

# **NEW BUSINESS OPPORTUNITIES**

**DSM AND ENERGY EFFICIENCY INITIATIVES**

**EDP GROUP 2017**



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## 1. FRAMEWORK

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In recent years, Energy Policies worldwide have reinforced the need to promote the improvement of energy efficiency and, in some cases, such as in Europe, set ambitious goals and introduce new challenges/opportunities for the business sector. The current framework – Energy Efficiency Directive 2012/27/EU and Energy Performance of Buildings Directive 2010/EU/31 - envisages to achieve the 2020 20% headline target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date.

Under this framework, Portugal set the ambitious target of 25% minimum reduction of primary energy consumption in 2020 and Spain 24%, supported on Energy Efficiency Action Plans: PNAEE in Portugal (<https://dre.pt/pdf1sdip/2013/04/07000/0202202091.pdf>) and PAEE in Spain ([www.idae.es/index.php/mod.documentos/mem.descarga?file=/documentos\\_11905\\_PAEE\\_2011\\_2020\\_A2011\\_A\\_a1e6383b.pdf](http://www.idae.es/index.php/mod.documentos/mem.descarga?file=/documentos_11905_PAEE_2011_2020_A2011_A_a1e6383b.pdf)).

More recently, the so-called “Winter Package” adopted by the European Commission (EC) in November 30<sup>th</sup> 2016, represents a reload of EU legislation (e.g, Energy Efficiency, Renewables and Energy Performance of Buildings Directives) under the name “Clean Energy for All Europeans”, reinforcing the European commitment towards decarbonizing the economy.

The Clean Energy Package is another step for the European Union’s Energy Union project, addressing energy policy objectives aiming at better engaging consumers in the energy transition through a set of new legislative proposals and initiatives. New targets for 2030 has been set: 27% on the share of Renewables to the final energy consumption and 30% on Energy Efficiency.

These ambitious goals, combined with the market opportunities they induce, have led to the development of demand-side management initiatives, for instance in the fields of energy efficiency, fuel switching and load optimization. Additionally, the economic crisis experienced in southern Europe increased the appetite for energy savings that can be achieved through energy services.

Active promotion of demand side management is one of the top commitments of the EDP Group, along with the anticipation of customer needs. In this context, EDP adapted its organizational structures, business models and operational plans in order to strengthen its leading position and benchmark in the global energy market, by developing and offering their customers innovative products and services related to energy efficiency and distributed generation, supported on communication campaigns and partnerships with other operators in the industry.

EDP has assumed energy efficiency as one of the most material issues for the company’s performance with high impact on our business, in line with its climate strategy.

Moreover, EDP considers innovation as a key element to energy efficiency improvement. Under this framework EDP Group implemented an innovation governance model based on 5 strategic areas: Cleaner Energy; Smarter Grids; Customer- Focused Solutions; Data Leap and Energy Storage.

In order to promote the deployment of energy efficiency, EDP also created synergies for increasing energy efficiency through the management of the distributed generation/storage/consumers.



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In this respect, EDP assumed the following commitments:

Generate Economic Value		
Provide customers with continuous access to energy efficiency products and services: Reduce overall consumption by 1 TWh before 2020 (against 2014 levels).	Encourage partnerships in promising and unproved clean energy technologies, energy efficiency and smart grids research, by investing €200M in innovative projects by 2020.	Expand the installation of smart meters to more than 90% of EDP's low voltage power network delivery points in Iberia by 2030, utilizing new smart grid technology.

Moreover, on an Iberian level, three strategic objectives regarding the commercial activity were set in the Business Plan for 2016-2020: to maintain the energy market leadership, to be the preferred company to customers and to have oriented profitability.

In Brazil, as a strategic objective for 2020, EDP aims to achieve an excellent service to customers by improving supply quality, and thus ensuring high levels of customer satisfaction. EDP Brasil strategy further contemplates specific positions and developments to each of its business units. For Commercialization and Energy Solutions, the main strategy is to consolidate leadership position on the supply and services segment. This includes a set of activities focused on development of energy services offer with higher added value (Energy Efficiency, Distributed Generation, among others) and growth through the acquisition of an energy services company (APS – Soluções de Energia). For the regulated market, the National Electric Energy Agency (ANEEL) imposes to distribution companies the regulatory obligation to apply 0.4% of its net operational revenues in energy efficiency projects, according to specific criteria, and 0.1% for the National Program for of Electric Energy Conservation (PROCEL).

Anticipating the new energy paradigm, we are convicted that EDP is preparing its presence in a future where production, distribution and consumption will be increasingly decentralized. Therefore EDP provides a range of energy solutions oriented to the specific needs of the different customers' segments, through a diversified offer of competitive products and services.

In the following chapters we detail this diversified offer (chapter 2) as well as the initiatives related to energy service provision (chapter 3), namely those that allow customers to change the amount and/or timing of use of electricity in response to supply conditions: smart grid paradigm, electric storage and other services.

In summary, the present document focus on customer solutions, which covers energy efficiency products and services offered by the supply companies (EDP Brasil, EDP Comercial, EDP España and EDP Serviço Universal), as well as projects and initiatives that are being developed by EDP Distribuição (distribution company) and EDP Inovação (innovation company), regarding smart grids, electric storage, microgeneration and other services.



## 2. CLIENT-FOCUSED PRODUCTS AND SERVICES

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Throughout its value chain, EDP makes available a wide variety of Energy Services related to its electricity and gas activities, ranging from the ashes and gypsum resulted from the electricity generation, to the decentralized solar solutions offered by the supply companies.

Energy services are classified into ten categories, which were established within the EDP Group by taking into account the comprehensive concept proposed and developed by Bertoldi & Rezessy of the European Commission (Energy Services Guide for the EDP Group):

1. Energy analysis and audits.
2. Project design and implementation.
3. Energy management.
4. Monitoring and evaluation of savings.
5. Maintenance and operation.
6. Property/facility management.
7. Energy and/or equipment supply).
8. Provision of service (space heating/cooling, lighting, etc.).
9. Integrated energy systems<sup>1</sup>.
10. Other energy services.

The set of measures envisaged in the European Commission's Winter Package of Dec 2016 "Energy Clean For All", in the downstream segment, retail and services, where Europe wants to strengthen customer protection, renewable energy penetration and energy efficiency targets and consequent reduction in emissions, are in total alignment with EDP's vision in the commercial business and business targets. Since 2009, EDP Comercial (EDPC) has been developing a strategy and enabling the organization to leverage the technological change and access in the energy retail market to develop and commercialize innovative offers of decentralized generation, distributed storage and electric mobility with increasingly scale in the retail market.

In terms of business alignment via KPI's, EDP Group has implemented sustainability indicators for all companies, areas and employees since 2017, which in case of EDPC enables the development and achievement of the DSM and EE strategy and targets. Specifically, in addition to energy efficiency revenues (10%) and customer satisfaction (10%), the company's KPI still has an indicator of corporate sustainability performance (5% weight) and all areas and employees define the most appropriate to its area of work, with the validation of the sustainability and corporate center, in order to ensure alignment with the main drivers of value creation in the medium term. Energy Efficiency – EDPC top material issue – results of its strategic exercise of sustainability materiality with the top management and first line directors, focusing EDPC as a development platform of innovative business models and development of attractive DSM and EE value propositions for retail customers.

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<sup>1</sup> New category, introduced by the EDP Working Group, when services cover more than one category.



