# **Lithium** Call


CORFO

InvestChile
FOREIGN INVESTMENT PROMOTION AGENCY

Collaborates:

Comité de Minería No Metálica
Gobierno de Chile
COMITÉCORFO

# OPPORTUNITIES TO LITHIUM VALUE ADDED INTEGRATION IN CHILE

# IN CHILE


# LITHIUM

## NATIONAL COMITTEE

On January 26th 2016, President Michelle Bachelet announced a new Policy regarding Lithium and Salt flats.

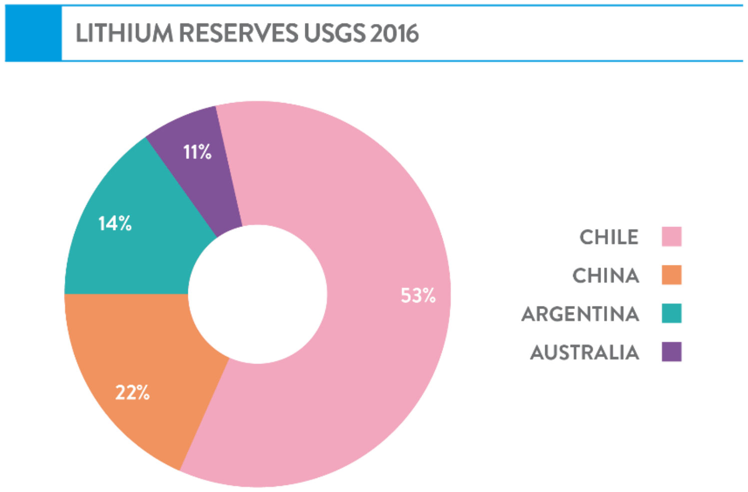
*Move forward an integrated salt flats governance, starting point to sites explorations and resource exploitation. In need of developing technological capabilities to safeguard the salt flats sustainability and move forward to value added products.*


# LITHIUM RESERVES

## IN CHILE

According to USGS (2016) worlwide Lithium reserves are 14,3 million tons.

Chile's Salar de Atacama reserves are about 7,5 million tons (40 millions LCE) making the country the richest in economical proven reserves.




SOURCE USGS 2016

# CONTEXT

## LITHIUM MARKET | WOLDWIDE Li SUPPLY

**SQM**

25%

**Albemarle**

17%

ALBEMARLE

SQM
THE WORLDWIDE BUSINESS FORMULA

**CHINA**

(Others, not including Tianqui-Talison)

14%

**Tianqi 51%**

**Albermarle 49%**

24%

TALISON LITHIUM

**FMC**

9%

FMC
The Lithium Story.

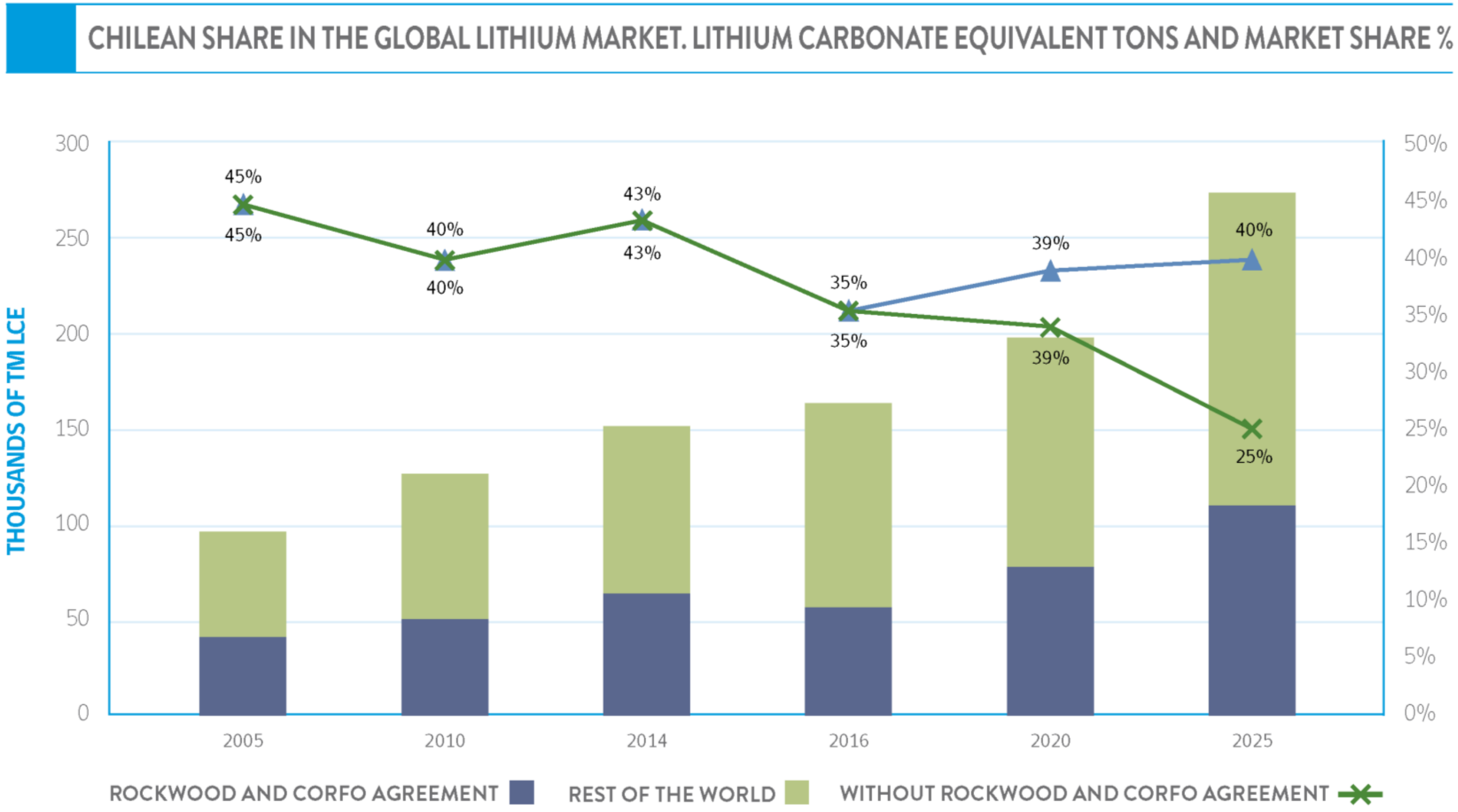
**Others**

11%

LCE: Lithium Carbonate Equivalent

# CONTEXT

## CHILEAN LITHIUM MARKET (conservative analysis)




SOURCE: CORFO

# CONTEXT

## CHILEAN LITHIUM EXPORTS

**Lithium Carbonate | Lithium Hydroxide | Lithium Chloride | Brine**

**2015** **USD 302 Millions**

**2016** **USD 589 Millions**

*2016 Chilean exports are about 40% of worldwide Lithium market (Chile: 79,500 tons LCE).*

# CONTEXT

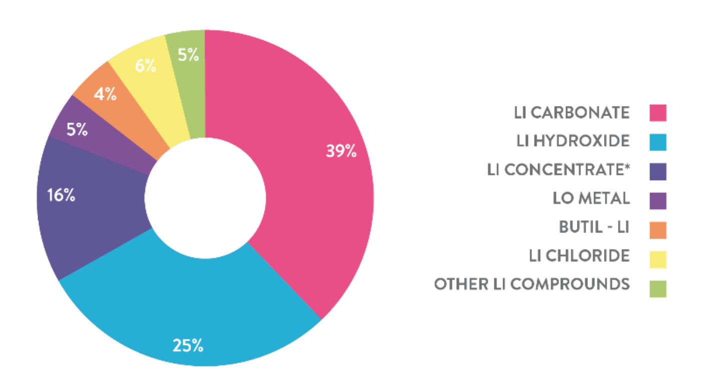
## LITHIUM DEMAND 2017 | 2035

2017 Lithium demand is expected to reach 188,000 tons LCE, having Lithium Carbonate as the main product.

**2035 conservative scenario:** Lithium demand outlook are around 610,000 tons LCE, having about 290,000 tons destined to battery production.

