

CHILE´S STRATEGY FOR INNOVATION IN ENERGY TRANSITION AND LOW EMISSION MINING

14th Annual General Meeting IGF 2018

Modern Mining Law and Policy: Accountable, Equitable and Innovative Approaches

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Gobierno
de Chile

**CORFO, the Chilean Economic
Development and Innovation Agency
(since 1939)**

Our Mission is to improve the competitiveness and the productive diversification of the country by encouraging investment, innovation and entrepreneurship, strengthening in addition the human capital and technological capabilities to achieve a sustainable and territorially balanced development.

- + 13.833** beneficiaries in 2017
- + More than 1.000 Startups** supported in 2017
- + 800** innovation projects in companies in 2017
- + +35 R&D Consortia** linking industry and academia
- + 20 Technology Centers**
- + 150.000 credits and guarantees** granted to SMEs
- + More than 50 VC funds** and close to **US\$ 900 million in available funds**

NATIONAL MINING INNOVATION PROGRAM

FROM COPPER TO INNOVATION



ALTALEY

VISION 2035: Chile has a developed a technology based mining industry that addresses productivity challenges with a robust collaborative innovation ecosystem with the industry, suppliers, R&D entities and Public Sector.



250 world class suppliers



US\$ 4 billions exports in goods and services



TECHNOLOGY ROADMAP 2035

A public-private collaborative approach



TRACTION AREAS



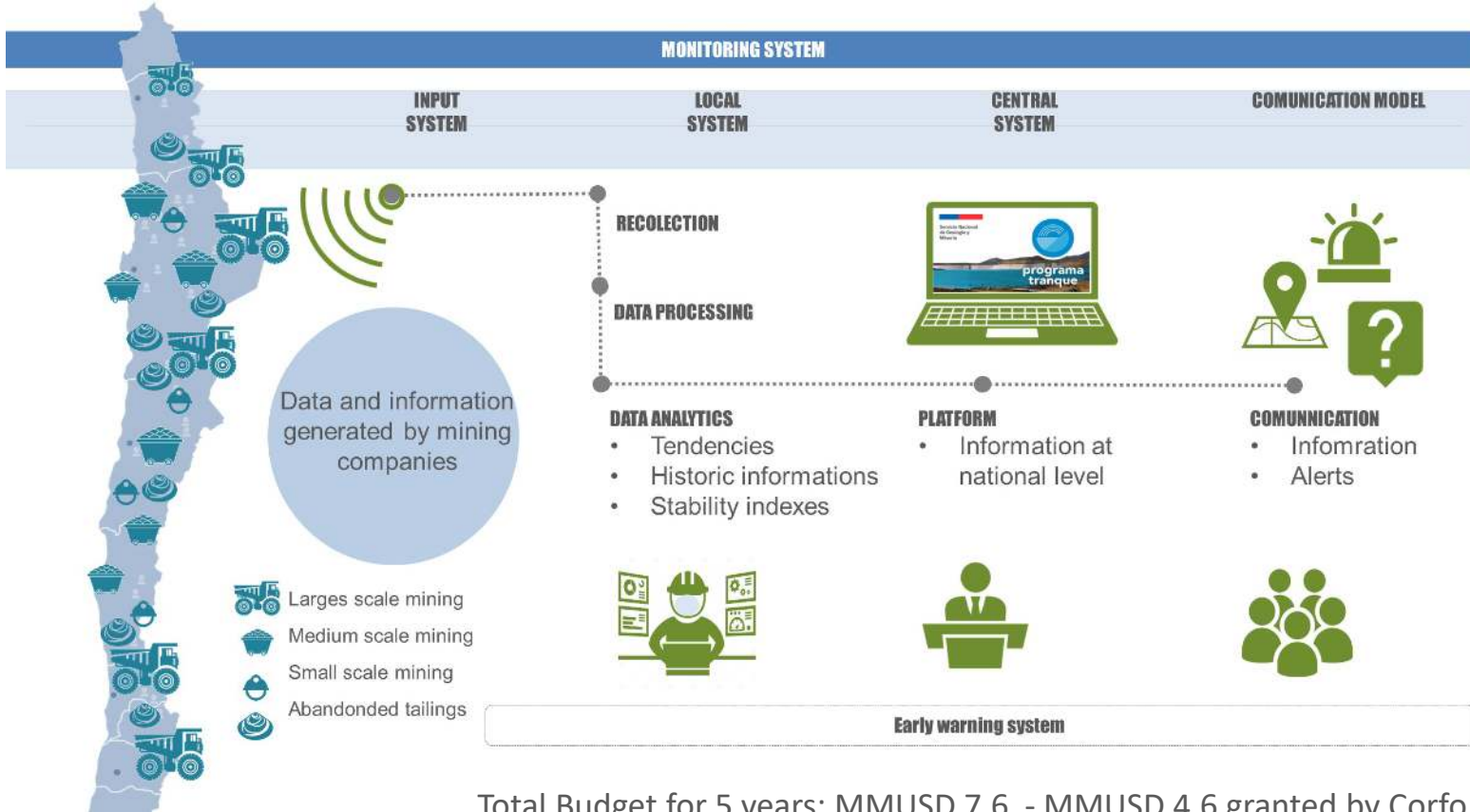
ENABLING AREAS



TRANSPARENT TAILINGS INITIATIVE



Providing QUALITY, RELIABLE AND REAL-TIME INFORMATION (chemical and physical stability) to mining companies, communities and authorities, STRENGTHENING operational management, PROMOTING a risk culture and IMPROVING communication between the parties and the response to eventual emergencies situations.



Lidera:



Socios estratégicos:



Gracias al aporte de:



Apoyan:



Co-desarrollado con:



Total Budget for 5 years: MMUSD 7,6 - MMUSD 4,6 granted by Corfo

HIGH VALUE MINERALS FROM TAILINGS CONSORTIA

Promoting a secondary mining industry from Tailings

- 2 R&D Consortia supported by Corfo are developing strategies and technologies for recovering high value minerals from tailings, such as rare earths, cobalt and others.
- The strategy is to promote re-processing some tailings to extract remanent Copper and Molybdenum, as well as high value minerals, helping to close in a sustainable way old or abandoned ones.