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## ENERGY SERVICES

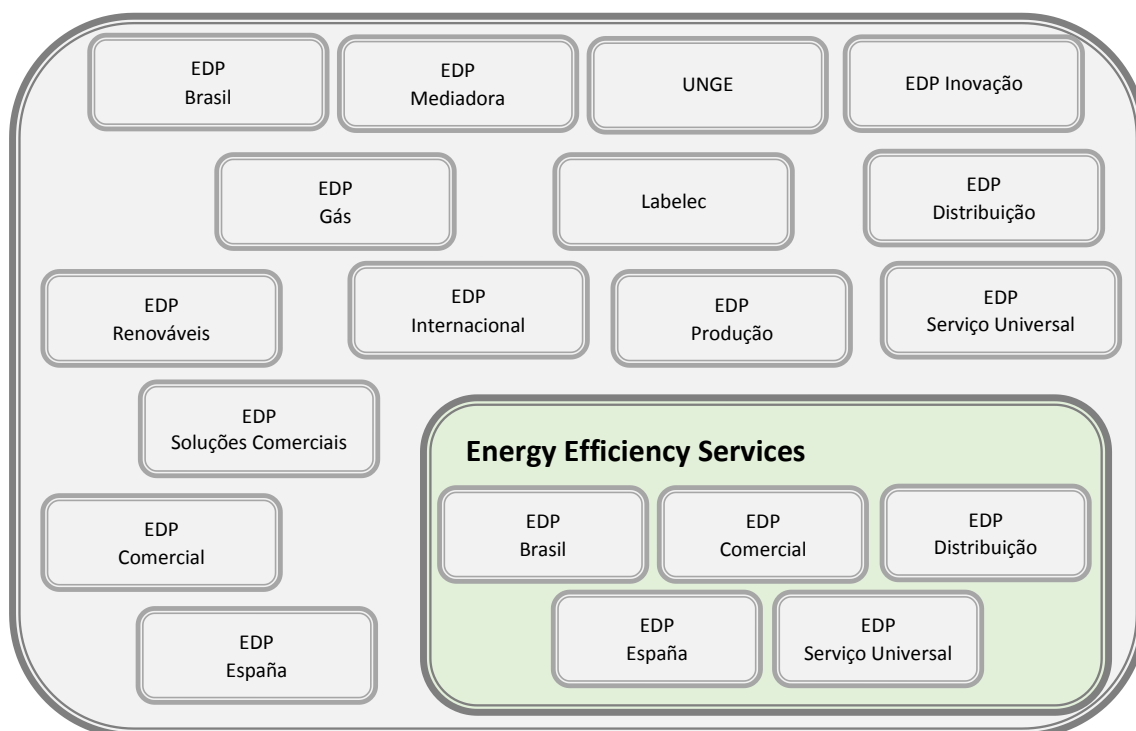


Figure 1- EDP Companies involved in energy services initiatives

The following subchapters approach refers to the Business Units that are involved in energy efficiency services.

### 2.1 BUSINESS UNITS

#### EDP Brasil

EDP Brasil has been investing in the consolidation of new energy services businesses, boosting the development of energy efficiency projects, distributed photovoltaic generation projects and investing on the expansion of its business units through transmission, therefore consolidating its operations in all segments of the electric sector.

In 2015, EDP assumed its commitment of expanding its presence in energy efficiency through the acquisition of APS – Soluções de Energia, which acts mainly in energy management systems and replacement of obsolete equipment for efficient devices. In 2016, the integration of the former APS, an energy efficiency company with 23 years of existence, was completed. The successful process brought EDP Culture to the new associates, which are now part of EDP Soluções em Energia (Energy Solutions) that includes a service and distributed energy company located in São Paulo and an energy efficiency company based in Porto Alegre (RS). In 2017, the energy efficiency projects carried out represented a 51.8 GWh savings and a reduction of GHG emission of 30,457 tCO<sub>2</sub>.

EDP Brasil has also entered the photovoltaic distribution generation market with the beginning of EDP Solar implementation. The new operation follows ANEEL Resolution no. 482/2012, which established rules



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so that consumers can generate their own energy with injection of surplus energy into the electric grid, in a credit compensation system for the consumer's favour. Nine agreements were signed providing for solar projects totalling 10,740 kWp of installed capacity.

In addition to the energy services offered by the services companies, EDP in Brazil also develops energy efficiency programs for low income customers and non-profit organisations, through its distribution companies – EDP São Paulo and EDP Espírito Santo. These programs are part of a legal obligation of Brazil's electric sector.

Law No. 13280/2016 establishes the application of 0.5% of the distributors' net operational revenue in Energy Efficiency projects, of which 0.1% is for the National Program for of Electric Energy Conservation (PROCEL) and 0.4% for the Energy Efficiency Program (PEE) of the distributors, in accordance with ANEEL requirements. In 2017, EDP Brasil invested more than R\$ 27.24 million, which resulted in energy savings of 16.72 GWh/year and 9.54 GWh/year in São Paulo and Espírito Santo respectively - corresponding to 2,433 tCO<sub>2</sub> avoided emissions.

Also in 2017, EDP Brasil invested in the expansion of its transmission and distribution assets through the acquisition of a 14.5% share of CELESC, the largest energy commercialization and distribution company of Santa Catarina. Additionally, the Company acquired 4 lots of 1,184 km extension in transmission lines. This investment has increased tenfold the operational area of EDP in Brazil.

### **EDP Comercial**

Since 2009, with the creation of EDP Serviços, and more recently with the Customer Program 365, internationalized since 2012, the organizational structure of the Commercial area has also made yearly reorganization steps in order to become a more competitive company, innovative and agile enough to take less time to market, and lead the energy and service markets in the new energy transitions to new energy paradigm, in the retail market of new downstream, and meanwhile become the preferred company of customers.

During this period, from 2012 to 2017, EDPC has promoted several protocols (#12) with sectorial and business associations to promote Energy efficiency opportunities covering some of the more intensive processing industry as plastic, ceramic, chemistry, melting, textile and metallurgical as well as the fast growing tourism sector.

In the new Business Plan for 2016-2020, EDPC has defined a set of strategic objectives for the B2C and B2B segments, regarding not only electricity but also new products and services aligned with smart grid solutions and reinforced the commitment to develop the energy services offer as an important differentiator and additional source of revenues and profitability.

The 2020 targets have also been declined in annual targets and specific action plans (POSAs) and commitments of each company. Highlight for the 5 strategic priorities for 2017 for EDPC are: Focus on customer retention; Maintenance of high levels of customer satisfaction; Maintenance of the already high penetration rate of the dual Iberian offer; Increase in the penetration rate of services in Iberia; Extended supply of energy services in 3 geographies.

In 2017, numerous macro initiatives were maintained to boost the business, residential and innovative energy services offer, worth highlight:



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In B2B, continued our effort to promote bundle offers, putting together electricity and energy efficient services. Some successful examples of this approach includes Millennium BCP, Silvex and SLB -Sport Lisboa e Benfica.

Our portfolio of energy and efficient services continues to grow. In energy, we began negotiations with specific clients regarding new contract forms like Renewable PPA - Power Purchase Agreement, following the same approach of EDP in Spain.

To boost energy efficient services in SMEs EDPC launched a self-service digital platform – save to compete (<http://www.edp.pt/save-to-compete>) – that allows clients to design their own energy efficient solutions. Total amount of sales reached 1,4 M€ using this new channel. Partnerships with business associations was also reinforced, and used as a channel to promote save to compete program.

It is also import to mention the participation in the PPEC program, with 13 initiatives to reduce the energy consumption in B2B segment. This program represents a total investment of more than 16 M€ in energy efficient solutions.

