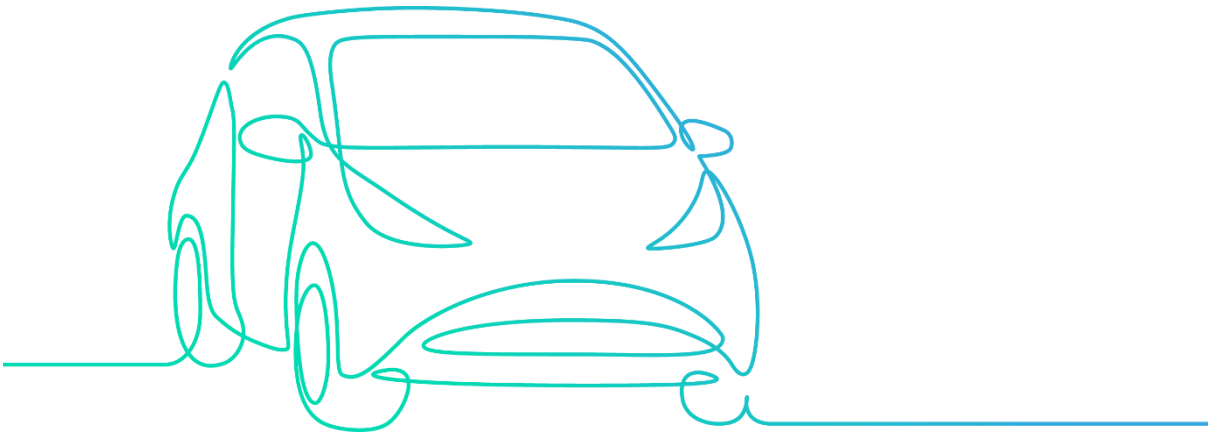
V2MARKET



Conclusions of the market study

D3.3

JUNE 2022

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Deliverable

PROJECT ACRONYM	GRANT AGREEMENT #	PROJECT TITLE
V2Market	101033686	V2Market. Valorising energy Efficiency and Flexibility at Demand-side using Vehicles to Grid (V2G) and Vehicle to building (V2B) Technology

DELIVERABLE REFERENCE NUMBER AND TITLE

D3.3

Conclusions of the market study. Report on the conclusions of the study of the different markets, and the key elements to be considered for the different business model elements, as well as legal, market and policy barriers and opportunities

Revision: <v1.0>

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Statement of Originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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Summary

This deliverable is the result of the findings in the WP3: *Analysis of the electricity markets and its potential for integrating V2G* within the V2Market project. The main objective of the D3.3 is to summarize the key aspects to be considered in the design of the V2G business model. During WP3 the potential of V2G flexibility services in the electricity markets has been introduced, (day-ahead market, intraday auctions market, intraday continuous market, and local flexibility markets), considering the participation of the aggregator and the EV owner in these markets.

The main objective is to identify legal, market, and policy barriers, whilst considering opportunities that will feed the policy recommendations in the exploitation phase (WP8).

This document is a report that includes in the first section the principal information related to regulation in terms of storage and regulatory sandboxes in Spain. Sandboxes are a framework supervised or controlled by the regulator to allow testing of new business models which can produce innovative outcomes which benefit consumers and the electricity sector. The deliverable 3.3 in its second section has a total of 20 different conclusions written in different tables, to summarize all the information, including needed changes, opportunities and actors involved.

Along with the market study outputs from WP2, the key elements will be considered for the business case development in WP4 and WP5, and for assessing the needs for ICT tools in WP6.

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TABLE OF ACRONYMUS

Acronym	Description
ACER	Agency for the Cooperation of Energy Regulators
CEER	Council of European Energy Regulators
CNMC	National Commission for Markets and Competition
DER	Distributed Energy Resource
DA	Day Ahead Market
ESL	Electricity Sector Law
EU	European Union
EV	Electric vehicle
OMIE	Omi Polo - Español
REE	Red Eléctrica de España
TSO	Transmission System Operator
SEE	Secretary of State for Energy
V2B	Vehicle-to-Building
V2G	Vehicle-to-Grid
V2H	Vehicle-to-Home

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1/ REGULATION AND EXPECTED FUTURE DEVELOPMENTS

Before summarizing the main conclusions reached in Deliverables 3.1 and 3.2, we will look in this section at the current state of the regulation in Spain regarding storage, with special emphasis on EV storage. It is important to note that the EU is working on a strategy to become independent from Russian fossil fuels which requires the massive deployment of renewable energy. This strategy, via RePowerEU[1] specifically recognises the fact that storage (incl. distributed storage) is key for enhancing the security of supply given the high and rapid penetration of renewable energy. Consequently, it is foreseeable that EU legislation will increasingly look at facilitating the participation of storage, such as EV batteries, in the system. Therefore, while Spanish regulation is still at an early stage with its storage regulation, this is likely to change quite radically and fast. Indeed, an example of this fact is the proposed regulation on sandboxes currently underway, where the CNMC has expressly stated flexibility and aggregation as candidates for pilot testing.

1.1 Regulation of storage in Spain

In this section we will look at the grid access for storage. The ESL, in its article 6, letter h) defines the owners of storage facilities, as “the natural or legal persons who own facilities which defer the final use of electricity to a later time of when it was generated, or that perform the conversion of electrical energy into a form of energy that can be stored for subsequent reconversion of said energy into electrical energy”.

Article 33.12 ESL foresees access and connection permits to the grid for storage installations connected to renewable generation plants, stating the following:

“The holders of access permits for electricity generation facilities that hybridize said facilities by incorporating electricity generation modules that use renewable primary energy sources or by incorporating storage facilities may evacuate the electrical energy using the same connection point and the access capacity already granted, provided that the new installation meets the applicable technical requirements”

[1] COM(2022)230 Final Communication from The Commission to The European Parliament, The European Council, The Council, The European Economic And Social Committee And The Committee of The Regions RepowerEU Plan. https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF

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Thus, it seems that EV batteries could fall into the category of storage associated with a self-consumption installation, in other words, under the same supply point. If this were the case, the EV could inject energy from the battery into the grid up to the maximum power established in the access and connection permits granted by the system operator for the generation system (i.e. the nominal power of the solar installation). Self-consumption installations with a generation power over 15 kW or not located on urbanized land are required to obtain such access and connection permits, as determined by Royal Decree 244/2019. This could be the case of an EV charging at home during the day from the solar installation and injecting energy into the grid when generation is higher than consumption or in the more expensive hours of the day (ie. at night, if there is no or low consumption at home).

