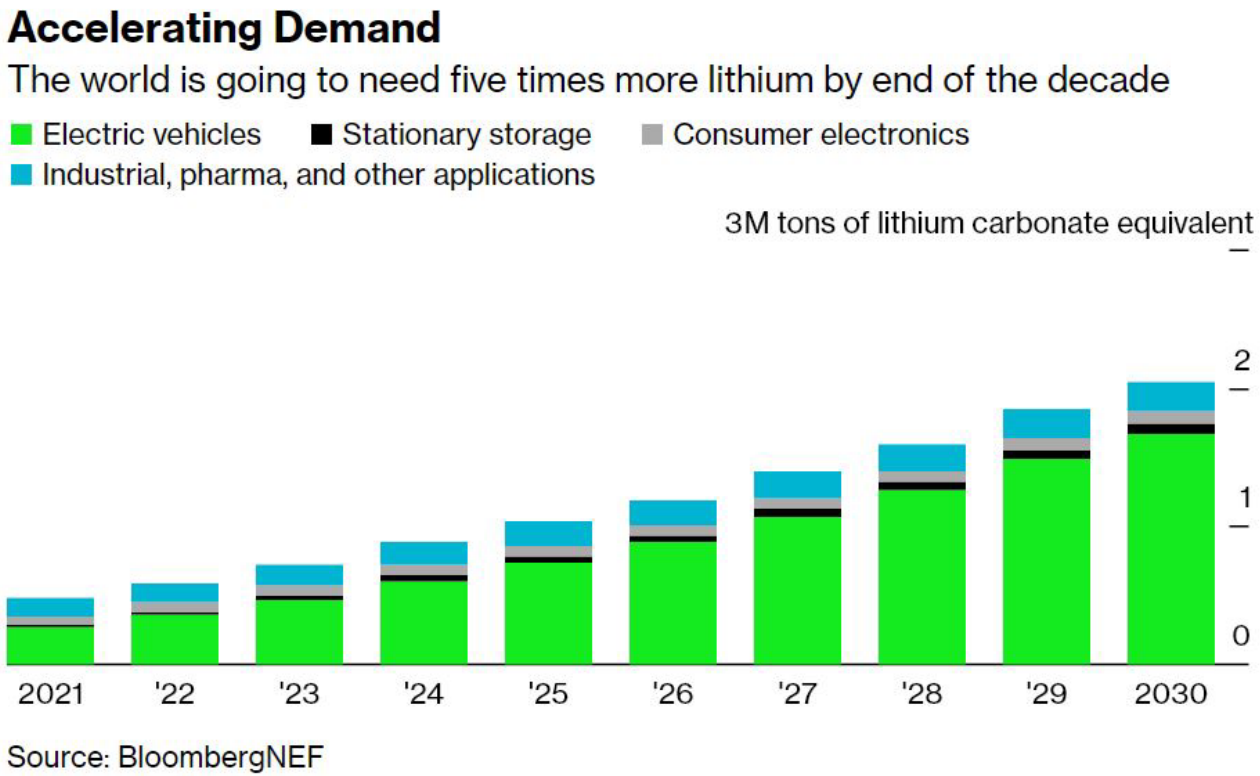
Imperial Valley should focus on the long-term game:

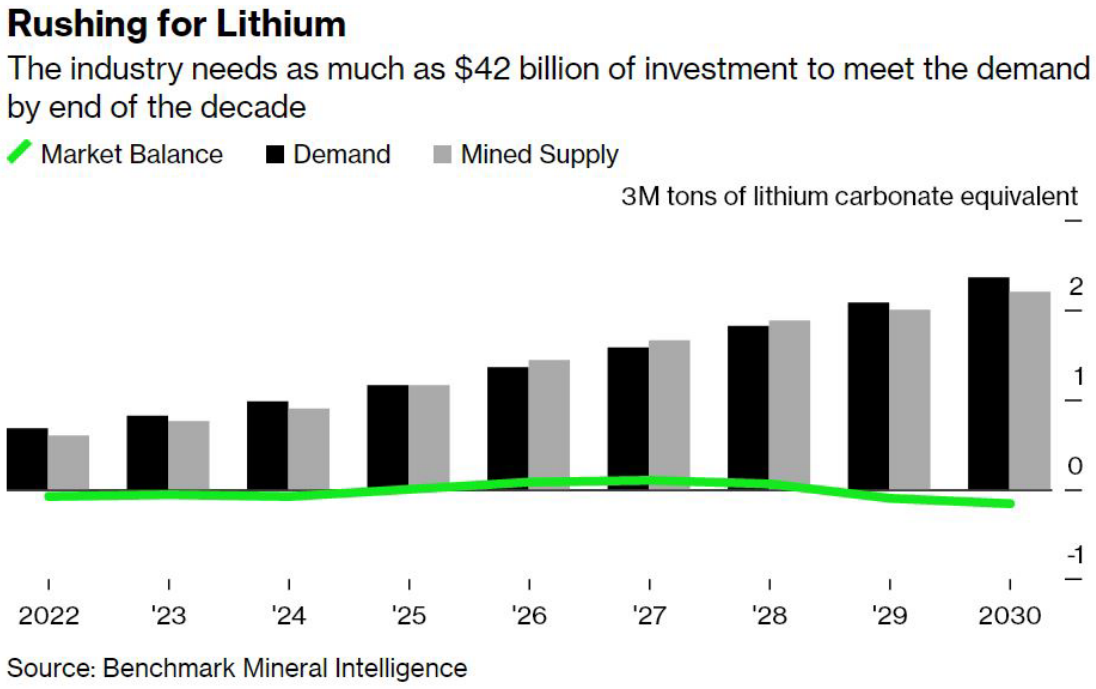
DLE as the future for supplying EVs

Recovering Mn-Zn-K-etc. coproducts

Integrated battery manufacturing/recycling

SSGF Li producers could finish coming to full-scale at the right moment (late 2020s):





What worries me the most:

- Impact of air quality and asthma problems on the potential for a “Li revolution” in the Imperial Valley.
- Health issues related to the Sea drying up need to be tackled successfully, if economic prosperity for the workforce and communities is going to be realized.
- Playa dust bacterial mitigation efforts should parallel Lithium Valley development efforts.
- Otherwise: “If you build it, they may not come*”

*Apologies to Kevin Costner and “Field of Dreams”