To communicate all these new business strategies, we have been intensively using digital channels like LinkedIn, customized email marketing and google adwords.

In B2C, the launching of the new commercial concept - the EDP Smart Home EDP - that brings together Solar Energy, Batteries, Electric Mobility and EDP re:dy offerings which allows remote and convenient monitoring and remote control of energy production and consumption, and which positions EDP in the emergent new downstream energy market. This concept won the world energy retail award in Barcelona in 2017, which awards innovation in retail to the level of customer relationship and new models of energy retail.

The edp Re:dy app won a prize at the World Summit Award 2017 - a competition launched by the United Nations to recognize the best creative applications and interactive content. The app was awarded in the “Environment & Green Energy” category.

Also in B2C, main achievements in solar energy worth emphasize: with the installation of more than 15.000 solar energy systems, we managed to lead this emerging market with a 80% market share in solar. EDP launched last year, energy storage solutions associating lithium batteries with solar energy.

In 2017, EDPC has generated EUR 49.9 million (vs. 2016 = EUR 45.2 million) in energy efficiency services, including, for instance, energy audits and certifications, Save to Compete program and initiatives under the Plan for Promoting Efficiency in Electricity Consumption (PPEC), promoted by the Portuguese Energy Services Regulatory Authority (ERSE - <http://www.erse.pt>). Please see EDPC’s website with all offered products and services (<https://energia.edp.pt/particulares/>). Taking into account the leadership of EDP in the electricity supply market in Portugal, as well as the growing market's appetite for Energy Efficiency solutions, EDP remains in an excellent position to lead this market for energy services (as the main Demand Side Manager enabler) and maintain at the forefront of business models innovation, continually developed in pilot tests, with the support of EDP Inovação and external suppliers for further dissemination in the market.





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### **EDP Distribuição**

In what concerns energy efficiency, EDP Distribuição, as the Portuguese Distribution System Operator, takes over the mission of promoting energy efficiency, based on the study of possible measures and on the analysis of available technological solutions, contributing to a more rational use of electricity and reinforcing its position in terms of innovation and sustainability.

With that goal in mind, EDP Distribuição has established partnerships with Universities and Research Centres, namely to develop the smart grid concept, an essential axis of the European energy policy with demanding goals on emission reductions, energy efficiency, integration of renewable energies and a more proactive role of the final customers.

Regarding the InovGrid Project led by EDP Distribuição, it has been increasingly recognised at international level, considered by the European Commission, Eurelectric and the Joint Research Centre as the reference project out of over two hundred currently ongoing smart grid projects in Europe.

In the new Business Plan for 2016-2020, EDP Distribuição has defined a set of strategic objectives, which include the investment in innovation to contribute, for instance, for sustainable mobility, smart grids and other products and services that promote energy efficiency and savings. EDP Distribuição prepared in 2016 the Development and Investment Plan on the National Distribution Network (High Voltage and Medium Voltage network) for the 2017-2021 period. After the Regulator pronounced his recommendations concerning the Plan in 2017, EDP Distribuição prepared a final version, which is still awaiting to be approved by the Government. This plan includes EUE 30.9 million (primary costs) associated with the promotion of access to new services, which includes the promotion of Smart Supervision, Operation and Telecommunication Systems, and Innovation.

In 2017 EDP Distribuição installed around 600,000 smart meters associated with end-user's facilities.

EDP Distribuição has also been promoting the improvement of its office buildings energy efficiency, taking into account national and EU policies, namely the 2012/27/EU Directive. Hence, as an energy efficiency measure, EDP Distribuição installed self-consumption renewable energy production units (wind and photovoltaics). This measure reduces the building's energy dependency on the electrical grid and its greenhouse gas emissions.

### **EDP España**

In Spain, Energy Efficiency activities are carried out since 2010 by the Energy Services Company. The aim of this unit is to develop and coordinate the necessary mechanisms to achieve an appropriate positioning for the energy services business, making it possible to increase the Group's commercial range. Promotion of Energy Efficiency is namely encouraged through the website <http://www.edpenergia.es/eficienciaenergetica/>, which describes the activities undertaken by the Group and details the products and services offer by segments and technology: optimisation and consumption management, facility management, distributed generation and Integrated energy solutions.

During 2017, EDP Energy Services' savings reached around 5,8 GWh/year, avoiding 2.639 tCO<sub>2</sub> emission.

In 2017, EDP España has generated EUR 61,57 million (vs. 2016 = EUR 42.9 million in energy efficiency services, including, for instance, maintenance services (e.g. Funciona), energy equipment management and the Save to Compete program, where measures to reduce energy consumption on industrial facilities are developed ([www.savetocompete.com](http://www.savetocompete.com))).



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The most important project of the year in the area was the start of the construction of the natural gas connection to Group 2 of the Aboño Thermal Power Plant, which involves the replacement of fuel oil and gas oil by natural gas as starting and support fuel, with the consequent reduction in emissions.

## **EDP Inovação**

EDP Inovação is the key promoter company for innovation within the EDP Group. It was set up established in 2007 with the objective of creating an autonomous entity responsible for the internal innovation activities and for promoting added-value innovations as well as fostering stronger links with the entrepreneurial ecosystem.

EDP seeks to integrate in its business innovation in new technologies, processes and products, and as well as in innovative business models, in order to enhance competitiveness and create value for stakeholders. EDP Inovação follows an Open Innovation processes that promote overall performance and foster synergies, while simultaneously establishing alliances, partnerships and collaborative approaches to sharing resources, skills and risks philosophy that engages and promotes adoption both from within and without.

EDP also develops projects aimed at improving the operation of its assets. It holds among the innovation tools that EDP Inovação has established to foster and interact with startups lie the incubation/program for startups (EDP Starter), the acceleration program (EDP Open Innovation) and the venture capital fund for investment in cleantech (EDP Ventures). These act at different levels of startup's maturity, together working to support startups in order to support them from inception to investment and promoting internal and external initiatives to stimulate innovation and entrepreneurship.

The Governance model for Innovation in the EDP Group is based on five strategic areas:

- **Client-focused Solutions**, addressing retail, and focusing on diversification, by channelling its innovation work towards a wider range of supply with innovative products and services and new business models and improved customer satisfaction and involvement. The solutions developed seek to transform EDP into an agile, customer-oriented company through intelligent pricing and aggregation systems, energy efficiency and increased electrification;
- **Smarter Grids**, focusing on the development of smart grid infrastructures and customer-focused applications and operations, to ensure that their central role in the energy system meets business needs. These new smart grids will have to address, in particular, energy efficiency improvement targets, with the growing integration of intermittent renewable sources, as well as the increasing penetration of electric vehicles and storage;
- **Cleaner Energy**, focusing on identifying and promoting the development of new energy generation methods through renewable sources or through reductions in greenhouse gas emissions and new technologies to improve the operations and efficiency of existing energy production assets;
- **Data Leap**, a cross-cutting area, which seeks to leverage the latest developments in Information and Communication Technologies (IT) to accelerate innovation in all business areas. Its main focus is the use of new ICTs, such as Big Data, Cloud Computing, Advanced Analytics and the Internet of Things and the identification of opportunities for operational optimization and business development through digital innovation and data use.



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- **Energy Storage**, seeking to understand the rapid changes in energy storage technologies and their application to energy systems. The challenges of intermittent power, microgeneration, electric mobility and increased customer training require technological solutions that increase the flexibility of electrical systems in which supply and demand must be constantly balanced. Storage is therefore a key tool in addressing these areas throughout the energy value chain.