In any case, it is important to determine what will be the requirements for connection of EVs which can feed energy into the system, establishing a simplified procedure to do so, as has already been done for self-consumption under 15 kW.

Royal Decree 1183/2020 on access and connection to transport and distribution networks includes storage which may inject into the grid under the type of installation that may request access and connection to the grid permits. Article 6.3 establishes that storage facilities that can inject energy into the transmission and distribution networks, will be treated as applications for generation installations, without prejudice to the technical access criteria that must be considered for this type of installations, as a result of their condition as installations that can also behave as demand installations.

Similarly, to what was mentioned above, it would seem like the owner of an EV could request access and connection permits for the battery of the EV associated to his or her supply point without the need of also having a self-consumption installation. In this case, the EV would charge from the grid, rather than the self-consumption installation. Again, it is necessary to determine the applicability of this provision to EV batteries and further develop the authorisation procedures, with simplified authorisation for some cases, establishing a fast track of “connect and notify” for certain installations, and “apply and connect” for others, like is the case in the UK.

In the chart below a relation of the most relevant applicable regulations in place in Spain is provided, regarding storage, with a specific focus on its applicability to EV batteries. The referenced regulations refer to grid access and connection requirements as well as the possibility for storage to participate providing certain services to the system.

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REGULATION	DESCRIPTION
Royal Decree 1053/2014 passes a new Complementary Technical Instruction, ITC-BT-52 “Facilities for special purposes. Infrastructure for recharging electric vehicles”	This Technical Instruction regulates from an electrical point of view the connection of the infrastructure for the recharge of electric vehicles.
Law 24/2013 on the Electricity Sector.	Royal Decree-Law 23/2020 modified ESL on two points regarding storage. On the one hand, it included a definition of owners of storage facilities. On the other hand, it included within the access and connection article that holders of access and connection permits for generation plants would be able to use that same capacity already granted in their permits should they hybridize their installation with another renewable technology or with storage, to inject energy into the grid from that hybridization or storage.
Royal Decree 1183/2020 on access and connection to transport and distribution networks.	It regulates access and connection permits to the DSO’s and TSO’s networks and establishes that storage installations with the capacity of injecting energy into the grid may request such permits, like a generation installation.
Resolution of December 11, 2019, of the CNMC, which approves the conditions related to the balance for balance service providers and the liquidation subjects responsible for the balance in the Spanish peninsular electricity system.	This resolution allows the participation of the demand and storage systems in the balance services, establishing the conditions for the aggregation of these facilities and for their authorization to participate in the different balancing services.

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REGULATION	DESCRIPTION
Resolution of December 10, 2020, of the CNMC, passing the adaptation of the system's operating procedures to the conditions related to the balance approved by Resolution of December 11, 2019.	This Resolution contemplates that each programming unit providing balancing services must have a minimum offer capacity of 1 MW.
Resolution of January 13, 2022, of the CNMC, approving a new operating procedure 3.11 and modifying operating procedure 3.2 to develop an automatic power reduction system.	It allows the participation of all installations or groups of installations that have a physical unit with a specific electrical location to participate in redispatching in Spain, which includes stand-alone storage, which will need to have a differentiated programming unit for injection and consumption of power.

1.2 Regulatory sandboxes:

The European Commission in its latest recommendations for speeding up permit-granting procedures for renewable energy, encourages the setting up regulatory sandboxes, as they could support innovation and facilitate the subsequent adaptation of the regulatory environment of innovative decarbonisation technologies needed for climate neutrality[2].

In Spain, there is currently a draft Royal Decree for setting up the general framework for regulatory sandboxes for the promotion of research and innovation in the electricity sector[1] which require the approval of the Ministry for the Ecological Transition and the Demographic Challenge. Sandboxes allow testing grounds for new business models that are not covered by current regulation or supervised by regulatory institutions.

The proposed regulation defines the general framework of the regulatory sandbox and establishes the requirements for a pilot project to access the sandbox. The access will be

[2] COMISSION RECOMMENDATION C(2022)3219 on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements. EUR-Lex - C(2022)3219 - EN - EUR-Lex (europa.eu)

granted by means of calls (with a specific topic) for which, apart from what provided in the RD, specific requirements will be established.

All subjects of the electricity system (article 6 ESL) can access regulatory sandboxes, which therefore includes aggregators, the market operator (OMIE), electricity suppliers, producers, DSOs, storage facility holders, consumers or energy communities. The proposed projects must have a status of planning and potential development sufficiently advanced and must require for their implementation of, at least, one exemption in the regulation of the electricity sector, with the ultimate goal of giving rise to regulatory innovation.

Additionally, pilot projects must meet the following requirements to become eligible:

a) Possess technical feasibility
b) Guarantee the absence of risks for the electrical system
c) Ensuring consumer protection
d) Comply with the principle of economic and financial sustainability
e) Propose a regulatory innovation
f) Any other condition established by the calls

Specifically, this regulatory innovation proposal should be understood as:

1. Ability to contribute to improving regulation and regulatory learning.
2. Utility to guide the transposition of European regulations.
3. Ability to generate potential benefits for consumers.

Sandboxes will be organized by Ministerial Order, setting the requirements to be met by promoters to participate in each call. The procedure for access will consist of two phases:

1. Evaluation of the projects that request access to the sandbox in the call, by the Secretary of State for Energy (hereinafter, SEE) and the CNMC. The maximum term to resolve will be six months.
2. Subscription of the test protocol between the promoters who have obtained a favourable evaluation and the SEE, which will determine the conditions and rules that will govern the tests by the pilot project.

Once they have accessed the sandbox, the pilot projects must do the following to be able to start the tests:

a) Provide guarantees. The promoters will provide financial guarantees to cover the responsibility for damages that may be incurred. However, the amount of such guarantees is not specified.

b) Sign, where appropriate, the corresponding secondment agreements between the promoter and the participants. A participant is any agent other than the promoter who takes part in the tests. The secondment agreement shall specify, at least, the kind of test that will be carried out, the role played by each participant, the guarantee system, the withdrawal regime, data processing and the suspension regime.
c) Prove compliance with these two previous requirements before the SEE
d) Communicate to the SEE the start date of the participation in the sandbox.