**2035 high scenario:** Lithium demand outlook of some experts are around 1,200,000 tons LCE of which about 750,000 tons would supply the electro mobility industry. Bloomberg in line with this forecast estimates sales of electric vehicles that would reach 40,000,000 units by 2035-2040.

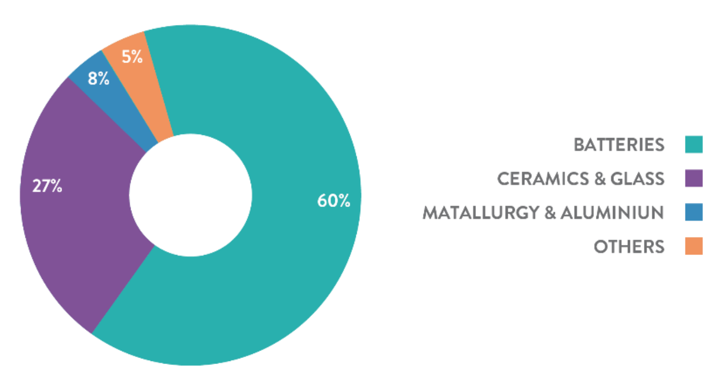
LITHIUM DEMAND BY CHEMICAL COMPOUND - 2017 BASE SCENARIO




*USED IN DIRECT APPLICATIONS

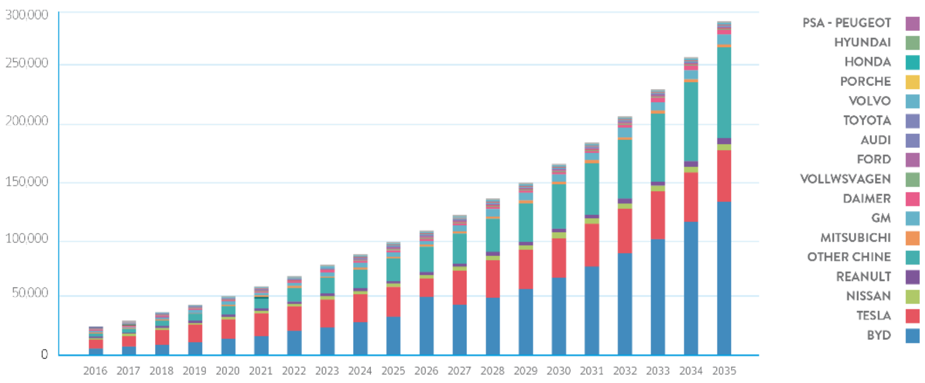
SOURCE SIGNUM BOX ESTIMATES

LITHIUM CARBONATE MERCHANT MARKET 2017 - BASE SCENARIO




SOURCE SIGNUM BOX ESTIMATES

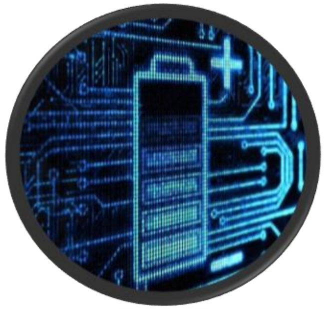
LITHIUM CONSUMPTION IN BATTERIES FOR HYBRID AND ELECTRIC VEHICLES - TONS LCE




SOURCE SIGNUM BOX ESTIMATES

# VALUE CHAIN

## GLOBAL TECHONOLOGY TRENDS



### Consumer electronics & Devices

The rise of mobile phones, laptops and other devices has boosted the lithium demand, and over the past five years the successful introduction of smartphones and tablets continues to drive this trend.

### Electric Vehicles

Lithium demand traction is expected to change in the short term and will come mostly from its use in electric vehicles and large energy storage systems.

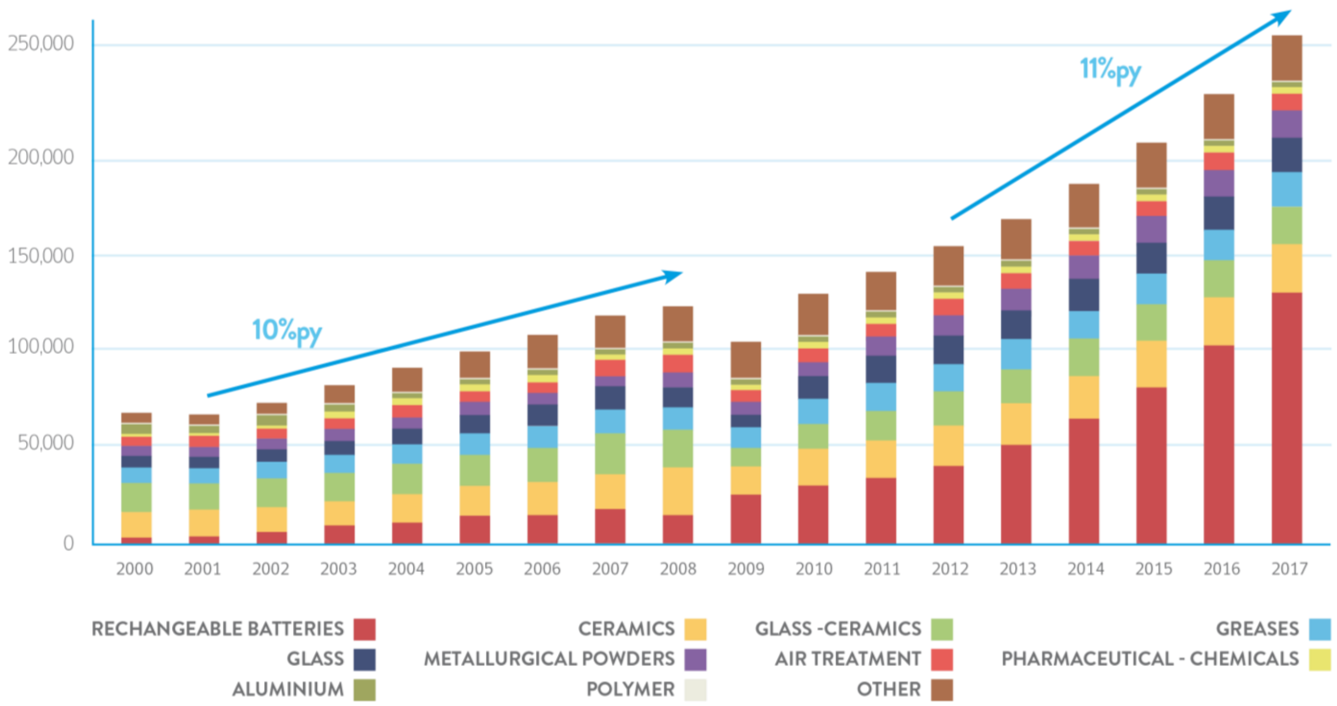
### Almacenamiento Térmico

There is an incipient interest in developing thermal salts based on $LiNO_3$ (lithium nitrate) thus improving the melting and freezing points of the molten salts currently used in CSP plants.