For each of these strategic areas there is an Innovation Workgroup operating under the sponsorship of EDP Group's Executive Board.

### **EDP Serviço Universal**

EDP Serviço Universal is the portuguese last resort supplier, and its main activities include the acquisition of all the Special Regime generation (Renewables + Cogeneration) and in spot and future markets the real consumption of its customer's portfolio, as well as the supply of electricity to final customers, under regulated tariff.

According to these business principles, the company assumes as a fundamental pillar of its relationship with the customer the delivery of an exemplary commercial service (in accordance with the standards set by the quality of service regulation) and the ability to advise the client about the efficient use of electric power.

Providing information about market liberalization in Portugal, which is expected to be concluded by the end of 2020, will be maintained as a business commitment. Through the presence and remote contact, EDP Serviço Universal will provide all sort of clarification about how to move to the liberalised market and where the customer can find information about the commercial players available in the market.

Over the years, the customer has recognized the commercial quality of service and the company's commitment to do counselling on savings in energy consumption. This result is reported in the annual market research directed by EDP Serviço Universal Service and management information monitored by the Portuguese Energy Services Regulatory Authority (ERSE - [www.erse.pt](http://www.erse.pt)).

From 2014 to 2016, EDP Serviço Universal has generated EUR 744 thousands revenues in energy efficiency initiatives under the Plan for Promoting Efficiency in Electricity Consumption (PPEC), promoted by ERSE.

The investment in 2016 amounted to EUR 1.1 million and it is expected to reach EUR 690 thousands in 2017 and EUR 700 thousands in 2018.



## 2.2 PRODUCTS AND SERVICES

In 2016, the EDP Group generated around EUR 93 million revenues from energy efficiency products and services (+16% than in 2015). The associated total investment amounted to EUR 63 million.

ENERGY EFFICIENCY SERVICES CATEGORIES		2015	2016
1	Energy analysis and audits	6,0%	7,6%
2	Project design and Implementation	0,1%	0,7%
3	Energy Management	1,9%	1,7%
4	Monitoring and evaluation of savings	0,4%	0,3%
5	Maintenance and operation	57,2%	12,7%
6	Management of property and facilities	0,0%	0,0%
7	Supply of energy and/or equipment	26,0%	28,4%
8	Supply of the service (e.g. steam, heating, lighting, ...)	0,0%	0,0%
9	Integrated energy services	4,1%	46,1%
10	Other energy services.	4,3%	2,6%
<b>TOTAL</b>		<b>79,877,147</b>	<b>92,974,508</b>

Some of these products and services are described in the following subchapters, by energy services category, and main improvements during 2016 are highlighted.

For each category, a brief description on the type of products and services covered is provided, based not only on the comprehensive concept proposed and developed by Bertoldi & Rezessy of the European Commission, but also on EDP's reality in terms of services provided throughout its value chain (Energy Services Guide for the EDP Group).

### 1. Energy Analysis and Audits

The company acts as a consultant in energy rehabilitation, provides energy analyses for identification of actions with improved profitability to obtain the desired reduction in energy consumption.

#### 1.1 Energy audits (Portugal | B2C and B2B segments; Spain and Brazil | B2B segment)

Energy audits are made available by EDP Comercial both for B2C and B2B segments. In Spain and Brazil this services is done for B2B customers. In 2016, a remote auditing was launched to fasten penetration of this basic initial service. Also in 2016, following the publication of the Royal Decree 56/2016 in Spain, a periodic conduct of energy audits in large companies was made mandatory. This has triggered the contracting of this type of services by EDP, resulting in 216 audits to installations that consume 38 GWhe and 47 GWht.



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In Portugal, EDP Comercial started to mass deploy Energy Audit's subsets such as the Lighting Home Audit, as a part of Funciona service. In this initial year, EDP Comercial audited more than 12.000 Homes that generated over 80.000 sales of LED Light bulbs. EDP also piloted an Appliances Audit that will be deployed in 2018.

### 1.2 Energy certification (Portugal and Spain | B2C and B2B segments)

Energy certification are available for both B2C and B2B segments in Portugal and Spain, with EDP quality assurance, which is mandatory when buying/selling real estate.

In Portugal, EDP is the market leader since 2012, with over 100.000 Energy Certificates issued to date, and maintained this leadership in 2017.

A gas certification service, aiming at facilitating gas contracting and subsequent promotion of the dual offer (electricity + gas) is also provided by EDP. In 2017 edp sold around 50.000 Gas certificates.

### 1.3 Improvement in power quality (Spain | B2B segment)

EDP identifies energy supply anomalies and alternatives to a better service supply, adjusting it to the requirements of the productive processes.

Also, EDP acts as a legal advisor to occurrences that affect the quality of supply.

## **2. Project Design and Implementation**

This category includes the design of a project including demand management measures as a priority. Energy needs are covered by more efficient energy supply / equipment whenever economically feasible.

### 2.1 Efficient Lighting (Portugal and Spain | B2B Segment)

EDP offers an efficient lighting analysis, by, firstly, making a diagnosis and identifying potential improvements. Taking into account customer's needs, EDP offer includes an efficient lighting project with a 100% financing.

Through Save to Compete new platform, now it's possible for the client to simulate the annual reduction potential of each business electricity installation.

### 2.2 Advisory Energy Service (Portugal and Spain | B2B segment)

EDP acts as an energy advisor, allowing industrial and commercials customers to have a more rational use of energy, minimizing energy costs.

An on-site study is performed in order to understand the processes' requirements and to maximize fuel use efficiency.

Improving areas such as lighting, motors and variable speed drivers, climatization and heating and cooling processes are identified.



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A detailed report is developed regarding the actual situation and the proposed measures. Assistance on measure implementation is provided.

### 2.3 B.O.T (Portugal and Brazil | B2B segment)

This service (Build, Operate and Transfer) includes the design, operation and maintainance of measures to achieve the final energy use defined in the energy contract.

## 3. Energy Management

The company acts as a consultant, providing energy demand management measures.

### 3.1 Energy management systems (Portugal and Spain | B2B Segment)

In Portugal, the “Gestão de Consumo” (an energy management system) is an energy service developed in-house that aims to simplify energy management for Industry and Commerce/Services sectors. Two innovative packs are available covering a set of services that simplifies regulatory, administrative and operational requirements on energy management for customers. Companies may obtain online and in real time their electricity, gas and water consumption, perform historic analysis, consumption trends and benchmark analysis (<https://gestaoconsumos.edp.pt/#login>). This programme proposes 3 levels of services:

- **Light:** innovative, low cost service including electricity consumption (main electric meter);
- **Standard:** innovative service performing real time analysis of consumptions (electricity, gas, water and others), aiming at controlling, analysing, predicting and comparing partial inter-site consumptions within the company and carrying out national/international benchmarks;
- **Premium:** Similar to the standard service, but customized to the client's business, with detailed models of analysis and advanced forecast of consumption, tariff simulation and personalised alerts in real time.

In Spain, a similar service is provided for the corporate and large customers segment – ACTIR platform. This service gives access to up-to-date information about customers contracts and was complemented in 2015 with “Óptima +”. This service facilitates the energy management of the companies, through a system that allows the monitoring and supervision of consumption in real-time, receiving immediate consumption warnings for both active and reactive power.

### 3.2 Energy management systems (Portugal and Brazil | B2B Segment)

In Portugal, there is a regulatory framework, the SGCIE (Sistemas de Gestão dos Consumos Intensivos de Energia - Intensive Energy Consumption Management System), that aims to certify and promote energy efficiency in the industry segment. This framework sets a compulsory certification for installations with consumption equal or higher than 500 tep/year.