As the CNMC has pointed out in their report on the draft Royal Decree3, these sandboxes should not only include those projects that require a regulatory exemption, but also those that require the application of a, for now, non-existing regulation, precisely because innovation will require the implementation of new market actors or systems which do not exist currently, such as aggregation and local flexibility markets. It is therefore expected that this will be corrected in the final Royal Decree which is passed.

Similarly, the CNMC can also authorise demonstration projects that can contribute to the improvement of the operation of the wholesale electricity market and the operation of the system, provided that they meet the criteria laid down in article 24 of Circular 3/2019[4], namely:

- The product or service which wants to be tested is innovative.
- The applicant can demonstrate that the innovation will provide benefits to the consumer.
- The System Operator or, as the case may be, the distribution network manager, justify the absence of risks for the operation of the system or for the affected distribution network, respectively.
- There is some requirement in the regulations that prevents the implementation of the innovation.
- There is a perfectly developed plan to test the innovation. The plan will include clear objectives, criteria and indicators of success and a specific execution period that may not exceed thirty-six months.

[3] Report on the Proposal Royal Decree by which the general framework for regulatory sandboxes for the promotion of research and innovation in the electricity sector is established, from April 28th, 2022. Reference: IPN/CNMC/011/22

[4] Circular 3/2019, of the CNMC by which the methodologies that regulate the functioning of the wholesale electricity markets and the management of the system are established. (Official State Gazette, nº 289, 02/12/2019)

In the Bridge Beyond 2025 paper[5], ACER and CEER point out the benefits of such sandboxes in advancing European regulation in the promotion of energy efficiency and for reaching the EU carbon emission reduction and energy transition goals.

Further, the CNMC explicitly mentions aggregation and local flexibility markets in their report on the proposed Royal Decree, as issues which will require testing and innovation for their implementation, thus indicating they are worthy of access to such sandboxes or demonstration projects. The choice of the instrument for testing (sandboxes or demonstration projects) will depend on the scope of the project and who is competent for granting the regulatory exemption or defining the required regulation, in which case it would fall under the approval of the Ministery of Ecological Transition or the CNMC, or even both. Finally, it should be noted that the CNMC recommends including the DSO in those pilot testings as that may have an impact on their operation, as would be the case for the development of local flexibility markets and V2G.

1.3 Recommendations from ACER

On the ACER's Final Assessment of the EU Wholesale Electricity Market Design published on April 2022, ACER recognises that the power system will need significant and diverse flexible resources to optimise the value of growing shares of intermittent generation and to smoothen the increased volatility.

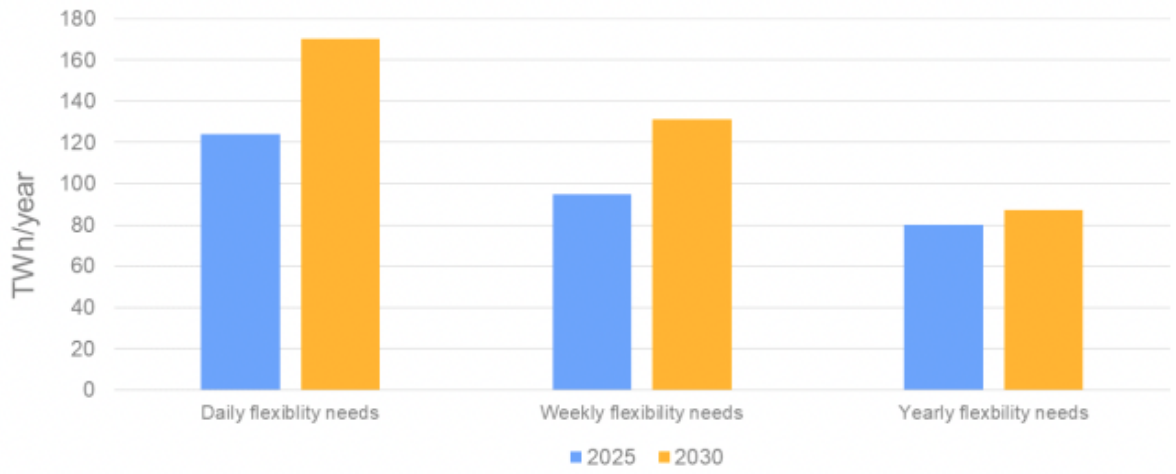

Figure 1. Expected evolution of flexibility needs in the EU in 2025 and 2030 by ACER (based on simulations made by the Joint Research Centre) [1].

[5] The Bridge Beyond 2025 Conclusions Paper, 19th November, 2019. The Bridge Beyond 2025_Conclusion Paper.pdf (europa.eu)

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The increasing flexible resources entering the power system need marketplaces where their contribution can be recognised and traded. ACER recommends introducing products that better reflect a changing reality (e.g., products linked with renewable generation or net demand) and could offer better hedging solutions and stimulate trading and the related investments in flexible resources. ACER considers that the most straightforward incentive to invest in flexible resources remains the price signal [1].

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2/ MAIN CONCLUSIONS OF THE MARKETS STUDY

After the redaction of the previous deliverables (D3.1 and D3.2), the main 20 conclusions of the V2G market study are presented in this section. The conclusions are classified into three main categories regarding:

- EV technology & V2G
- Electricity markets
- Market participants and new figures

EV TECHNOLOGY & V2G CONCLUSIONS

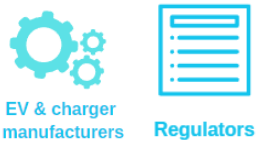
EV TECHNOLOGY & V2G	V2MARKET
	V2G TECHNOLOGY WILL HELP THE INTEGRATION OF RENEWABLE ENERGY RESOURCES IN THE ELECTRICAL SYSTEM
CONCLUSION	As the share of renewable energy increases in the electric system more complexity is added to the system due to the intermittent character of the renewable generation. This introduces additional variability and uncertainty to the grid. Large introduction of renewable resources in the system makes the process of balancing supply and demand even more challenging. The risk of overgeneration in moments of high renewable generation is increased. Due to this, it is mandatory to increase the flexibility in the system and V2G can be a good solution for this flexibility problem. V2G technology could play an essential role in enabling electric vehicles to improve the efficiency of the electricity grid, reducing greenhouse emissions from transport and electricity generation. V2G allows to store energy in the batteries during moments of high renewable generation and to inject this energy later in moments of low renewable production. V2G has the potential to literally drive the energy transition.
OPPORTUNITIES	• **Increase the renewable share** in the electricity market and system. • Decrease electricity prices due to the shift of supply and demand. • Give **flexibility** to the electricity system using **V2G technology**.