# END-US MARKET

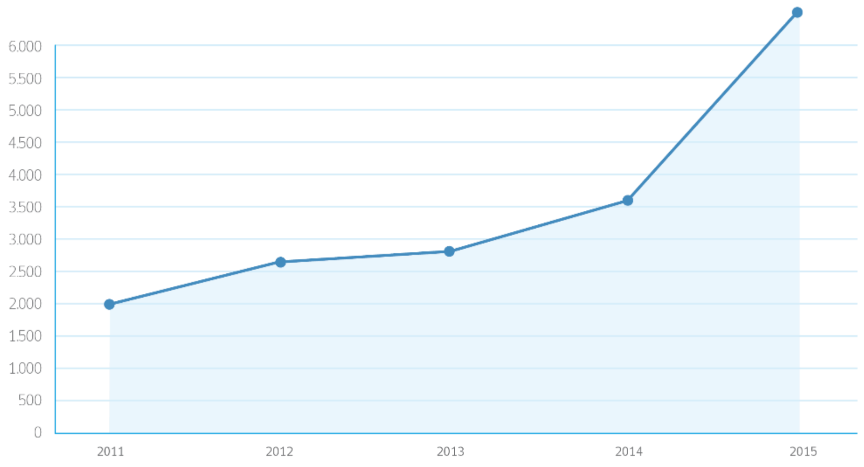
## ITS RECENT EVOLUTION AND FUTURE PROSPECTS

WORLD CONSUMPTION OF LITHIUM BY END-USE




SOURCE: LITHIUM MARKET OUTLOOK 2017. ROSKILL INFORMATION

ABOUT 6,500 PATENTS JUST IN 2015




SOURCE: CORFO

AMPEREX TECHNOLOGY LTD • BOSCH GMBH ROBERT • BYD CO LTD •
COMMISSARIAT ENERGIE ATOMIQUE • GS YUASA INT LTD • HITACHI LTD •
LG CHEMICAL LTD •
MATSUSHITA ELECTRIC IND CO LTD •
MITSUBISHI CHEM CORP • NEC CORP • NINGDE AMPEREX TECHNOLOGY LTD •
NISSAN MOTOR • SAMSUNG ELECTRONICS CO LTD •
SAMSUNG SDI CO LTD • SANYO ELECTRIC CO •
SONY CORP • TOSHIBA KK • TOYOTA MOTOR CO LTD •
UBE INDUSTRIES • ZEON CORP •

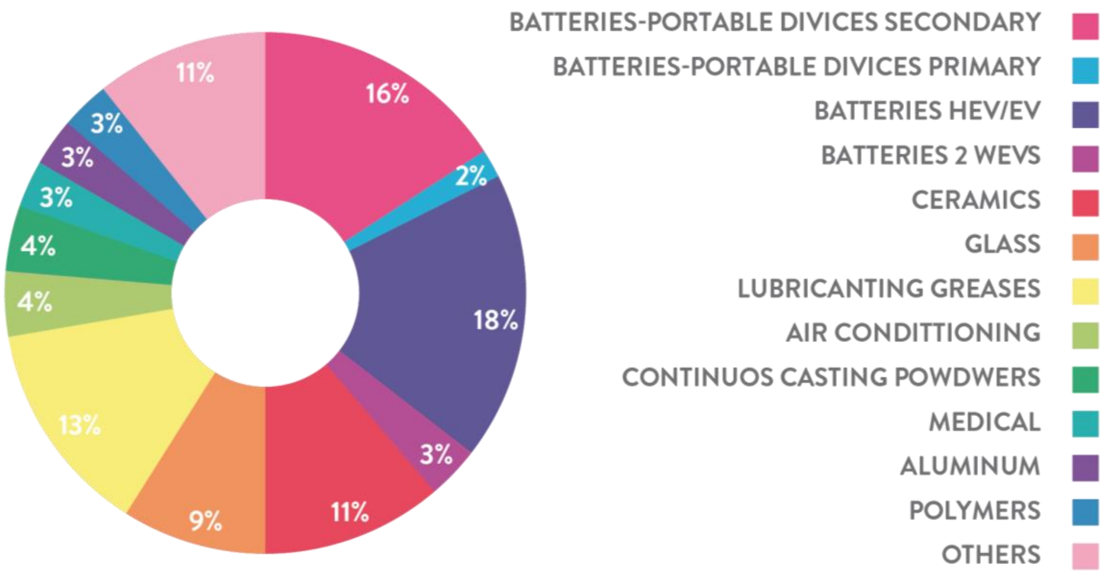
# END-US MARKET

## ITS RECENT EVOLUTION AND FUTURE PROSPECTS

| | | Application | Products |
|---|---|---|---|
| Traditional Uses |  | Glass/Ceramics | • Spodumene<br>• $Li_2CO_3$ |
| |  | Greases / Lubricants | • LiOH |
| |  | Chemical Synthesis | • Li Organometallics fed by Li Metal LiCl |
| Energy |  | Portable Electronics & Other Handhelds | • BG $Li_2CO_3$<br>• BG LiOH<br>• BG Li Metal<br>• BG Electrolyte Salts<br>• BG LiCl<br>• BG Alloys<br>• BG Specialty Compounds |
| |  | Hybrids | |
| |  | Battery Electric Vehicle (BEV) | |
| |  | Grid and Other Power Storage Applications | |

Fuente: Albermarle

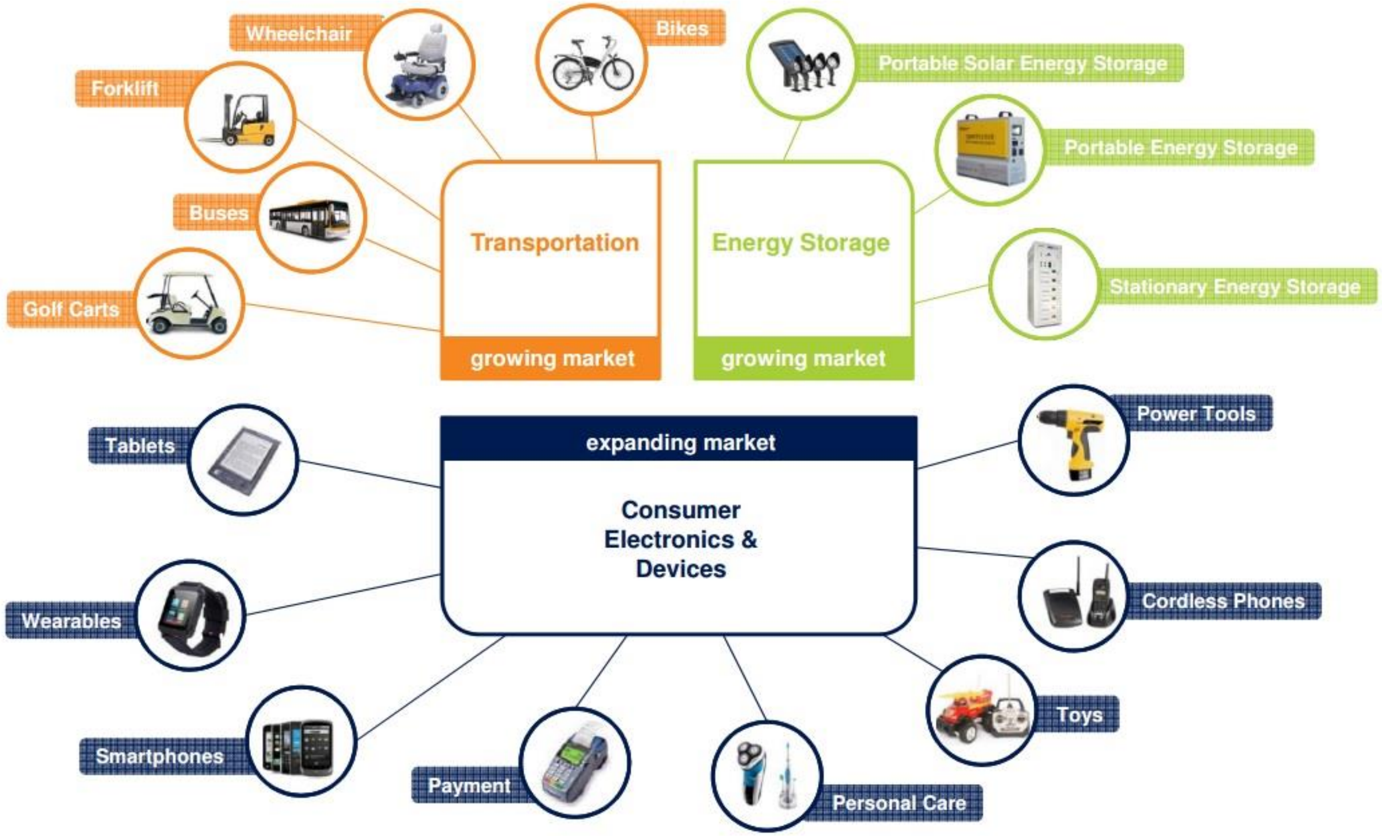
**LITHIUM CONSUMPTION BY APPLICATION 2017 - BASE SCENARIO**




SOURCE SIGNUMBOX ESTIMATES HEV/EV. HYDRID ELECTRIC VEHICLES / ELECTRIC VEHICLES. 2WEVS: TWO-WHEELS ELECTRIC VEHICLES.

