Impact of Measures Associated with COVID-19 on the National Electric Energy Sector

Carlos Suazo Martínez SPEC
csuazo@spec.cl

Rodrigo Moreno
Universidad de Chile and the Complex Engineering Systems Institute (ISCI)
rmorenovieyra@uchile.cl

Héctor Otárola SPEC
hotarola@spec.cl

Introduction

The measures to control the advance of COVID-19 are unprecedented in our country. These measures include the declaration of the State of Constitutional Exception of Catastrophe, the imposing of a curfew at national level, the creation of sanitary cords that limit transportation between boroughs/provinces/regions, and the declaration of mandatory quarantine areas with strict limitations on free transit (see details in Table 1), which have not only had a great impact on various sectors of the economy but also on people's daily lives. In this context, the Chilean electricity market has been significantly affected, showing a significant decrease in the country's electricity demand levels and changes in the consumption pattern given the progressive advance of quarantines and the order of the curfew.

This document aims to analyze the main phenomena that have occurred in the electricity sector in recent weeks, addressing variations in the pattern of consumption by demand at the national level in the use of electric energy by various industrial sectors, the effects in terms of the supply of electricity companies, and other relevant parameters of the electricity market such as spot prices and quantities of generation with renewable and conventional sources.

Table 1. Brief timeline of the progress of measures associated with COVID-19 to date

Date	Action
11 March	The World Health Organization (WHO) declares the outbreak of coronavirus a global pandemic.
13 March	The Ministry of Health orders quarantine at a school in the Santiago Metropolitan Region as a result of a confirmed case of COVID-19 and the Ministry of Education updates its protocols in view of the virus.
14 March	The Ministry of Health confirms that Chile is at Phase 3.
16 March	Chile moves to Phase 4 of coronavirus and the President announces the shut-down of border crossings and ensures a supply chain.
18 March	President declares State of Constitutional Exception of Catastrophe throughout the national territory.
18 March	Ministry of Economy announces the closure of all shopping areas, with the exception of pharmacies, supermarkets, banks, and medical centers.
22 March	The Government of Chile decrees new sanitary measures, among which are a national curfew and stricter controls on movement.
25 March	The Ministry of Health declares total lockdown for seven boroughs of the Santiago Metropolitan Region.
27 March	The Ministry of Health declares total lockdown for Temuco and Padre Las Casas.

29 March	The Ministry of Health declares quarantine for the cities of Chillán and Osorno.
4 April	The Government restricts personal temporary exemptions for residents in boroughs in quarantine to two per week.
4 April	The Ministry of Energy, as an exceptional measure, limits peak hours during April and May.
10 April	Departures from the Metropolitan Region at Easter fell 74% compared to 2019.
16 April	Parliament work on a regulation that prohibits the disconnection of all basic services during the pandemic.

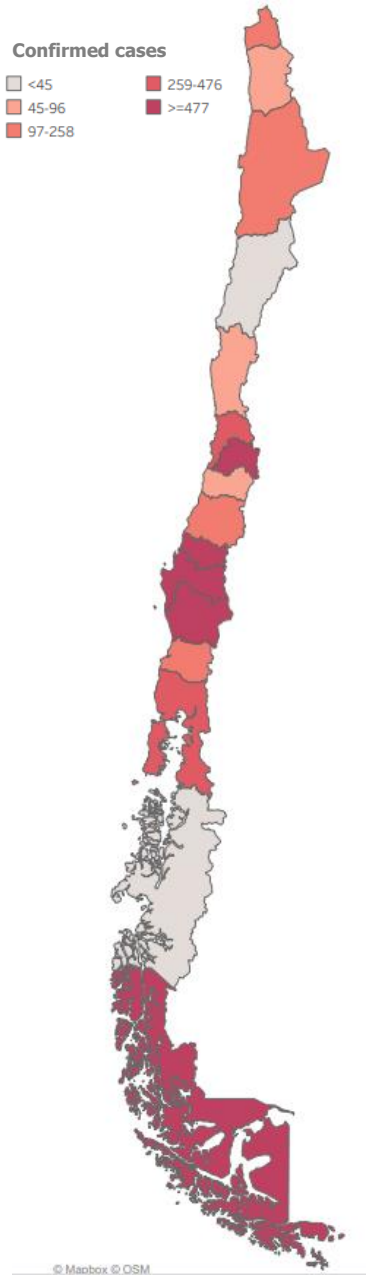


Figure 1. Confirmed cases by region.