Scott K Baker/Shutterstock

Tina L. Anderholt Shields, PE

Manager

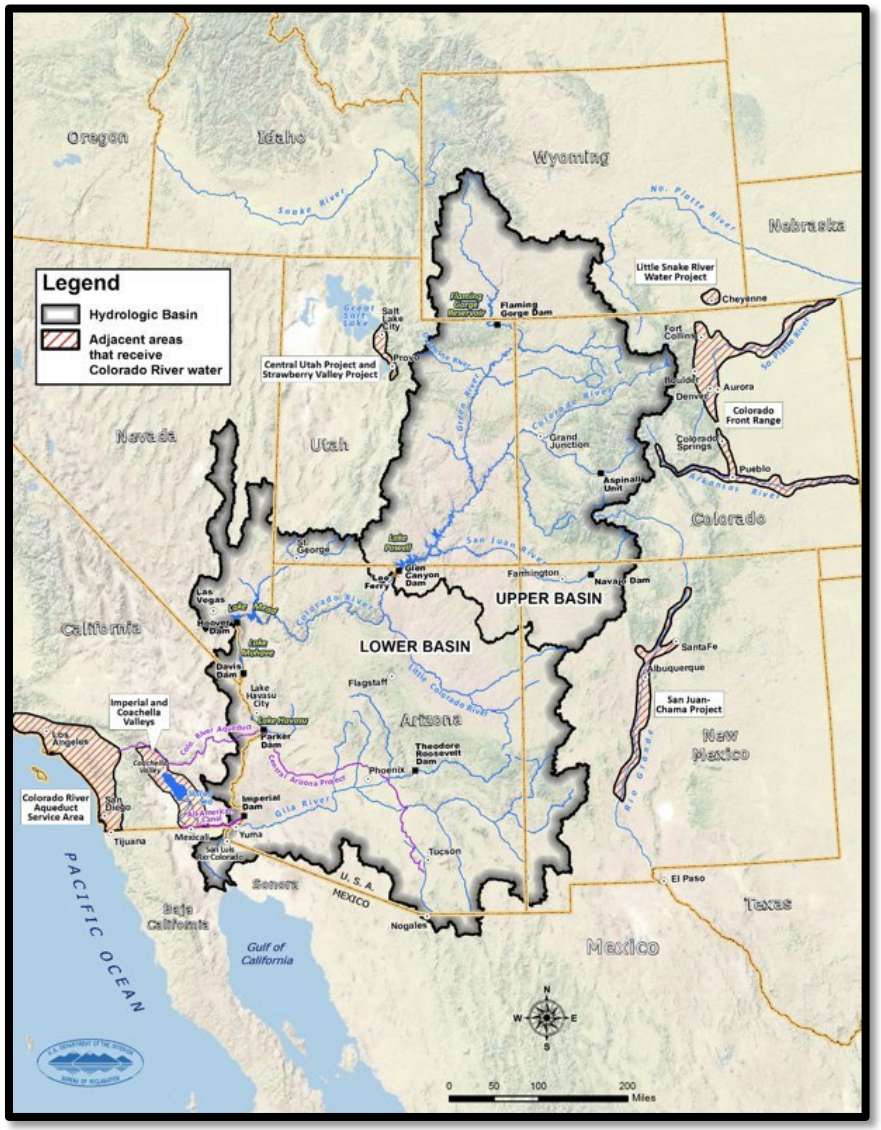
Water Department

Imperial Irrigation District

Colorado River Hydrology and Operating Conditions Update

June 16, 2022 – Lithium Valley Commission Meeting

Tina Anderholt Shields, PE
Water Department Manager



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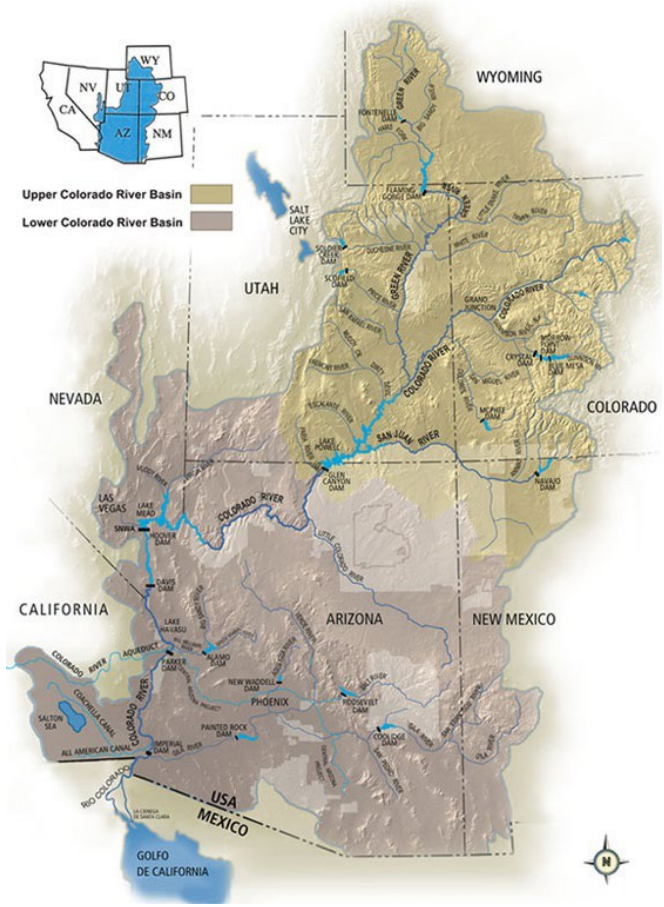
Colorado River Water Users and Uses



- 1,450 miles long from Colorado to the Mexican border; encompassing seven states, two countries and 246,000 square mile watershed basin
- Lee's Ferry divides system into 2 basins (Upper and Lower)
  - Upper Basin = Colorado, New Mexico, Utah, and Wyoming
  - Lower Basin = Arizona, California, and Nevada
  - Republic of Mexico
- 4 million acres of farmland
- Serves nearly 30 million people
- 10 American Indian Tribes
- Environmental uses (incl 4 endangered fish species)
- Hydropower facilities generate more than 12 billion kWh of low-cost power for 3 million people

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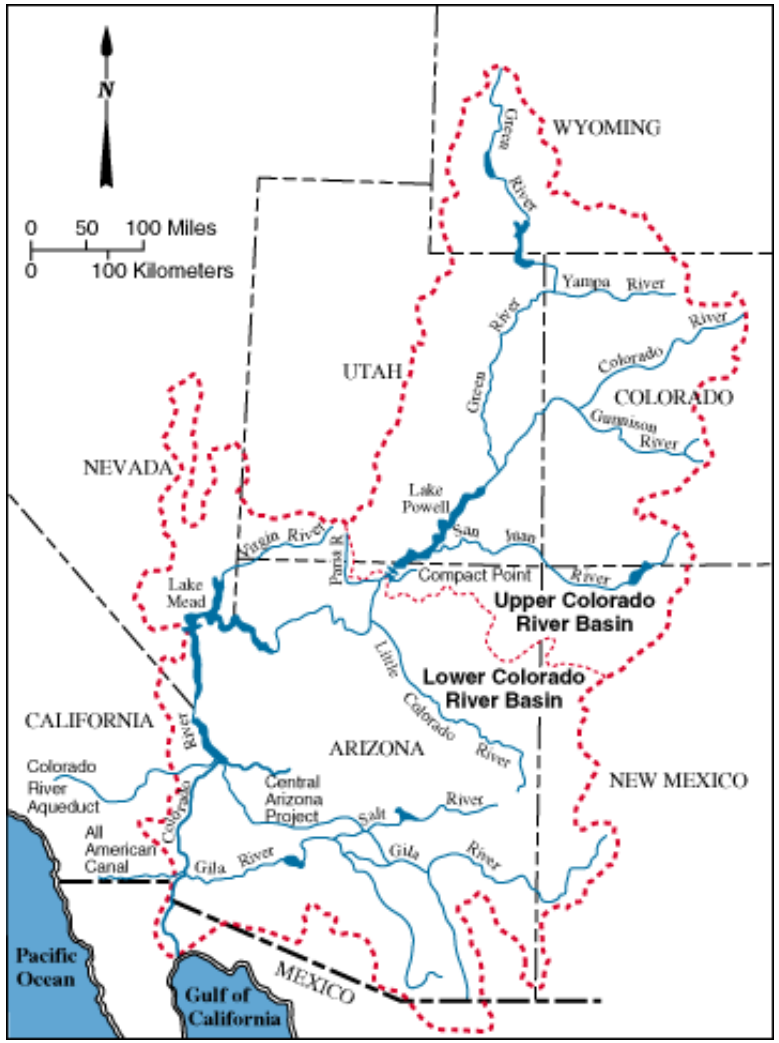
Colorado River System Storage

Reservoir	Percent Full	Storage (MAF)	Elevation (feet)
Lake Powell	27%	6.639	3,536.20
Lake Mead	28%	7.366	1,045.57
Total System Storage*	35%	20.705	NA

- Lake Powell = 27 MAF
- Lake Mead = 28.5 MAF (4 years of storage)
- Total reservoir storage = 60 MAF

Annual yield was originally estimated at 17.5 MAF and then 15 MAF, but over the last 20 years is averaging less than 10 MAF.