This year, for communication purposes, EDP has built a new landing page in its website, with a interactive



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simulator that indicates to the client if it's a good opportunity and if it's mandatory.

An equivalent system is available in Brazil - SGE (Sistema de Gestão Energética – Energy Management (GE) System: control of the entire energy consumption (electricity, gas, water and others) aimed at reducing energy losses).

### 3.3 TRE (Portugal | B2B Segment)

EDP Comercial makes available an Operational Technician responsible for the facilities (TRE - Técnico Responsável de Exploração), as well as for facilities well functioning and energy decision making.

## 4. Monitoring and evaluation of savings

The company acts as a consultant as part of an energy services contract.

## 5. Maintenance and Operation

The company acts as a consultant as part of an energy performance maintenance contract.

### 5.1 Funciona (Portugal and Spain | B2C and B2B segments)

After the success of this service in Spain in previous years, EDP launched it in Portugal in 2013. For the residential and business segments, EDP provides electricity and natural gas services regarding installation check-ups and repairs. It delivers technical assistance to the main kitchen appliances and urgent services whenever required. Together with equipment maintenance it contributes to the increase of the customers' safety, savings and comfort – **Funciona**.

During 2017, the main novelty in Portugal was the launch of the light audit as an alternative to the installation check-ups which identifies the bulbs with potential for replacement and informs the customer about the best options to reduce lighting consumption in their homes by changing to the LED technology. This was promoted through a dedicated ATL advertising campaign that emphasized the savings component of the product. There were also introduced several new features in the technical assistance: partial payment of the spare parts used in repairs and their price guarantee together with the payment through the EDP bill.

By the end of 2017, around 300,000 customers had joined the service (more 100,000 customers than in 2016), corresponding to a 8.9% market penetration.

In Spain, EDP offers two other modalities for small businesses, which include the revision and maintenance of air conditioning equipment and appliances (**Funciona Luz** and **Funciona Clima**). Also in Spain, the mandatory gas inspection was included in the Funciona operation. The serviço grew to around 580,000 clients, roughly 50,000 more customers than the previous year.

It is expected that in 2020 there will be about 1 million customers in the Iberian market using this service

### 5.2 Integra (Portugal and Spain | B2B segment)

Energy service developed to provide facilities maintenance and technical assistance to customers, available in two levels of services:



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- **base**, that includes planned maintenance and access to online systems for real time control of electricity consumption;
- **premium**, that includes planned maintenance, technical assistance, access to electric generator if necessary and the online system for real time electric consumption control.

For 2015, the offer was revised, some features were adjusted, the price reduced and other options added, such as the Technical Exploration Officer. For EDP Comercial customers, this service can be paid in monthly instalments. In 2017, a new service variant for low-voltage installations was launched. It is called 'Integra BT' and it attracted 101 customers.

### 5.3 RECS (Portugal | B2B Segment)

EDP offers an integrated solution for building certification under the Regulation on Energy Performance of Buildings (RECS - Regulamento de Desempenho Energético dos Edifícios).

In a first phase, an energy audit is conducted to identify improvement opportunities. The management of the HVAC systems is done in order to guarantee an efficient operation of the systems and to issue the energy certificate.

In 2017, for communication purposes, EDP built a new landing page in its website, with a interactive simulator that indicates to the client if it's a good opportunity and if it's mandatory.

## 6. Property/Facility Management

The company acts as a consultant, increasing the knowledge of end customers as owners/managers of facilities.

### 6.1 Facilities refurbishment (Portugal and Brazil | B2B Segment)

EDP conducts construction and refurbishment projects of electric or natural gas installations to adjust to customers' business needs.

## 7. Energy and/or Equipment Supply

The company provides power (green) under specific schemes and/or installs equipment and/or replaces obsolete equipment with more efficient devices.

### 7.1 PPEC (Portugal | B2C and B2B Segments)

EDP participates in the Plan for Promoting Efficiency in Electricity Consumption (PPEC) since 2007, promoted by the Portuguese Energy Services Regulatory Authority (ERSE - [www.erse.pt](http://www.erse.pt)). Launched every two years, PPEC is a voluntary project based on a national tender in which all electricity related entities might participate, encouraging the implementation of measures for the adoption of more efficient habits and equipment by the different segments - residential, commercial and services, industry and agriculture. The programme considers either tangible measures (e.g. variable speed drivers, high efficiency motors, CFL and LED lamps, etc.) or intangible ones (e.g., awareness of good practice in energy use, education





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projects in schools, etc.). EDP is participating actively in PPEC through EDP Comercial, EDP Distribuição and EDP Serviço Universal.

In 2016, a new competition was launched to be implemented in 2017-2018. The EDP Group got 19 measures approved (3 more than in the previous competition), representing 67% of the funding available (<http://www.erse.pt/pt/planodepromocaodaeficiencianoconsumoppec/ppec17-18/Paginas/default.aspx>). It is estimated that the implementation of these measures will allow for savings of roughly 1,157 GWh and a reduction of 428,105 tonnes of CO<sub>2</sub>, taking into account the lifetime of the equipment.



Table 1 – 2017-2018 PPEC Measures

Measures	Budget 2017-18 (€)	Savings (MWh)	CO2 avoided (t)
<b>Intangible</b>			
Education and awareness-raising project for Energy Efficiency, aimed at students and teachers of secondary education - TWIST 3.0 (EDP SU)	332,587	-	-
Energy Audits and Training for Energy Efficiency in Institutions of Social Solidarity (EDP C)	260,000	-	-
<b>Tangible – Domestic sector</b>			
Replace your light bulbs with LEDs (EDP C)	325,000	65,700	24,309
Smart multi-socket (EDP SU)	802,240	82,687	30,594
Heat Pumps for water heating and Flow Reducers II (EDP C)	436,200	38,503	14,246
Efficient Water Heater and Flow Reducers (EDP C)	247,500	26,784	9,910
<b>Tangible – Commercial and Service sector</b>			
Installation of LED traffic lights (EDP C)	499,492	71,699	26,529
Replacement of Halogen Spotlight with LEDs in Small Business (EDP C)	298,750	56,160	20,779
Efficient lighting solutions for public buildings (EDP C)	618,740	41,264	15,268
Public lighting with LEDs (EDP C)	844,100	58,867	21,781
Variable Speed Drives (EDP C)	289,842	24,894	9,211
Optimization of HVAC Systems in Hotels (EDP C)	370,403	26,409	9,771
Optimization of HVAC Systems in Public Buildings (EDP C)	372,903	26,409	9,771
<b>Tangible – Industry &amp; Agriculture sector</b>			
High efficiency motors (EDP C)	896,767	127,666	47,236
Variable speed drives (EDP C)	1,131,059	174,443	64,544
Consumption management systems - Load interruption and management (EDP C)	578,086	76,722	28,387
Implementation of energy efficiency solutions for compressed air systems (EDP C)	900,982	93,518	34,602
Integrated Energy Efficiency Solutions (EDP C)	757,153	79,384	29,372
Replacement of T8 Fluorescent Lamps and Bells with LEDs (EDP C)	1,266,794	85,932	31,795

## 7.2 Heat pumps and water heating systems (Portugal and Spain | B2C segment)

In B2C segment, EDP replaces obsolete water heaters with heat pumps, Intelligent Water Heaters, and Gas Instant Boilers which are much more efficient. Part of this services are leveraged in PPEC initiatives as showed in Table 1. In 2017, EDPC sold and installed over 2,000 efficient water heating solutions. On the EDPC website, detail information and a simulator are provided, where customers can assess the best solution for their specific needs and the potential generated savings.