State of the pandemic in Chile

It was not until mid-March that Chile entered the so-called Phase 4, which corresponds to a viral circulation and an untraceable community spread of the disease in question. That same week, the Chilean Government declared the State of Constitutional Exception of Catastrophe throughout the national territory, the closure of all shopping centers and the imposition of a 7-hour curfew from 22:00 to 05:00 hours. The whole situation occurred two months after the World Health Organization (WHO) in China reported cases of pneumonia of unknown etiology detected in the city of Wuhan, and only two weeks after the detection of the first case in our country in Talca, Maule Region.

As of April 16, 9,252 cases of COVID-19 have been confirmed by laboratories, with a cumulative incidence rate of 47.5 per 100,000 inhabitants[1]. The national distribution of infected patients is illustrated in Figure 1, where a higher concentration of cases is observed in the Metropolitan Region, and the regions of Ñuble, Biobío, La Araucanía, and Magallanes. It is precisely in these areas that compulsory quarantines have been decreed in recent weeks, restricting the free movement of people and ordering all inhabitants to remain in their homes.

The measures adopted by the Government of Chile aim to preserve the general health of the population, to avoid saturating the health systems over the next few months. In the electricity sector, the National Electric Coordinator has taken measures to safely continue the electricity supply, which range from the separation of the operation tasks of the system in three Control Centers, leasing of hotels for dispatchers with residence outside of Santiago, and the preparation of recruits to replace dispatchers, among others.

[1] Epidemiological Report – Enfermedad por SARS-CoV-2 (COVID-19) al 17 de abril de 2020, Department of Epidemiology, Ministry of Health, Government of Chile.

Impact on electricity consumption across different productive sectors

As a result of the health crisis, the electricity sector has seen a drop in the level of electricity consumption. Given the strict relationship that the use of electrical energy has with the level of productivity of the different sectors of the economy, we have carried out an analysis in order to understand which are the economic sectors that have been most affected in terms of their electricity consumption, product of the evolution of the pandemic. To do this, we have analyzed the evolution in electricity consumption of the more than 2,500 free customer withdrawals registered in the Transfer Balance of the National Electric Coordinator during the month of March 2020. The general results are shown in Table 2, which illustrates the weekly percentage change in consumption of electricity demand by item, with respect to the levels observed in the first week of March[2] (week 10, with week 11, 12 and 13 being the second, third and fourth week of March respectively).

Table 2. Drop in consumption of electrical energy compared to the first week of March (Week 10) by industry.

Industry	Week 11	Week 12	Week 13
COUNCIL OF BUILDING AND CONDOMINIUM ADMINISTRATION	0.18%	-22.10%	-41.18%
CONSTRUCTION	-6.98%	-22.48%	-32.96%
FINANCIAL INTERMEDIACION	2.53%	-15.88%	-29.03%
TEACHING	10.11%	-15.41%	-27.76%
TRANSPORT, STORAGE, AND COMMUNICATIONS	0.05%	-12.31%	-26.20%
PUBLIC ADMIN. & DEFENCE, INSURANCE, OBLIG. SOCIAL FFILIATIONS	4.66%	-12.67%	-20.70%
REAL ESTATE, BUSINESS, AND RENTAL ACTIVITIES	-0.21%	-9.12%	-14.11%
HOTELS AND RESTAURANTS	4.85%	-8.58%	-13.77%
FISHING	2.70%	-0.50%	-13.12%
AGRICULTURE, LIVESTOCK, HUNTING AND TIMBER	-3.82%	-9.14%	-12.60%
SOCIAL AND HEALTH SERVICES	1.97%	-6.91%	-12.19%
METAL MANUFACTURING INDUSTRIES	4.19%	-2.54%	-7.96%
ELECTRICITY, GAS, AND WATER SUPPLY	1.89%	-3.69%	-7.20%
NON-METAL MANUFACTURING INDUSTRIES	-0.53%	-0.72%	-6.67%
RETAIL & WHOLESALE COMMERCE, MOTOR VEHICLES & DOMESTIC APPLIANCES	0.88%	-9.43%	-5.71%
OTHER ACTIVITIES (COMMUNITY, SOCIAL, & PERSONAL)	3.73%	1.84%	-4.31%
MINING	-3.17%	-0.35%	3.91%

The information collected on electricity consumption by company was crossed with information obtained from the Internal Revenue Service in order to classify the different withdrawals with the respective economic items[3].