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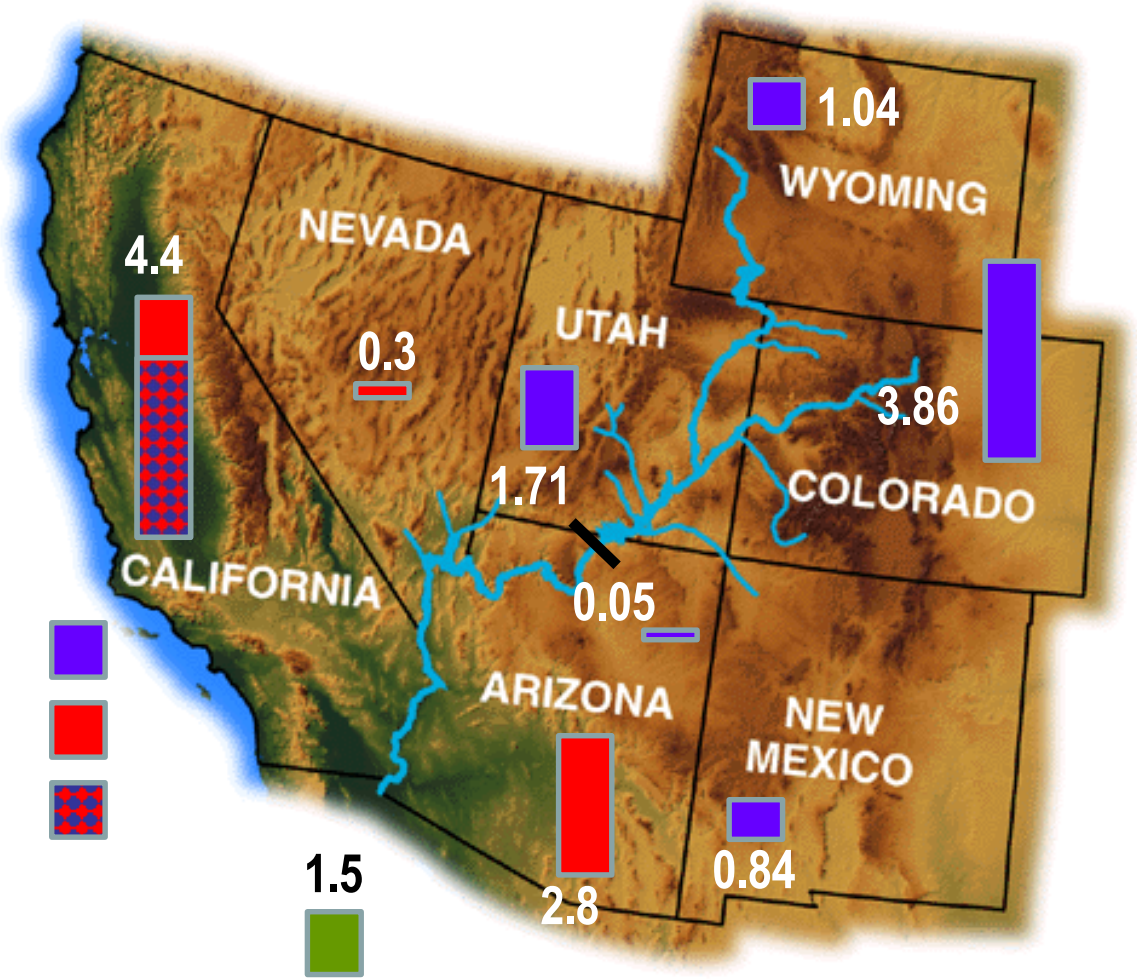
*Total System storage was 25.013 MAF (42% of capacity), this time last year.

Colorado River Basin State Entitlements



Upper Basin (7.5 MA

Lower Basin (7.5 MA

IID (3.1 MAF)

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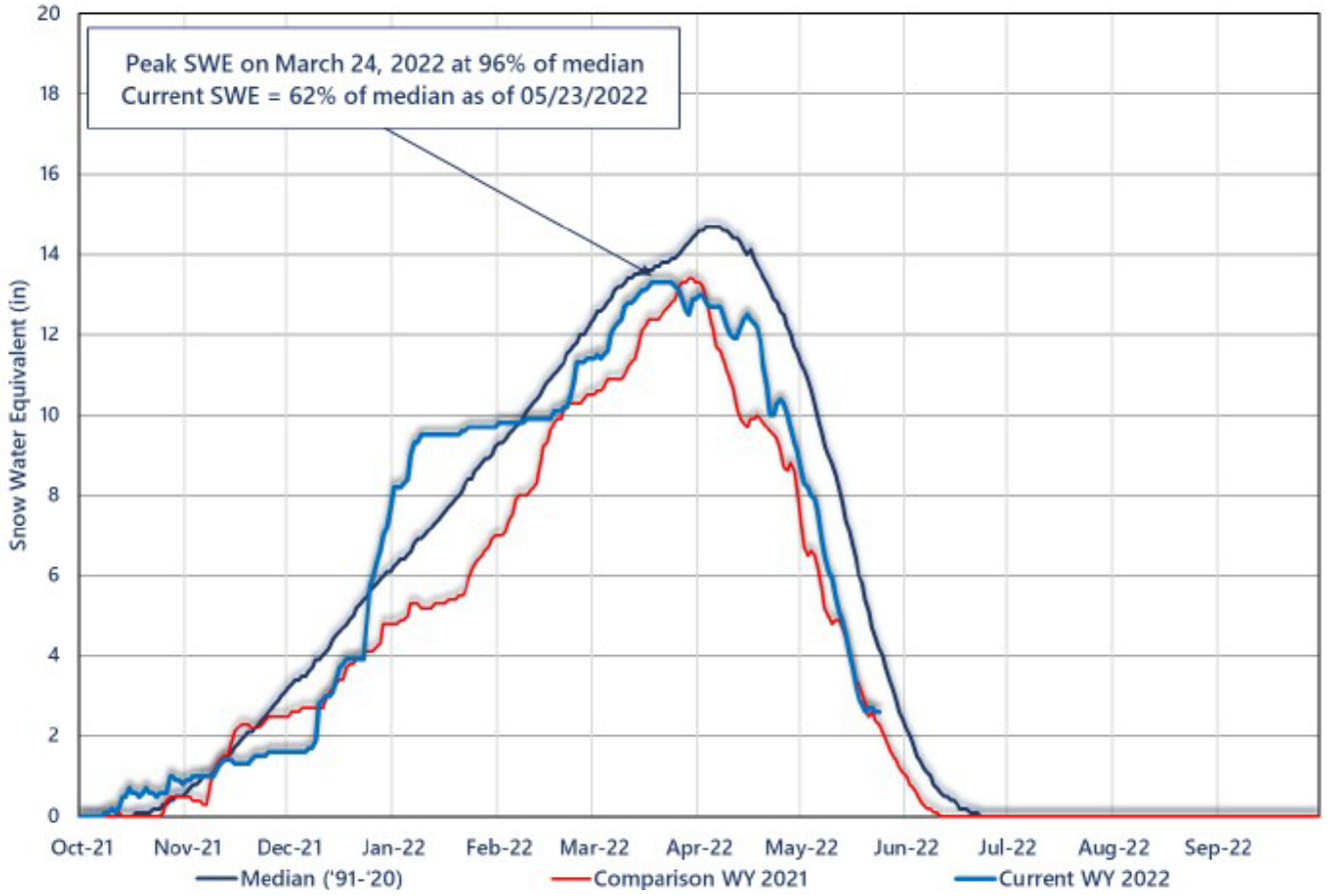
Upper Colorado River Basin

Water Year 2022 Snowpack and Inflow into Lake Powell

Water Year 2022

- Forecasted Inflow 5.98 MAF 62% of average
- Inflow forecast from 51% - 78% of average