## 7.3 Water heating systems (Portugal | B2B segment)

EDP provides either new solutions design or the optimization of the existing systems. Water heating systems for companies focus on the following main solutions: boilers, heat pumps and thermal solar systems.



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#### 7.4 Compressed air system (Portugal and Brazil | B2B Segment)

The optimization of compressed air systems includes integrated solutions in the several process phases: production, storage, treatment, distribution and use.

#### 7.5 HVAC System (Portugal | B2B Segment; Spain | B2C and B2B segments; Brazil | B2B segment)

Integrated solution for HVAC systems optimization, from the design to the system installation and maintenance.

In 2017, EDPC launched HVAC Systems for the B2C segment selling and installing in this starting year over 200 systems. Funciona Service at the same time created an Add On to address the maintenance needs for the HVAC B2C systems.

#### 7.6 High Efficient Motors (Portugal and Brazil | B2B Segment)

Installations of more efficient motors, replacing obsolete ones.

#### 7.7 Green Electricity (Portugal and Spain | B2C and B2B Segment)

By December 2017, EDP had 3,343 B2C green energy customers, and 622 B2B customers, representing a total annual consumption of 129.6 GWh respectively, corresponding to a 35% increase when compared to 2016, mainly due to the B2B growth segment.

The green electricity offer is available at EDP's website for the residential market (for the normal and bi hours tariffs options) and corporate liberalized market (for the normal, bi and tri hours tariffs options). All customers receive annually, around May, a brochure explaining the origin of the green energy they consume – 68.4% for B2C clients and 35.8% for B2B clients - and promoting the 100% renewable option of Green Tariff for B2C and B2B.

In 2017 EDP in Spain achieved an energy mix of 42.8% of its energy from renewable sources (12 points above the national average). This has ensured that all domestic customers of free market B2C have green electricity and some of the B2B customers.

#### 7.8 EDP Solar Energy (Portugal | B2C and B2B segments and Spain | B2C segment)

In 2017, EDP Comercial launched a new solar energy ATL campaign with the aim to increase the access to electricity production by self-consumption, with monthly payments starting at € 19,90, over a period of 36 months.

In addition, customers who subscribe to edp solar energy are also entitled to exclusive offers of a solar energy plan, that allows to have 10% discount on the electricity they consume from the grid at night, and to edp re:dy, for only € 19,90, which allows customers to monitor the production of their solar system, know how much they are saving and manage their energy consumption from home (<https://www.edp.pt/particulares/servicos/solar-energy>). The solar energy offer also applies to the b2b customers.

#### 7.9 Voltage Level Increase (Portugal and Brazil | B2B Segment)



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The voltage level increase involves the installation of a voltage transformation station and its connection to the existing electric facility. EDP offers this service, so customers have access to appropriate electricity supply, in accordance to their energy needs.

#### 7.10 Efficient Lighting (Portugal and Brazil | B2B Segment)

Efficient lighting solutions for small and medium-sized enterprises, allowing them to reduce costs and, at the same time, ensuring the maintenance of lighting comfort levels. Customers may opt for the following two solutions: replacing light bulbs with more efficient ones and replacing the entire lighting system.

In December 2017, the PPEC initiative “Replace your light bulbs with LEDs” for the B2C segment was launched with an ATL campaign. In only one month over 40.000 lamps were sold.

### 8. Provision of Service

The company guarantees the supply of an energy service that will generate lower cost to the customer.

#### 8.1 Re:dy (Portugal and Spain | B2C segment)

This domestic electricity consumption monitoring and active management service was first launched in Portugal in 2013. Two years later, it was made available in the Spanish market. It allows customers to monitor, control and manage household consumption in real-time, namely remotely turn on and off appliances, schedule tasks, automate the working and control the consumptions of electric appliances from anywhere, via an internet portal and smartphone (iOS and Android) – <https://www.edp.pt/particulares/servicos/edy-en/>.

The operation of edp re:dy is made possible by a set of hardware - re:dy Box, re:dy Plug, re:dy Meter, re:dy Switch and re:dy plug A/C - an application in the EDP servers where the service is configured, and a set of mobile applications for remote access.

Some of the energy efficiency features available are:

- Scenario programming according with the users needs habits and away periods.
- Individual equipment control and energy consumption analysis.
- Alert that helps the client to eliminate waste of energy.
- Advice on the best tariff and optimized contracted power.
- Reception of monthly personalized consumption analysis reports.
- Air conditioning remote IR control

The edp re:dy offer was reviewed, the interfaces of the mobile application and energy report reformulated and several communication initiatives were launched. The edp re: dy, in addition to being sold by itself, is offered to customers in bundle with solar energy, batteries and electric mobility solutions to control the energy production or consumption associated with the electric car. At the end of 2017, a total of more than 9,000 edp re:dy clients was achieved in Portugal.



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## 8.2 Set of energy services for B2B segment

Power factor correction*	Thermal-Heat recovery	Variable speed drivers	Solar Hot water production	Public Lighting (LED)
Portugal, Spain and Brazil	Portugal	Portugal, Spain and Brazil	B2B segment in Brazil	B2B Portugal and Brazil

\* inclusion of a new approach which consisted in the rental of the Battery to EDP Comercial that managed the consumption of the installation and guarantees the exemption of the reactive payment during the contract period.

## 9. Integrated Energy Services

The company acts as a consultant in areas related to energy supply and the installation of more efficient equipment and/or the rehabilitation/refurbishment of buildings, including the integration of all the above energy services categories.

### 9.1 Save to Compete (Portugal and Spain | B2B segment)

In particular for the business sector in the Iberian Peninsula, EDP supports the implementation of energy efficiency projects through the Save to Compete programme, which identifies measures to reduce energy consumption, promoting their implementation and funding through the savings induced. The reduction of energy costs allows companies to be more competitive and releases the resources necessary for their growth, through a self-paid project. It also allows companies to implement the measures without the need to allocate financial resources.

In 2017, following the needs of business decision makers and the new Marketing trends, EDP Comercial focused on the re-launch of save to compete program, now with an innovative self-service platform, in which each consumer can easily access to the company energy efficiency opportunities. They can simulate and create their own proposal and even upload it already signed.

This is a new paradigm shift for the energy efficiency services sales in SMEs market.

To re-launch and commemorate the 5th anniversary, an event was held at the Museum of Electricity in Lisboa. This one counted with a balance of these 5 years, presentation of the new concept, demonstration of the platform and the success case of clients from the program, like Sakthi, Sonae Arauco and Capsa Spain.

In the last 5 years this program already saved 20 million euros to the companies and avoid 68 thousand tons of CO2 emissions.

In Spain, EDP signed protocols with business associations of the Autonomous Communities of Asturias in 2013 and the Basque Country in 2014, a cooperation agreements with the Basque employers' associations ADEGI, CEBEK and SEA Entrepreneurs Alaveses. In 2016 the program was extended to another region in Spain, Cantábria. It has 72 applications under evaluations, which corresponds to a total consumption of 1.05 TWh/year and a potential investment of around 16 M€, and was recently awarded the first project worth 0.6 M€ directly funded by the program.



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Since the launch of the programme in Portugal (2012) and in Spain (2013), 387 applications have been registered. By the end of 2016, the programme has already provided savings of around 144 GWh, leading to a bill reduction of approximately EUR 16,1 million and avoiding 61 tons of CO<sub>2</sub>. These results are disclosed online and can be viewed on the Save to Compete website ([www.savetocompete.com](http://www.savetocompete.com)).