# ION-LITHIUM BATTERY INDUSTRY

## MARKET SIZE




Source: Albermarle Holdings

*The global market for lithium batteries is expected to continue its accelerated growth* ***to double the current market*** *estimated at about $ 20-22 billions.*

**By 2022,**
**the market size of lithium batteries (*)**

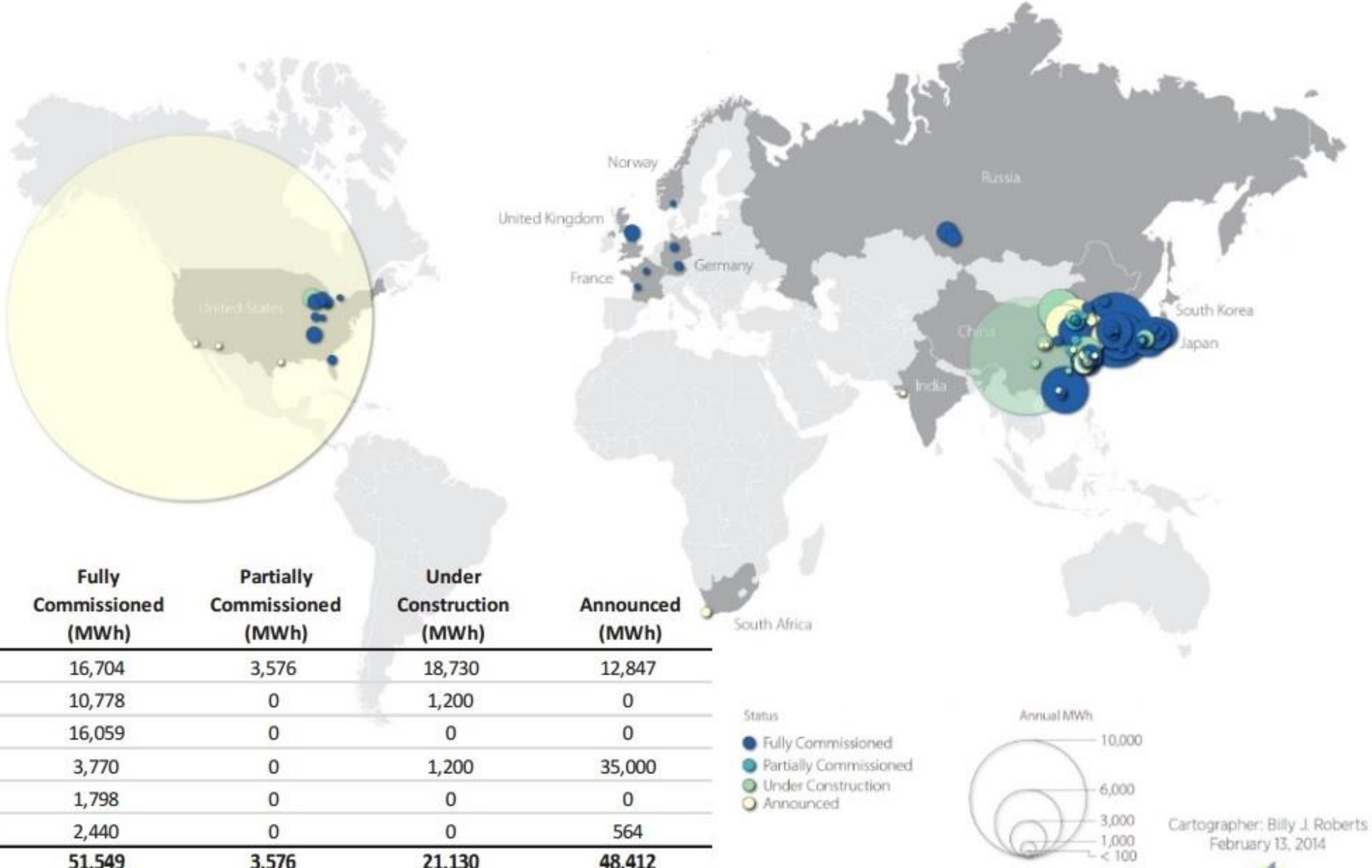
**US$ 40 ~ 46 billions**

(*) Source: Allied Market Research entitled, "World Lithium-Ion Battery Market: Opportunities and Forecasts, 2015-2022" 2016.

# GLOBAL PRODUCTION CENTER

## HEAVILY CONCENTRATED MANUFACTURING

### Li-Ion Batteries

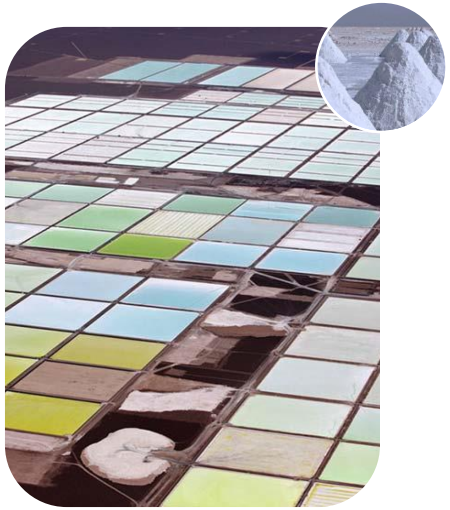


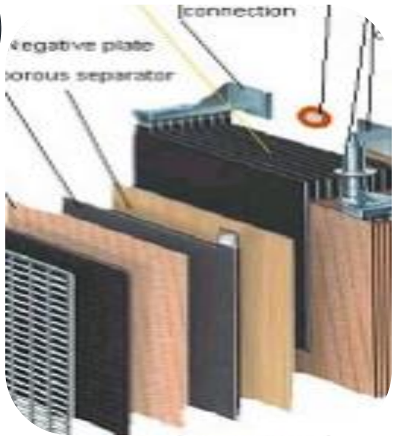

| | Fully Commissioned (MWh) | Partially Commissioned (MWh) | Under Construction (MWh) | Announced (MWh) |
|---|---|---|---|---|
| China | 16,704 | 3,576 | 18,730 | 12,847 |
| Japan | 10,778 | 0 | 1,200 | 0 |
| Korea | 16,059 | 0 | 0 | 0 |
| U.S. | 3,770 | 0 | 1,200 | 35,000 |
| EU | 1,798 | 0 | 0 | 0 |
| Rest of World | 2,440 | 0 | 0 | 564 |
| **TOTAL** | **51,549** | **3,576** | **21,130** | **48,412** |

Note: This map includes factories that are fully and partially commissioned, under construction, and announced. Capacity is not disclosed for all factories.
Source: Corporate reporting. Bloomberg New Energy Finance BNEF (2015).

# LITHIUM VALUE CHAIN FOR EV

Raw material processing → Components Manufacturing → Cells Production → Assembly with thermal control and electric charge → Vehicle integration






**Raw material processing**

- Lithium chloride.
- Lithium carbonate.
- Lithium hydroxide.
- Lithium nitrate.

**Components Manufacturing**

- **Cathodes:** Li, Mn, Ni, Co, Fe, P, Al. Precursors material.
- Anodes: Purified graphite.
- **Electrolitos:** $LiPF_6$, $LiClO_4$.
- Binders (functional compounds).

**Cells Production**

- Packing: Metal laminate (steel, aluminum).
- Lead.
- Insulation.
- Ventilation.

**Assembly with thermal control and electric charge**

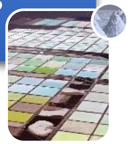
Components:
- Mechanics.
- Electrical.

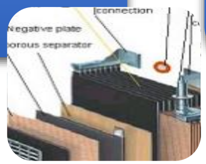
**Vehicle integration**

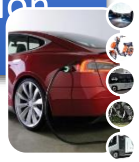
Individual elements:
- Motor.
- Tires.
- Positioning systems.