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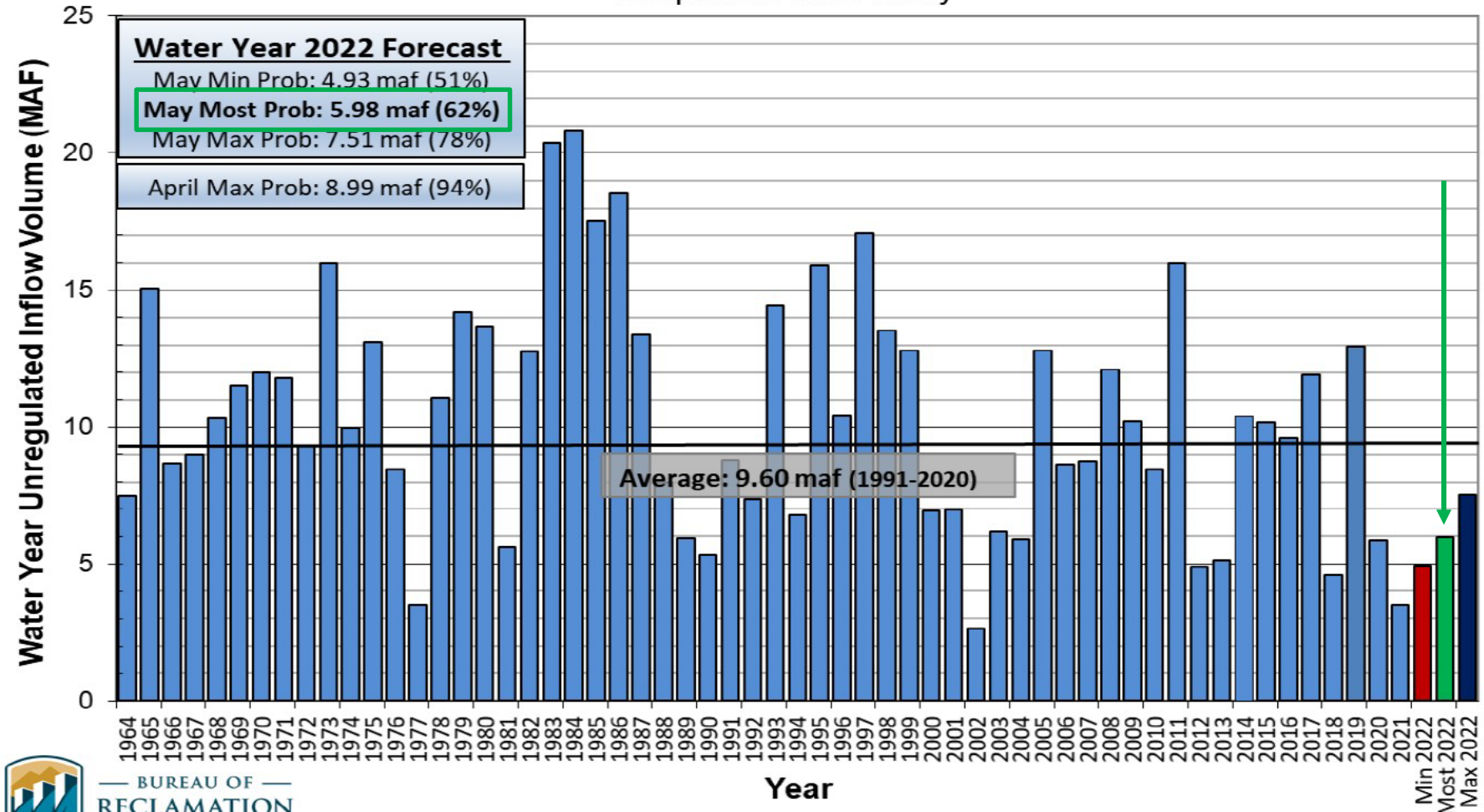
Lake Powell Unregulated Inflow
Water Year 2022 Forecast *(issued May 4)*
Comparison with History



— BUREAU OF —
RECLAMATION

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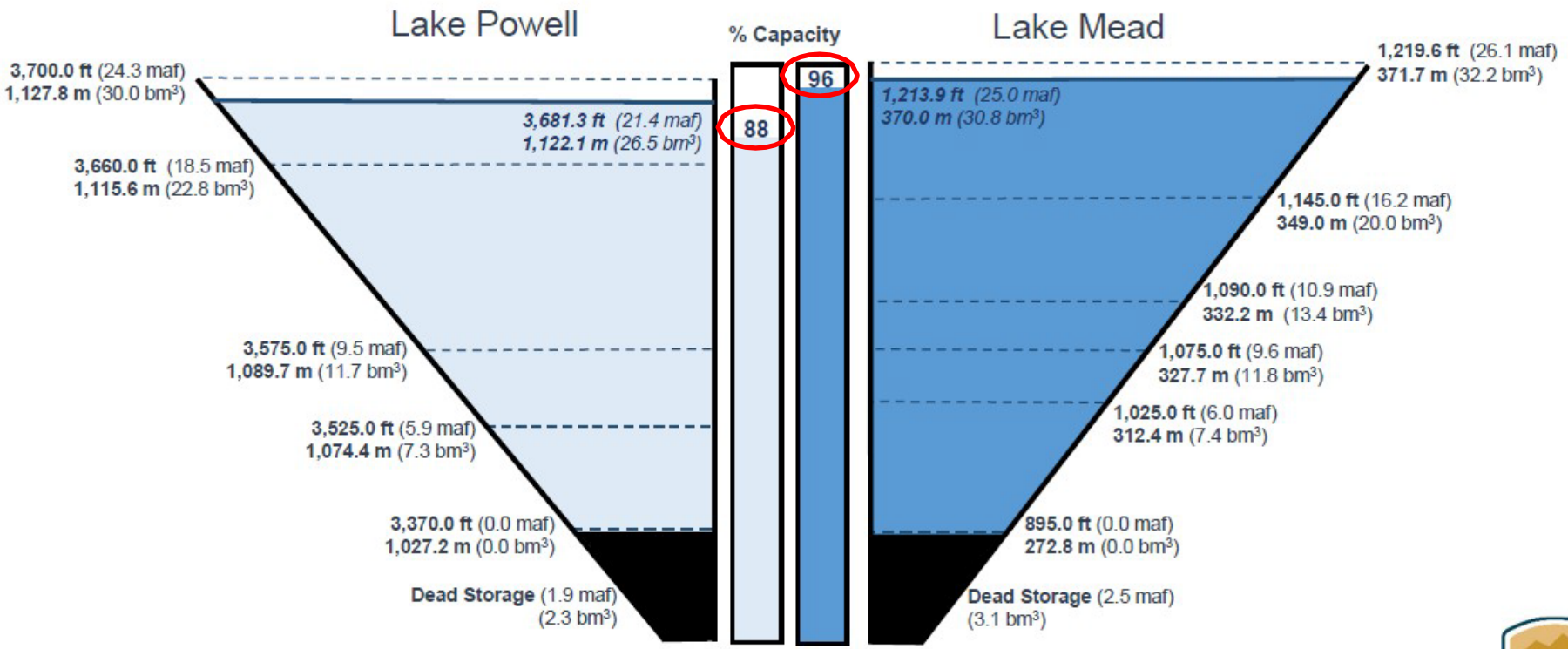
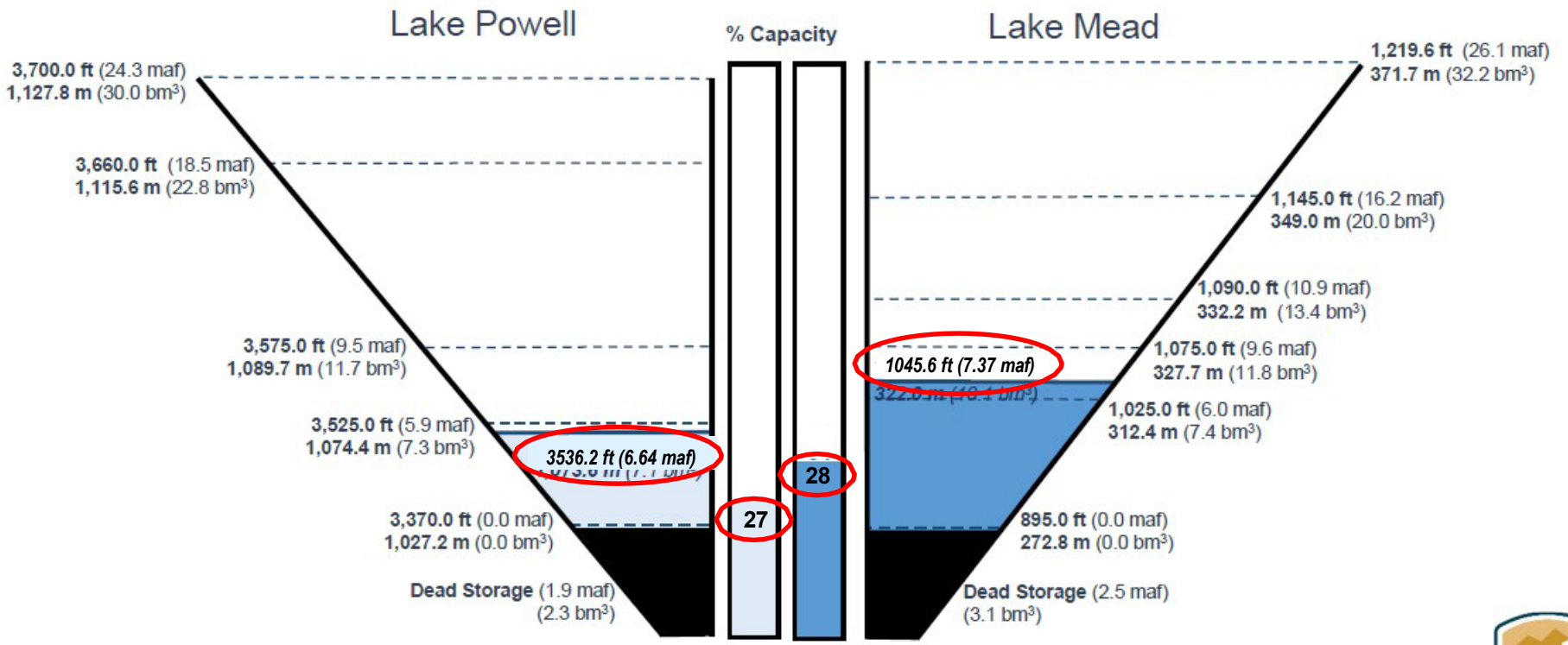
Entering Current Drought
December 1999



