Energy Chile - California
Executive Summary
Session 2: Electrification Decarbonization Transition

June 16th, 2021

The Chile California Council and the Ministry of Energy of Chile held the second of four working group sessions that will discuss common challenges and opportunities Chile and California face as they transition to more sustainable energy systems. The second session took place June 16th, 2021 and focused on comparing their electrification decarbonization goals, key challenges, and opportunities. The next meetings will examine Chile's and California's approaches to foster and implement significant transitions to cleaner mobility and green Hydrogen. A consolidated document will be prepared highlighting the tangible results of these four sessions and next steps to follow.

This executive summary provides an extract of what was discussed in this second session. Participants, sponsors and organizers all found the session very useful and had positive comments on what was achieved.

The main highlights center around the potential exchanges between Chile and California regarding strategies, policies and incentives for the electrification decarbonization transition, and some of the most central technological and planning challenges, including pricing issues, electrification of more end-uses, upgrading transmission and storage infrastructure, and developing more flexible supply and demand of electricity.

The rest of the document showcases participants and the agenda of the meeting before providing a summary of key points that came out of the meeting.

I. PARTICIPANTS

Javiera Aldunate – Head of the International Office, Ministry of Energy of Chile	Ignacio Fernández - Southern California Edison
Alex Santander - Head of Energy Planning and New Technologies Unit at the Ministry of Energy of Chile	Roberto Araos – DECYTI Director – Ministry of Foreign Affairs of Chile
Gabriel Prudencio - Sustainable Energies Division, Ministry of Energy of Chile	Aura Rearte - ACESOL
Trinidad Castro – World Energy Council Chile	Sebastián Gonzalez - ACESOL
Rafael Friedmann - CCC Chair	Teresita Vial - ACESOL
Marcela Angulo - CCC Councilor & Universidad de Concepción	Nicolás Westenenk – Generadoras de Chile
Merrian Borgeson - Natural Resources Defense Council	Anna Ferrera – California Energy Commission
Alana Sanchez – California Energy Commission	Héctor de la Torre – California Air Resources Board
Juan Pablo Carvallo – UC Berkeley	Matías Alcalde – CCC
Eduardo Gorchs – Siemens	Juan Silva – CCC

II. AGENDA RECAP

*Times are expressed in Pacific Standard Time (California)

PART 1: Introductory remarks		
9:00 am – 9:05 am	Welcome & general protocols for the meeting	Representative before the CCC Matias Alcalde
PART 2: Chile & California Context		
9:15 am - 9:25 am	Pillars of the "Electrification Plan of Chile by the Ministry of Energy of the Government of Chile".	**Alex Santander,** Head of Energy Planning and New Technologies Unit at the Ministry of Energy of Chile
9:25 am - 9:35 am	Pillars of the "Electrification Plan of California by the California Energy Commission".	Alana Sanchez, International Relations Senior Advisor, California Energy Commission
PART 3: Discussion groups Participants were assigned in advance in the following discussion groups, to work on a "living" document of simultaneous work. The objective was to discuss successful and failed experiences of programs, policies and incentives useful both for Chile and California.		
9:35 am - 10:05 am	**Group 1:** "Electrification in a scenario of massive entry of renewable energies-opportunities, challenges, new technologies and investments for storage and transmission"	
	Group 2: "Electrification of home infrastructure – programs and policies to encourage the transition, new forms and technologies"	
	Group 3: "Integrated demand and supply planning for the transition, ensuring system resilience and economies of scale"	
PART 4: Open Discussion, conclusions and next steps		
10:05 am - 10:15 am	Each group selected a representative to present the main points of view discussed.	
10:15 am - 10:40 am	Questions and open discussion.	
10:40 am - 11:00 am	Identification of the main actions to work on for the future meetings.	
	Comments to consider for the next sessions.	

III. PRINCIPAL FINDINGS AND DISCUSSIONS

A summary of what was presented and discussed in the meeting follows per the meeting agenda presented earlier.

At a high level, both Chile and California are seeking to decarbonize their electric generation while at the same time, significantly expanding the use of electricity to replace fossil fuels with cleaner, non-GHG emitting electricity. Some of the key goals, policies and opportunities shared, follow:

Chile's Electrification Decarbonization Transition

- The Energy Planning and New Technologies Unit at the Ministry of Energy of Chile has established a **"Long term energy planning"**, which defines energy future demand and supply projections based on input from broad citizen participation.
- To achieve Chile's goal of carbon neutrality by 2050, six measures have been established (indicated in parenthesis is the proportion of GHG emissions reduction from each):
    - **Sustainable and Efficient Industry (25%)**
    - **Green Hydrogen (21%)**
    - **Electromobility (17%)**
    - **Sustainable and Efficient Building (17%)**
    - **Coal Phase Out (13%)**
    - **Energy Efficiency (EMS) (7%)**
- Almost **80%** of those measures are based on **electrification**, either **direct** (directly to the grid) or **indirect** (storage, green hydrogen or autonomous grid energy solutions)
- **Coal phase-out allows clean electrification** like Green Hydrogen production, machine drive electrification, electromobility, and electric heating.
- The **electricity sector contributes 32%** of GHG emissions in Chile. Therefore, there is a **great opportunity** to transform this problem into a great environmental and climate solution for society.
- Air quality impacts from fuelwood must be solved as soon as possible. Some challenges are:
    - **Cultural reasons** that promote fuelwood as an energy solution.
    - **Cost of fuelwood** is lower than any other energy solution today.
    - **Deficient quality of electric service** in rural areas where fuelwood is mostly used
    - Electric solutions **don't provide all key housing services** (e.g., cooking)
- **Between 2020 and 2050**, **energy demand will increase by a factor of 1.29**, and total **electricity demand will increase 2.75 times.**
- **Electricity will grow from** less than 25% of current total energy demand to almost 50% by 2050, under the **carbon neutrality scenario.** Without carbon neutrality, it implies a slow electrification level (less than 30%).
- The Ministry of Energy has been developing **programs that promote electrification:**
    - **Commercial self consumption impulse program *(Ponle Energía a tu Empresa)***
    - **Electric taxis impulse Program *(Mi taxi electrico)***
    - **Electric heating impulse program *(Recambia tu calor)***
    - **Residential self-consumption impulse program *(Casa solar)***
- Main challenges for electrification transition:
    - **Efficient energy prices for society to avoid inequities in access to clean energy**
    - **Clean electrical grid operation based on renewable energy sources.**
    - **Transmission and storage system expansion**
    - **Improve quality of service**

- **Optimal mix between utility scale and distributed renewable projects**
- **Resilient and reliable distribution system** adaptable to climate change and natural disasters
- **Decrease levels of energy poverty by ensuring cleaner energy is available to all**
- **Role of the State** as enabler for new technologies and broad energy access

California's Electrification Decarbonization Transition

- **Clean electricity works in synergy with other state efforts to reduce emissions** and make the state's electricity system more resilient, affordable and environmentally sustainable.
- Officially titled "The 100 Percent Clean Energy Act of 2018," **Senate Bill 100 is central to improving California's energy system**:
  - Sets a **2045 goal** of powering **all retail electricity sold in California and state agency electricity needs with renewable and zero-carbon resources**
  - Updates the state's Renewables Portfolio Standard to ensure that **by 2030 at least 60 percent of California's electricity is renewable.**
  - Requires the Energy Commission, Public Utilities Commission and Air Resources Board to work together to enable California to achieve 100 percent clean electricity. They have to issue a joint policy report by 2021 and update it every four years.
- **Related Clean Energy Efforts:**
  - **Transportation electrification**: All new cars and passenger trucks sold in the state must be zero-emission by 2035. The electricity powering zero-emission vehicles must also be carbon-free.
  - **Building decarbonization:** Decarbonize energy uses in buildings, mainly natural gas used for space and water heating.
  - **Energy efficiency:** Improve energy efficiency standards for buildings and appliances to reduce customer bills and offset the need for additional generation capacity.
  - **Load flexibility**: Increase the ability of the grid to shift the timing of electricity use to sunny and windy parts of the day when most renewable energy is produced.
- **Benefits of 100% Clean Energy:**
  - The phaseout of fossil fuel-generated electricity is expected to **reduce smog-related deaths** and illnesses of more than 23 million Californians.
  - **Disadvantaged communities** and low-income neighborhoods that have historically suffered poor health, dirty air and other burdens will reap the **highest health benefits from clean electricity**.
  - **SB 100-driven growth** in the capacity to generate and store clean electricity **can create thousands of new high-quality clean energy jobs**, specially in solar and wind systems.

Summary of Group Discussions

Group 1 - "Electrification in a scenario of massive entry of renewable energies opportunities, challenges, new technologies and investments for storage and transmission"

- **Technology**:
  - On both the supply and end-use side there are **technologies needed that don't exist yet** (e.g., hydrogen electrolysis infrastructure, long-duration storage, hybrid plants)
  - Important to showcase and compare how **pricing mechanisms and market design** impact the type of technologies that are profitable to develop and operate.
  - Some **incentives and policies are needed particularly in Chile to boost and drive specific technology developments** (e.g., California's policy forbidding fossil fuel pick-up truck for 2025)
- **Economics (carrots and sticks):**
  - ***Sticks* have more certainty**, for example, banning fossil fuels for pick-up trucks means there will be no sales at that time, so you can better predict adoption of other types of vehicles.

- *Sticks* are **more unpopular and harder to support** publicly than *carrots*. Incentive policies like rebates and other types of price reduction for equity and increased adoption become important.
- It's challenging to make sure the **adoption pace will be enough to meet goals**, and how stakeholders in the power system will be able to build under uncertainty of adoption trends.