INVOLVED FIGURES	

EV TECHNOLOGY & V2G

V2MARKET

THERE IS A NEED OF STANDARDIZATION OF COMMUNICATION PROTOCOLS FOR CHARGERS AND EVs

CONCLUSION	Although EVs and EV infrastructure are expected to be massively deployed on a global scale in the coming years **there is a lack of standardization of socket, connectors, and communication protocol for chargers**. For the development of V2G, it is essential that electric vehicles and chargers are able to communicate under a standard framework, not only in Spain, but at a European level.
NEEDED CHANGES	Regulations should be adapted to EU provisions, such as article 4.8 of Directive 2014/94/EU stipulates that operators must be allowed to provide charging services directly (on a contractual basis with the customer) or indirectly (though a hub), on behalf of other providers. This necessarily requires roaming technology between different actors to allow users to charge using a single identification or payment method. Also, charging stations must be able to communicate with all EVs. However, the recently passed Royal Decree 184/2022 on recharging services in Spain is not sufficient to ensure harmonization or open access to e-mobility service providers to all charging points.
OPPORTUNITIES	Spain is still at a very early stage of charging infrastructure deployment. Thus, there is an opportunity to ensure standardization between charging points.
INVOLVED FIGURES	

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EV TECHNOLOGY & V2G

V2MARKET

V2G & EV COSTS ARE DROPING AS DEMAND INCREASES

CONCLUSION

The cost of EV components and EV infrastructure has fallen due to technology innovation and a higher demand of EVs. EV sales set new records particularly in countries with policies that support zero emission regulations in transportation.

V2G hardware prices are dropping as the interest in this technology is growing, but still, have a higher cost than a normal EV solution. It is expected that in the next years the price of charging infrastructure will go down driven by a higher demand from customers and a wider offer of compatible vehicles.

Batteries represent the highest cost in terms of EV components. During the last decade the average unitary cost of EV storage systems declined due to the increased production of lithium-ion battery packs, because of higher demand, and it is expected to continue going down, but rising commodity prices start to bite the prices [2]. The decrease in price will be due to the introduction of new technologies and an increasing production and demand. Battery improvements will have a big positive impact in the EV sector.

OPPORTUNITIES

- Lower infrastructure and EV costs will help to reach higher EV penetration rates.
- Develop of new storage techniques and innovation.
- With higher demand of EVs more stakeholders and users will be interested in technologies such as V2G, V2H or V2B.

INVOLVED FIGURES

V2G and EV fleets

EV & charger manufacturers

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EV TECHNOLOGY & V2G

V2MARKET

SPAIN NEEDS TO SPEED UP THE DEPLOYMENT OF EV INFRASTRUCTURE TO UNLOCK EV POTENTIAL

CONCLUSION

There is an insufficient deployment of the public electric vehicle infrastructure in Spain, when compared to other European countries. The number of charging points across Spain needs to be increased to ensure that the infrastructure is ready to reduce market barriers and reduce uncertainties for EV owners.

According to estimations of the sector the Spanish Association of vehicle manufacturers ANFAC, at the end of 2021 there were only 13.411 available public charging points. The association expects to achieve 360.000 public charging points by 2030.

In 2014, the Alternative Fuel Infrastructure Directive set that by 2020 should be at least a ratio of 1 charging point per each 10 EVs, only Netherlands, Italy and France reached a ratio equal of higher than that [3].

NEEDED CHANGES

Ensure connection processes for EV and V2G are smooth and transparent to market participants and customers.

OPPORTUNITIES

The Integrated National Energy and Climate Plan 2021 – 2030 (PNIEC) includes measures to achieve a total fleet of 5 million electric vehicles and 500.000 public chargers by 2030.

Some of the measures already in place:

- The Moves III plan by the Spanish government, which offers subsidies for the deployment of charging infrastructure both for public and private use.
- The Royal Decree 1053/2014 lays down the minimum endowments for recharging points in newly built buildings and parking lots.
- The Royal Decree Law 29/2021 sets obligations for gas stations to install charging infrastructure of 50 kW or 150 kW on direct current, depending on their volume of operations.

INVOLVED FIGURES

Public entities

Financial actors

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EV TECHNOLOGY & V2G

A NON-DISCRIMINATORY DATAHUB MUST ENSURE EQUAL ACCESS TO INFORMATION

CONCLUSION

Directive 2019/944 recognises the importance of ensuring consumers have access to their consumption data in "quasi-real" time, so as to be able to offer their flexibility to the network. This barrier has also been identified in Australia, a leading country in the deployment of DER.

Currently in Spain there is a data hub managed by the DSOs, called Datadis, as well as a project named SIORD, aimed at reducing communication costs. However, both models are managed by the DSOs themselves. In local flexibility markets, the DSOs will be the customers of flexibility services provided by EV owners through aggregators. Therefore, it does not seem impartial that DSOs should be managing access to data which is required by aggregators to provide services to these same DSO's.

A solution to the problem of potential information asymmetry would be to separate the physical management activity of the network and the management of customer data.

In this way, the DSO would continue to carry out its tasks of maintenance and operation of the electricity distribution grids in its territory, but an independent operator would manage the data, giving access to the same information, and in a harmonized format, to all suppliers or aggregators.

NEEDED CHANGES

In order to do so, the Electricity Sector Law should be amended to mandate an independent entity as manager of the "data hub", concentrating the measurement data that it currently manages and all the distribution data (measurement, load curve and other customer data).

OPPORTUNITIES

The data hub would foster competition and equal access to information by all agents involved, creating a level playing field.

