ENERGY BALANCE IN THE NEW ELECTRICITY BUSINESS CONTEXT

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ABSTRACT

During the last years many changes have happened in the electricity sector, leading to a paradigm shift that could meet new aspirations, needs and objectives, such as: moving to an user centric approach, supported by value-added services, innovative price plans, micro-generation, etc.; improving supply overall security while increasing DER and electricity distribution capacity; promoting an effective liberalized market; implementing Demand Side Management (DSM) measures in order to answer to the external pressure for energy efficiency; and implementing a network transformation, supported by assets and processes renovation and by network automation capabilities.

In the new Distribution business concept, Energy Balance concept emerges to quantify the energy consumed or produced by a network or system, associated with the analysis of the energy flows through various dimensions that will help answering to operational, business and market needs.

Supported by a business benefits analysis, we believe that accurate and detailed Energy Balances will be decisive for future investment decisions (CAPEX), OPEX resulting from the need to take corrective actions over the network, and more commercial and financial approaches related to billing and unaccounted energy, among others.

In this context, EDP Distribuição is working in order to redefine its IT Architecture and to introduce the necessary components to respond to challenges that are being faced, namely the ones mentioned that are correlated with the Energy Balance concept.

THE RELEVANCE OF THE ENERGY BALANCE CONCEPT IMPLEMENTATION

Why EDPD needs to correctly characterize energy flows within distribution network

Being Portuguese mainland DNO, with approximately 6 million customers, excepting some thousand installations from small LV Distributors, EDPD is also responsible for metering data acquisition, management and delivery to other entities and market players.

This responsibility extends the traditionally more technical concept of Energy Balance corresponding to the internal point of view to a different and expanded one that also takes into account the market related needs, completing an important set of reasons to effectively characterize energy flows:

- Precisely determine energy amount to be billed due to network operations, according to applicable regulation;
- Provide information to all market players so that they can clearly identify individual payments and contributions, namely entities like TNO and Supplier of Last Resort (SLR);
- Provide daily reconciliation information to System Operator in order to calculate energy balances and necessary adjustments between acquired energy from each market supplier and total amount of energy consumed by their customer’s portfolio [2];
- Deliver information to liberalized market agents about their’s clients energy consumptions [3];
- Control and determine energy balance between MV incumbent operator and LV DNOs;
- Support Special Regime Generation payments management operations by the Supplier of Last Resort , as well as the subsidized costs (over costs) redistribution among the related players;
- Provide regular data to the Energy Services Regulatory Authority (ERSE) and the Directorate General for Energy and Geology (DGEG), like: electricity
consumption from different segment levels in order to calculate market profiles; energy balances between market players; SRP; etc;

- Calculate network technical losses and identify ways to improve operation;
- Identify and control commercial losses, particularly frauds affecting contracted power demand and energy; revenue assurance;
- Optimize overall network operation through correct and earlier address of needs, in order to keep coping with quality of service required by legislation and, simultaneously, improve efficiency and create operational and financial conditions for network modernization demand by near future challenges.

Mentioned needs were identified based on actual services completed by an extensive processes gap analysis that evolved several organizations.

Based on that, it was possible to identify areas to be improved through the implementation of a new application that will address the EB in its different perspectives – from technical to commercial, including relation with other stakeholders.

Conceptually speaking, it corresponds to the implementation of a centralized application where meter data and events from all installations are aggregated and added-value EDM functions could be implemented.

Energy balances could be instrumental detecting such kind of situations, while maximum demand monitoring and remote contract power control could also contribute to minimize fraud or theft.

Looking to present EDPD situation, most of those functions are easily supported for VHV, HV customers and network installations, MV and Special Low Voltage (SLV) customers and all generation stations, from HV to micro-generation.

In order to complete both MV and LV levels, a significant amount of secondary substations should be considered, as well as all residential customers, excepting some thousands that are considered in pilot installations.