# LITHIUM VALUE CHAIN FOR EV

Raw material processing → Components Manufacturing → Cells Production → Assembly with thermal control and electric charge → Vehicle integration







Relative market value

| Raw material processing | Components Manufacturing | Cells Production | Assembly with thermal control and electric charge | Vehicle integration |
|---|---|---|---|---|
| x 1 | X 4 | X 14 | x 20 | x 100 |
| US$ 1b (*) | US$ 3,50b (**) | US$ 13,6b (**) | US$ 19,6b (**) | US$ 100b (***) forecast 2020 |

Main players

| Raw material processing | Components Manufacturing | Cells Production | Assembly with thermal control and electric charge | Vehicle integration |
|---|---|---|---|---|
| Albemarle<br>SQM<br>FMC<br>TIANQI | Samsung-Umicore-BASF<br>L&F-Clariant-Easpring<br>Nichia-Mitsubishi Chemicals<br>Ube Industries-3M | BAK-PEVE-Leclanché<br>AESC-Panasonic-LG Chem-NEC-Toshiba<br>BYD-Samsung SDI<br>JC Sanyo | BYD-LG Chem-GM<br>GSYuasa-Hitachi<br>Lishen-Tesla<br>Panasonic | GM-BMW-Hyundai-Nissan<br>Ford-Magna-Eaton-BAE<br>BYD Auto-Luxgen motors<br>Chery Automobile |

A123 -Toyota Motor

Toyota Motor-Tesla

Panasonic-Sanyo-LG Chemicals

Bosch-Lithium energy Japan

Fuentes: (*) FMC. 2013. (**) AVICENNE ENERGY 2015. (***)Global Electric Vehicles Market & Volume (Plug-in, Battery, Hybrid, Fuel Cell) Motors 2015.

# CHILEAN LITHIUM CALL

## CORFO & INVESTCHILE PROGRAMS

CORFO

LITHIUM SPECIALIZED INDUSTRY

InvestChile
FOREIGN INVESTMENT PROMOTION AGENCY

IFI, Integrated Development Initiatives -
PRAP, Pre-Investment Support Program -
Guarantee -
R & D Tax Incentive -
Subsidies for Innovation -
Competitiveness Training Program -

- Promotion
- Investor Assistance
- Aftercare

ALBEMARLE

CORFO | Albemarle Contract

**Preferred lithium prices**
**Supply assurance**

# ESPECIALIZED PRODUCERS CALL

# INVITATION

# CONTEXT

## CORFO AND ROCKWOOD CONTRACT

**Fourth Clausure, number 8 of CORFO and Rockwood contract:**

**Preferable lithium prices.** RLL is obliged for as long as the "*Convenio Básico*" operates and prior to CORFO's approval, to sell its lithium production at the lowest exportation market price (FOB Chile) of the last six months ("*Obligación de Precio más Favorable*", "most favorable price obligation") to value added lithium producers (public or private corporations) which among others, elaborate products as lithium cathodes, ion-lithium battery components or lithium salts in Chile ("*Productores Especializados Establecidos en Chile*", "Local Specialized Producers", "LSP").

By Local Specialized Producers (LSP) it will be considered companies established in Chile which have developed or acquired technologies to produce lithium value added products such as the ones already listed or others. Therefore, no LSP will be allowed to produce from RLL lithium supply products such as lithium carbonate, hydroxide and or chlorine in any of its grades.

Therefore, no LSP will be allow to comercialized Lithium carbonate, hydroxide or chloride from the Lithium supply obtained by this contract.

# CONTEXT

## CORFO AND ROCKWOOD CONTRACT

**Fourth Clausure, number 8 of CORFO and Rockwood contract:**

The obligation acquired by RLL will not exceed, at the moment of signed its contract with the LSP's, the 15% of RLL's local annual theoretical production stated in annex VII of "*Anexo Convenio Básico*".

Once the 15% recently mentioned is fully allocated to LSP's, then that percentage of the local annual theoretical production will be increased in 2.5% year on year until reaching the 25%.

To make this obligation functional, CORFO shall designate either one or more LSP with one year in advanced to the beginning of supply by RLL.

***- Supply stability throughout 27 years (until 2044).***

*- Guaranteed **lowest price for** long term contracts.*

*- Inicial volume: 6,700 tons Li2CO3, ramping up to 16,000 tons in 2023 and until 2044.*

*- Including LiOH and LiCl the final available volume is up to 20,000 tons LCE.*

# FAVORABLE ENVIRONMENT TOWARDS INVESTORS

## OPPORTUNITY HIGHLIGHTS

- Chile as a leader of Lithium produceer gives confidence in supplying stability.
- Chile guarantees long term Lithium sources, forecasting to be expanded by Codelco (Maricunga).
- Chile is an emergent economy, the best evaluated to do businessess within Latam, as well as renowned worldwide.
- The State of Chile is looking to bring foreign investment to the country.
- Align with the Official National policy regarding Lithium and Salt flats, document by the President (2016).
- Synergy with Solar Technological District in Atacama Region.

# CALL

## COMPANY'S SELECTION PROCEDURE

### A — Applying

Letter of Interest

**Time limit: June 30th, 2017**

Road Show, Frankfurt Germany
**May 18th, 2017**

### B — Prequalification

Selection of companies

Eligibility criteria:

Production experience
Tecnological capabilities
Market experience
Environmental trackrecord
Financial solvency

Prequalified companies notification

### C — Proyects enhancement

Q&A process with prequalified companies only

90 days to project presentation

Criteria:

**Value added per lithium unit**
**Technological sophistication**
**Local human resources**

# CALL

## LETTER OF INTEREST

**Contents**

### Participants

- Candidate: single company, compsortium, joint venture or other.
- Company's general information concerning itself and it's holding related companies.
- Financial reports proving capacity to make the necessary investments.
- List of legal procedures (sworn statement).
- Confidentiality agreement.

### Area to develop

- Name areas interested in developing in Chile.
- Name product(s) looking to produce in Chile and provide market information.
- Describe the company's technological capabilities that will allow to fulfill the project regarding value added products.
- Market experience.
- Describe current operation sites.
- Provide a trackrecord regarding relationship with communities in operation sites, security, health and environment.
- Provide a gross estimation of local capital expenditure to develop your Project.

# LOCATIONS & REAL ESTATE ALTERNATIVES

# IN NORTHERN CHILE

# LOCATIONS

## 1 TARAPACA REGION
### ALTO HOSPICIO – IQUIQUE

- ❑ ZOFRI Alto Hospicio Industrial Park – PEZAH
- ❑ Lots starting from 1,500 m2 (developed)
- ❑ Iquique Maritime Terminal – 17 Km
- ❑ Free Duty Zone