Notes
- *Units: feet (ft); meter (m); million acre-feet (maf); billion cubic meters (bm³)*
- *Water stored in Dead Storage cannot be released or withdrawn from the reservoir and, therefore, is not available for use.*
- *Schematic is for illustrative purposes only and is not to scale.*

Current

June 2022



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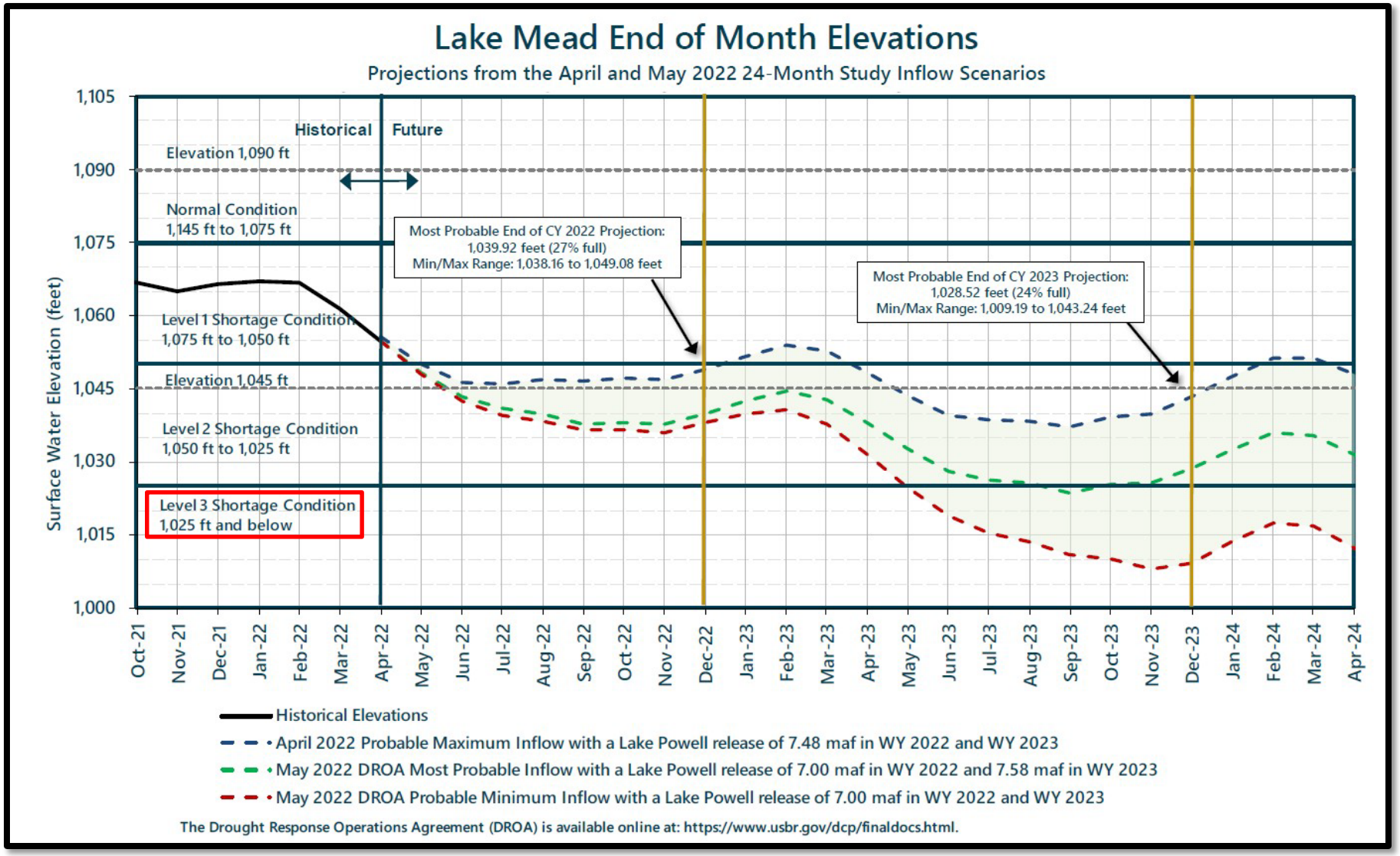


https://www.usbr.gov/lc/region/g4000/riverops/24ms-projections.html

2007 Interim Guidelines, Minute 323, Lower Basin Drought Contingency Plan, and Binational Water Scarcity Contingency Plan

Total Volumes (kaf)

Lake Mead Elevation (feet msl)	2007 Interim Guidelines Shortages		Minute 323 Delivery Reductions	Total Combined Reductions	DCP Water Savings Contributions			Binational Water Scarcity Contingency Plan Savings	Combined Volumes by Country *US: (2007 Interim Guidelines Shortages + DCP Contributions)* *Mexico: (Minute 323 Delivery Reductions + Binational Water Scarcity Contingency Plan Savings)*					Total Combined Volumes
	AZ	NV	Mexico	*Lower Basin States + Mexico*	AZ	NV	CA	Mexico	*AZ Total*	*NV Total*	*CA Total*	*Lower Basin States Total*	*Mexico Total*	*Lower Basin States + Mexico*
1,090 - 1,075	0	0	0	*0*	192	8	0	41	192	8	0	*200*	*41*	***241***
1,075 – 1,050	320	13	50	*383*	192	8	0	30	512	21	0	*533*	*80*	***613***
1,050 - 1,045	400	17	70	*487*	192	8	0	34	592	25	0	*617*	*104*	***721***
1,045 - 1,040	400	17	70	*487*	240	10	200	76	640	27	200	*867*	*146*	***1,013***
1,040 - 1,035	400	17	70	*487*	240	10	250	84	640	27	250	*917*	*154*	***1,071***
1,035 - 1,030	400	17	70	*487*	240	10	300	92	640	27	300	*967*	*162*	***1,129***
1,030 - 1,025	400	17	70	*487*	240	10	350	101	640	27	350	*1,017*	*171*	***1,188***
<1,025	480	20	125	*625*	240	10	350	150	720	30	350	*1,100*	*275*	***1,375***