Source: AMTC - Tailings Consortium Codelco Tech-

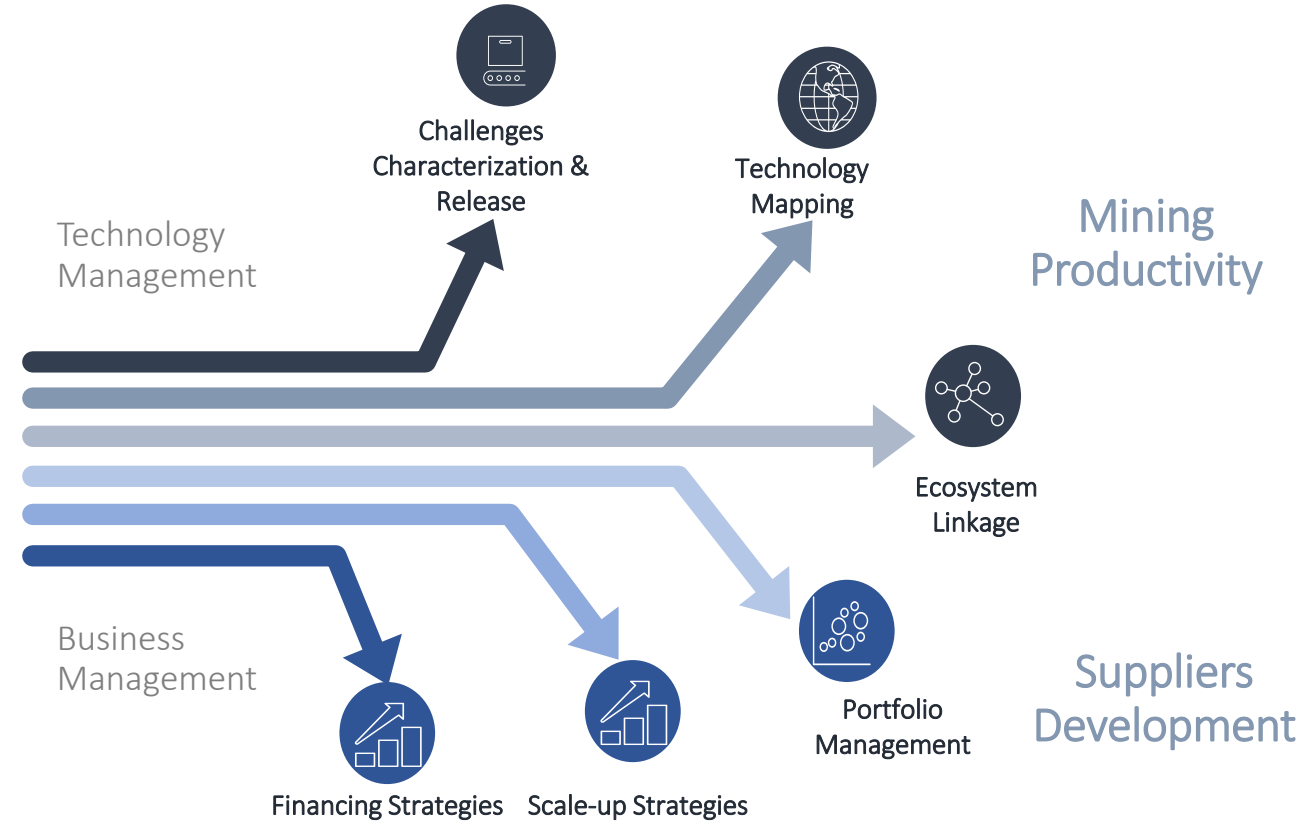
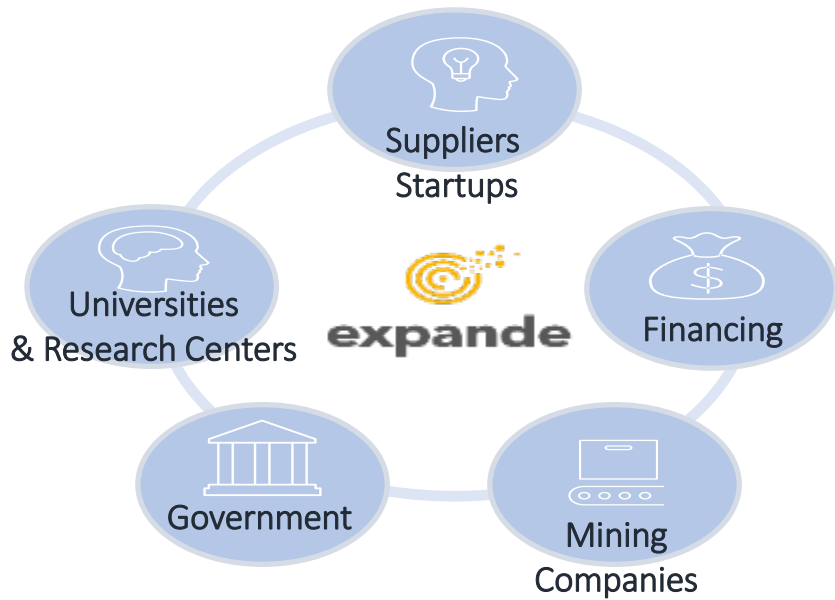