❑ **Owner: Zona Franca de Iquique S.A. - ZOFRI**

## 2 ANTOFAGASTA REGION
### LA NEGRA SUR AREA

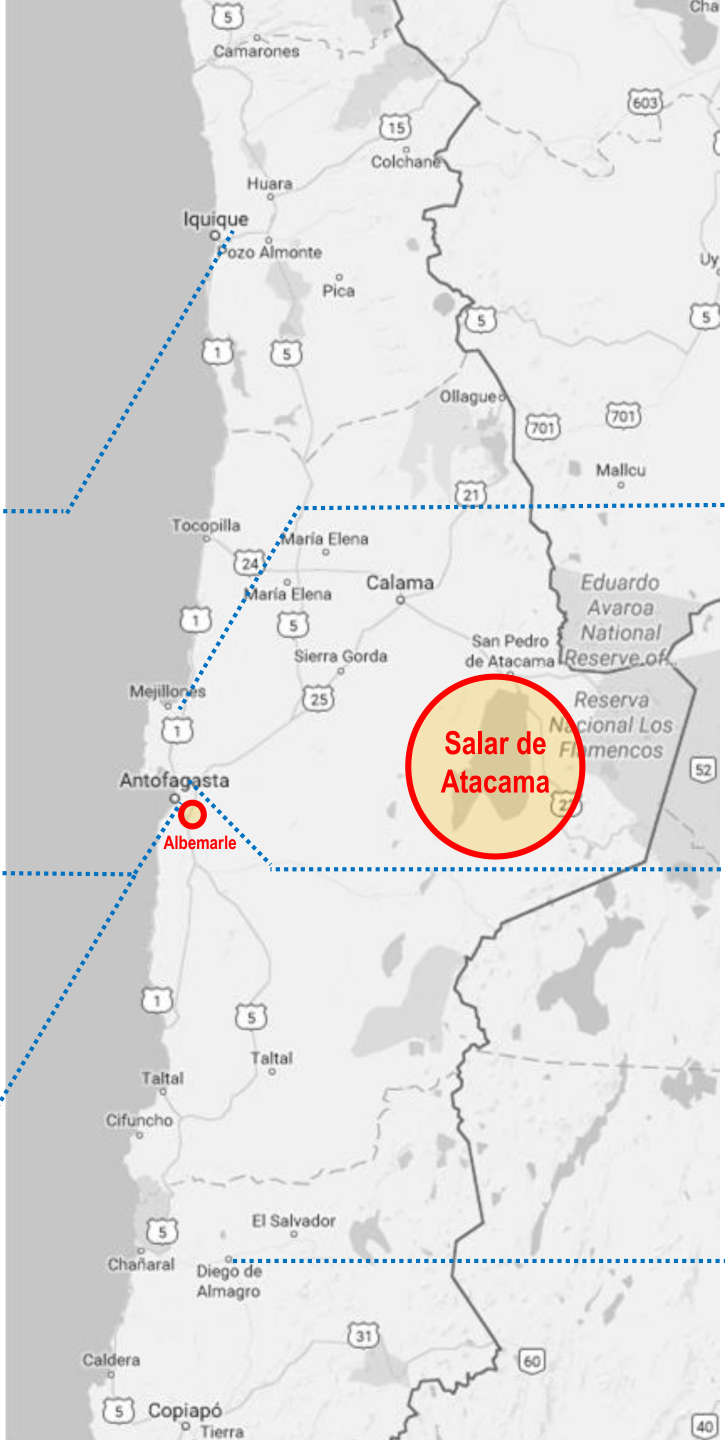
- ❑ Location is on the southern entry to Antofagasta
- ❑ 3 plots making 20.3 Hectares
- ❑ Antofagasta Maritime Terminal – 18 Km

❑ **Owner: Ministry of National Assets**

## 3 ANTOFAGASTA REGION
### LA NEGRA NORTE AREA

- ❑ Location is on the southem entry to Antofagasta
- ❑ 2.53 Hectares plot abailable
- ❑ Antofagasta Maritime Terminal – 19 Km

❑ **Owner: Ministry of National Assets**




## 4 ANTOFAGASTA REGION
### MEJILLONES – SOUTHERN ACCESS

- ❑ Antofagasta Region, Mejillones Southern Access
- ❑ 20.12 hectares
- ❑ Mejillones Maritime Terminal – 12 Km

❑ **Owner: Ministry of National Assets**

## 5 ANTOFAGASTA REGION
### SALAR DEL CARMEN AREA

- ❑ Northern access from Antofagasta to Pan-American Highway
- ❑ 2.53 Hectares plot
- ❑ Antofagasta Maritime Terminal – 16 Km

❑ **Owner: Ministry of National Assets**

## 6 ATACAMA REGION
### DIEGO DE ALMAGRO

- ❑ 18 km north of Diego de Almagro town
- ❑ 26.477 Hectares (5.262 Feasibility Studies)
- ❑ Barquito Port (CODELCO) 89 km

❑ **Concesion Managment Solar Energy Development Committee**

# ALTO HOSPICIO - IQUIQUE

## TARAPACA REGION

### FEATURES

The estates belong to "ZOFRI Alto Hospicio Industrial Park – PEZAH". Location: 17 km East of Iquique, ZOFRI (the Iquique Duty Free Zone) and Iquique Maritime Terminal. It is strategically placed, close to Maritime Terminal, good road connectivity and attractive operation conditions. All business based in the Industrial Park enjoy Free Duty Zone advantages which include:

- Merchandise inside Free Duty Zone are considered as out of territory. They are not subject to taxes, import duties nor any other custom related duties.
- Domestic sales inside Duty Free Zone and sales out of the country not submitted to Chilean taxes nor custom duties.
- Domestic sales inside Duty Free Zone TVA exempt.
- Corporate income tax exempt.
- Any corporate income tax paid, gives 50% credit on personal income tax.

ZOFRI industrial Park (PEZAH)
31 Hectares developed


**Surface available**

Lots starting from 1,500 m2 (developed)

**Price** Rent: USD 1.35/m2 month (untill 03/2019)

Sales: USD 229/m2

**Offer**

Long term lease & Sale

**Application**

Open

**Term**

To be defined by project

**Energy**

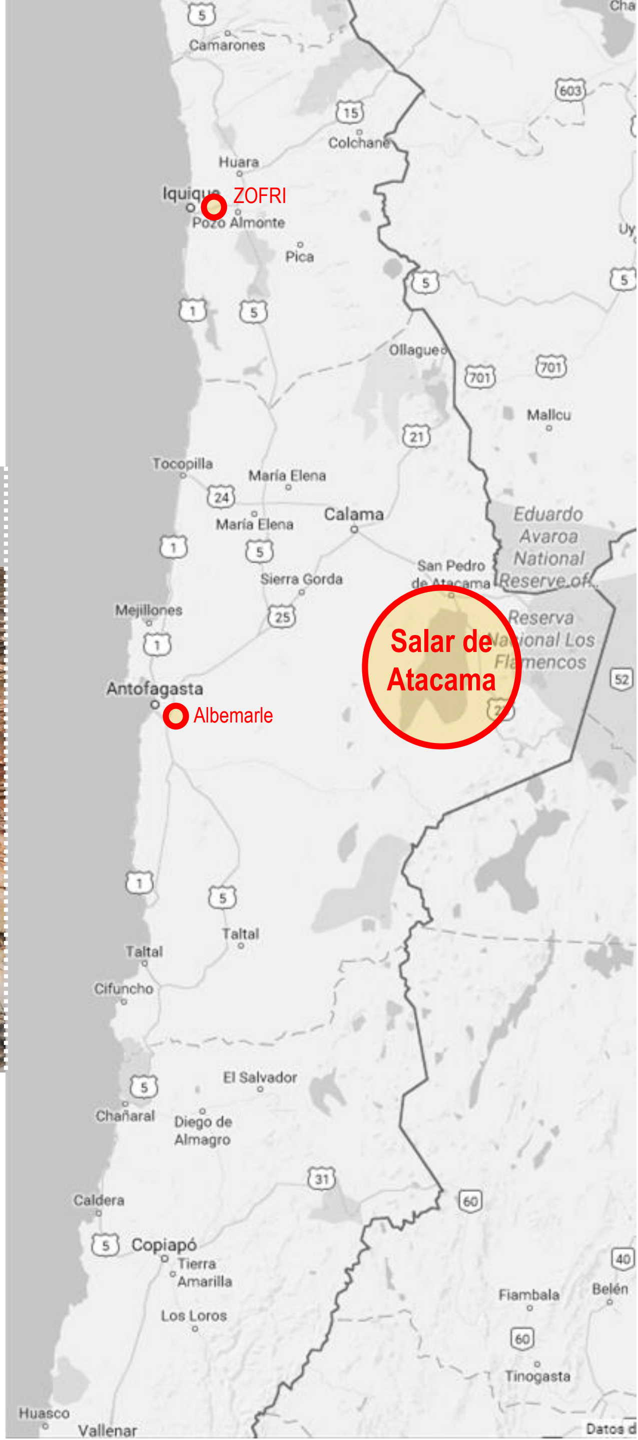
Connected to public grid

**Water**

Connection to public network

**Distance to maritime terminal**

Iquique Maritime Terminal – 17 Km



# DIEGO DE ALMAGRO

## ATACAMA REGION

### FEATURES

Land in the **Solar District Project** zoning, 18 km north of Diego de Almagro town and 1.5 km North of future substation Cumbres through route C-13.