### 9.2 Cuota Ahorro (Spain | B2B segment) and E:cient (Brazil | B2B segment)

In line with the Save to Compete concept, through Cuota Ahorro in Spain and E:cient in Brazil EDP makes a complete facilities' assesment, implements the energy efficiency projects and invests on customers' facilities. A part of the generated savigs is used to pay EDP's invesments.

### 9.3 Energy Efficiency Programme – PEE (Brazil | B2C and B2B segment)

Among the initiatives carried out under the PEE programme, the project “Boa Energia nas Escolas” (Good Energy in Schools) consists of training teachers from the public network of São Paulo and Espírito Santo so that they can share with their students the information on the safe and efficient use of energy. For this purpose, it includes distribution of educational kits with materials to be used in the classroom.

Through the PEE, EDP São Paulo benefits local communities by promoting the exchange of electric showers for solar heating systems, as well as distributing kits with six LED lamps - actions that make up the Good Solar Energy Programme.

For the past nine years, the project generated energy savings of 9 GWh/year, equivalent to the consumption of 4 thousand families. It also should be noted the Solidarity Efficiency project, which consists of replacing inefficient bulbs of residential customers with LED lamps and counts on a mobile unit (Led Truck) as a trading post. More than 12.5 residences were contemplated, and one lamp was donated to a charity association for every 80 bulbs replaced.

In Espírito Santo (Brazil), an agreement was signed with the State Government to carry out energy efficiency projects in the Department of Roads and State Highway (DER), the State Secretariat of Education (Sedu) and public schools. Replacements of 10,607 light bulbs were carried out by LED technology, which allowed an annual saving of approximately 455 MWh - enough to supply 2.4 thousand residential units. An agreement was also reached with the State Public Ministry (MPES) for the modernization of the system's lighting and air conditioning. The 2,231 light bulbs were replaced by LED technology, plus six air-conditioning units replaced by more efficient models. As a result, MPES started to show savings of about R\$ 119 thousand (93 MWh in energy) per year.

## 10. Other Energy Services

The company acts as a consultant in areas related to energy supply and the installation of more efficient equipment and/or rehabilitation/refurbishment of buildings not covered by the above categories.

### 10.1 Electric Mobility (Portugal, Brazil and Spain| B2C and B2B Segments)

#### EDP Comercial

For residential customers this solution includes:



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- Supply of green electricity with premium tariffs;
- Supply and installation of solutions for electric vehicles (EV) charging station for B2C and B2B;;
- Additional innovative services including re:dy for managing consumption of EV and charging tariffs, and access to other mobile applications in development, access to the mobi-e card for charging in public charging stations.
- A specific webpage with relevant information to help customers overcome the initial barriers of this new paradigm of sustainable transportation: n to help customers overcome the initial barriers of this new paradigm of sustainable transportation: <https://www.edp.pt/particulares/servicos/electric-mobility>.

Since 2016, several digital campaigns to promote the concept were developed and the number of autopartners, summing up by now 13 partnerships. In 2017, the emphasis was on boosting electric mobility in Portugal, especially through initiatives in partnership with 13 automobile manufacturers and the development of Fast Loading Stations.

EDP Comercial has currently 10 fast chargers connected to the public network Mobi.e, located in some cities across Portugal and in the highway that connects Lisbon to Oporto.

Moreover, for business customers, EDP makes available a simulator for the comparison of the total cost of ownership of 3 types of vehicles – 100% electric, plug-in hybrids and combustion models. This analysis allows customers to have a real perspective on their total fleet costs.

#### EDP Spain

During 2017, EDP Spain is decisively promoting its position in sustainable mobility solutions. It does so in two strategic areas, namely public infrastructure development and mobility solutions for B2B and B2C customers.

In public infrastructure, EDP already has more than a dozen charging points in operation. It also participates, together with the main charging infrastructure managers, in the European project CIRVE, which promotes the development of a network of forty fast recharging points along the main corridors of the Spanish geography. At the same time, EDP, supported by state programs such as MOVALT, is developing an ambitious growth plan, which will make it a benchmark recharging manager.

EDP offers its customers mobility and linked recharging solutions for homes (B2C) and businesses (B2B). Solutions that allow customers to install and manage recharging points in an intelligent, sustainable and economical way.

#### EDP Brasil

In 2017, the Company established a partnership with BMW, announcing the construction of the first electric vehicle charging corridor in Brazil, connecting Rio de Janeiro to São Paulo. This corridor is expected to be concluded by the end of the first quarter of 2018.

#### EDP Distribuição - MOBI.E Project

Portugal has been promoting an integrated strategy for Electric Mobility in order to ensure that this is a real alternative to the circulation of internal combustion vehicles, contributing effectively for the decarbonization of the environment, and EDP Distribuição as been an important stakeholder in order to achieve this goals.



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In 2010, the Portuguese Government started the Program for Electric Mobility, aimed to define and regulate the electric mobility services and activities, and establishes a nationwide Network of Electric Vehicle Charging Points – Project MOBI.E.

EDP Distribuição participates since 2010 in the Project MOBI.E, as an Operator of Electric Mobility (EDP MOP) and its main responsibilities are to install, explore, make available and maintain a Pilot Network of Electric Vehicle Charging Points. Currently EDP MOP operates about 1,000 Charging Points nationwide.

In 2017, EDP Distribuição participated in the replacement of the first 200 Charging Points of 3,7kW for new Charging Points of 22kW, which will upgrade in power and technology the MOBI.E network.

EDP MOP operation of MOBI.E Pilot Network - Numbers until end of 2017:

- . 1,000 Charging Points
- . 4,400 different Electric Vehicles made more than 280.000 Charges
- . 1.9 GWh Energy Supplied
- . 1,250 ton CO2 Saved

The UDME - Unit for the Development of Electric Mobility in EDP Distribuição, is involved in several projects at national and European level, as well as other activities:

- Sharing Cities Project: European project that started in 2016, which involves 3 lighthouse cities, Lisbon, London and Milan, and intends to test a new approach to creating smart cities. Promoting international cooperation between industry and cities, the project seeks to develop affordable solutions that result in commercial solutions with high market potential for smart cities. UDME actively participates in the work package that intends to install new electric mobility solutions, both on public roads and in private spaces, and monitor the behavior of the different electric vehicles that circulate around the city, and supply charging points already existing in the Mobi.E network, and the new loaders installed under this project.
- Suscity Project: already in its third year of implementation, this project focuses on the development and integration of new tools and services to promote the efficiency of urban resources with minimal environmental impacts by investing in the modeling of urban systems and data representation supported by the collection and "big data" processing, having as study area a pilot zone in the Lisbon Expo.
- Other initiatives: UDME collaborates in several initiatives to promote Electric Mobility, both within the EDP Group and in partnership with public and private entities nationwide. In this context, UDME has contributed with its knowledge, technical information and data from the Charging Points of the MOBI.E network, which have already allowed results of the impact of the Electric Mobility on the load profile at the EDP Distribuição network in the pilot zone, and simulation programs for different consumption scenarios are being developed to evaluate the future impact of these solutions on the energy distribution network.





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### 3. SMART GRID PARADIGM, ELECTRIC STORAGE AND OTHER SERVICES

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The traditional electrical system architecture is characterized by a unidirectional flow of energy from few centralized production sites to many users, which it is not suitable for a massive integration of distributed small/medium power renewable generation plants.

