ENABLING DEMAND RESPONSE IN EMERGING ECONOMIES: THE CASE OF CHILE

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Overview

To become carbon neutral by 2050, Chile is rapidly increasing the share of renewables in the electricity matrix. By 2030, renewables' share is expected to increase to 75% or more and may reach 95% in 2050 [1–3]. This increase in intermittent electricity generation will require additional flexibility to ensure that electricity supply and demand continue to be constantly balanced. A promising source of system flexibility is demand response – temporary alterations to energy consumption in response to the needs of the electricity grid.

Demand response (DR) programmes have been primarily used in North America and Europe [4]. However, DR can also help reduce decarbonisation costs in emerging economies that are transitioning to low carbon systems whilst simultaneously growing their energy demand [5,6]. DR has not yet been deployed in Chile, but it could represent a vital system flexibility source [7–9]. Chile's electricity demand is expected to double or triple by 2050 [1]; the country has pledged to close down coal plants, which currently provide electricity when renewables are not available, by 2040 [2,10]; furthermore, Chile has limited access to other sources of flexibility such as electricity imports from neighbouring countries [11].

Through a comparative policy analysis of DR between Chile and two European countries, France and the UK, this paper aims to provide policy insights for the deployment of DR in Chile. France and the UK are the most advanced countries in enabling DR regulation, volume and number of participants in Europe [12,13]. This study compares the policy context, DR policies, market, and regulatory frameworks of the three countries and identifies themes relevant for the deployment of DR in Chile.

Methods

The criteria for choosing Chile, France and the UK are as follows:

Chile is an interesting case for examining demand response in emerging economies. As other emerging economies, its electricity demand is growing exponentially and at the same time it has additional needs for system flexibility. It also has a liberalised electricity market, which makes trading demand resource in electricity markets DR possible.

France and the UK have considerable experience in DR and use it to provide system flexibility at different timescales. To different extents, they have adapted their markets to facilitate the participation of DR and have policies in place to encourage electricity end users to provide system flexibility.

Although at present, the three countries have very different energy sectors, given their similar decarbonisation goals and similar approach to achieve them – increasing the share of variable renewable energy in the electricity generation matrix and electrification of the energy sector – they face comparable challenges in terms of new system flexibility requirements. However, whilst Chile is at the early stages of decarbonisation, France and the UK started earlier and are already using demand response in their electricity systems. Their experience in this area can thus provide valuable insights into how to promote demand-side flexibility [14,15].

The analysis mainly focuses on non-domestic energy users, which account for the largest share of electricity consumption in Chile. Also, there is sufficient experience about the industrial and commercial sector's ability to provide DR to allow for a meaningful analysis of what encourages DR provision in this sector.

The review of the literature is based on three themes:

- Energy policy context: electricity generation, electricity demand, and system flexibility
- Demand response: demand response policy and deployment
- Electricity markets: participation of demand response in balancing and ancillary services, wholesale markets, and capacity markets; access by different service providers; adapting electricity markets to demand response resources.

The literature used in the analysis comprises primary sources, such as reports published by governmental departments, electricity systems operators, and electricity regulators, and secondary literature from peer-reviewed journals complemented by publications from international specialised bodies such as the International Energy Agency and

specialist organisations such as SmartEn (Europe's Association for Smart Energy). The databases used were mostly Google Scholar and Science Direct.

Sources were obtained through Boolean searches in Google Scholar and Science Direct, and through ‘backward chaining’ of some of the key articles on each of the three countries.

The search for peer-reviewed literature was conducted in English; for primary sources, the search was conducted in Spanish, French, and English. The analysis of the literature comprised comparing the countries' policy context, market structure and approach to end-user barriers to identify insights relevant to the Chilean energy policy context.

Results

Preliminary thoughts about promoting demand response in Chile:

1) There is a need for research on the costs and benefits of demand response for the Chilean power system, in particular: assessments of technical DR potential of the mining, industrial, services and residential sectors; estimates of the technical capacity of DR potential to address the specific challenges of the Chilean system, such as renewable generation curtailment and the impact of infrequent extreme weather events; evaluation of DR in comparison with other sources of flexibility.

2) Identify ways of expediting the adaptation of electricity markets to demand response. Some thoughts of how to do these are: a) exploring the possibility of opening all markets to DR rather than using a gradual approach as it has been the experience in France and the UK; b) using the know-how and experience of other countries that have opened their electricity markets to DR and are currently deploying demand-side flexibility such as the UK and France, reviewed in this study, and others such as Finland, Ireland, and the USA; and c) maintain long term policy certainty whilst also incorporating sufficient flexibility to adapt regulations when necessary.

Conclusions

Deploying explicit demand response can be a long process as markets need to be adapted to a new type of resource. However, there are also significant advantages, especially the size of the DR potential in countries with growing electricity demand, and the low investment costs of demand response deployment. Transfer of knowledge from countries that are successfully deploying demand response can help countries such as Chile expedite the development of market and regulatory structures that can enable the use of DR.

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