The project area have been allocated 26.477 Hectares. Is reserved for solar power projects and industrial park.

The Industrial Park will be allocated land with fully developed plots. To be supplied power by the Solar District.

Solar Power will be made available 24/7 at US$ 50 per around MW/h and going down.

**Solar District Project**


### Surface

Zoning plan in development. Once development done detailed conditions will be made public. Please inform yourself if your business is akin to Alternative Energy projects. We thank your expression of interest.

### Energy

Connection available starting 2018

### Distance to maritime terminal

Barquito Port (CODELCO) 89 km

### Water

Can be bought to CODELCO

Its desalinization plant has available capacity by batches of 100 l/s

# CHILEAN POTENTIAL MINERAL DEVELOPMENT

# Co-Ni-Mn

# Chilean Potential Mineral Development

## COBALT Co | NICKEL Ni | MANGANESE Mn

A

**Deposits** → Studies and prospection of potential development regions → Antofagasta, Atacama, Coquimbo

B

**Tailings** → R&D to recover high value elements from tailings → **High Potential**

Around 700 tailings, 400.000 tons/y produced by Copper Mining

**Transforming Liabilities into Assets**

CORFO Matching Grants for
**“Strategic Technological Projects”**
**Valuable Elements Recovery**

**USD 3,9 MM**

# LABOUR MARKET
# IN NORTHERN CHILE

# LABOUR MARKET AND SALARIES

## NORTHERN CHILEAN REGIONS

### Monthly Labor Costs - Professionals - ( US$ dollars after tax )

| US$/pm | Years of Experience | | | | |
|---|---|---|---|---|---|
| **Professions** | **1** | **5** | **10** | **15** | **20** |
| Civil Engineering | 1,737 | 2,892 | 4,336 | 5,201 | 5,959 |
| Electrical Engineering | 1,921 | 3,079 | 4,525 | 4,858 | 5,400 |
| Computer Science Engineering | 1,635 | 2,508 | 3,599 | 4,182 | 4,699 |
| Industrial Engineering | 1,740 | 2,976 | 4,373 | 5,358 | 6,145 |
| Mechanical Engineering | 1,579 | 2,838 | 4,262 | 5,417 | 6,270 |
| Chemical Engineering | 1,454 | 2,805 | 4,495 | 4,852 | 5,477 |
| Business Administration | 1,544 | 2,541 | 3,786 | 4,549 | 5,206 |
| Electrical Technic | 1,293 | 2,120 | 2,803 | 3,132 | 3,401 |
| Business Technic | 1,232 | 1,571 | 2,106 | 2,785 | 3,163 |
| Industrial Technic | 1,463 | 2,269 | 2,829 | 2,997 | 3,244 |
| Computer Technic | 1,293 | 1,942 | 2,605 | 3,029 | 3,364 |
| Mechanical Technic | 1,232 | 1,933 | 2,511 | 2,991 | 3,566 |
| Management Control and Inf. Systems Engineering | 1,345 | 2,624 | 3,347 | 3,847 | 4,185 |

Source: Conexión Consultants

### Workforce

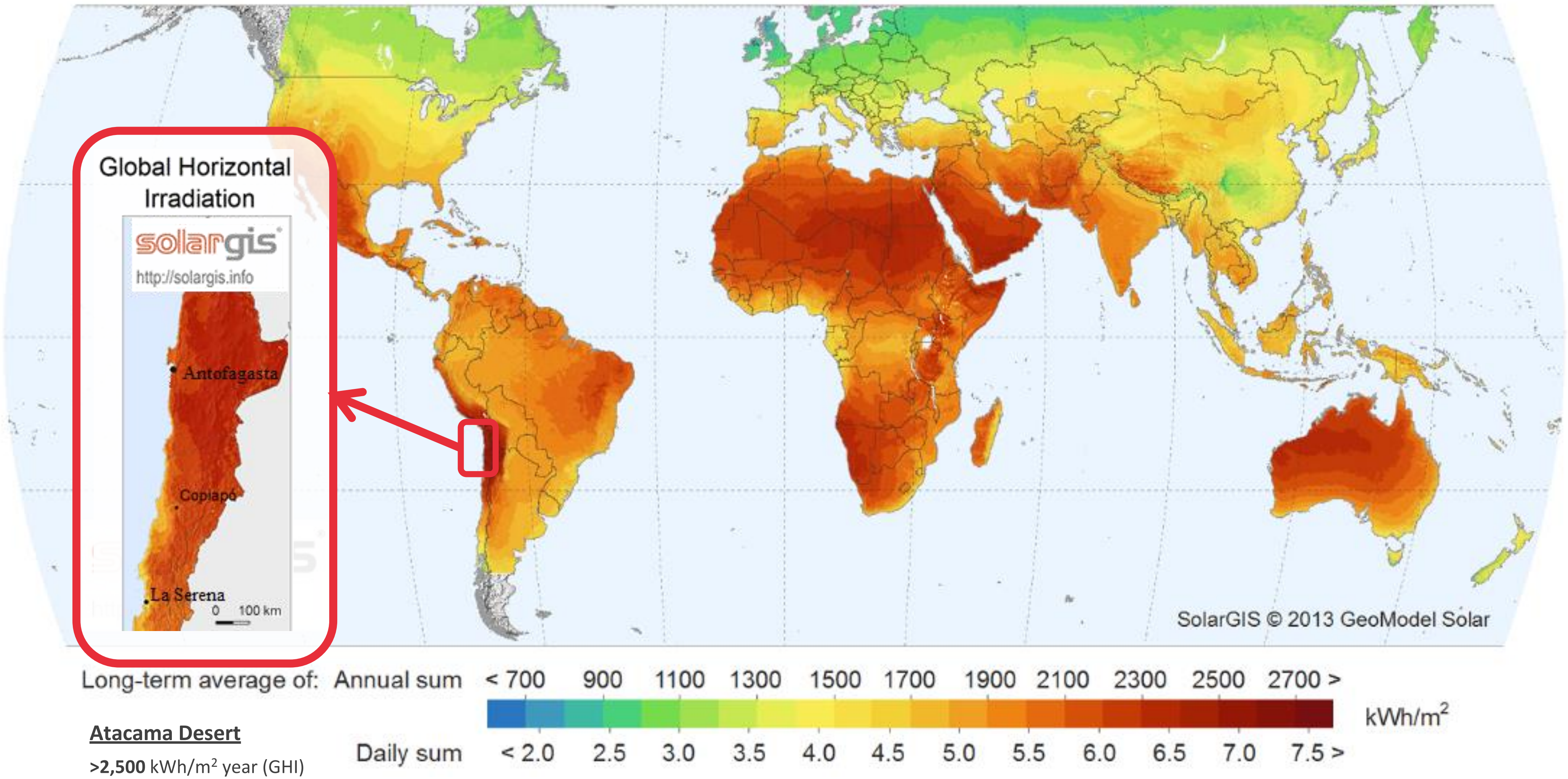
| Region | TOTAL | Employment Rate | Unemployment Rate |
|---|---|---|---|
| Tarapaca Region | 185,480 | 91.3% | 8.7% |
| Antofagasta Region | 291,250 | 92.2% | 7.8% |
| Atacama Region | 138,740 | 92.1% | 7.9% |