Total Budget for 5 years: MMUSD 3,7 - MMUSD 2,2 granted by Corfo

Total Budget for 5 years: MMUSD 2,5 - MMUSD 1,5 granted by Corfo

MINING OPEN INNOVATION PLATFORM FOR SUPPLIER DEVELOPMENT

Stakeholders



Coordinated by



SMART MINING: INTEROPERABILITY CONSORTIA

Interoperability is an enabling platform to smart, connected mining operations



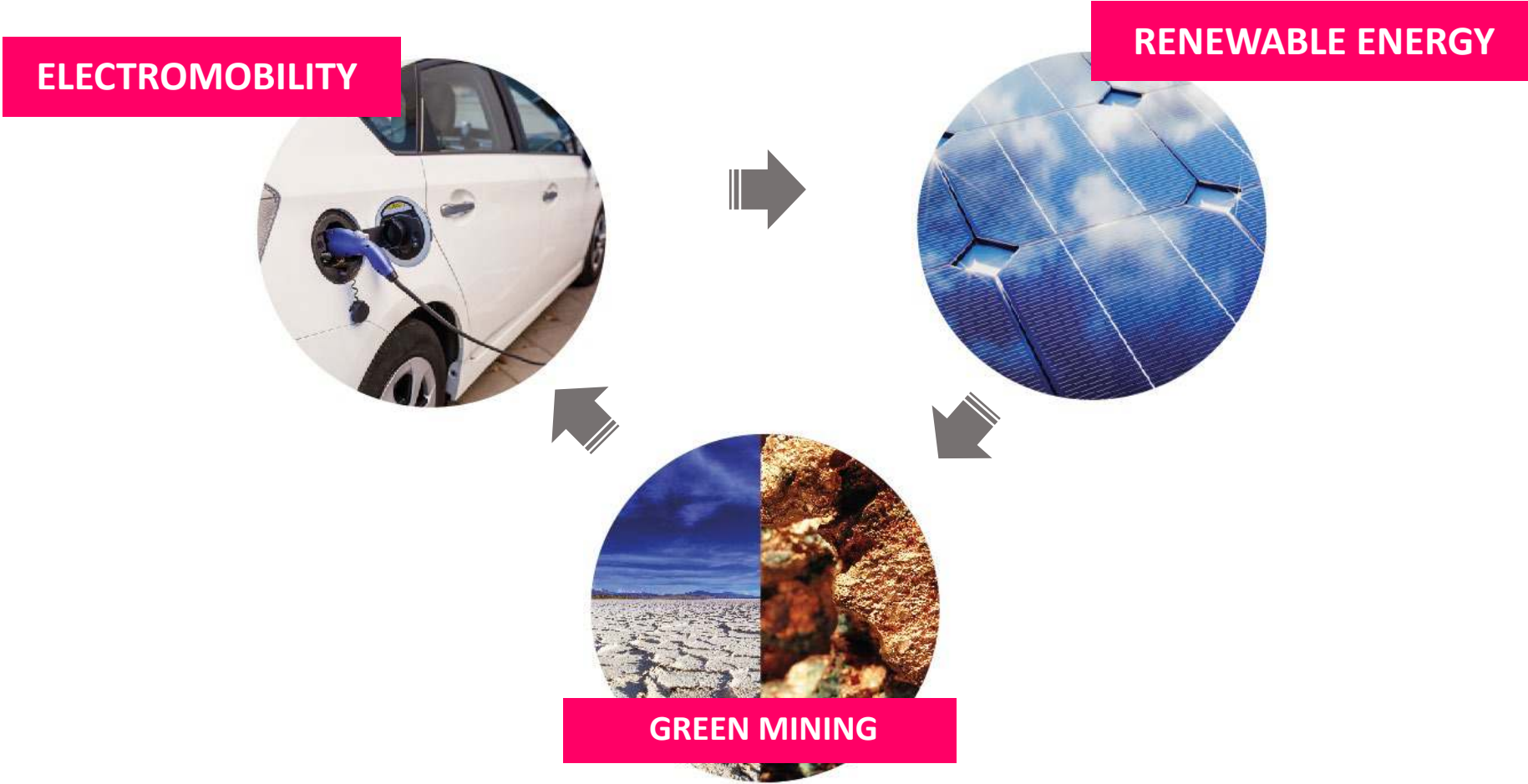
INTEROP CONSORTIA



- Develop and promote guidelines
- Facilitate bench tests
- Contribute to standards development (link to ISO working groups and GMG)
- Disseminate a maturity model for suppliers development