It can be observed that among the items with a greater impact on the reduction of their electricity consumption, the Administration of Buildings and Condominiums stands out, where a significant reduction in demand for electrical energy of the order of 40% is observed. This includes the consumption of emblematic buildings in the capital such as, for example, Edificio de la Industria, the Edificio Millenium, and Parque Titanium, among others. This is consistent with the transfer restrictions originating from the mandatory quarantine

[2]It is important to note that the industries of greater energy intensity are Electricity, Gas, and Water Supply (49%); Mining (26.8%); Non-Metal Manufacturing Industries (8.4%); Agriculture, Livestock, Hunting, and Timber (3.4%); and Metal Manufacturing Industries (3%). The percentage indicated previously denotes the individual contribution of each industry at national demand level during the last week of March.

[3]The results of the analysis carried out in this document were obtained from SPEC's Enerlytics platform (www.spec.cl).

in the boroughs of the Greater Santiago Metropolitan Region.

Restriction on the free transit of inhabitants under quarantine has also significantly affected electricity consumption of other items such as Financial Intermediation (Banks, Insurance Companies, Investment Companies, among others) and the Transportation, Storage and Communications sector, where a significant drop was observed in companies such as Metro (-30%), Buses Metropolitana (-32%), among others. The situation is different between communication companies where a spectrum of variations is observed: Entel (-1.32%), Claro Chile (+ 2.6%), WOM (-3.11%) and Telefónica del Sur (+ 4.9%). Other items where a significant reduction in electricity consumption was observed corresponds to Education (both primary, secondary, and university). In the case of higher education, the effect on productivity of the decrease in electricity consumption in universities has been diminished as a result of the use of telecommuting platforms to teach online classes.

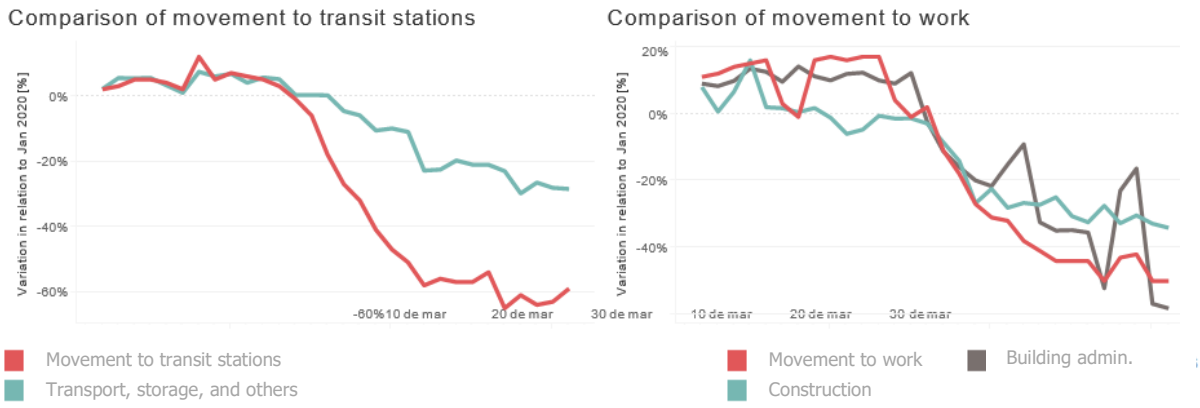
The previous situation corresponds to the behavior of consumption when they are grouped by category, which does not imply that all the companies in a category have the same behavior. Figure 2 illustrates the evolution in daily consumption of different withdrawals by item with respect to the levels observed on March 2, 2020.

The average of the variations in electricity consumption by industry is shown in **red**, while the individual situation for the different consumptions of the companies in each sector is shown in **gray**.

