2
DER MANAGEMENT

Digitalization in the energy sector in Chile

- DSM/DR
- Energy Storage
- VPP
- Distributed Energy

DER Management alludes to the way in which the energy resources distributed in the electrical network are managed, seeking that said management efficiently take advantage of the availability of resources according to the conditions in which the system is found.

Application presence by country

Uses/Applications	Germany	Finland	Japan	China	USA	UK	Sweden	France	South Korea	Singapore
DSM/DR										
Energy Storage										
VPP										
Distributed Energy										

Application potential by sector

Uses & Applications	Transportation	Industry	Buildings	Electricity Generation	Finance	Public Sector	Main type of energie
DSM/DR							Electricity
Energy Storage							Electricity
VPP							Electricity
Distributed Energy							Electricity

Enabling Technologies

Technologies	Load monitor	In home display	Smart thermistat	Smart light	Smart plug/switch	Smart appliance	Hub	Smart meters	AMR/AMI	V2G	EV/PHEV	IED (relays, SCADA...	PMU	WAMS	Smart Sensors	Sensor and actuator	LAN/HAN/NAN/WAN	Cloud	5G	Machine learning	Data mining	Nature inspire	ANN	Multi-agent systems	Clustering	NLP	Digital twin	Autonomous vehicle	Blockhain	Actuators	3D printers
Uses & Applications	Smart home & Smart building							Smart grid							IoT & IoE					Big data, machine learning & AI										Physical action	
DSM/DR																															
Energy Storage																															
VPP																															
Distributed Energy																															

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2.1 Demand Side Management(DM) Demand Response (DR)

Changes by end consumers from their normal electricity consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce less use of electricity at times of high wholesale market prices or when system reliability is compromised.

Common examples

- An industry that does not have problems with changing its operating hours (for example a mine), could perfectly participate in a DR program, since it only has to adjust to what is requested by the utility and thus has the possibility of reducing its costs.

Opportunities

- (5/5) Consumers can get financial benefits by reducing or shifting their energy demand.
- (5/5) It improves the reliability of the grid, since transmission element are less stressed.
- (4/5) Reducing electricity when demand is highest often results in lower wholesale prices.

Information, infrastructure and regulation requirement

- Users must give permission to access their information.
- Smart metering is required.

Barriers

- (5/5) **Economic:** low participation due to low economic incentives and uncompetitive prices for sale of energy to the system.
- (4/5) **Technical:** if an excessive response to demand occurs, this can generate problems in the network
- (3/5) **Security:** given that massive access to system information is needed by users, it becomes more susceptible to attacks; the information needed to implement this technology can be considered sensitive by the users.
- (3/5) **Others:** difficult accessibility to information, especially critical in rural areas.

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Application synergies

- Microgrids (1.3) users may participate in a DR program in order to get revenues for it.
- Users may have an Energy storage (2.2) system or DER (2.4) to continue with the electricity supply during the hours that network power should not be used according to the DR program.

International real application

BeeBryte
New ways for energy efficiency

BeeBryte, a France and Singapore company, provides cloud-based intelligence software that can monitor real-time load for large commercial and industrial consumers. It uses artificial intelligence for weather forecast, occupancy, usage and energy price signals, the software can automatically switch loads such as HVAC systems to battery storage based on time-of-use charges and delivers up to 40% savings in utility bills[4].

[4] "International Review of Demand Response Mechanisms in Wholesale Markets", June 2019.

Examples of international goals

The goal is to generate 200 MW of flexible power by 2020, through a response energy system to centrally controlled demand.

National key partners and resources

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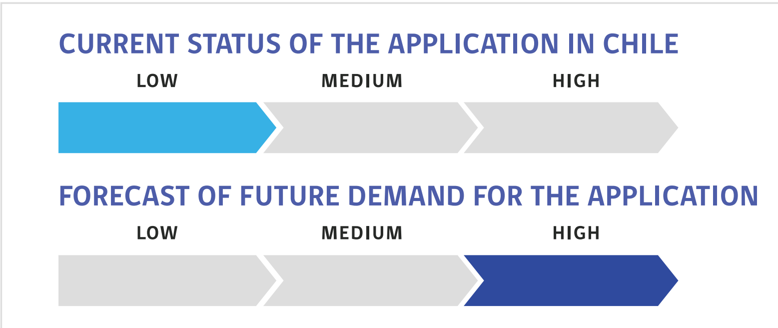
Public policies recommendations to Chile

- There must be a participatory process where each of the agents can intervene and evaluate the proposed regulatory environment and the agents' responsibility need to be well defined.
- The information delivered and the amount of user participation must be limited to avoid threats such as induced blackouts.
- A tariff and tax adjustment are needed to establish a demand management, enabling a variety of hourly price schemes that encourages the user to intervene to reduce peaks.