# SOLAR

# ENERGY PROGRAM

# CONTEXT

## NORTHERN CHILE | OUR ADVENTAGE → "A SINGULARITY"




**Atacama Desert**

**>2,500** kWh/m$^2$ year (GHI)

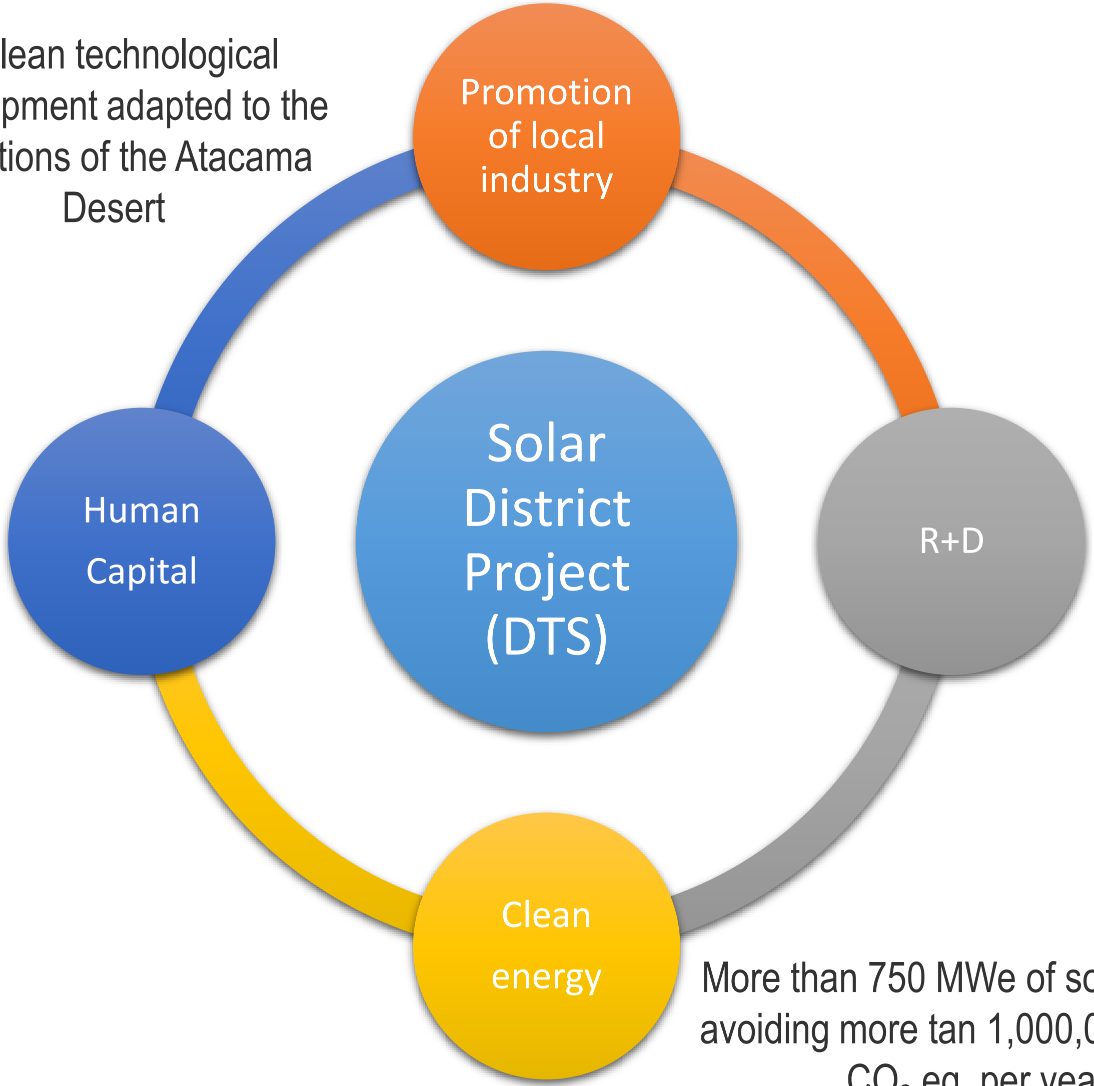
**>4,000** solar hours/year

# SOLAR DISTRICT PROJECT

## OBJETIVES

Chilean technological development adapted to the conditions of the Atacama Desert

Local value capture and job creation

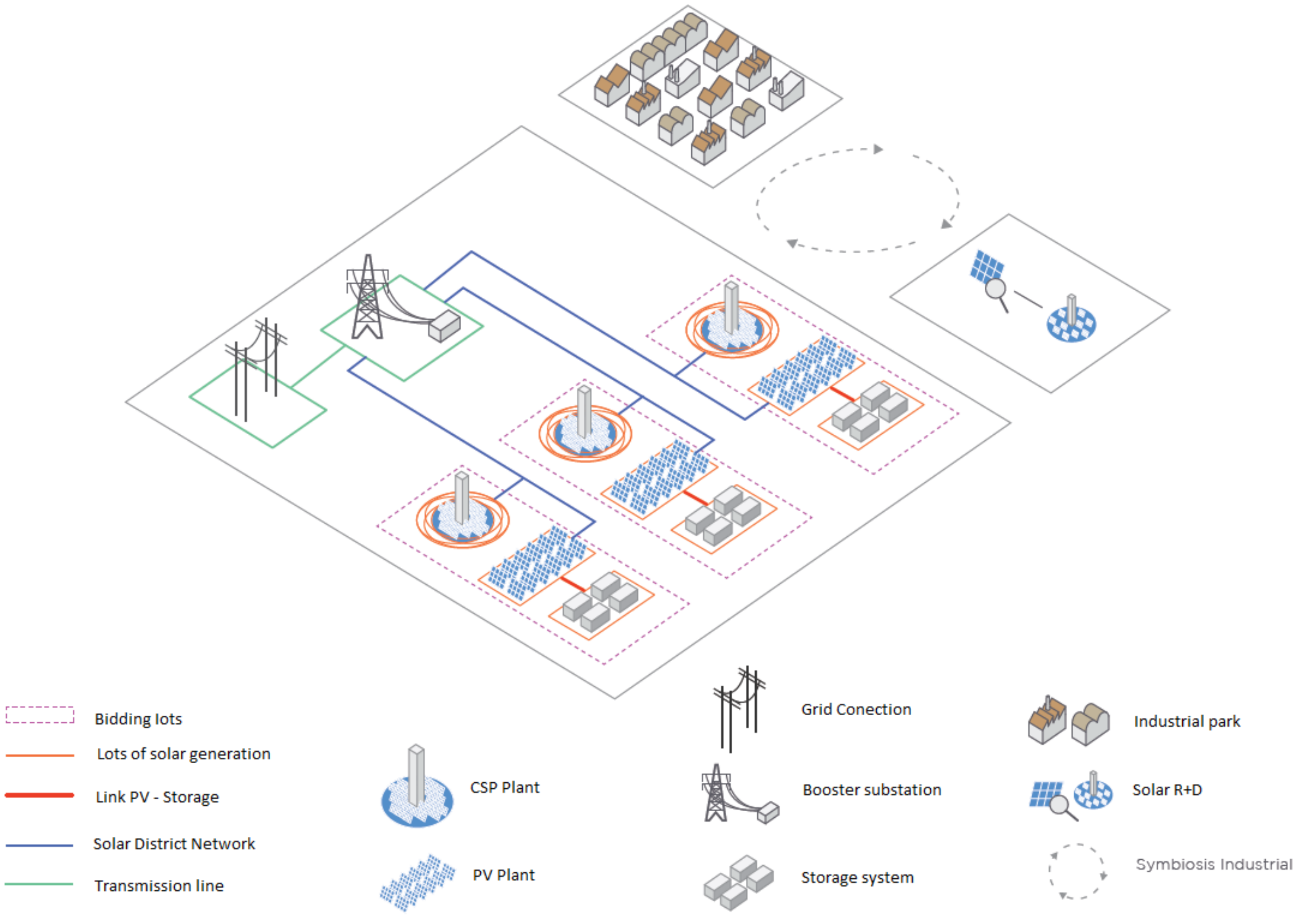


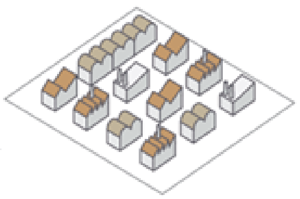

Several solar generation technologies, energy storage and solar fuels

More than 750 MWe of solar power, avoiding more tan 1,000,000 Ton de $CO_2$ eq. per year

# SOLAR DISTRICT PROJECT

## SYMBIOTIC PARK



POTENTIAL INDUSTRIAL DEVELOPMENT

- Industrial gas
- Solar fuels
- Storage
- Solar metallurgy
- Water treatment
- PV module assembly
- Metalmechanical industries