In sectors such as the Administration of Buildings and Condominiums, Teaching, Hotels and Restaurants, Financial Intermediation, together with Social Services and Health, a similar behavior of the industries/institutions is observed throughout the country, presenting a limited variation between the patterns of consumption within these items. In the rest of the items, the situation is not so clear about the effect of measures to face the pandemic.

In this regard, items such as Agriculture, Livestock and others vary throughout the country, not only triggered by the advance of the pandemic, but also by the nature of each production process. Likewise, we have detected a small increase in electricity consumption related to mining processes, although this situation is not homogeneous in the different tasks.

As mentioned, the previously analyzed decreases in electricity consumption are due to the policies that have been adopted to limit the population's mobility levels. Thanks to the data published by Google[4], it is possible to quantitatively study the correlation between the decrease in the mobility levels of the population and the impact on electricity consumption. Figure 3 shows the variation in the levels of mobility to Transit Stations (metro, bus network, others) and the decrease in electricity consumption in the Transportation, Storage and other items. Likewise, it shows the comparison between mobility to work with respect to the variation in electricity consumption in items such as Construction and Building Administration.



Impact on consumption patterns throughout the nation

After the declaration of total quarantine in some boroughs of the country, most of the stores, companies, restaurants, malls and offices are closed or under severe restrictions. As a result, the demand levels in the system have dropped by an average of 800 MW (comparing the first week of March with the second week of April), where the electrical demand for a current normal working day is similar to the consumption level of a weekend or holiday in the pre-quarantine situation as illustrated in Figure 4. This translates into a drop of nearly 10% in electricity generation compared to the levels in early March[5]. Under the public policies of the health sector, it is expected that this situation will continue during the first weeks of April.

[4] Movement data obtained from a report published by Google Inc. https://www.google.com/covid19/mobility/

[5] For the second week of April, the drop in consumption over the Easter holiday was not taken into account.

The levels of demand experienced during the last two weeks of March are equivalent to the volumes presented in 2017 nationally, another indication of how the measures related to the management of the pandemic are changing the routines of people and the energy they use for their activities. It is expected that the level of consumption will continue to decrease as cases of infection in the different boroughs/cities of the country increase and it is necessary to increase the number of inhabitants under compulsory quarantine.