INVOLVED FIGURES

EV TECHNOLOGY & V2G

V2MARKET

E-ROAMING: CHARGING INFRASTRUCTURE MUST BE INTEROPERABLE

CONCLUSION

EVs are a combination of storage and mobility, meaning that charging and discharging of the battery can occur in different locations. **E-roaming technology and interoperability agreements** between final users, charging infrastructure operators and aggregators or electricity suppliers have to be developed in order to allow any EV owner to provide their flexibility to the system at any charging point and receive compensation in exchange. In this way, the DSO would continue to carry out its tasks of maintenance and operation of the electricity distribution grids in its territory, but an independent operator would manage the data, giving access to the same information, and in a harmonized format, to all suppliers or aggregators.

NEEDED CHANGES

A European standard for vehicle to grid communication interface needs to be adopted, which **defines a vehicle to grid (V2G) communication interface for bi-directional charging/discharging of electric vehicles.** In this sense, an international standard already exists: ISO 15118 Road vehicles -- Vehicle to grid communication interface

OPPORTUNITIES

The capacity of dissociating the location where energy is consumed (charging) from the location where energy is injected into the grid (discharging) can be a solution to the lack of firm capacity in the low voltage network in Spain.

INVOLVED FIGURES

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EV TECHNOLOGY & V2G

V2MARKET

V2G

TECHNICAL REGULATIONS MUST INCLUDE V2G REQUIREMENTS

CONCLUSION	From the technical perspective, ITC-BT 52 is the technical instruction that regulates the connection of the infrastructure for the recharge of electric vehicles, whether public or private. Accordingly, it also lays down the different kinds of connection diagrams applicable depending on the electrical design and distribution of the building.
NEEDED CHANGES	Currently, the Ministry of Industry, Trade and Tourism of Spain is undergoing a process for reviewing the Electrical Low Voltage Regulation and its technical instructions, including ITC-BT-52. The public consultation period ended in March 2021.
OPPORTUNITIES	It would be expected and desirable that such modifications of the technical instructions contemplate the **inclusion of the terms of V2G and V2B** and set the requirements for bidirectional charger deployment.

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ELECTRICITY MARKETS

ELECTRICITY MARKETS	V2MARKET
V2B & V2H	**V2B AND V2H ARE ATTRACTING BUSINESS MODELS WHEN COMBINED WITH SELF-CONSUMPTION**

CONCLUSION

Currently, V2B and V2H are the only regulatory viable business models for V2G in Spain. They present an attractive business model when combined with solar self-consumption. This tandem allows the possibility to charge the battery during high solar capacity hours with no cost and discharging at peak hours.

NEEDED CHANGES

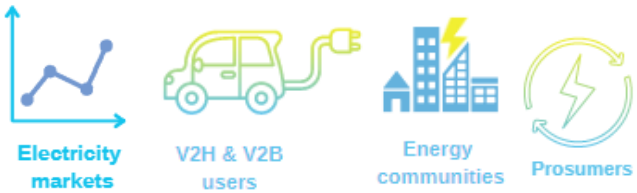
Under the current regulation, V2G would be limited to behind-the-meter operation. Meaning they are able to provide savings on the energy bills –by maximizing self-consumption benefits or shifting consumption to valley period. The regulation must evolve to allow V2G to inject energy into the electricity grid under energy surplus and shared-energy schemes (Peer-to-peer trading).

OPPORTUNITIES

Residential EV owners tend to charge their EVs after returning from work, which is also usually the time of peak demand in the grid, thereby coinciding with the household consumption peak. Discharging the battery during high consumption hours, thus reducing the energy demand, will provide benefits to the grid and a reliable source of savings for V2B/V2H owners.

In local energy communities, once regulation allows it, V2B/V2H could store energy from the community's renewable sources at high production hours and then give it back during high price hours.

INVOLVED FIGURES



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ELECTRICITY MARKETS

V2MARKET

V2G STANDS AS A SOLUTION FOR SHORT-PERIOD GRID MANAGEMENT NEEDS

CONCLUSION

V2G can be a good solution for grid congestions or moments with high demand or high electricity prices, especially during short periods of time (up to 4 hours) and requests made with short time in advance (seconds to 5 minutes).
The main driving factor when deciding to extend the distribution is the necessity to handle congestion in the grid, meaning nodes that are stressed or infrastructure that has aged. V2G can offer generation/consumption flexibility to the distribution grid to optimize investments in distribution grid infrastructure.

NEEDED CHANGES

The regulatory framework affecting the distribution activity is still strongly in favour of traditional network investments and thus, in practise, it generally prevents using flexibility services from DERs as an alternative.
Spain must complete the transposition of Directive 944/2019, that will promote the uptake of flexibility services through market mechanisms that alleviate the need to upgrade or replace electricity capacity and support operation of the distribution system.

OPPORTUNITIES

- V2G has the possibility to offer flexible generation capacities and put into operation its fleets with low marginal costs.
- V2G's flexible operation can offer an alternative to distribution grid reinforcement and expansion.

INVOLVED FIGURES

V2G and EV fleets

Electricity markets

DSOs

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ELECTRICITY MARKETS

EV CHARGING SUPPLY TARIFF: AN INCENTIVE TO ACCELERATE THE EV DEPLOYMENT

CONCLUSION

Careful design of EV tariffs is crucial to achieve the right incentives for the development of EVs. Tariffs must evolve towards smart tariff models, where charges, tolls and energy price reflect the real opportunity cost of the electricity market prices.

Tolls and charges can incentivise consumers to shift consumption, such as EV recharging, away from the hours of their individual peak demand, to keep their cost of charging as low as possible. EV should receive clear market signals in order to charge during low-consumption hours. This will incentive the implementation of smart charging features to be able to charge EVs when the price is as low as possible automatically.

NEEDED CHANGES

Spain can expect hours of high solar generation to be extremely cheap in the wholesale market, even possibly reaching negative prices during those hours in that period. Current tolls and charges tariff may need to evolve to adapt to this new scenario, as the mid period of the day will become the one promoted for consumption like, for example, EV charging.

OPPORTUNITIES

Spain presents one of the highest rates of smart meter deployment in the EU (99%) and already offer dynamic electricity price tariffs, therefore offering price signals to costumers.