Being well knowned, the ability to have a right...
understanding on how losses and inefficient operations could affect the distribution business is gaining additional relevance in an unbundled and non regulated market, where costs controlled approaches are among the top level priorities and can represent the difference between being profitable or not.

About EDPD strategy for advanced metering rollout

Providing all network and customers interfaces with advanced metering features is only one of the main subjects covered by our innovative and transformation project for third generation electricity network of the future, called InovGrid [4].

Energy management, DER integration and control, and intelligent networks functionalities are also core for the project and will be tested on-site during this year in a limited deployment for several thousands installations.

The existing C&I and producers remote metering installations, completed by secondary substations and residential customers covered by the InovGrid, will represent a full technological and communicational infrastructure that maps the distribution network, serving many different purposes including the advanced energy balances calculations.

SYSTEMS IMPLEMENTATION APPROACH

When speaking about systems implementation in a new and much more competitive world for Distribution Business, this means deeply connecting technical components with more commercial ones, moving from real-time oriented operations to periodical ones and vice-versa.

![Functional architecture for the EB system](image)

Figure 4 – Functional architecture for the EB system

Main IT challenges

These are just some part of the challenges imposed by EB IT implementation, as seen from the following list:

- Support calculations processes based on dynamic network topologies, complemented by GUI adequate representations;
- Manage great level of metering data detail for each internal installation and supply point;
- Generate scheduled an on-demand reports according to multiple dimensions of analysis and aggregation combinations;
- Estimate values, based on existing and future rules, for more than 6 million points;
- Implement advanced data analysis algorithms to identify unusual consumption profiles based on unusual drifts, excessive energy time-of-use, seasonality unmatched criteria, deviation from typical profiles, etc.;
- Interact with several existing systems, both from commercial – data acquisition, MDM, billing, reconciliation, switching – and technical systems – SCADA and outage management;
- Archiving high volumes of historical data – raw data and official reports; etc.

A phased approach will be put in place for a two years process, allowing to gradually capturing all business value as the organization also evolves and the InovGrid is rolling out.

All actual latent benefits will be captured on phase 1, while phase 2 will give the right answer to the major technical challenges related to network topology real-time integration and advanced consumption analysis, particularly for the residential sector.

EXPECTED BUSINESS BENEFITS

From a broad perspective benefits could be expressed in terms of the Distribution value-chain, from investment to market services.

Improving network technical information and calculate technical and commercial network losses will provide ways to optimize investments and minimize maintenance activities, providing, at the same time, supportive information for decisional processes.

As seen, characterize energy that flows within the network, represents relevant information for market operation, evolving several stakeholders like Regulator, Suppliers, System Operator, Customers, among others.

Normalizing estimation and profiling methods for both data delivery to market operators and billing purposes will have a positive impact on cash flows, minimizing errors associated with unbilled energy, as an example.

Revenue assurance is also an important topic that could directly benefit from the ability to execute detailed consumption analysis and implementing fraud detection advanced mechanisms.

Quantitative analysis
Considering a conservative approach for predictable benefits, the project is expected to achieve break-even in three years, where the main impacts could come from technical losses reduction, followed by a decrease in anomalies, thefts and frauds.

We expect that within three years technical losses drop by a factor of 0.5%, while commercial losses will face a decline of approximately 12%.

All values refer to DNO benefits based on actual regulation without including the ones for the overall System that should result from rebilling unbilled energy and incorrect contracted power values due to fraud and intentional acts.

Those last mentioned values are estimated and correspond to more than one million euros in a 4 years period.

It is also relevant not to neglect other important advantages that could result from this implementation, namely the expected improvement in all metering data services to the market, reinforce relations with Regulator through capacity to quickly and better answer to new requirements, and finally, creating conditions to increment internal workers satisfaction through the ability to provide a more efficient and quality one service.

REFERENCES

[2] – Manuel Matos et. al., Consumers and Networks characterization – Electrical energy settlement process study for each Supplier, November 2008