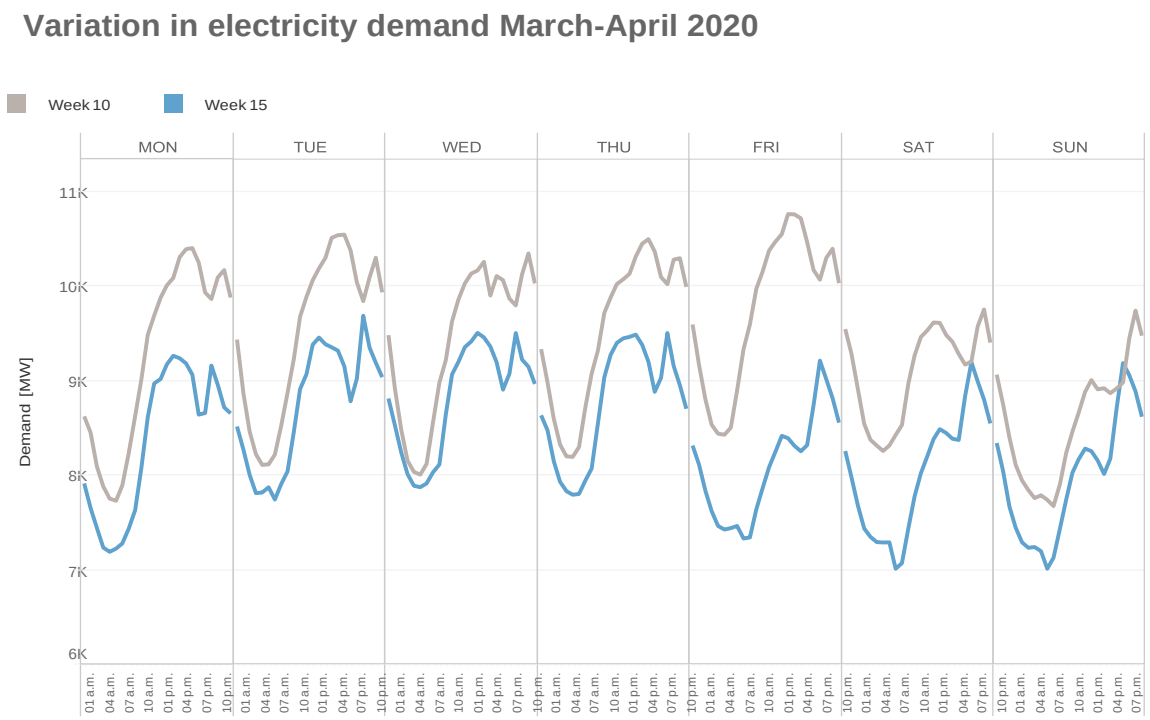


Figure 4. National electricity demand per hour: Week 10 (2-8 March) & Week 15 (6-12 de April).

The new day-to-day of many people involves teleworking activities, low mobility, less use of transport networks, among other changes. In this situation, it is expected that the activities of the population will be less governed by routines and strict adherence to schedules. In this context, it is expected that national electricity consumption patterns will be disturbed.

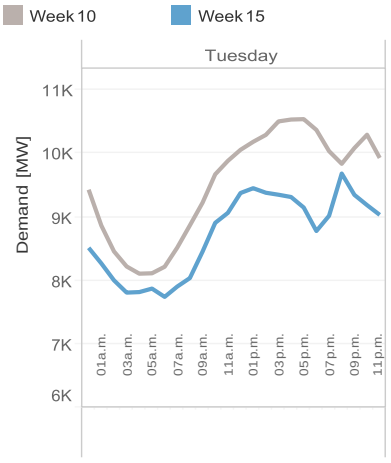
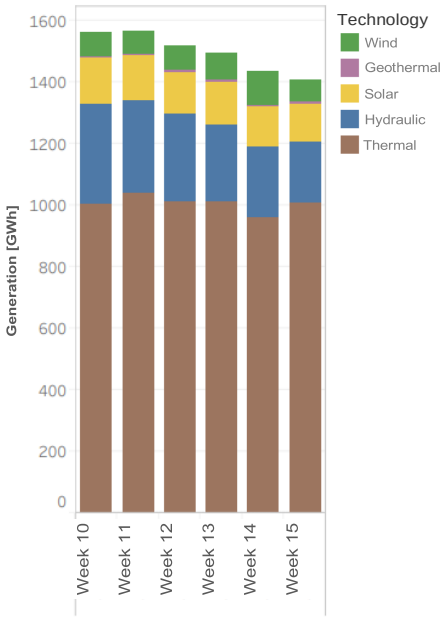


Figure 5. Demand on Tuesday: Week 10 (First in March) & 15 (second in April).

Thus, along with the closure of most commercial premises from 6.00pm together with the curfew from 10.00pm, there has been a change in consumption patterns with a peak demand between 1.00pm and 2.00pm, an abrupt drop in consumption from 4.00pm and a new, very short peak at 8.00pm. Figure 5 illustrates these phenomena, illustrating the daily demand profile for a Tuesday in the first week of March and the second week in April. At first glance, it appears that such behavior is linked to the effects associated with telecommuting.

Unlike countries such as China, Germany, and the United Kingdom, where the reduction in demand has meant an increase in the percentage share of renewable energy in the matrix[6], the reduction in electricity demand in Chile has not been accompanied by a cleaner generation matrix according to the results of the operation of the National Electric System. In principle, there is a drop in the levels of hydroelectricity generation of around 40% and a relatively constant level of generation by thermal units, as shown in Figure 6. According to data published by the National Energy Commission, coal consumption in the electrical matrix increased by 7.6% in March compared to February, while natural gas and LNG had a joint increase of 5.5% during the last month.



Although the system's spot price level has fallen dramatically in recent weeks (as seen in Figure 7), this decrease is not only justified by a lower level of demand, but also by a sharp drop in the price level of the main international commodities (Henry Hub, Brent, or WTI). In addition to the above effect, we have observed over recent weeks that part of the units based on coal, natural gas-LNG and hydroelectricity that were out of service during the first weeks of March[7], have returned to operation, contributing to its drop. Likewise, it is important to mention that the high levels of prices observed for the beginning of March were also justified by Argentine gas cuts and less water availability.