2.2 Energy Storage

The conversion of electrical energy from a power network into a form in which it can be stored until converted back to electrical energy.

Common examples

- In addition to traditional storage technologies such as lithium or lead acid batteries, there is the possibility of storing thermal energy in molten salts and then use that heat in a steam turbine and generate electricity.

The National Renewable Energy Laboratory (NREL) has launched a project aimed at increasing the efficiency of thermal storage to then use the energy to drive a turbine-generator set.

Opportunities

- Reduction in conventional technologies due to increased permissible penetration of NCRE's due to increased flexibility in production/consumption offset.
- Electric power plants infrastructure reduction due to better exploitation of produced energy in time.
- Electric power plants and transmission management improvement due to better consumption peak control efficiency.
- Gives flexibility to the system due to the ramp capacity it can deliver.

Information, infrastructure and regulation requirement

- Infrastructure development
- Energy balance framework to full usage of storage availability

Barriers

- **Economic:** It's currently not competitive compared to the conventional alternatives due to technologies' higher investment costs.
- **Regulation:** the regulation and participation of energy storage in some markets are not fully defined.
- **Others:** displacement of conventional generation plants.

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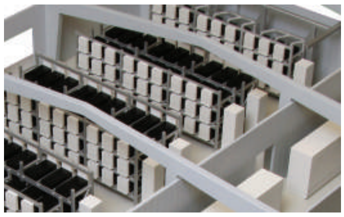
Application synergies

- Energy storage it's a great ally with DER (2.4), in particular with technologies that use intermittent resources, such as PV panels, wind turbines, mini hydro, etc., since it's possible to stored energy during periods of abundance and use it in scarcity periods.

International real application



Daimler has launched a 13 MW "second use" project in the German town of Lünen, and a 15 MW project in Hanover. It's the world largest second-use battery storage and its build form retired car batteries.

Examples of international goals

The goal is to eliminate the 50 MW limit for this type of project.

It's expected that by 2035 the costs of storage technologies will have a 50% decreased approximately. Also, incentive schemes for investments in storages related to distributed installations are in place.

The goal is to have 200 MW of energy storage by 2025.

National key partners and resources

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Public policies recommendations to Chile

- Establish economic incentives for the participation of flexible resources in energy markets (energy, capacity, and ancillary services) that effectively reflect the value of their flexibility.

CURRENT STATUS OF THE APPLICATION IN CHILE

LOW | MEDIUM | HIGH

FORECAST OF FUTURE DEMAND FOR THE APPLICATION

LOW | MEDIUM | HIGH

2.3 Virtual Power Plant (VPP)

Distributed power plant that aggregates the capacities of various DER in order to participate in operation of the system and the electricity market as a special power plant.

Common examples

- If a person owns several properties in different places, and has distributed generation in each of these, it is possible to participate in the wholesale or contract market as a single generator in the form of VPP.
- World VPP capacity was almost 4 GW in 2019. Leading the market is Europe, with 2.1 GW under VPP control (mostly through supply-side VPPs), followed by Asia Pacific and North America with 1.1 GW and 0.7 GW under VPP control in 2019, respectively.

Opportunities

- They can reduce operational costs by competing with conventional generators thanks to their lower equivalent fuel cost.
- They provide opportunities for the development of other digitalization uses such as microgrids, energy storage, DSM, etc.

Information, infrastructure and regulation requirement

- Smart metering is required.
- Not the same regulations as conventional generators, but special rules for VPP.

Barriers

- **Economic:** Infrastructure: internet quality and access by the resources used for VPPs; high computational cost.
- **Regulation:** complexity in legal and/or regulatory terms.