INVOLVED FIGURES

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Grant Agreement No. 101033686

ELECTRICITY MARKETS

V2MARKET

15 min

LOWER GRANULARITY OF PRODUCTS WILL REPRESENT AN OPPORTUNITY FOR V2G PARTICIPATING IN ELECTRICITY MARKETS

CONCLUSION

One of the main advantages of the V2G technology is the quick activation service that it can provide to the system and their ability to charge and discharge the EV batteries for short periods. Nowadays, the granularity of the Spanish day-ahead and intraday electricity markets' product is 1 hour. In the next years, and according to European regulation, the wholesale market will reduce the granularity of their products to 15 min. This new granularity fits better with V2G services and the EV integration into the electricity market. It will allow EV owners or aggregators to trade in periods of 15 minutes, within this scenario of shorter settlement periods, V2G would offer higher rates of flexibility as EV owners could have the possibility to acquire the compromise of injecting or consuming energy during short time periods, adapted to their necessities.

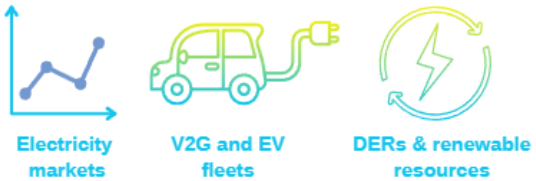
NEEDED CHANGES

- Changing the granularity of the markets to 15 minutes.

OPPORTUNITIES

- Higher participation of V2G, EV, renewable resources and DERs in the electricity markets.
- Shorter products will fit better the needs of the end users.

INVOLVED FIGURES



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ELECTRICITY MARKETS

V2MARKET

REVIEW STORAGE AND V2G INTEGRATION IN THE ELECTRICITY MARKETS

CONCLUSION

V2G technology is a good option for providing short-period services in the electricity market. However, V2G cannot participate on the global electricity markets since it is considered a stand-alone battery and that technology is not currently introduced into the wholesale market.

Regarding local electricity markets, since it is not regulated in Spain, V2G cannot participate in those markets either. V2G technologies are starting to be considered, but there is not a specific road map for the inclusion of V2G. Storage and V2G need to be able to have a net consumption balance or a net selling balance schedule after their negotiation on the electricity market.

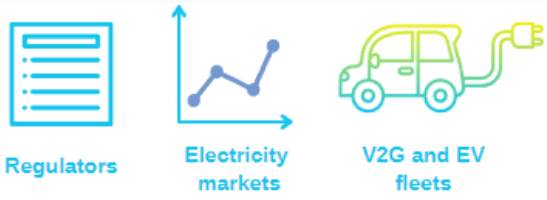
NEEDED CHANGES

The changes to allow storage resources to participate in the electricity market are not too difficult to implement and it is expected to be included soon. These facilities should be able to have a net consumption balance or a net selling balance schedule after their negotiation into the electricity markets.

OPPORTUNITIES

Because of its ability to rapidly activate and to operate for short times (few minutes to few hours), aggregated V2G is a good solution for products in the global markets covering peak periods and large ramps of generation. The adoption of more storage in the electrical system would avoid investments in more expensive peak generation, traditionally provided by gas power generation resources.

INVOLVED FIGURES



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ELECTRICITY MARKETS

0.1 MWh

A LOW MINIMUM BID IN THE ELECTRICITY MARKETS FACILITATES THE PARTICIPATION OF AGGREGATED RESOURCES

CONCLUSION

The minimum bid in wholesale electricity markets in Spain is 0,1 MWh that is under the 0,5 MWh minimum recommended in the Regulation (EU) 2019/943. Low bidding limits facilitate the integration of energy resources in the markets, the effective participation of demand-side response, energy storage and small-scale renewables including direct participation by customers. In case of small resources, the figure of the aggregator is an essential tool that must be regulated and introduced into the electricity system.

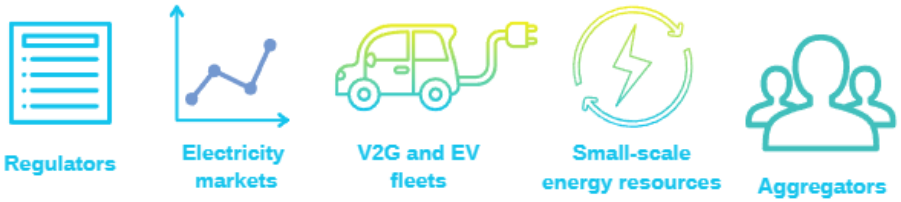
NEEDED CHANGES

- Regulatory framework for aggregators.

OPPORTUNITIES

- Participation in global wholesale markets.
- New figures such as aggregators.
- New revenues for EV and V2G users.
- Integration of active consumers and small-scale resources through the figure of the aggregator.

INVOLVED FIGURES



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ELECTRICITY MARKETS

LOCAL FLEXIBILITY MARKETS: A VALUABLE OPPORTUNITY FOR V2G

CONCLUSION

Local flexibility markets will be an opportunity for V2G to complement their revenue streams through the participation in global wholesale electricity markets. If local markets are activated in a certain area by a DSO, V2G and DERs located within this area will be allowed to participate in the flexibility auctions. Thus, V2G as a flexible energy resource will give a service to the distribution grid operator obtaining a revenue for that. It is expected that the revenue received by the resources giving the service will be higher than in wholesale electricity markets due to the needs of the DSO to solve the constraint on a certain area of the grid.

NEEDED CHANGES

- Regulate local flexibility markets in Spain (operation, figures involved, settlement…).
- Integrate local flexibility markets with the rest of wholesale electricity markets and their resulting schedules.
- Introduction of new figures in the electricity market.

OPPORTUNITIES

- Add new revenue streams to V2G fleets, DERs and consumers.
- Active participation of prosumers and demand-side response.
- New market tools for DSOs to solve constraints on the distribution grid.
- Introduce the needed changes in the national regulation according to Directive (EU) 2019/944.

INVOLVED FIGURES

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ELECTRICITY MARKETS

V2MARKET

V2G, A GOOD OPTION FOR AVAILABILITY SERVICES

CONCLUSION

Local flexibility markets will allow V2G fleets to provide availability services to the distribution grid where users that are providing the service will only have to be connected to the grid during the service time or period. If the DSO finally needs their V2G flexibility, it will activate them and send the request for charging/discharging the EV batteries during a certain time.

NEEDED CHANGES

- Regulate local flexibility markets in Spain (operation, figures involved, settlement…).
- Introduce local flexibility products with an availability component.