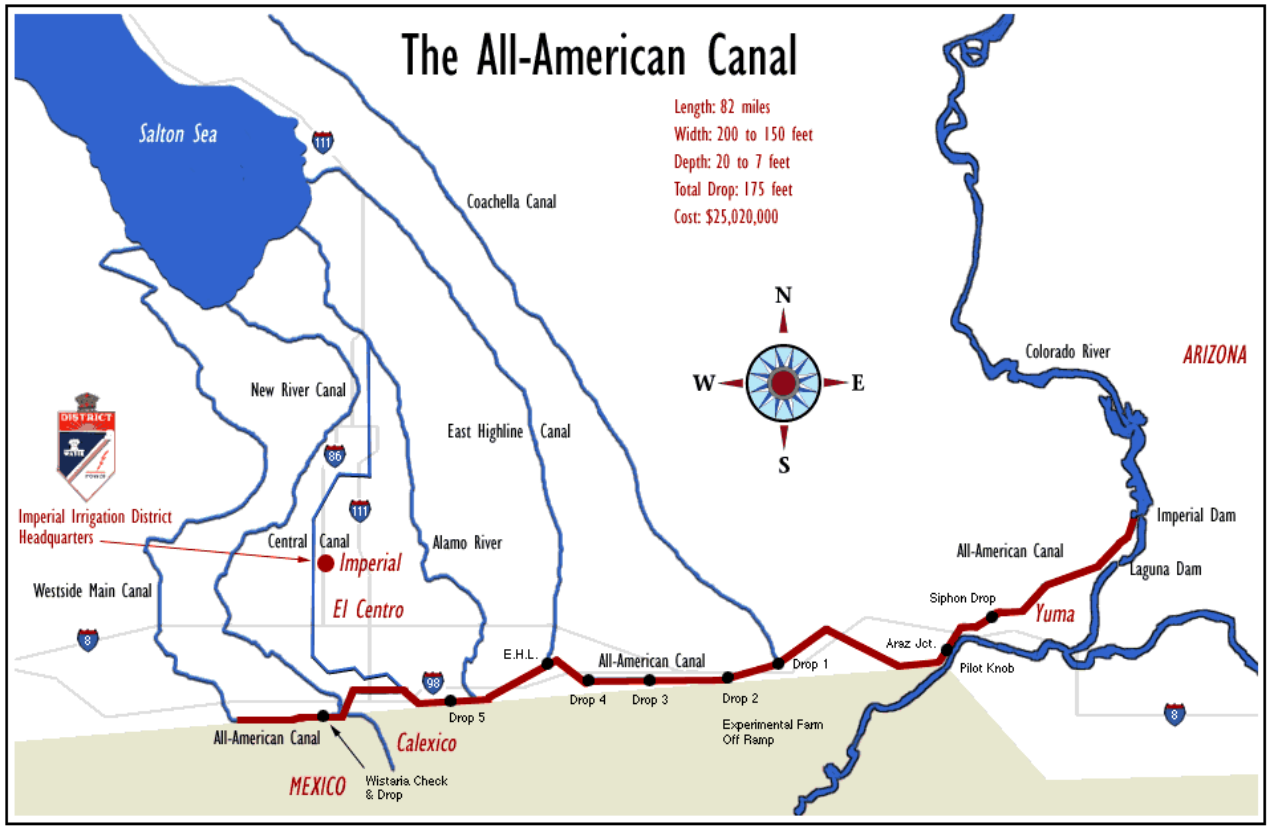
Projected 2023 Reductions + Contributions

Projected 2023 Reductions + Contributions

The Secretary of the Interior will take affirmative actions to implement programs designed to create or conserve 100,000 acre-ft per year or more of Colorado River System water to contribute to conservation of water supplies in Lake Mead and other Colorado River reservoirs in the lower basin. All actions taken by the United States shall be subject to applicable law, including availability of appropriations.

IID's Water Supply & Service Area

- 3,100,000 acre-feet annual Colorado River consumptive use entitlement
- 1,062,216 – gross acres within boundaries
- 520,307 – total acreage receiving water
- 471,364 – total farmable acreage
- Imperial Dam diversion structure, headworks and six desilting basins
- 82-mile long All-American Canal; 3,047 miles of canals/laterals and drains



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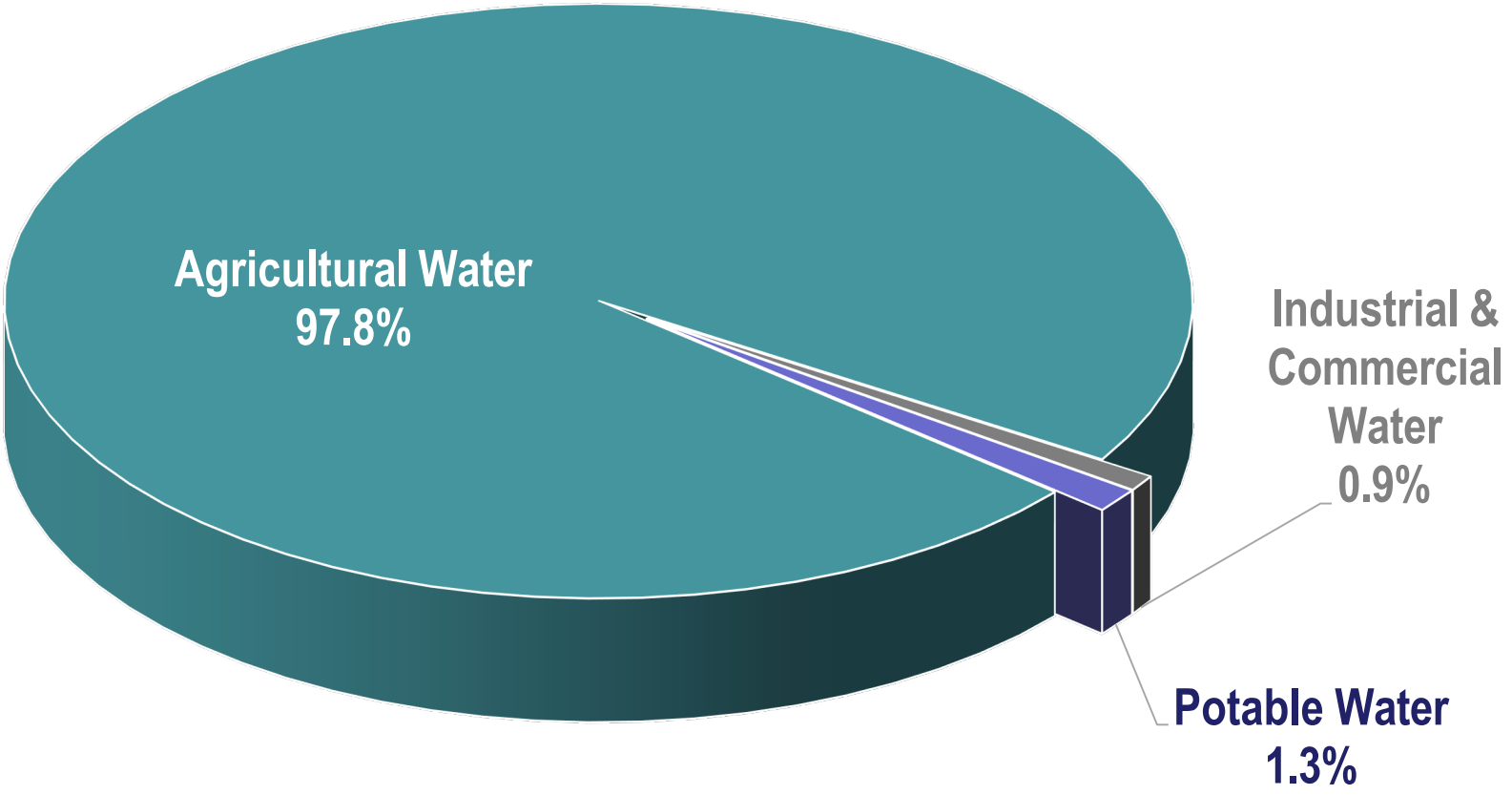
Proposed 2022 Water Apportionment Chart



IID Interim Water Supply Policy for New Non-Agricultural Projects (IWSP)

- In September 2009, the IID Board of Directors adopted an IWSP to satisfy current and near-term development water supply demands.
- The IWSP currently designates 25,000 acre-feet of water for new non-agricultural projects within IID's water service area.
- To date, only 1,200 acre-feet of IWSP water has been contracted for leaving a balance of 23,800 acre-feet available for new projects.