On a zonal level, there are differentiated behaviors throughout the country regarding the level of consumption by distribution company. Figure 8 illustrates the drop in demand by distribution company when comparing weekly levels in comparison to the first week of March (week 10).

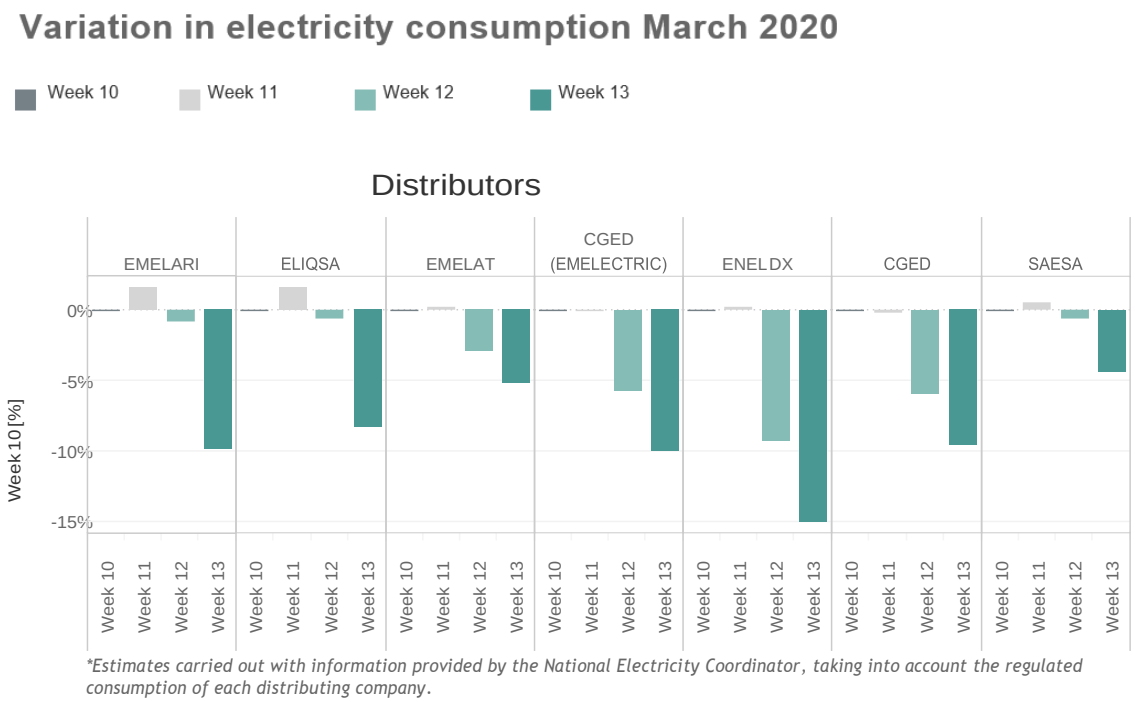
The first measures adopted by the Government triggered a decrease in demand, impacting mainly the central zone of the country, with a considerable drop in Santiago (Enel Distribución).

To the north of La Serena, companies such as Emelari, Eliqsa and Emelat registered greater variations in the level of consumption during the first three weeks of March, experiencing a considerable drop in electricity demand towards the end of the month.

As for the situation in the south of the country, note that the mandatory quarantines in the communes of Chillán, Osorno, and Temuco that began at the end of March caused a decrease in electricity consumption in these areas (for example, SAESA). The total quarantine in some areas of the south of the country is still in force, so it is expected that the decrease in demand will continue throughout April.

[6] China: https://bit.ly/2Ke15Sv ; United Kingdom: https://bit.ly/2KhqfzA ; Germany: https://bit.ly/2VF7Vpj

[7] Non availability of thermal power plants such as Kelar, Norgener, and Bocamina, as well as the limitation hydraulic series Ralco-Pangue-Angostura



*Estimates carried out with information provided by the National Electricity Coordinator, taking into account the regulated consumption of each distributing company.

Figure 8. Variation in consumption by supplier compared with the demand from the first week of March 2020 (Week 10). Companies shown in order of their geographical location, north to south (left to right).