OPPORTUNITIES

- V2G and the rest of DERs can perceive revenues for being available for the DSO.
- Add new revenue streams to V2G fleets, DERs and consumers.
- New market tools for DSOs to solve constraints on the distribution grid.
- Active participation of prosumers V2G and demand-side response in local availability services.

INVOLVED FIGURES

ELECTRICITY MARKETS

V2MARKET

DIFFERENT TYPES OF FLEXIBILITY TIMEFRAMES OPEN NEW OPPORTUNITIES FOR V2G

CONCLUSION

As it is explained in the V2Market D3.2 the prototype operation model of local flexibility markets proposed by OMIE has different types of negotiation depending on the delivery horizon of the flexibility auctions: short-term local flexibility auctions and long-term local flexibility auctions. This new and different type of flexibility trading opens different opportunities for V2G.

- Short-term local flexibility trading fits well with V2G individual users. The trading is intraday or day-ahead, this way V2G final users will have more time to decide if they are able to participate or not in the flexibility auction and if it fits with their vehicle availability.
- Long-term local flexibility market fits well with V2G fleets or users that always have some vehicles connected to the grid or with users that have always the same mobility pattern and can ensure that they will not need the vehicle within the flexibility period established by the DSO.

NEEDED CHANGES

- Regulate local flexibility markets in Spain (operation, figures involved, settlement…).
- Introduce short-term and long-term local flexibility auctions according to the DSO's needs.

OPPORTUNITIES

- Open different local flexibility markets trading models to solve DSO's grid constraints.
- Short-term and long-term flexibility auctions facilitate the participation of V2G in local markets.

INVOLVED FIGURES

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ELECTRICITY MARKETS

FIRST STEPS TOWARDS THE DESIGN OF LOCAL FLEXIBILITY MARKETS IN SPAIN

CONCLUSION

Local flexibility markets are not regulated yet in Spain. Currently, there is a pilot being carried out by OMIE (IREMEL) which aims at providing useful guidelines for future regulation. Local and Flexibility markets aim to give tools to DSOs and customers to simplify the use and integration into the electricity market of distributed energy resources and adding new revenue streams. Also, local flexibility markets provide DSOs a range of products and solutions to help them resolve constraints in the distribution grid, improving the efficiency of the system in a competitive and transparent process.

NEEDED CHANGES

The lack of standardization in products, platforms and communication protocols between DSOs may be a barrier for the development of local flexibility markets. It is expected that in the next months the Spanish government and the National Regulatory Authority (CNMC) will present a proposal of the regulatory framework.

OPPORTUNITIES

- Local flexibility markets can cover the needs of distribution networks through the participation of DERs, providing an **alternative to grid reinforcements**.
- Local flexibility markets are an opportunity for aggregators, energy communities, distributed resource owners, EV or V2G EV owners or current market participants to obtain **new revenue streams.**

INVOLVED FIGURES

MARKET PARTICIPANTS AND NEW FIGURES

	MARKET PARTICIPANTS AND NEW FIGURES V2MARKET
	AGGREGATORS WILL UNLOCK THE VALUE OF DISTRIBUTED RESOURCES
CONCLUSION	Aggregators will play an important role in flexibility markets by aggregating in their portfolios different type of energy resources such as V2G, photovoltaic energy, storage or demand-response. The more varied their portfolio is, the more flexibility options will be covered. For example, a portfolio that only aggregates photovoltaic generation may not contribute with their flexibility at times when there is no solar production.
NEEDED CHANGES	The aggregator figure is contemplated by Spanish national law but no proper regulatory framework has been developed. Currently, the regulation only referrers to the participation of aggregators in balancing services and wholesale electricity markets. However, the interaction between electricity suppliers, DSOs and aggregators is not yet regulated. For example, issues such as the possible imbalances caused by the actions of an independent aggregator on the supplier's portfolio must be considered.
OPPORTUNITIES	By being part of the aggregation platform customers can receive incentives for joining the platform such as sign-up bonus, bill credits every month, or partial coverage of upfront cost of installation or EV. **The benefits of participating in an aggregation platform can serve as an economic incentive for investing in EVs.**

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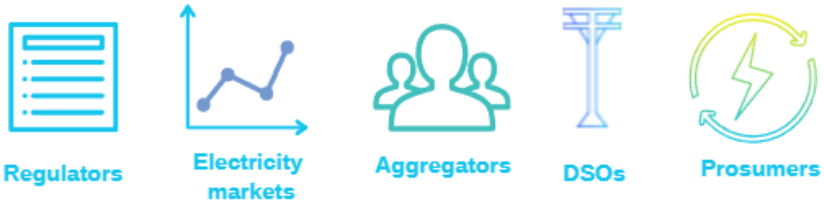
INVOLVED FIGURES	
AGGREGATION MODELS	• **Combined aggregator – retailer**: As agents used to dealing with DSO's and the market operator, retailers will presumably be interested in acting as aggregators through their existing customer base and using aggregation services as added value to attract new customers. • **Independent aggregators:** In this model an aggregator sells services to other market participants such as retailers or networks. Indeed, according to Directive 2019/944 must be able to provide services to customers separately from suppliers. • **Independent service provider:** they provide the tools used to procure services from EVs but not the services themselves, such as hardware or software manufacturers. They act as facilitators and require interaction with other agents. • **Customer as an aggregator:** This would only be possible for large consumers who are able to participate in the market directly.

MARKET PARTICIPANTS AND NEW FIGURES

V2MARKET

ENERGY COMMUNITIES MUST BE ADECUATELY REGULATED TO ENCOURAGE THE PARTICIPATION OF CITIZENS

CONCLUSION

Energy communities are legal entities that can carry out all kinds of activities within the electricity sector, such as, generation, distribution, supply, EV charging or aggregation within their community. The communities are made up of individuals, small businesses, companies, municipalities, and cooperatives, among others. In local communities, V2G could serve to store energy from the community's renewable sources at high production hours and then give it back during, either to the grid or to a building, at high price hours.

NEEDED CHANGES

As with aggregation, the provisions from the Directives relating to energy communities have not yet been transposed into Spanish regulation. If regulated appropriately, providing these **energy communities** with more favourable conditions vis-a-vis other agents, they could be a very powerful tool, as these communities could provide several cross-services relating to mobility to their members (car-sharing, V2G, etc).