https://www.iid.com/water/municipal-industrial-and-commercial-customers

IID Interim Water Supply Policy

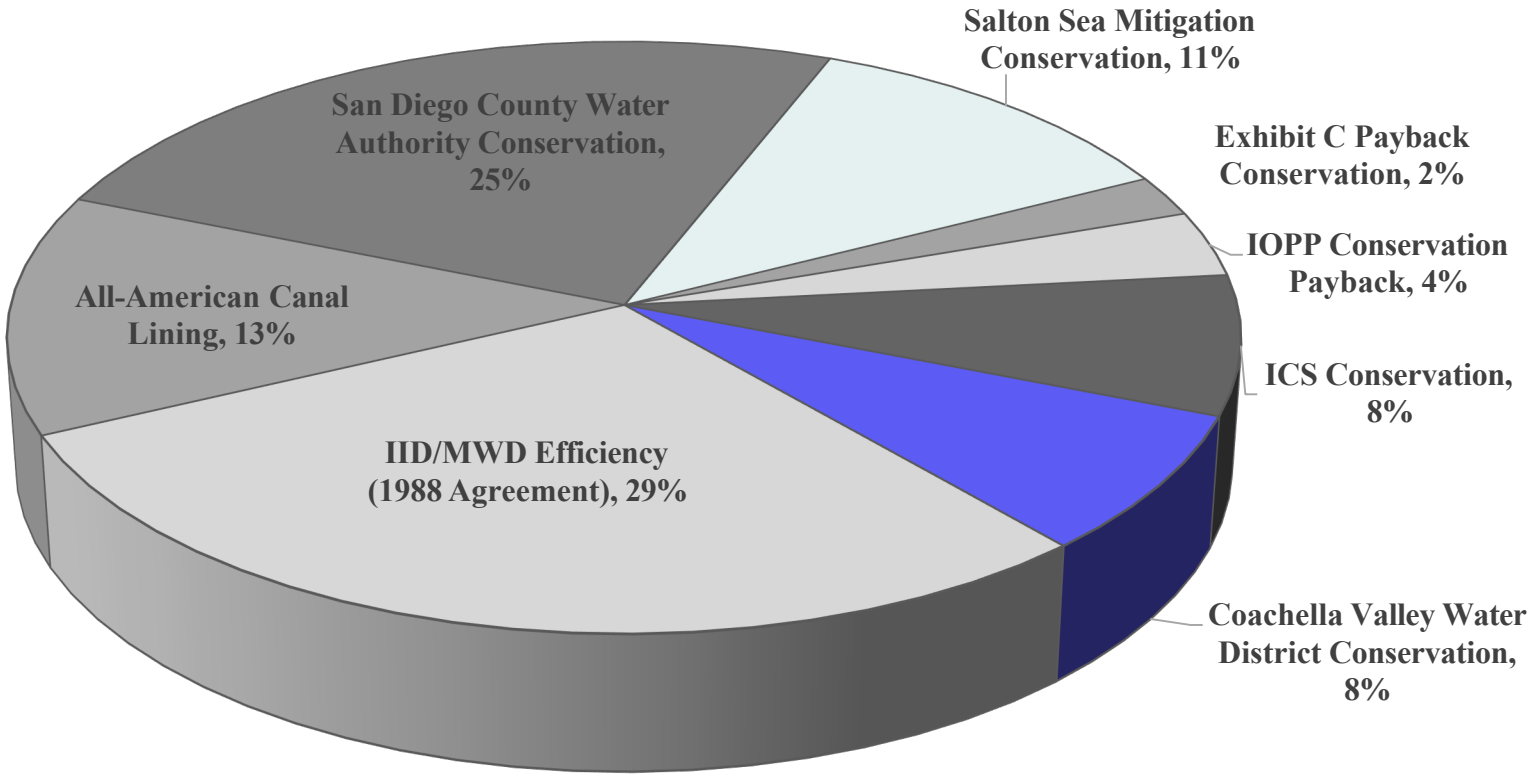
IWSP requirements include, in part, a data submittal outlining project water demands and relevant project information such as that required by a Water Supply Verification/Assessment, appropriate water use efficiency BMPs, and CEQA compliance.

The IWSP establishes two fees to fund projects identified in the IID IWRMP or other supplemental water supply projects:

1) **Reservation Fee** – This provides for a 2-year "hold" (renewable twice for a total of up to six years) on the IWSP water supply for a project; billed upon completion and approval of the project's IWSP water supply agreement.

2) **Water Supply Development Fee** – Annual tiered pricing fee based on a project's contracted maximum use water supply; billed annually once operational water delivery has commenced.

IID's QSA Water Conservation & Transfer Summary
(2003-2021 Total = 6,754,287 AF)



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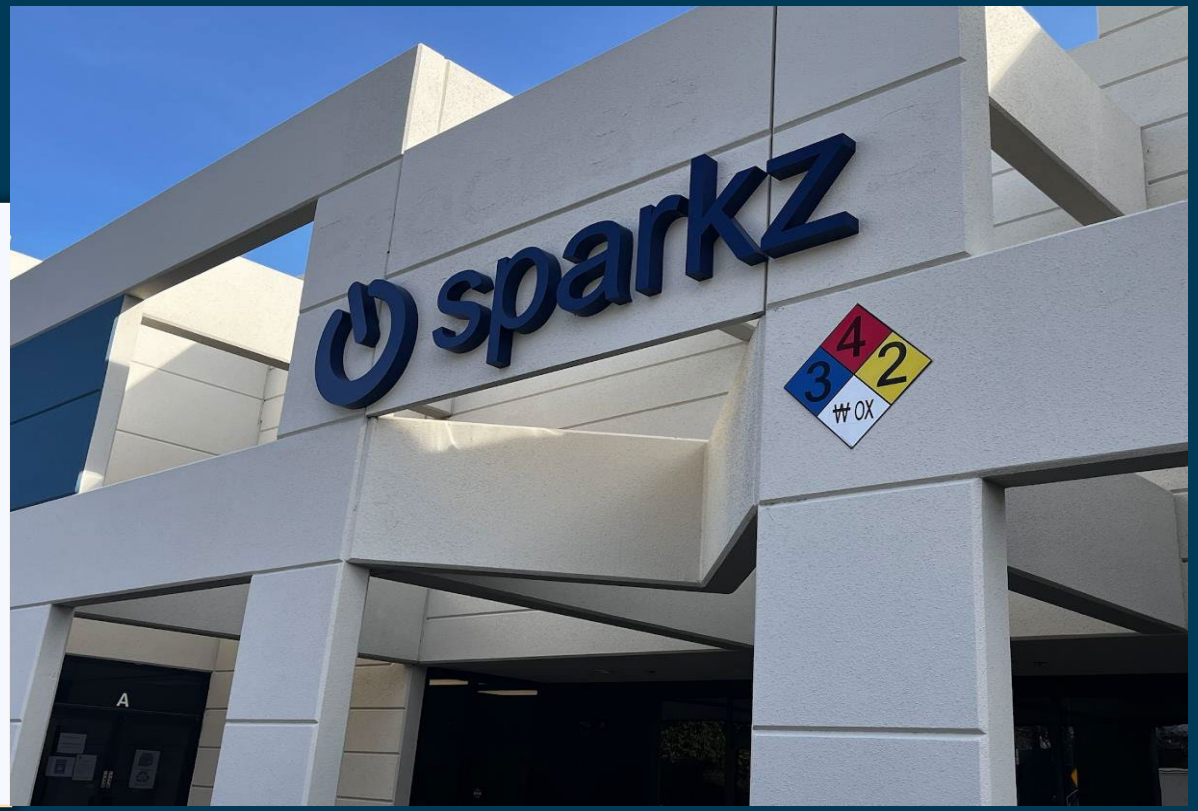
Abby Rodriguez

Manager

Product and Business Development

Sparkz

sparkz



REENGINEERING SUPPLY CHAIN FOR LITHIUM BATTERY WITH COBALT-FREE CATHODES

Who We Are

- We are an emerging, well-funded disruptive organization focused on the development, manufacturing, and distribution of world-class energy storage systems

- We focus on lithium-ion, cobalt-free, environmentally friendly vertically integrated manufacturing of lithium-ion, cobalt-free cells using two chemistries
  - Lithium Iron Phosphate (LFP)
  - Nickel Iron Aluminum (NFA)

- We have a comprehensive solution toolbox and resources

- We partner with major OEM’s

Experienced Management Team

Dr. Sanjiv Malhotra

Founder & CEO

US Dept. of Energy, Oorja Protonics Inc, Kleiner Perkins, H Power Corp.