A VIRTUOS CIRCLE: ELECTROMOBILITY, RENEWABLE ENERGY, GREEN MINING



ELECTROMOBILITY



RENEWABLE ENERGY



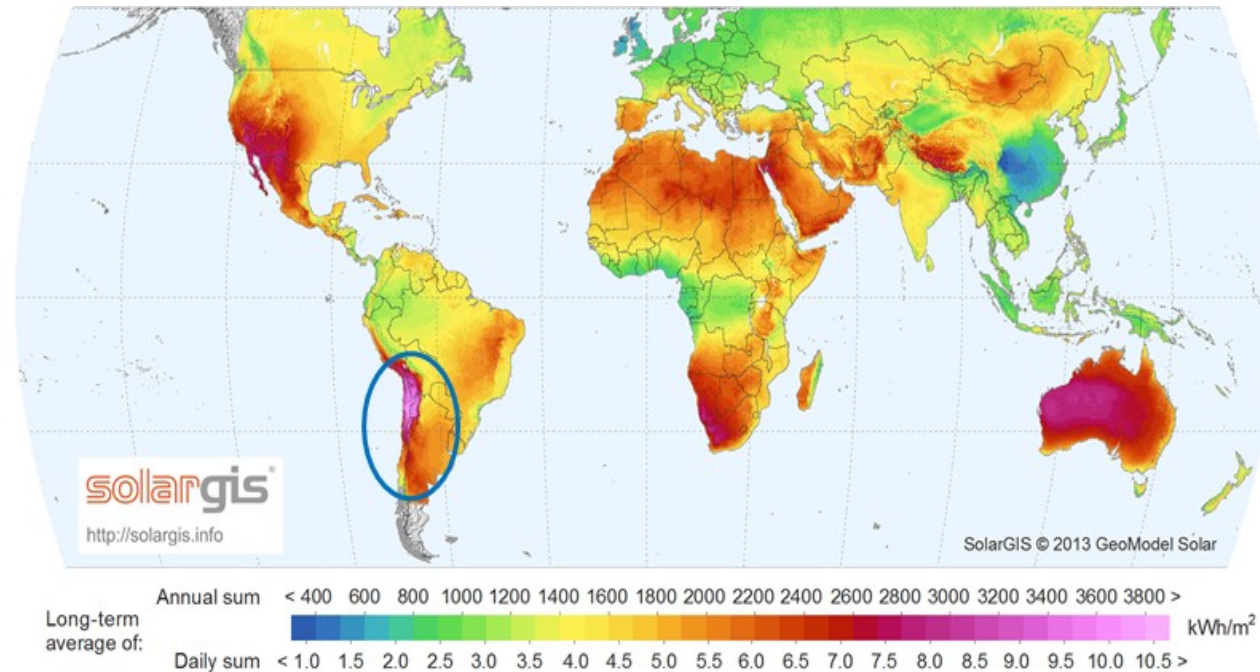
GREEN MINING

- LITHIUM
- COPPER
- COBALT AND OTHER MINERALS

A UNIQUE OPPORTUNITY FOR CHILE

Atacama Desert singularities

- Highest solar potential
>3.500 kWh/m²
>4.000 sun hours/year
- Biggest metallic mining district in the world
- Strong position in non metallic mining - lithium production and natural nitrates



Opportunities for Chile

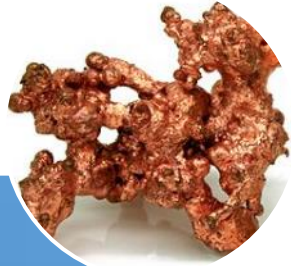
- Global trend: exponential growth of electromobility and hydrogen-based economy
- Increased demand of lithium.
- Increased demand of copper (additional 2 - 4 millions tons of low emission copper).

ENERGY TRANSITION & GREEN MINING: INNOVATION STRATEGY

Vision 2030: Chile as leading supplier of lithium and low-emission copper for the electric car industry



World's leading lithium producer



World's largest low emission copper producer

Long term supply of lithium carbonate/hydroxide (battery grade)

Lithium added value products (cathodes, others)

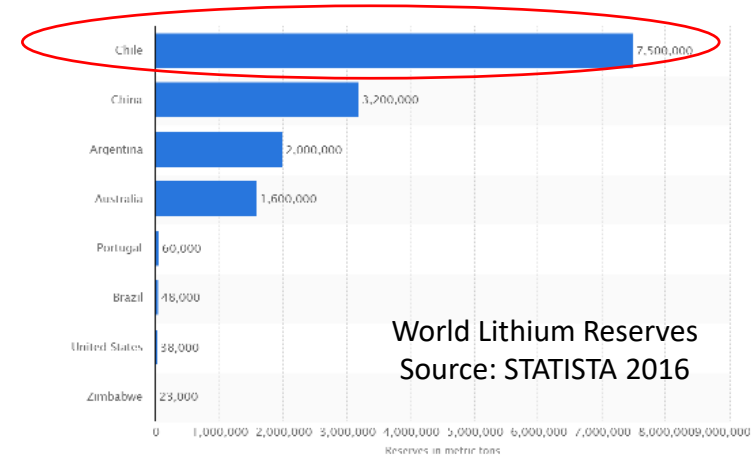
Solar energy for continuous electricity supply (mix PV/CSP) at average cost of 50 USD/MWh

Fossil fuels substitution
Hydrogen and Synthetic fuels based on circular economy approach