- **Planning challenges:**
  - There's **uncertainty** in predicting and understanding the way that zero-carbon technologies are going to be used, and levels and pace of adoption of electrification across different end-uses.
  - If adoptions happen **too quickly**, there might **not be enough supply. I**f it happens **too slowly**, there might be **stranded investments.** There is **no historical information** for these adoption trends.
  - Need to **integrate transportation and power systems** in planning. Planners now have to understand where the charging infrastructure should be developed, who should own it, at what pace, etc.

Group 2 - "Electrification of home infrastructure – programs and policies to encourage the transition, new forms and technologies"

- Long-term planning for **housing is needed**. Chile does not have **a robust plan for electrification;** especially in homes.
- This long-term planning must include **companies and commercial enterprises** entering the market so the final users can choose who their electric provider will be.
- There is a **huge opportunity** to change end-users; especially, to replace the use of **fuelwood in Chile. Communication with the final user** will be key to change cultural patterns that favor fuelwood use.
- Must have a plan for people to **get used to the new technology so they can experience the benefits**. Part of this plan is how to involve all society in the changes and prove their **benefits for health and household economics.**
- Another big issue is **infrastructure**, where both Chile and California have to finance a massive inclusion of new end-uses to the grid. Need to plan infrastructure for new buildings, electromobility, and how to build capacity for electric buildings.
- In all these areas, there are plenty of **opportunities** identified to continue **engaging, cross-learning and sharing information on best practices.**
- **Important to develop policies and market mechanisms that enable consumers to turn into prosumers — where homes can generate electricity for sale to others as well as self-use, and/or modify their electric demand to align with grid needs.**

Group 3 - "Integrated demand and supply planning for the transition, ensuring system resilience and economies of scale"

- **Transmission needs and issues:**
  - One **main difference** between Chile and California is the **potential risks of wildfires**. The transmission lines in Chile don't run in areas that are as risky as in California. Yet Chile and California face similar disaster prevention and management challenges (fires, earthquakes, floods, etc.). Past and current collaborations continue to provide enhanced capabilities and knowledge creation.
  - Focus on **policies and projects to address issues and ensure adequate and timely investments by utilities.**
- **Experience and approaches to storage:**
  - **Storage in California is a silver bullet** because it addresses a solution for many issues such as trying to get rid of natural gas.

- Chile is using **natural gas to accelerate coal phase-out**, in contrast to California, where the focus is also on reducing the use of natural gas.
- In California in general storage is being implemented in 3 main areas:
  - **(1) Utility scale**, where large batteries are being installed close to transmission substations;
  - **(2) Distribution storage or neighborhood storage,** which reduces customer impacts when electricity is shut-off during high risk of fire situations, by providing electricity to impacted communities;
  - **(3) Behind the meter or in-home batteries,** which enable homes to optimize their onsite generation and EVs. Equity is a significant issue, as only wealthy homes can afford home battery storage systems

- **Equity and environmental justice are** taking center stage in the agenda in California as it kicks off the scoping plan update. For the next 18 months California will revise progress of its climate goals for 2030 and 2045.
- **Decarbonization goals and Natural Gas vs Coal:**
  - There are some practical lessons for Chile, for example for **cap-and-trade of carbon credits or other pricing policy options.**
  - One good example is California's **LCFS (low carbon fuel standard**), a practical **zero-sum approach** where **more carbon intensive fuels compensate less carbon intensive fuels or projects**.
- **Carbon pricing: Need to revisit the current pricing schemes as** the carbon tax in Chile is **extremely low (5 USD/tonC)** and the fact that **38% of the revenue is paid by renewable energy projects**, which is contradictory.

FINAL DISCUSSION

- Regarding **grid planning for electrification**, a link was provided for this proceeding that just opened in California: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M382/K451/382451995.PDF
- A link was provided on i**nteresting technologies for heat pumps** in Maine: https://www.efficiencymaine.com/heat-pumps/
- From the Chilean side, a very important actor missing in the conversation is the **Electrical Coordinator (Coordinador Eléctrico – CDEC).** Both **CDEC and CAISO** are contemplated for the next session.
- Because operational institutions follow what has been discussed here, it's important to create **specific studies or round tables that address for example the transmission and investment needs of the proposed transition.**
- Regarding the transition from coal to natural gas, it is important to **get popular sectors involved in the transition, including labor unions, etc. For example,** the head of the United States mine workers union acknowledged that with **coal phase-out, its workers are running out of jobs,** so they ask that these workers be taken care of with retraining so they can get jobs in the "new green economy
- Attendees can contact Juan Pablo Carvallo for information on the work he has done to **model future electrification transition in the most cost-effective way.**
- Information was requested on **how California's building codes have adapted to EVs and other electrification end-uses.**