OPPORTUNITIES

Energy communities could be granted a more favourable access to the market. For example, they could have economic advantages, such as, **access to specific remuneration** (this is already the case with public subsidies like CE Implementa), or some sort of energy netting between the different assets owned by the community. Also, they could have **administrative benefits**, such as the possibility to share energy from self-consumption installations over the 500-meter limitation or participation in balance services in a simpler way, etc.

INVOLVED FIGURES

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MARKET PARTICIPANTS AND NEW FIGURES

V2MARKET

DSOs MUST BE INCENTIVIZED TO PROCURE FLEXIBILITY SERVICES

CONCLUSION

DSOs are responsible of the reinforcement, the operation, the maintenance, and the expansion of the distribution grid to guarantee that the network has enough capacity to integrate new distributed assets in the grid. Therefore, although DSOs are not a new figure, they will have to adopt a new role in the integration of V2G in the system. While in Spain there are over 300 DSOs, only 5 of them own 80% of the total distribution network.

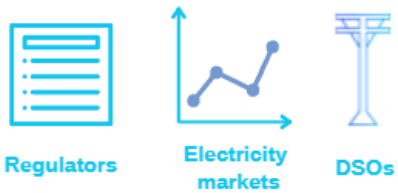
NEEDED CHANGES

Currently DSO in Spain receive remuneration based on their obligations as operators of the distribution network, essentially construction, operation, maintenance of the network. Article 32 of Directive 2019/944 refers specifically to the requirement for Member States to set a framework which generates incentives for DSOs to **obtain flexibility services** in order to improve the operation of the network. Therefore, it would be desirable that the remuneration of the DSOs was reviewed considering this objective, in order to align the DSO's obligations with their remuneration.

OPPORTUNITIES

DSOs could participate in a demonstration plan of regulatory sandbox in order to test the flexibility services that could be provided with V2G, in line with the Directive.

INVOLVED FIGURES



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3/ CONCLUSIONS

MAIN CONCLUSIONS OF THE STUDY V2MARKET	
	• V2G technology will help the integration of renewable energy resources in the electrical system.
	• There is a need of standardization of communication protocols for chargers and EVs
	• V2G & EV costs are dropping as demand increases.
	• Spain needs to speed up the deployment of EV infrastructure to unlock EV potential.
	• A non-discriminatory datahub must ensure equal access to information.
	• E-roaming: charging infrastructure must be interoperable.
V2G	• Technical regulations must include V2G requirements.
V2H & V2B	• V2B and V2H are attracting business models when combined with self-consumption.
	• V2G stands as a solution for short-period grid management needs.
	• EV charging supply tariff: an incentive to accelerate the EV deployment.
15 min	• Lower granularity of products represents an opportunity for V2G participating in electricity markets
	• Review storage and V2G integration in the electricity markets.
0.1 MWh	• A low minimum bid in the electricity markets facilitates the participation of aggregated resources.
	• Local flexibility markets: a good opportunity for V2G.
	• V2G, a good option for availability services.

MAIN CONCLUSIONS OF THE STUDY V2MARKET	
	• Different types of flexibility timeframes open new opportunities for V2G.
	• First steps towards the design of local flexibility markets in Spain.
	• Aggregators will unlock the value of distributed resources.
	• Energy communities must be adequately regulated to allow the participation of citizens.
	• DSOs must be incentivized to procure flexibility services.

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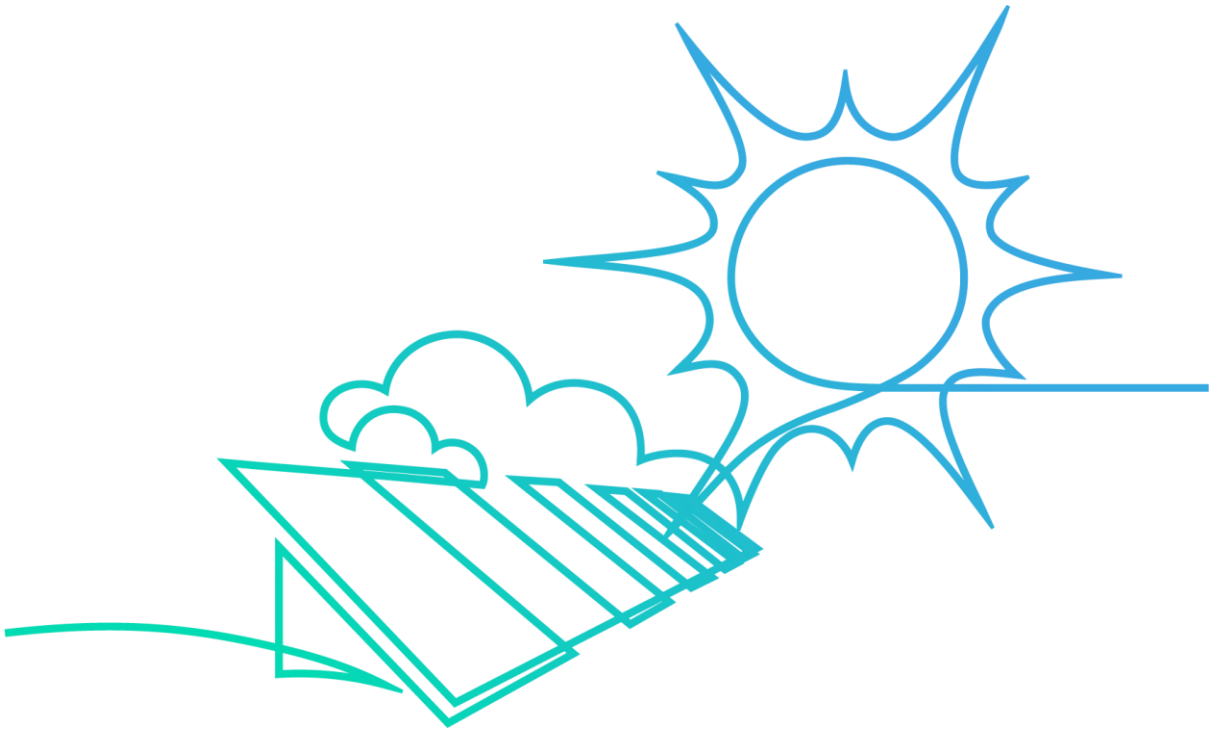

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Figures

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