NATIONAL STRATEGY FOR LITHIUM DEVELOPMENT

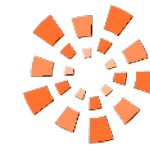
- The Chilean government owns the lithium resources in the Atacama salt flat through Corfo, the Economic Development Agency. 2 current contracts:
 - Albemarle: 140 kTons de LCE hasta 2043
 - SQM: 216 kTons de LCE hasta 2030
- Chile owns more than 50% of the world reserves.
- Call for local manufacture of added value lithium products



Convocatoria **Litio** Lithium Call



SOLAR PV FOR HIGH RADIATION CONSORTIA



PROGRAMA
ENERGÍA SOLAR

To adapt and/or develop solar photovoltaic power technologies that respond better to the unique conditions in desert and high-radiation regions

- Reduce LCOE by 2025
- Increase performance and durability
- Develop local industry



Total Budget 7 years: MMUSD 20 - MMUSD 12 granted by Corfo)

HYDROGEN IN MINING CONSORTIA

To adapt or develop technologies aimed to substitute $\geq 50\%$ fossil fuels in mining haul trucks and underground fleets

- Reduce diesel consumption
- Reduce CO2 emissions
- Develop local industry

DUAL COMBUSTION H2-DIESEL



Total Budget for 5 years: MMUSD 20 - MMUSD 5,8 granted by Corfo

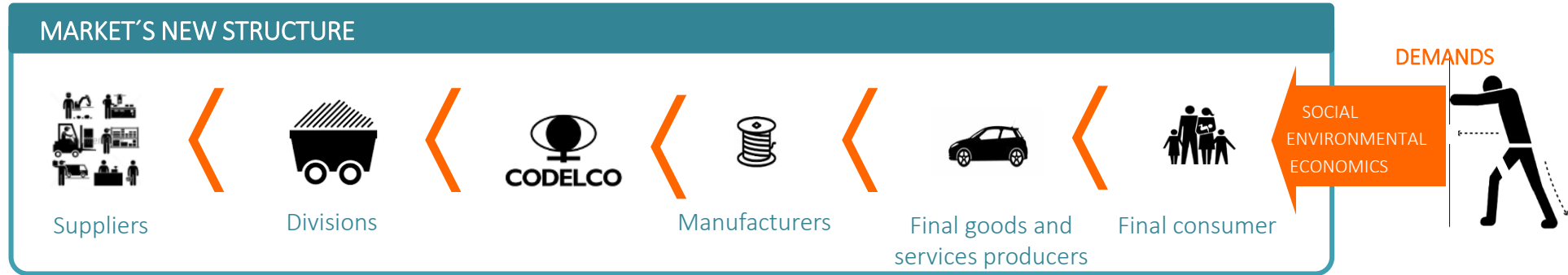
FUEL CELLS



Total Budget for 5 years: MMUSD 2,2 - MMUSD 1,1 granted by Corfo

CODELCO'S RESPONSIBLE COPPER INITIATIVE

MARKET TRENDS ARE REFLECTED ACROSS THE VALUE CHAIN



Seeks to articulate the copper value chain to respond effectively to the requirements of the market and society, through a system of traceability in all its stages and thus achieve sustainable and responsible practices.



8 DIMENSIONS



3 Partnerships (to date)

- Emissions footprint
- Water footprint
- Carbon footprint
- Respect for Human Rights
- Health and occupational safety
- Impact on communities and territories
- Transparency, ethics and compliance
- Inclusion and gender parity



SOLAR MINING TECHNOLOGY INSTITUTE – RFI stage

INTERNATIONAL REQUEST FOR INTEREST END OF OCTOBER 2018 TO CREATE A CONSORTIA
(INDUSTRY, TECHNOLOGY CENTERS, UNIVERSITIES)



AREAS



SOLAR ENERGY

- Solar PV high radiation
- CSP and storage
- Solar Fuels

LOW EMISSION MINING

- Circular economy approach to mining
- Novel low emission mining and metallurgy process
- Traceability (CO2, others)

ADVANCED MATERIALS FOR ELECTROMOBILITY AND ENERGY STORAGE

- Lithium, copper and other metals added value products
- Improved molten salts for storage

THE INSTITUTE WILL RECEIVE RESOURCES FROM THE R&D ROYALTY OF THE LITHIUM CONTRACTS

~ MMUSD 150-200 IN 10 YEARS

CHILE'S STRATEGY FOR INNOVATION IN ENERGY TRANSITION AND LOW EMISSION MINING

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