Application synergies

- By aggregating different elements like Microgrids (1.3), DER (2.4) and Energy storage (2.2), it's possible to form a VPP.

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International real application

Moixa, a UK company, has announced plans to build a virtual power plant made up of solar panels, batteries and electric vehicles (EVs). They will begin installing clean energy infrastructure in 250 council homes, as well as in 100 schools and council buildings in the region. Together these technologies will offer a combined 4 MW of generation and 4,2 MWh of storage capacity.

Examples of international goals

- No specific targets were found

National key partners and resources

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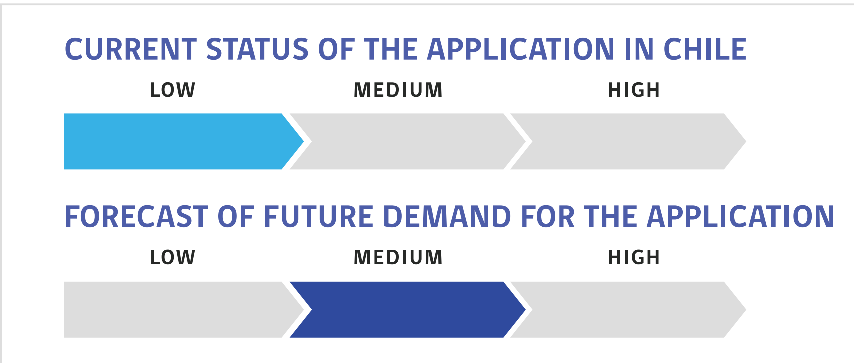
Public policies recommendations to Chile

- There mut be a regulatory adjustment so that the VPPs can participate in the energy market as they are generators that cannot be regulated under the same parameters as conventional generation.



2.4 Distributed energy (electricity/DG and gas)

Energy production applications at or near the point of consumption, which may or may not be connected to the distribution system.

Common examples

- There are different types of distributed generation technologies, such as photovoltaic and wind systems, cogeneration, gas turbine, batteries, etc.

In 2015 the DER installed capacity was 264 GW and it's expected that in 2025 will be almost 400 GW.

Opportunities

Economic: Lower costs thanks to technological advances in this application, such as the decreasing cost of solar panels and energy storage.

Environmental: In contributes to climate policies by reducing emissions.

Security: Since the energy is produced directly in the consumption points, it allows to decongest the network

Information, infrastructure and regulation requirement

- Smart metering is required
- Subsidies for the incorporation of distributed generation can encourage its adoption.

Barriers

Infrastructure: There must be an update of electrical systems in both technical (two-way power flow) and regulatory (tariffs) aspects.

Economic: Considerable investment cost.

Others: Large amount of information needs to be handled.

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Distributed energy (electricity/DG and gas)

Application synergies

- Distributed energy resources are the main part of applications such as Microgrids (1.3) and VPP (2.3). They give them the possibility of disconnecting from the main grid to operate in island mode and to aggregate various DER in order to compete with traditional plants respectively.
- Operating along Energy storage (2.2) systems, it's possible for example to store the excess generated during the day of PV panels and use them at night.
- By installing DER in residential or industrial applications, users become Prosumers (3.1).

International real application

The Tesla's Solar Glass Roof was launched in 2019. It consists in roof tiles that have a 10 kW capacity for a 2,000 square-foot roof and a cost of 42,500 USD[5].

1 "Solar Roof", Available on https://www.tesla.com/es_mx/solarroof

Examples of international goals

- (Germany) It's estimated that in 2024 the growth of distributed PV could be 50% higher compared to 2019.
- (China) The planning goal is having 60 GW of distributed solar energy by 2020 and 15 GW of distributed energy gas.
- (Korea) It's expected to supply more than 15% of the energy from distributed sources.

National key partners and resources

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Public policies recommendations to Chile

- Regulatory frameworks for a fair allocation of infrastructure costs. If support from local authorities is added to the above, the incentive is even greater.

CURRENT STATUS OF THE APPLICATION IN CHILE

LOW | **MEDIUM** | HIGH

FORECAST OF FUTURE DEMAND FOR THE APPLICATION

LOW | MEDIUM | **HIGH**