With the commitment to achieve 75% of clean capacity by 2020 and the goal of reduce CO<sub>2</sub> specific emissions by **75% until 2030** (vs. 2005), EDP is facing the challenge of balancing energy production and consumption in real time. As a consequence, EDP is preparing to advance into a new power model, where electrical grids are expected to radically change their behavior, becoming “smarter”.

These new smart grids will have to cope with the integration of unpredictable and intermittent renewable sources, as well as the increasing penetration of electric vehicles and storage.

In the following sections we include some details of initiatives that EDP set-up.

#### 3.1 INOVCity/INOVGRID

##### Portugal

InovGrid is an innovative project aiming at the implementation of a new set of technologies fostering the transition for a new operation paradigm of distribution networks. This approach will contribute for the improvement of service quality, losses reduction and the integration of new resources into distribution network. Besides, it is a key enabler for an increase in energy efficiency by customers, which is the most important value driver.

The first pilot was carried out in Évora between 2009 and 2012, with the installation of about 30,000 smart meters, enabling a more active behaviour of customers towards a reduction of energy consumption. In this project it was achieved a reduction of consumption of 3.9% in customers with smart meters when compared with a control group.

After having installed about 145.000 smart meters in 2015 and 450.000 in 2016, EDP Distribuição installed more 600,000 smart meters in 2017 in several Portuguese municipalities. By the end of 2017, a total of almost 1.300.000 customers have smart meters installed.

For most of these customers, billing is based on actual consumption and they have access to detailed information that allows greater control over their consumption's habits. In addition, it enhanced the capacity for implementation of energy efficiency services by market agents, with potential impact on their energy bills and in developing of new business models.

The implementation of other innovative systems in 2017, such as 2,900 DTC (distribution transformer controller), the conclusion of remote metering in 100% of secondary substations and in 100% remote of 75% public lighting circuits, contribute respectively for the improvement of network supervision, the reducing of technical and commercial losses and the improvement of service provided to municipalities, giving them more information and performance tools for improving energy efficiency.

As of 2016, EDP Distribuição is taking part on the Sharing Cities project, financed by the EU and set to be developed in the so called “Lighthouse Cities”, Lisbon, London and Milan. The Royal Borough of Greenwich in London, Porta Romana in Milan and Downton Lisbon will retrofit buildings, introduce shared electric



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mobility services, and install sustainable energy management systems with the main purpose of turning smart cities into a real concept

## **Spain**

Pola de Siero, in Asturias, was the first EDP InovCity in Spain.

In 2015, charging points for electric mobility, public lighting and a 5kW PV panel under construction were some of the developments occurred in 2015.

The charging points to electric vehicles can be used by anyone, through a card that EDP makes available in its website. Thus, it is possible to know which of the closest charging points are free for use.

The efficient lighting are equipped with presence sensors, flow regulation and telemetering point by point.

Also, at the end of 2017, 608,897 smart meters were installed in EDP's distribution grid, representing 94% of the total delivery points, aligned with the regulatory requirements imposed to the distribution companies, but it will be completed before the legal deadline.

EDP's plan for replacement all meter for smart metering started in 2011 and will be finished by 2018, when all residential customers have smart devices.

## **Brazil**

After implementing the InovCity project in the city of Aparecida (State of São Paulo) - 15,000 smart meters, donation of efficient appliances and solar kits - and its launch in two other municipalities in the State of Espírito Santo, EDP started two additional projects related to the smart city concept:

- Observatory for the Electricity Customer's Behavior Project: with a focus on integration of new solutions in the electricity distribution services, this project will enable the verification of the impact of these new solutions, legitimizing the process of business and technology decision. Furthermore, the project will provide the understanding and continuous monitoring of consumer's behaviour, measuring their receptivity and aspiration *vis-a-vis* the new solutions.
- Pilot project on the evaluation of consumer's reaction to the prepayment system and the low voltage differentiated rates in a smart grid environment.

In 2015, the project was implemented in two municipalities of Espírito Santo - Domingos Martins e Marechal Floriano. About 19 thousand customers were covered in six technological areas: smart metering, energy efficiency, electric mobility, public lighting, distributed generation and energy education. In 2016, the project was completed in Aparecida, delivering the pre-payment mode, which consisted of the simulation process of energy purchase through energy credits, in which the customers gained control of their actual energy consumption through pre-payment panel.

## **3.2 ENERGY STORAGE AND OTHER INITIATIVES**

### **Energy Storage**

Technical storage pilot solution testing with commercial batteries in residential settings to identify performance deviations against those reported by manufacturers and implement control strategies for batteries linked to photovoltaic panels.



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### ***Redox***

Development of a 30 kW battery with Spanish technology, for commercial and industrial use, and testing in real an environment on the Asturias low voltage power grid.

### ***V2G – Vehicle to Grid***

Development of a demonstrator to test the V2G solution, acquire technological knowledge and assess the challenges and opportunities offered by V2G technologies. The V2G charger is installed at EDP's headquarters and different use cases will be performed. The potential to use electric vehicles as a stationary vehicle to support renewable penetration and grid stability will be key drivers.

### ***Storage of MV Power in Évora***

A pioneer project in Portugal, consisting of an electric power storage system, with the functions of a backup for the University of Évora and network management support, notably through its features of grid voltage control and loss reduction, contributing to improve its energy efficiency. An effort was made, through tests and implementation of added functionalities, to ease the adaptation of this project into other case studies of grid management support. An example is its integration on the H2020 SENSIBLE.

### ***SMARES***

Design, manufacture, testing, validation and certification of smart, modular energy storage technology with an advanced management system based on a multi-level converter with output power of up to 6 MVA at 20 kV for use in systems powered by renewable sources, such as offshore wind farms..

### ***STOCARE***

Demonstration pilot project to define and specify a storage system with a battery connected to the grid, incorporated in a wind farm. The project aims to identify critical aspects related to real-time system maintenance operations and to evaluate the technical capacities for increasing the flexibility of the plant's operations.

### ***2nd life batteries***

The project aims at evaluating the potential to re-use batteries from electric vehicles for stationary applications. Among the several project objectives, it is critical to analyse and validate its technical performance in different stationary use cases, its economical viability and understand the supply value chain. The project is using used car modules from Nissan Leaf and it is being tested at EDP's laboratories in Labelec.

### ***Distributed Generation with Storage***

A project carried out jointly with the Federal University of Santa Catarina (UFSC), Brazil, for the use of distributed urban generation with decentralized photovoltaic solar systems and short-term storage. The initiative also evaluates auxiliary services for grid stability and impacts, as well as enabling new business models through distributed solar generation.



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## Other initiatives

### *Virtual Power Plant*

Also, EDP Distribuição participated on the SuSustainable project, financed under the FP7 framework. This project developed the concept of the Technical Virtual Power Plant (TVPP). Under this concept, benefits associated with changes to consumption patterns were evaluated, regarding technical losses reduction, deferred network reinforcements, increase on the hosting capacity of a MV network and voltage profile ([www.sustainableproject.eu/](http://www.sustainableproject.eu/)).

### *LisCool Nedo project*

EDP Inovação is participating in a project that will test different DSM (Demand Side Management) solutions, using a Daikin new cold storage technology. The equipments to be tested are installed at LNEG's and CM Lisboa premises and the aggregation platform technologies are being developed with Next Kraftwerke and Daikin/Efacec.

### *DOMINOES*

H2020 project aiming at the creation of a platform for demand response services in the distribution network through the use of local energy markets. This project foresees the participation of prosumers in these markets, providing flexibility for the network operator or as a source of other market services, including the ability to trade energy between them with possible use of Blockchain technology.