Exposure by suppliers in the context of the new scenario

This has not been a year without challenges for energy suppliers in the sector. Among others, as a result of a fall in the levels of demand triggered by the social upheaval, the creation of a price stabilization mechanism for Regulated Clients (Law No. 21,185), the 2-month reduction in the peak control period, among other factors. It is not straightforward to try to understand those who face higher risk scenarios due to the impacts of the pandemic on the demand levels of the system.

Figure 9 shows the variation in the withdrawal of consumption by supplier, with respect to the energy commercialized during the first week of March (Week 10). Part of the listed companies correspond to new companies in the Chilean market that have developed projects to satisfy the power awarded in bidding processes to regulated customers. Other companies correspond to marketers whose client portfolio consists exclusively or largely of items that have been strongly affected by the effects of the quarantine, namely: Retail, Transportation (Metro), Airlines, among others.

The effects that are finally observed in the local market will depend on the duration, depth, and effects that the pandemic causes in the different sectors and industries on a national level, in addition to its effects on electrical demand.

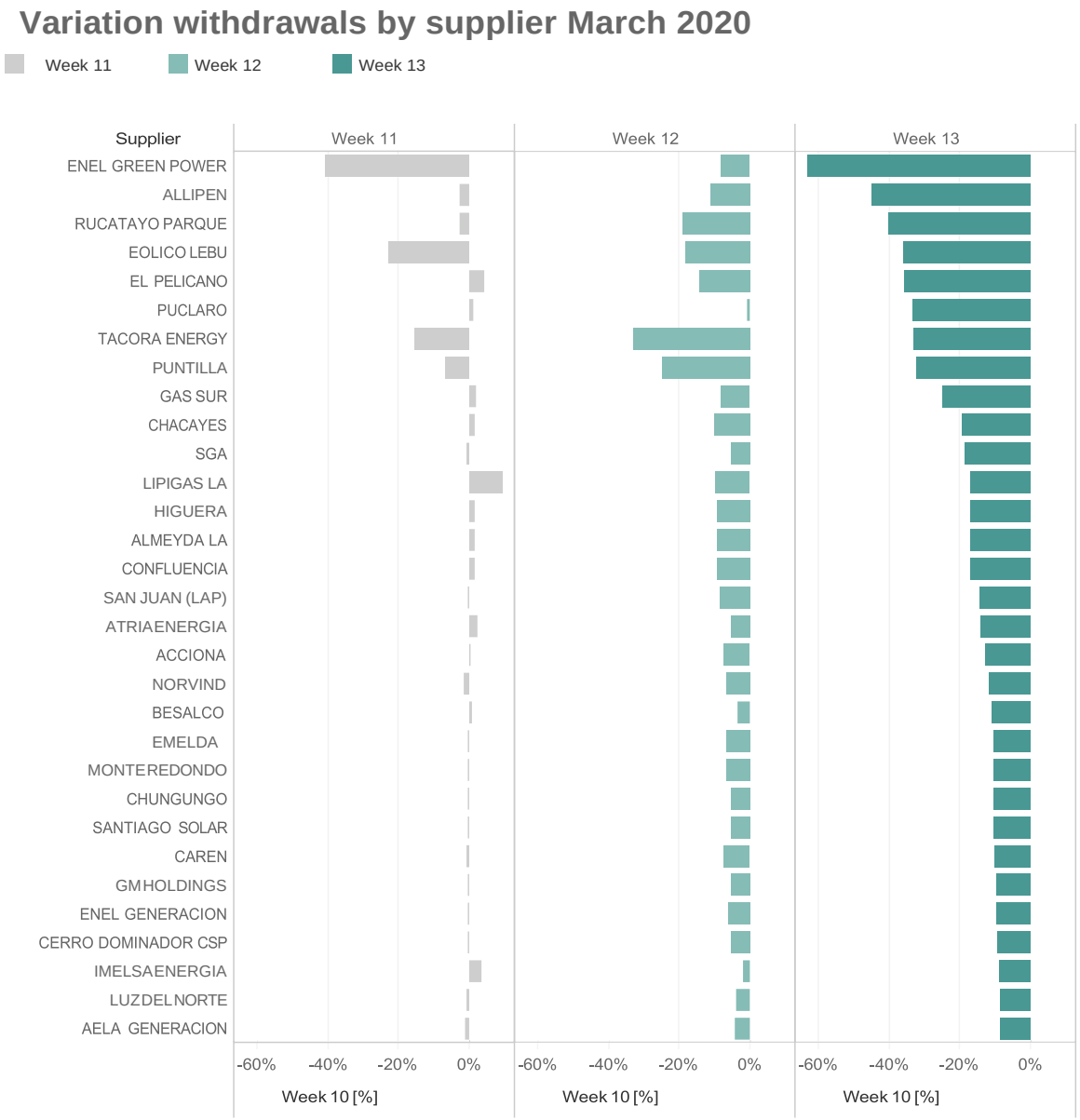


Figure 9. Variation in withdrawals by supplier compared to demand observed during the first week of March 2020 (Week 10).