Linkedin

Dr. Ali Abouimrane

VP of R&D

Argonne National Lab, National Research Council, Canada

Linkedin

Antonio Reis

VP of Engineering

Valence International Battery Teledyne Energy Systems, Inc.

Linkedin

Richard Dapaah

VP of Business Dev.

Morgan Stanley, Goldman Sachs, Agilent Technologies, HP

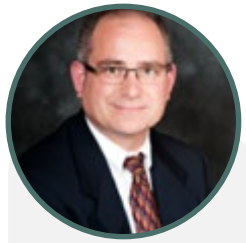
Linkedin

Bella Hayes

Head of Accounting

Deloitte

Linkedin



Rick Burkhardt

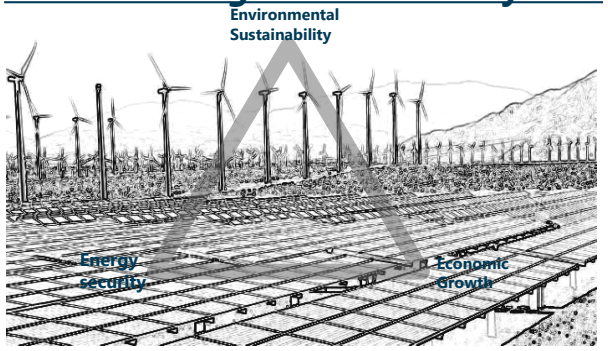
VP of Finance

Summit Power Group, Starbucks Corporation

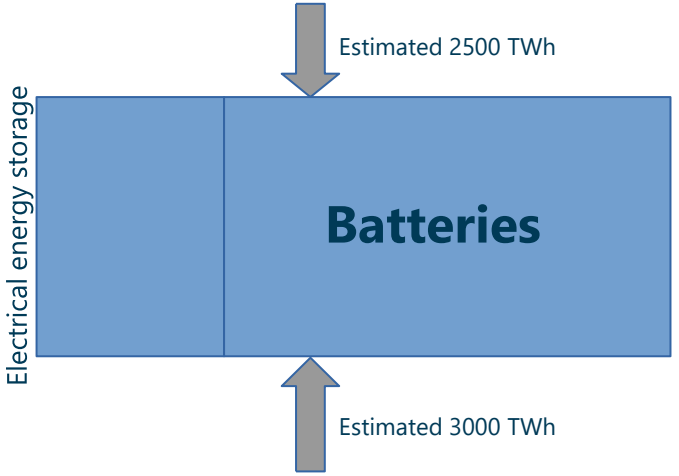
Linkedin

Batteries Are Key to Address Two Big Shifts

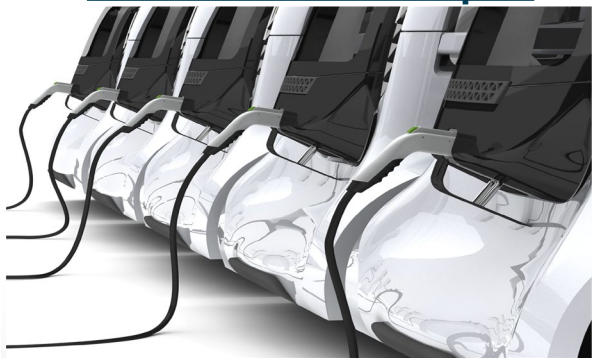
Decarbonizing the electrical system



- 2050 Net zero scenario envisages ~90% renewables (70% wind & Solar)
- Electricity production doubling to >40,000 TWh



Electrification of transport



- 2050 predictions of up to 70% of total transport to be electric.

Note: Estimates are based on data from International Energy Agency and own assessment.

$100 Billion Market Opportunity

First-Mover to Secure Multi-year POs with Market Leading OEMs

INDUSTRIAL /OFF ROAD

26.6 GWH
$10.6 B

Q4'2022

STATIONARY MARKET

25 GWH
$10.6 B

Q2'2023

MEDIUM & HEAVY-DUTY TRANSPORTATION

48 GWH
$22.8 B

Q4'2023

LIGHT-DUTY EV'S

1000 GWH
$42 B

Q4'2024

CONSUMER ELECTRONICS

48 GWH
$21 B

Q4'2025

Images are from the web and do not belong to Sparkz

Our Approach for LFP Production

- Formulations
  - Optimization leveraging water-based binders
  - Optimization of energy and power capacities
- Manufacturing/Product Development
- Quality
  - Robust Quality Management System
  - Product traceability to raw materials
  - Culture of continuous improvement

Sparkz Future Needs

- Material Processing Support
  - Federal Matching Funds
  - State Support of Manufacturing Equipment
  - State Support for Workforce Training and Development
- Community Impact
  - Local Jobs
  - Green Manufacturing
  - Safe Manufacturing
  - Growing Lithium Market

Questions?

info@sparkz.energy
Twitter: @IncSparkz
LinkedIn: SPARKZ Inc.,
Website: sparkz.energy

sparkz Energy Storage Products

Best in Class. American Made.

Discussion Among Lithium Valley Commissioners / Discusión entre los comisionados de Lithium Valley

Public Comment / Comentarios del público

Comment Instructions:

Limited to 3 minutes per comment

By computer: use “raise hand” feature in Zoom

By telephone: dial *9 to “raise hand” and *6 to mute/unmute your phone line

****

Instrucciones para los comentarios:

Límite de 3 minutos por comentario

Por computadora: use la función de “levantar la mano” de Zoom

Por teléfono: marque *9 para “levantar la mano” y *6 para silenciar y para activar el sonido

Discussion and Possible Action on Draft Findings and Recommendations Identified During the Incentive Workshop Held on May 26, 2022 / Discusión y posibles medidas sobre los borradores de los resultados y recomendaciones identificados durante el Taller de incentivos que se realizó el 12 de mayo de 2022

Public Comment / Comentarios del público

Comment Instructions:

Limited to 2 minutes per comment

By computer: use “raise hand” feature in Zoom

By telephone: dial *9 to “raise hand” and *6 to mute/unmute your phone line

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Instrucciones para los comentarios:

Límite de 2 minutos por comentario

Por computadora: use la función de “levantar la mano” de Zoom

Por teléfono: marque *9 para “levantar la mano” y *6 para silenciar y para activar el sonido

Planning for Upcoming Lithium Valley Commission Meetings and Activities / Planificación de próximas reuniones y actividades de la Comisión de Lithium Valley

Public Comment / Comentarios del público

Comment Instructions:

Limited to 2 minutes per comment

By computer: use “raise hand” feature in Zoom

By telephone: dial *9 to “raise hand” and *6 to mute/unmute your phone line

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Instrucciones para los comentarios:

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Por computadora: use la función de “levantar la mano” de Zoom

Por teléfono: marque *9 para “levantar la mano” y *6 para silenciar y para activar el sonido

Administrative Items / Temas administrativos

- Approval of Meeting Action Minutes for the Meetings:
  - March 24, 2022
  - May 12, 2022
  - May 26, 2022

- Aprobación de las actas de acción de las reuniones del:
  - 24 de marzo de 2022
  - 12 de mayo de 2022
  - 26 de mayo de 2022

Public Comment / Comentarios del público

Comment Instructions:

Limited to 2 minutes per comment

By computer: use “raise hand” feature in Zoom

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Informational Items / Temas informativos

- Media and Legislative Updates
- Lithium Valley Commissioner Updates

- Actualización sobre medios y legislación
- Actualización sobre el comisionado de Lithium Valley

Public Comment / Comentarios del público

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Adjourn / Levantar la sesión

Webpage / Página Web: www.energy.ca.gov/LithiumValleyCommission
List Serv / Lista de Correo Electrónico: Lithium Valley Commission

Thank you!

¡Gracias!

LithiumValleyCommission@energy.ca.gov

Break / Receso

Return at / Volvemos a las

LithiumValleyCommission@energy.ca.gov