The contraction effects of electricity demand originated from the measures adopted to control the pandemic could even affect the Small Means of Distributed Generation segment (MDG and SMDG). This because the drop in demand would push the spot price projections made by the National Energy Commission downward, such has been happening during the last rate fixes as illustrated in Figure 10, finally impacting price estimates of short-term knots that corresponds to the price finally received by the MDG (stabilized price).

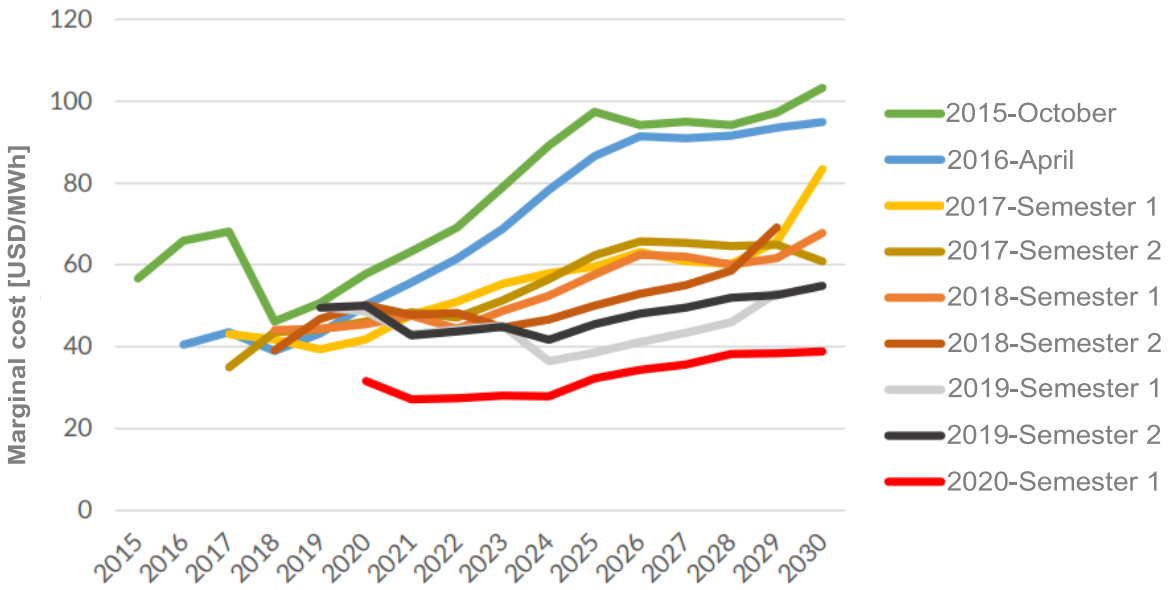


Figure 10. Projection of average marginal cost at Quillota 220 kV according to the Regulation of Short-term Knot Pricing (nominal values according to date of regulation).

Finally, it must be mentioned that during the first weeks of April we have observed a similar situation to the last week of March (Week 13), so we expect similar behavior in the sector during the month of April. There are still some challenges that will be important to address: i) Guarantee a sufficient, continuous, and quality supply mainly to those items that are most in demand during the pandemic (health, basic services, and others); ii) Guarantee the availability of dispatchers for daily operation, for which the National Electric Coordinator has established different strategies to effectively deal with it; iii) Provide mechanisms that guarantee access to energy services, mainly by the vulnerable population; and iv) Develop strategies that strengthen the financial sustainability of the different companies in the sector, minimizing the impacts that may affect the payment chain. Note that these challenges are likely to continue throughout all or much of 2020, so it would be appropriate to develop strategies to address them efficiently in the short term.